



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) **EP 1 686 227 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**02.08.2006 Bulletin 2006/31**

(51) Int Cl.:  
**E05F 15/12<sup>(2006.01)</sup> E05F 11/06<sup>(2006.01)</sup>**

(21) Application number: **06100749.8**

(22) Date of filing: **24.01.2006**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR  
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI  
SK TR**  
Designated Extension States:  
**AL BA HR MK YU**

(72) Inventor: **Gaggero, Anna**  
**16167 Genova (IT)**

(74) Representative: **Karaghiosoff, Giorgio**  
**Alessandro**  
**Studio Karaghiosoff e Frizzi s.r.l.**  
**Via Pecorile 25**  
**17015 Celle Ligure (SV) (IT)**

(30) Priority: **31.01.2005 IT SV20050005**

(71) Applicant: **Gaggero, Anna**  
**16167 Genova (IT)**

(54) **Chain actuator for moving windows, tilting frames or the like**

(57) Chain actuator (1) for moving windows, tilting frames or the like, of the type comprising a box-like casing (101), a chain (2), means for guiding said chain intended to help in defining a path of said chain inside said box-like casing (101), said path leading outside through an opening formed in said box-like casing (101), means (4) for moving said chain between a retracted position where the chain (2) is prevalently housed inside the box-like casing (101) and an extended position where the chain (2) is prevalently outside the box-like casing (101). Guiding means (201) comprise guide inserts (301,301') that are capable of being deformed according to temperature, said guiding inserts (301,301') defining at least a first and

at least a second path for the chain (2) according to temperature.

The chain actuator (1) has a transmission for transferring motion of a starting motor (104) to a kinematic chain by worm screw (304) and gear wheel couple (204). The worm screw (304) is coupled to the motor shaft (404) by a thrust bearing (604) riveted on one end of the worm screw (304), said bearing being supported by a collar obtained inside the bracket (504) supporting the gear wheel such that when the bracket (504) is secured to the motor (104), the axial movement moving away the worm screw (304) from the motor is prevented.

**EP 1 686 227 A2**

## Description

**[0001]** The present invention relates to a chain actuator for moving windows, tilting frames or the like, of the type comprising a box-like casing, a chain, means for guiding said chain intended to help in defining a path for said chain inside said box-like casing, said path leading outside through an opening formed in said box-like casing, means for moving said chain between a retracted position where the chain is prevalently housed inside the box-like casing and an extended position where the chain is prevalently outside the box-like casing. Actuators of this type are known for example by the Italian patent IT01291433.

**[0002]** As it is known, in various application sectors, and particularly in frame sector, for a long time chain actuators have been used allowing to effectively move shutters, above all of the tilting type, particularly when they are difficult to access and/or when their movement is not particularly easy for the user. For example in industrial buildings there are often tilting frames that are placed at the top in order to guarantee a sufficient lightening and at the same time an effective ventilation of premises above all in the case of fire fumes.

**[0003]** Some types of prior art actuators allow to automatically open and close the shutter to which they are applied, however they do not provide safety mechanisms allowing to firmly stop the shutter in a fixed position when it is necessary. Generally they are electronic control systems able to move the shutter in various manners and therefore also in fixed safety positions, but only at operating conditions of the electronic control that is till the electronic control is in operation. If the electronic control is not more reliable, for example due to an excessive increase in temperature due to a fire, the movement of the shutter to which the actuator is associated will become correspondingly unpredictable, that is after the correct control for opening the shutter in order to remove fumes in a room due to a fire the shutter could be involuntarily controlled as to be closed due to a wrong operation of the electronic control since a limit temperature threshold has been exceeded. As it is extremely possible after such involuntary closing control, if the gearcase will stop definitively to operate, the shutter will remain irreparably closed with obvious consequences for safety of people in premises. Moreover for safety reasons in order to allow exhaust of fumes in case of fire, regulations in force provide shutters of windows or the like to be locked in a firmly opened condition and to prevent the risk for the shutter to be in the closed position for example due to gravity reasons following a damage of the opening device that can be also a mechanical damage.

**[0004]** The present invention object is to provide an actuator overcoming prior art drawbacks and particularly suitable to be used to move frames while guaranteeing safety as greatest as possible in the case of fire risk.

**[0005]** The invention achieves its object by providing a chain actuator of the type described hereinbefore

wherein means for guiding the chain inside the box-like casing comprise guiding inserts that are capable of being deformed depending on to temperature, said guide inserts defining at least a first and at least a second path for the chain depending on temperature.

**[0006]** During normal operation, and so for temperature values lower than a certain threshold, guiding inserts have such a shape to help in defining a path within which the chain can normally slide. When temperature reaches a certain threshold, inserts get deformed taking such a shape to modify the path so that the chain stops in the reached position. Therefore each subsequent command for opening or closing the frame, to which the actuator is associated, has no effects on the chain movement that is by now firmly stopped. By suitably selecting materials, it is possible to provide the chain to be stopped when a temperature value is reached at which the mechanism moving the chain is reliably operating such to guarantee that such stop occurs when the frame is in its opening position. Advantageously to this aim the actuator according to the invention comprises an electronic control mechanism able to control the opening of the frame to which it is associated when temperature reaches a warning level lower than the one at which guide inserts begin to get deformed.

**[0007]** According to a further feature the chain has links with such a coupling profile to allow a pretension of the chain in a direction opposite to the one according to which the chain coils up on itself inside the box-like casing. The pretension determined by the inclination of the contact between the end and links, allows to achieve a stability of the chain in compressive direction particularly in case of fire, but also during normal use when the frame has to be kept opened.

**[0008]** In the case of fire it is therefore possible to guarantee a firm opening of frame or frames to which the actuator or actuators according to the invention are applied, guaranteeing a suitable and lasting ventilation of premises in order to exhaust fumes.

**[0009]** According to another aspect, the invention relates to a frame controlled for its opening/closing by a chain actuator between a position of maximum opening with the chain completely extended and a position of complete closure with the chain substantially retracted inside the box-like casing.

**[0010]** According to a further aspect of the present invention having important effects on safety and reliability characteristics of the actuator in a chain actuator for moving windows, tilting frames or the like, of the type comprising a box-like casing, a chain, means for guiding said chain intended to help in defining a path of said chain inside said box-like casing, said path leading outside through an opening formed in said box-like casing, means for moving said chain between a retracted position where the chain is prevalently housed inside the box-like casing and an extended position where the chain is prevalently outside the box-like casing, means for moving the chain comprise an electric motor connected by

means of mechanical transmission means to a pinion to which said chain is coupled.

**[0011]** Mechanical transmission means particularly comprise a gear reduction unit. These are composed of a gear wheel upon which a worm screw coupled to the motor shaft is engaged, said gear wheel being rotatably supported by a bracket that can be secured to the motor by means of screw tightening means.

**[0012]** Advantageously according to the present invention, the worm screw is coupled to the motor shaft by a thrust bearing riveted on an end of the worm screw, said bearing being supported by a collar obtained inside the bracket supporting the gear wheel such that, when the bracket is secured to the motor, the axial movement moving away the worm screw from the motor is prevented.

**[0013]** Moreover between the thrust bearing and the motor there is provided a spacer preventing the axial movement approaching the worm screw to the motor.

**[0014]** Further features and improvements are object of subclaims.

**[0015]** Features of the invention and advantages deriving therefrom will be more clear from the following detailed description of annexed drawings, wherein:

Fig. 1 is a perspective view of the actuator according to the invention applied to a frame.

Figs. 2 and 3 are cutaway orthogonal projection views of the box-like casing housing the actuator of fig. 1 in two different operating steps.

Fig. 4 is a cutaway view of the anchoring end of the chain in the position mounted on the complementary hooking of the frame.

Fig. 5 in the above part shows in not mounting condition the hooking of frame, the anchoring end of the chain and the first link of the chain to which the anchoring end is coupled, while the low part of fig. 5 shows the anchoring end hooked to the first link of the chain.

Fig. 6 is an orthogonal projection of a gear reduction unit.

Fig. 7 is an exploded perspective view of a detail of the assembly moving the chain and partially mounted.

Fig. 8 is a cutaway orthogonal projection view of the moving assembly of fig. 7 in the mounting condition.

**[0016]** Referring to figures 1 to 3, the chain actuator 1 comprises a box-like casing 101, typically made of aluminium or an equivalent metal material, having an elongated shape within which a chain 2 is guided so as to slide by guides 201 and guide inserts 301, 301' along a path leading outside through an opening 401 formed on a longitudinal wall. The chain 2 takes up a delimited position of the box-like casing 101, since the opposite portion is occupied by means 4 for moving the chain. These comprise an electric motor 104 connected by a mechanical transmission to a pinion 701 to which the chain 2 is

coupled. Guides 201 help in arranging the chain 2 with branch or branches inside the box-like casing 101 substantially parallel to longitudinal walls of the box-like casing when pulling and retracting. As shown in figure 2, guiding inserts 301, 301', typically made of plastic material, arranged at the opening 401, when normally operating, that is for temperature values lower than a certain threshold, typically 100 °C, allow to deflect gradually and with a curved path the arrangement of the chain towards the opening 401 from the direction substantially parallel to longitudinal walls of the box-like casing 101 to a direction substantially transversal and particularly substantially orthogonal to longitudinal walls and viceversa. When temperature exceeds said threshold, inserts 301, 301' melt and, as indicated in figure 3, take such a shape not to guide the chain 2 or to guide it giving an abrupt change in its path substantially at right angle causing the chain to be stopped in the position that has been reached.

**[0017]** Inner walls of the box-like casing 101 intended to house the chain 2 have a substantially U shape about which the chain 2 is arranged in a retracted position by the spiral coiling up when pulling and retracting about a pin (not shown in figure) to which the chain end 501 is associated. Advantageously guides 201 comprise a peripheral guide 601, 601' made of antifriction material, typically plastic material, abutting the corresponding longitudinal inner wall of the box-like casing 101. The guide 601, 601' allows to make easy the retraction of the chain 2, typically made of stainless steel, inside the box-like casing 101 and to reduce the sliding noise caused by the contact between it and the inside of the box-like casing.

**[0018]** Referring to figures 4 and 5, the chain 2 comprises an anchoring end 102 for connection to the body 3 to be moved, typically a window or door shutter. The end 102 has a substantially cylindrical shape intended to receive a screw 203 for fastening said body 3 to be moved by means of an anchoring member 103 fastened to said body 3 for example by means of screws and having also through holes for housing the two ends of the screw 203. The end 102 of the chain 2 has an extension prolongation having a complementary profile 202 hooking to an end link 302 of the chain 2. The hooking profile 202 has such an inclination with respect to the complementary profile of the link 302 that the link 302 is arranged in a position hooking the end 102 with inclined longitudinal axis, for example at 2° with respect to the normal to the axis of the cylinder 102, causing a pretension as indicated by arrow in figure 4.

**[0019]** Referring to figures 7 and 8, according to a particularly advantageous embodiment, mechanical transmission means transmitting movement of electric motor 104 to pinion 701 to which the chain 2 is associated, comprise a gear wheel (not shown in figure) upon which a worm screw 304 coupled to the shaft 404 of the motor 104 is engaged in addition to a gear reduction unit 204 according to prior art, such as the one shown in figure 6. The gear wheel is rotatably supported by a bracket 504, for example made of plastic material, that can be secured

to the motor 104 by screw tightening. The worm screw 304 is coupled to the shaft 404 of the motor 104 by means of a thrust bearing 604 riveted on one end of the worm screw 304. The bearing 604 is supported by a collar obtained inside the bracket 504 supporting the gear wheel such that, when the bracket 504 is secured to the motor 104, the axial movement moving away the worm screw 304 from the motor 104 is prevented. Moreover between the thrust bearing 604 and the motor 104 there is provided a spacer 704 preventing the axial movement approaching the worm screw 304 to the motor 104 in order to prevent axial loads exerted by the worm screw 304 on electric motor 104 above all when reaching the stop of the chain 2.

**[0020]** Advantageously the thrust bearing supports axial loads exerted by the worm screw on the motor. The fact of mounting it directly on the worm screw and that is on the head side thereof faced towards the motor allows to economically manufacture the thrust bearing also as regards its mounting in the kinematic chain. Moreover the fastening to the worm screw occurs by riveting, that is permanent set and so it is very quick, fast and cheap. Moreover the fact of manufacturing the stop of the axial withdrawing movement for the worm screw from the shaft of the electric motor as a separated member that is secured to the casing and functioning also as a rotation supporting member of the first gear cooperating with the worm screw is a considerable structural simplification limiting manufacturing costs and allowing to adjust the positioning of said stop. Moreover considering that the worm screw is the member the more stressed of the kinematic chain and whose load inevitably discharges on the motor shaft and it has a considerable axial component of said motor axis, so the fact of providing the thrust bearing and the opposite stop allows to limit loads on the axis of the motor discharging them at least partially on the stop and on the thrust bearing. Moreover in the case of substitution due to wear said arrangement allows to very quickly replace worn parts and particularly the worm screw having the thrust bearing integrated and the axial stop opposite to the thrust bearing, that is cooperating with the head side of the worm screw opposite to the one faced towards the motor and limiting the translation effect towards the outside from the axis of the motor caused by the worm screw engaged with the first gear wheel. Moreover the stop can be composed of a quality material having a low coefficient of friction avoiding to use said material for other parts of the casing.

**[0021]** According to a preferred embodiment, the actuator according to the invention comprises electronic means for adjusting and controlling the activation/disactivation of means for moving the chain 4. These electronic means comprise at least a positioning sensor of the chain 2 intended to produce a stop signal and a microcontroller sensitive to said signal. Microcontroller is arranged for controlling the movement of the chain 2 by means of the electric motor 104 between two extreme limit positions.

**[0022]** Preferably the actuator further comprises a

temperature sensor intended to produce a signal depending on temperature. Microcontroller is arranged to read said signal and to move the chain 2 in the most extended position outside the box-like casing 101 when the signal takes values greater than a certain threshold. The threshold corresponds to temperature values lower than melting temperature of guiding inserts 301, 301' so that the stop of chain 2 caused by melting of guiding inserts 301, 301' occurs when the chain is completely extended. So in case of fire it is possible to guarantee a firm opening of frame or frames 3 to which actuator or actuators 1 according to the invention are applied, guaranteeing a suitable and lasting ventilation of premises for exhaling fumes.

**[0023]** Naturally the invention is not limited to above embodiments, but it can be widely varied. For example there can be provided the pin for fastening an end of the chain to the box-like casing to be slidable so making more easy the coming out and retracting of the chain, such as in Italian patent application PD2001A000136. All this without departing from the teaching mentioned above and claimed below.

## Claims

1. Chain actuator for moving windows, tilting frames or the like, of the type comprising a box-like casing, a chain, means for guiding said chain intended to help in defining a path of said chain inside said box-like casing, said path leading outside through an opening formed in said box-like casing, means for moving said chain between a retracted position where the chain is prevalently housed inside the box-like casing and an extended position where the chain is prevalently outside the box-like casing, **characterized in that** said guiding means comprise guide inserts that are capable of being deformed according to temperature, said guide inserts defining at least a first and at least a second path for the chain according to temperature.
2. Actuator according to claim 1, **characterized in that** said second path is a path preventing the chain to slide.
3. Actuator according to claim 1 or 2, **characterized in that** said guiding means help in arranging said chain with branch or branches inside the box-like casing of the actuator substantially parallel to longitudinal walls of said box-like casing when pulling and retracting, the opening of the box-like casing being arranged on a longitudinal wall and guiding inserts being arranged at said opening to deflect gradually and with a curved path the arrangement of the chain towards said opening from the direction substantially parallel to longitudinal walls of the box-like casing of the actuator to a direction substantially transversal

and particularly substantially orthogonal to longitudinal walls and viceversa for temperature values lower than a certain threshold.

4. Actuator according to claim 3, **characterized in that** for temperature values greater than said threshold, guiding inserts take such a shape not to guide the chain or to guide it giving an abrupt change in its path substantially at right angle causing the chain to be stopped in the position that has been reached. 5
5. Actuator according to one or more of the preceding claims, **characterized in that** guiding inserts are made of plastic material melting for temperature values greater than said threshold. 10
6. Actuator according to claim 5, **characterized in that** plastic material has a melting temperature of about 100 °C. 15
7. Actuator according to one or more of the preceding claims, **characterized in that** the body-like casing is composed of aluminium or equivalent metal material. 20
8. Actuator according to one or more of the preceding claims, **characterized in that** inner walls of the box-like casing intended to house the chain have a substantially U shape about which the chain is arranged in a retracted position by the spiral coiling up when pulling and retracting about a pin to which a chain end is associated. 25
9. Actuator according to claim 8, **characterized in that** guiding means comprise at least a peripheric guide made of antifriction material, abutting the corresponding longitudinal inner wall of the box-like casing. 30
10. Actuator according to claim 9, **characterized in that** said peripheric guide is made of plastic material. 35
11. Actuator according to one or more of the preceding claims, **characterized in that** the chain has links with such a coupling profile to allow a pretension of the chain in a direction opposite to the one according to which the chain coils up on itself inside the box-like casing. 40
12. Actuator according to claim 11, **characterized in that** said pretension is determined by the inclination of the contact between push rod and links. 45
13. Actuator according to claim 12, **characterized in that** the chain comprise an anchoring end for connection to the body to be moved, said end having a substantially cylindrical shape intended to receive a screw for fastening said body to an extension pro-

longation having a complementary profile hooking to an end link of the chain, said profile having such an inclination with respect to the complementary profile of the link that said link is arranged in a position hooking the end with inclined longitudinal axis with respect to the normal to the axis of the cylinder.

14. Actuator according to claim 13, **characterized in that** said inclination is about of 2°C. 50
15. Actuator according to one or more of the preceding claims, **characterized in that** the chain takes up a delimited position of the box-like casing, the opposite portion being occupied by means for moving said chain. 55
16. Actuator according to claim 15, **characterized in that** means for moving the chain comprise an electric motor connected by mechanical transmission means to a pinion to which the chain is coupled.
17. Actuator according to claim 16, **characterized in that** mechanical transmission means comprise a gear reduction unit.
18. Actuator according to claim 16 or 17, **characterized in that** mechanical transmission means comprise a gear wheel upon which a worm screw coupled to the shaft of the motor is engaged, said gear wheel being rotatably supported by a bracket that can be secured to the motor by means of screw tightening means.
19. Actuator according to claim 18, **characterized in that** the worm screw is coupled to the motor shaft by a thrust bearing riveted on an end of the worm screw, said bearing being supported by a collar obtained inside the bracket supporting the gear wheel such that, when the bracket is secured to the motor, the axial movement moving away the worm screw from the motor is prevented.
20. Actuator according to claim 19, **characterized in that** between the thrust bearing and the motor there is provided a spacer preventing the axial movement approaching the worm screw to the motor.
21. Actuator according to one or more of the preceding claims 18 to 20, **characterized in that** the bracket for supporting the gear wheel and the bearing is made of plastic material.
22. Actuator according to one or more of the preceding claims, **characterized in that** it comprises electronic means for adjusting and controlling the activation/disactivation of means for moving the chain.
23. Actuator according to claim 22, **characterized in that** said electronic means comprise at least a po-

sitioning sensor of the chain intended to produce a stop signal and a microcontroller sensitive to said signal, said microcontroller being arranged for controlling the movement of the chain by means of the electric motor between two extreme limit positions.

24. Actuator according to claim 23, **characterized in that** it further comprises a temperature sensor intended to produce a signal according to temperature, the microcontroller being arranged to read said signal and to move the chain in the most extended position outside the box-like casing when the signal takes values greater than a certain threshold.

25. Actuator according to claim 24, **characterized in that** said threshold corresponds to temperature values lower than melting temperature of guiding inserts so that the stop of chain caused by melting of guiding inserts occurs when the chain is completely extended.

26. Frame controlled for its opening/closure by an actuator manufactured according to one or more of the preceding claims between a maximum opening position with the chain completely extended and a completely closing position with the chain substantially retracted in the box-like casing.

27. Chain actuator for moving windows, tilting frames or the like, of the type comprising a box-like casing, a chain, means for guiding said chain intended to help in defining a path of said chain inside said box-like casing, said path leading outside through an opening formed in said box-like casing, means for moving said chain between a retracted position where the chain is prevalently housed inside the box-like casing and an extended position where the chain is prevalently outside the box-like casing, **characterized in that** means for moving the chain comprise an electric motor connected by means of mechanical transmission means to a pignon to which the chain is coupled.

28. Actuator according to claim 27, **characterized in that** mechanical transmission means comprise a gear reduction unit.

29. Actuator according to claim 27 or 28, **characterized in that** mechanical transmission means comprise a gear wheel upon which a worm screw coupled to the shaft of the motor is engaged, said gear wheel being rotatably supported by a bracket that can be secured to the motor by means of screw tightening means.

30. Actuator according to claim 29, **characterized in that** the worm screw is coupled to the motor shaft by a thrust bearing riveted on an end of the worm screw, said bearing being supported by a collar obtained inside the bracket supporting the gear wheel

such that, when the bracket is secured to the motor, the axial movement moving away the worm screw from the motor is prevented.

5 31. Actuator according to claim 30, **characterized in that** between the thrust bearing and the motor there is provided a spacer preventing the axial movement approaching the worm screw to the motor.

10 32. Actuator according to one or more of the preceding claims 29 to 31, **characterized in that** the bracket for supporting the gear wheel and the bearing is made of plastic material.

15 33. Actuator according to one or more of the preceding claims 27 to 32, **characterized in that** it comprises electronic means for adjusting and controlling the activation/disactivation of means for moving the chain.

20 34. Actuator according to claim 33, **characterized in that** said electronic means comprise at least a positioning sensor of the chain intended to produce a stop signal and a microcontroller sensitive to said signal, said microcontroller being arranged for controlling the movement of the chain by means of the electric motor between two extreme limit positions.

30

35

40

45

50

55

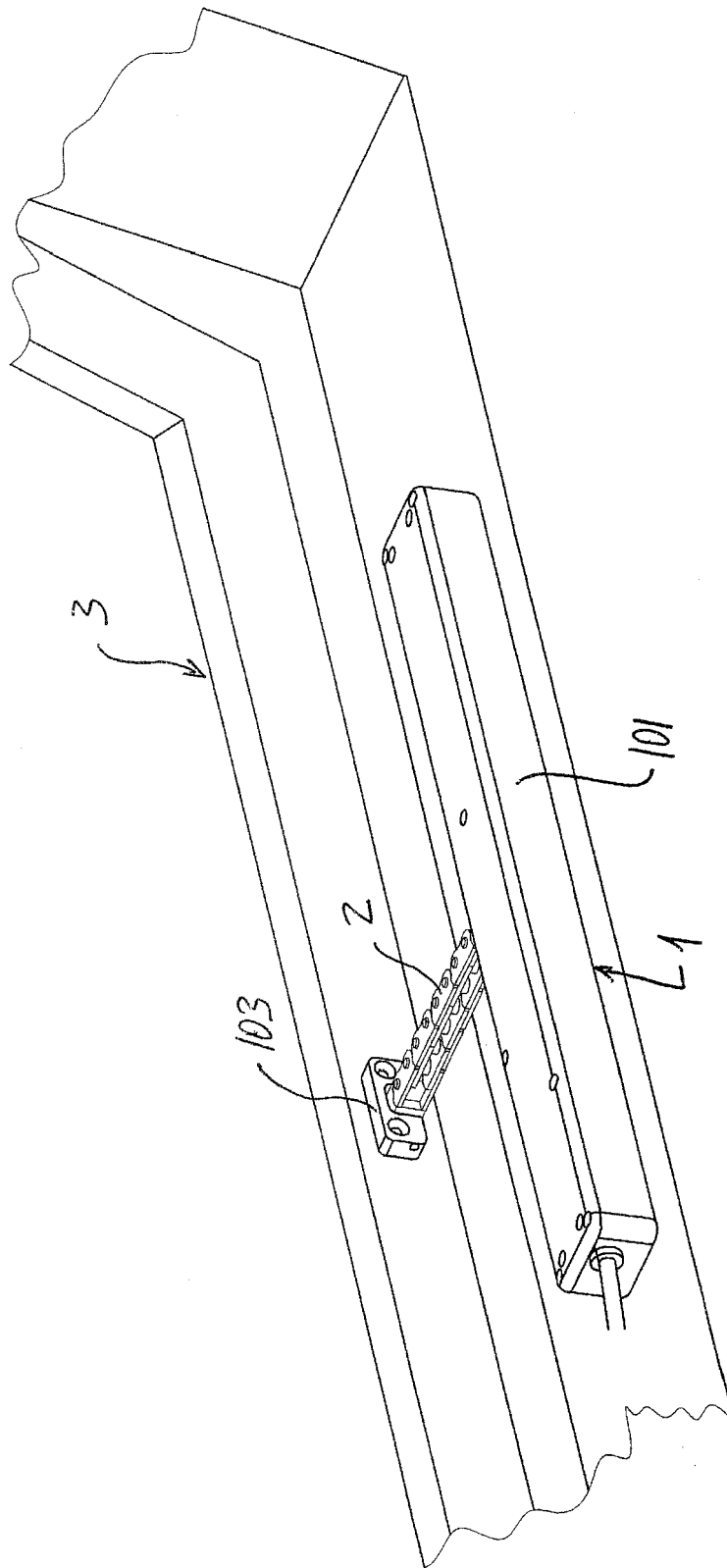


Fig. 1

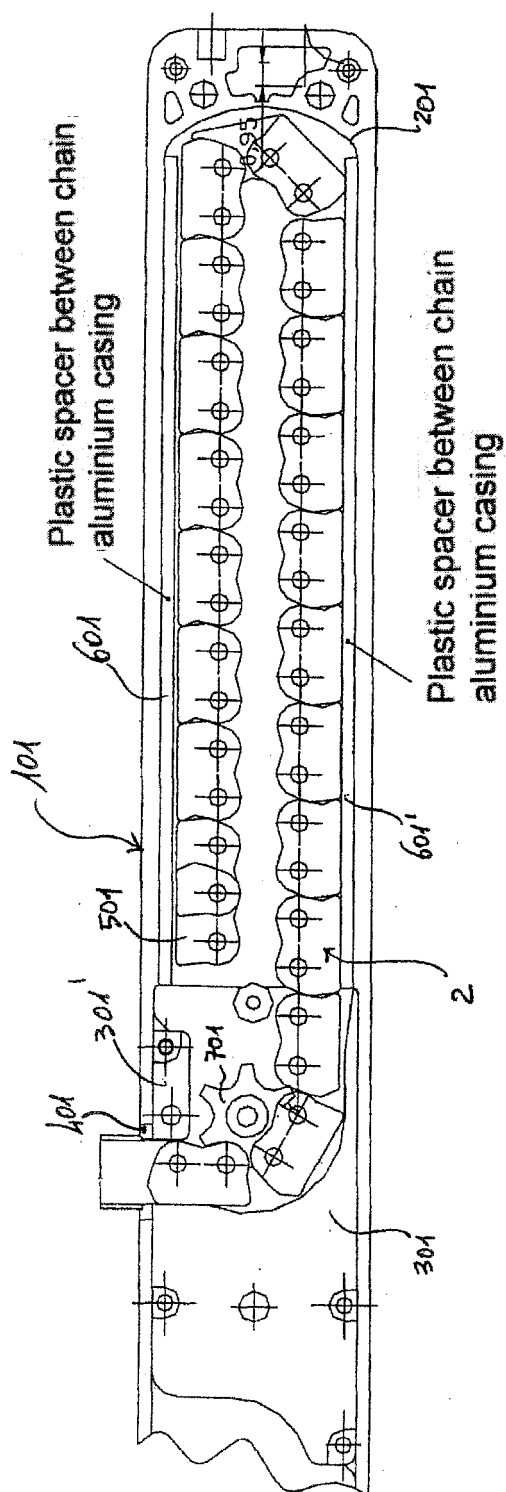


Fig. 2



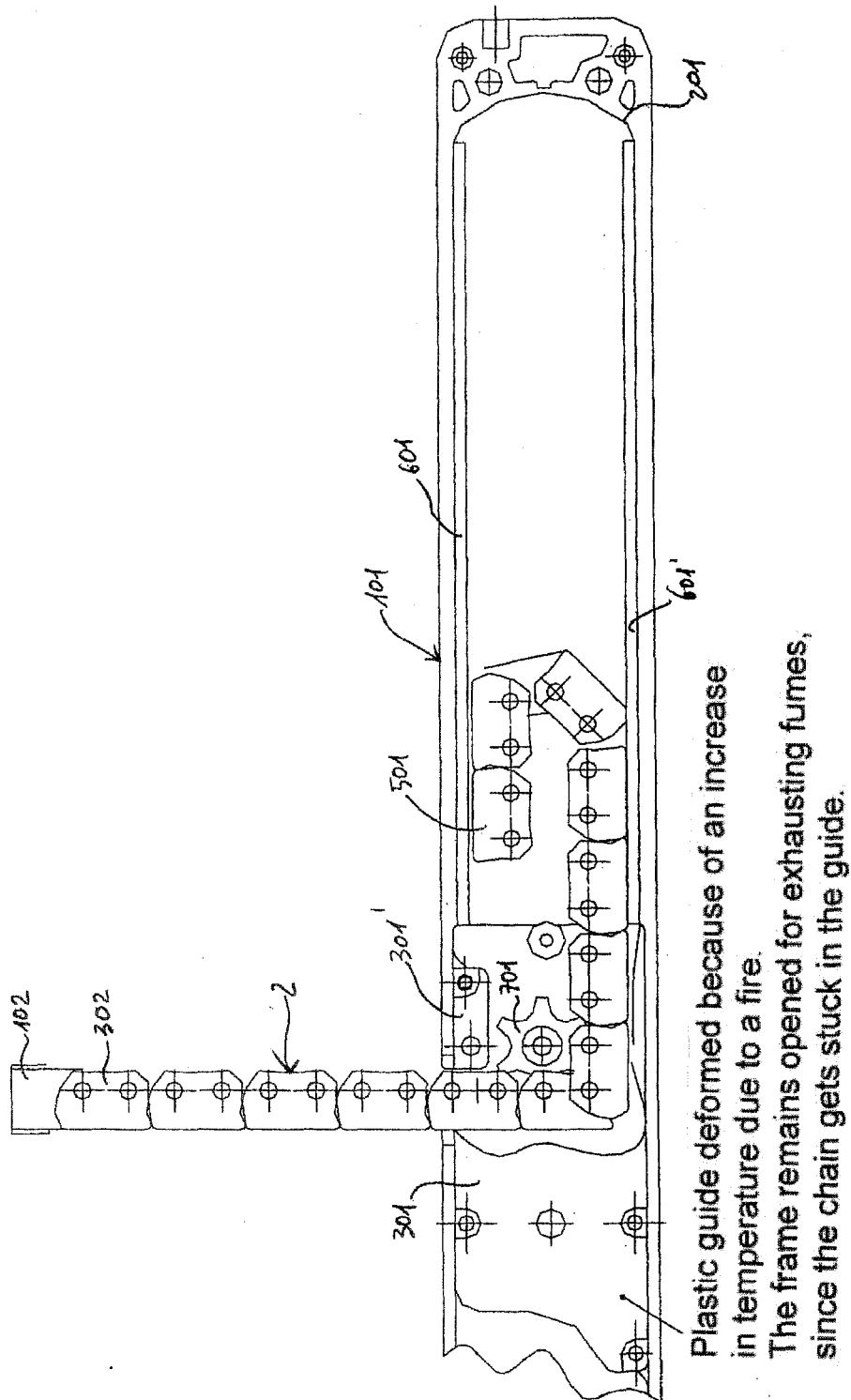


Fig. 3

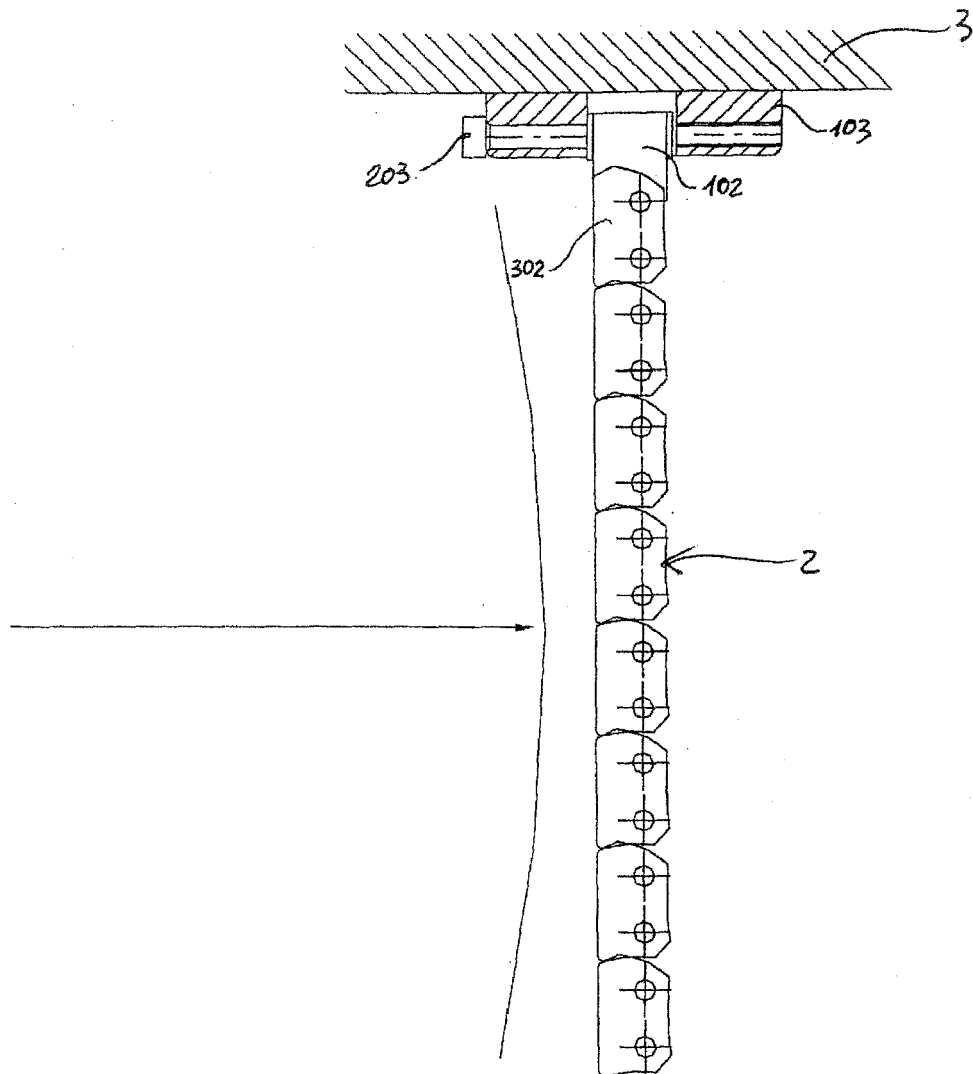


Fig. 4

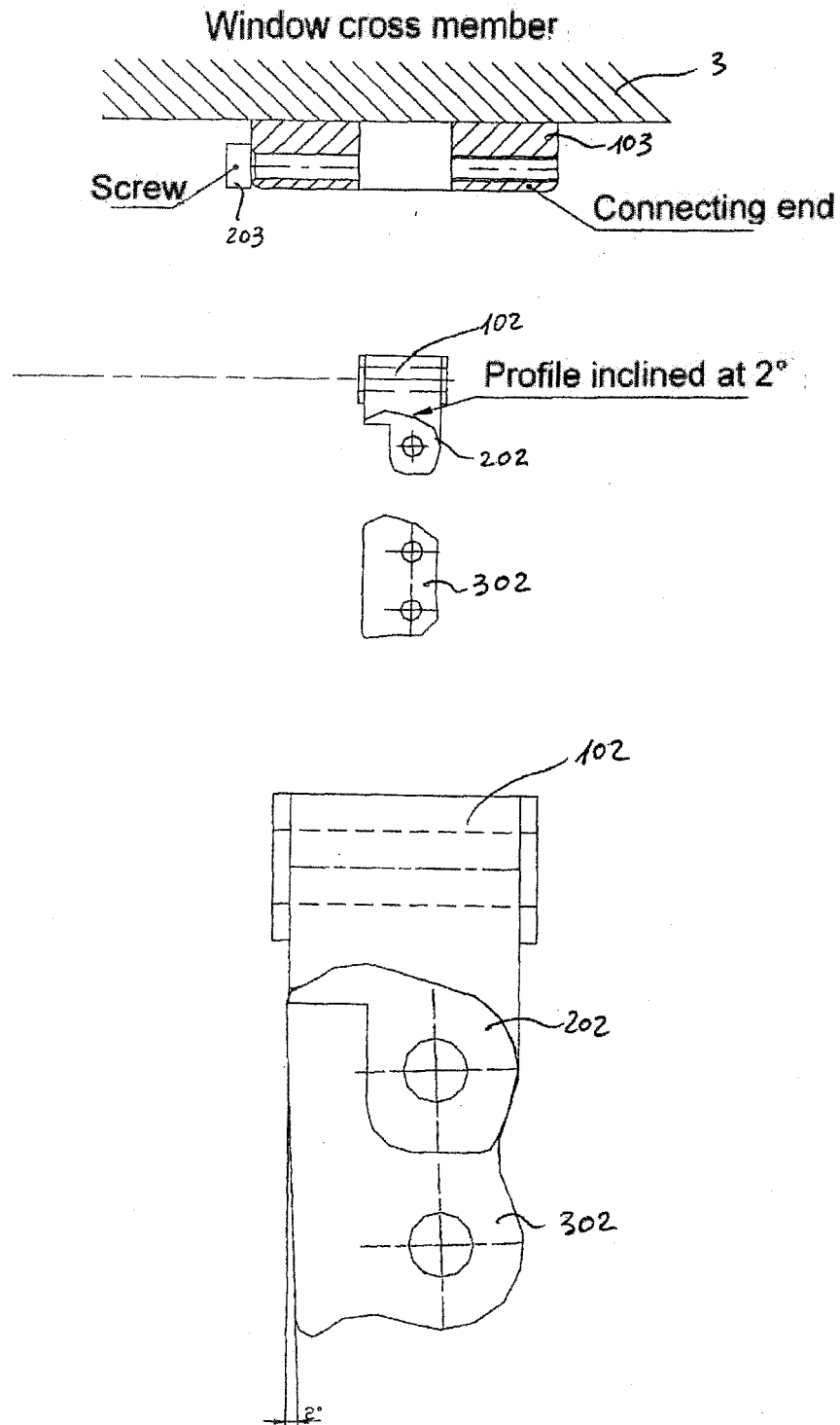


Fig. 5

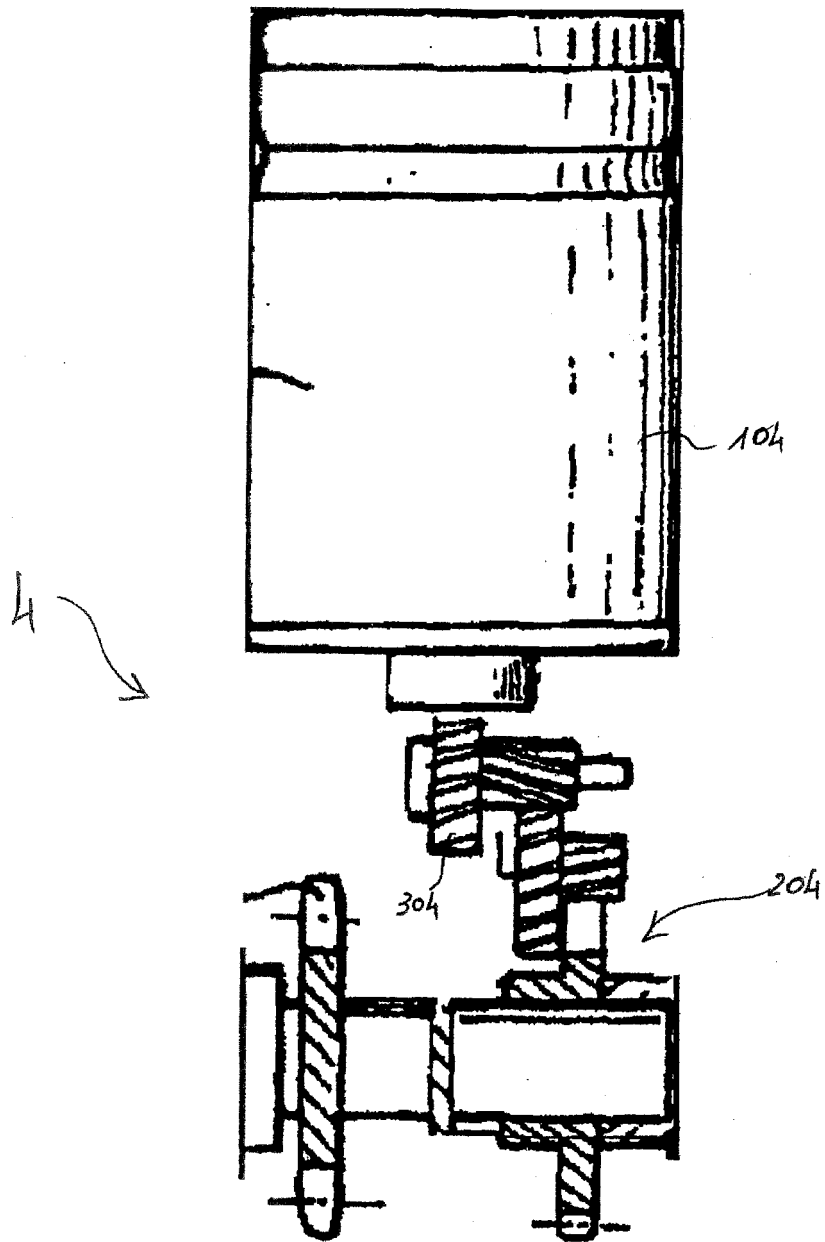


Fig. 6

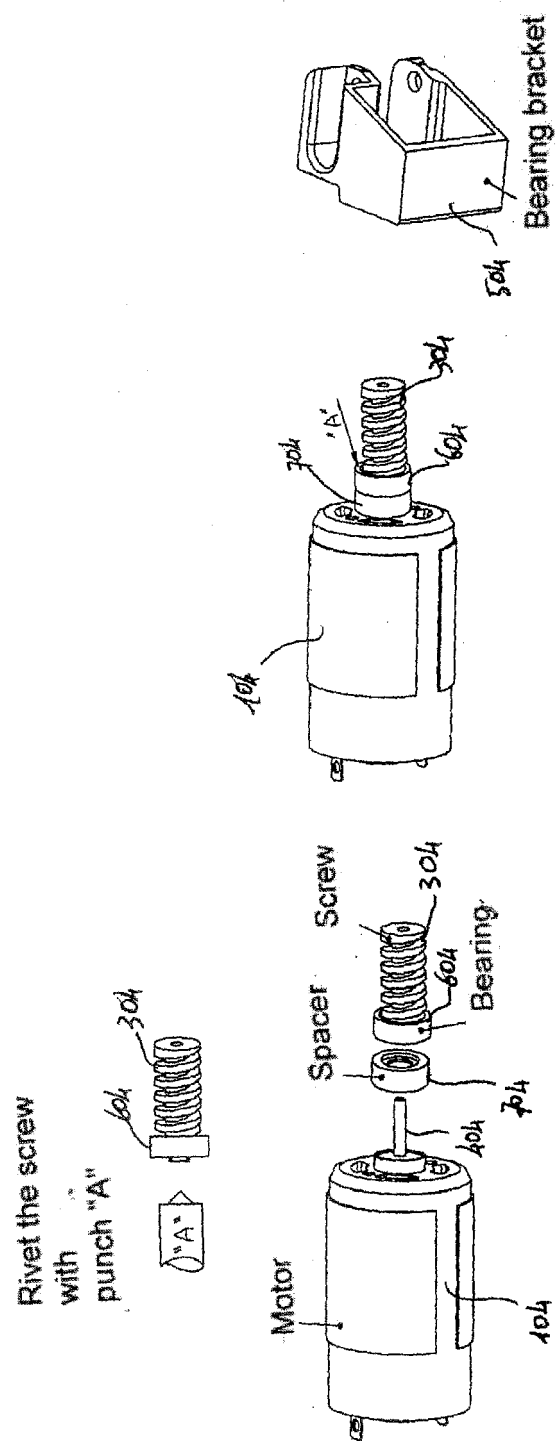


Fig. 7

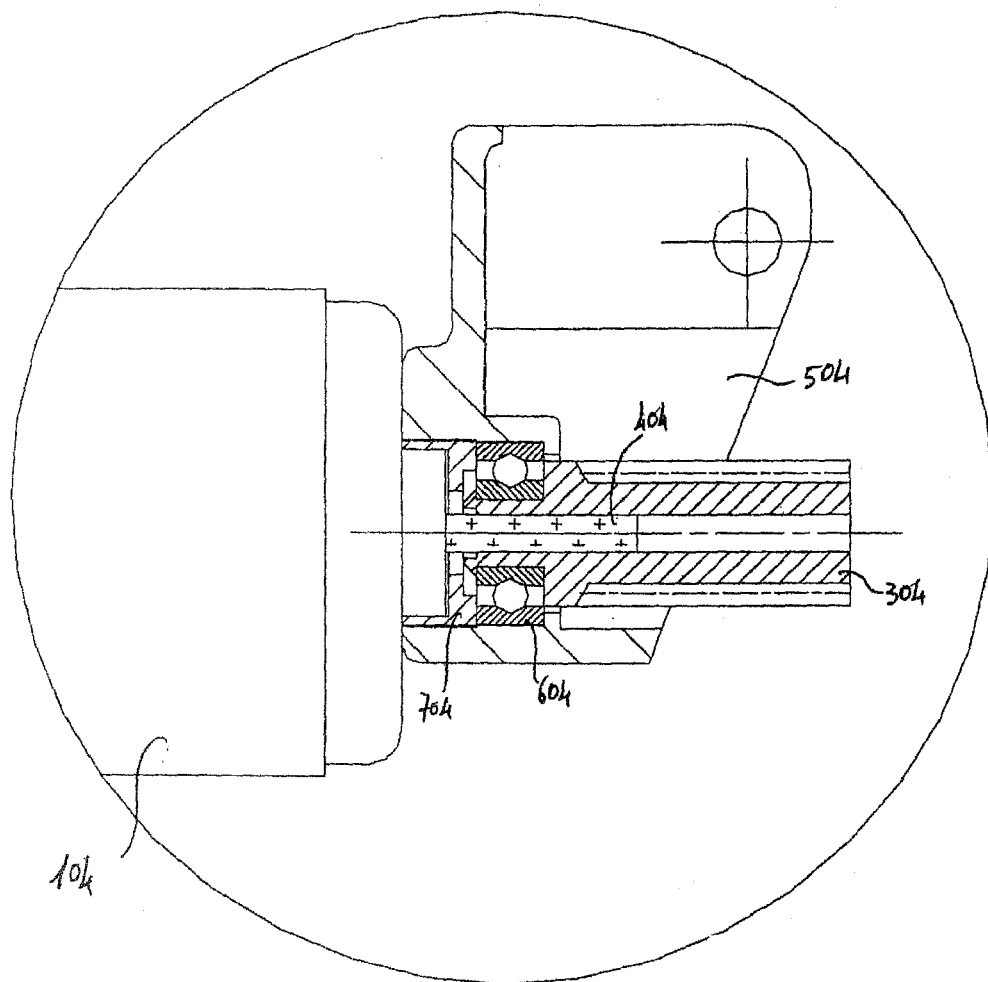


Fig. 8