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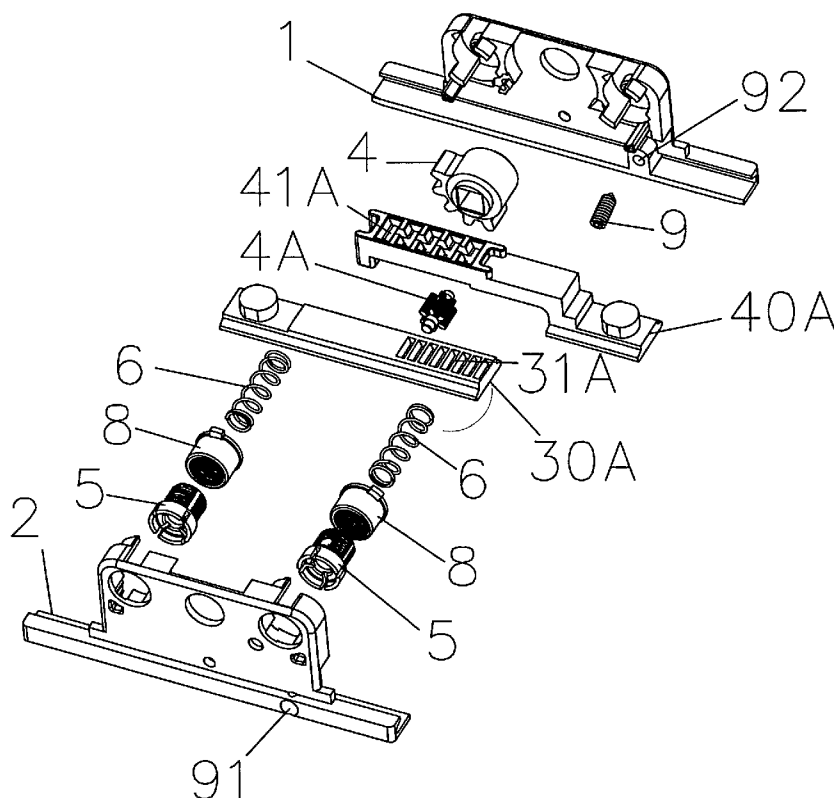


FIG. 9

(57) Abstract: The present invention discloses a door and window lock actuator. The actuator includes a front lock body frame and a rear lock body frame. A lock core device is placed between the front lock body frame and the rear lock body frame. Mounting holes are configured in the front lock body frame and the rear lock body frame. Mounting hole guide devices are placed into the mounting holes. The lock core device may be a unidirectional or bidirectional lock.

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## A WINDOW AND DOOR LOCK ACTUATOR

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## CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of Chinese Application Nos. 200710066912.9 and No. 200710066915.2, filed on January 26, 2007 with the State Intellectual Property Office of the People's Republic of China, which are hereby incorporated by reference in their entirety.

## FIELD OF INVENTION

[0002] The present invention relates to a door and window lock, and in particular concerns a door and window lock actuator.

## DESCRIPTION OF RELATED ART

[0003] Existing door and window locks generally all require that during installation there first be a lock location hole configured in advance on the door or window, then the door and window actuator is disassembled, each of the parts and subassemblies of the actuator are slipped into the lock location hole on the door or window, and then mounting of the actuator is done. During the actual process of installing door and window locks, as a result of the lock location hole opened on the window or door not being in exact correspondence with the actuator, in most situations the lock location hole is larger than the actuator, several problems occur. First, the mounting hole on the door or window is not exactly aligned with the mounting hole of the actuator of the window or door lock. When the actuator is being mounted on the window or door, the installer must fumble around with trial attempts and spend considerable time in finding the mounting hole of the door and window lock actuator, thereby causing a great reduction in installation efficiency and consuming manpower and time. Second, slanting or shifting may occur during the process of mounting the actuator, affecting the installation results of the actuator.

[0004] The actuators of existing door and window lock sets comprise two housings, with large and small coupling sockets, mounting bolts, etc. placed on the housing, there being a drive gear, drive rails, track piece, etc. inside the housing. Chinese Utility Model Patent No. 03280006.1 disclosed a door and window lock capable of bidirectionally locking closed, comprising two

drive rails, teeth of a drive gear and wherein the teeth of a drive rail correspond to them, the deflection of the drive gear causing the drive rail to shift, there being a transmission gear placed between the two drive rails, and in this manner by shifting one of the drive rails among them it causes the other drive rail to shift in the opposite direction; there are bumps placed on the drive rails, matching to connect with the track piece, the shifting of the drive rails causing the corresponding shifting of the track piece, thereby having the function of bidirectionally locking closed or opening. However, because this type of structure only causes one drive rail to shift, the direct application of force on the drive rails and the drive gear is only on one of the drive rails among them, while the other drive rail only shifts via transmission by the transmission gear placed between the two drive rails, and the transmission gear is only inserted between the two drive rails, without a proper point of fixed subjection to force. The internal resistance to torsional force of lock sets with this type of structure is not strong, and after the lock set has been in use for a long period, because the frictional force increases, it is prone to making it impossible to lock it closed or open it, and if considerable force is used in locking closed or opening, this very easily damages the lock set, greatly reducing the useful lifespan of the lock set.

## SUMMARY

**[0005]** The first technical problem that the present invention must resolve is to provide a structurally simple and easy-to-install door and window lock actuator that has good installation results.

**[0006]** The technical program adopted by the present invention to resolve the above-described technical problem is: A door and window lock actuator that includes a front lock body frame and rear lock body frame. The front lock body frame and the rear lock body frame have a lock core device placed between them. The front lock body frame and the rear lock body frame are configured with mounting holes. Mounting hole guide devices are configured inside the mounting holes.

**[0007]** The guide devices include a guide base. The guide base has threaded holes configured in it. Guide screws are placed inside the threaded holes. The guide screws have guide holes that allow penetration of the mounting screws. Springs are placed at the bottom of the mounting holes. One end of the springs is connected to the bottom surface of the mounting holes. The

other end of the springs is connected to the end surface of the guide screws. Locking blocks are on the outside surface of the guide bases. A first locking groove and a second locking groove are placed respectively on the lower part and the upper part of the inner surfaces of the mounting holes.

[0008] The mounting holes include front mounting holes on the front lock body frame and rear mounting holes on the rear lock body frame. The front mounting holes are through-holes, whereas the rear mounting holes are sunken holes. Mounting threaded holes are on the bottom of the rear mounting holes. The first locking groove is placed inside the rear mounting holes and the second locking groove is placed inside the front mounting holes.

[0009] The front mounting holes are configured with a first recessed groove and the rear mounting holes are fitted with a second recessed groove. A first lug is placed on the front lock body frame and a second lug is placed on the rear lock body frame. The first lug is inserted into the second recessed groove and the second lug is inserted into the first recessed groove. The sum of the length of the first lug and the thickness of the locking block is less than the depth of the second recessed groove. The sum of the length of the second lug and the thickness of the locking block is less than the depth of the first recessed groove.

[0010] The lock core device can be a unidirectional transmission lock core device.

[0011] The lock core device can also be a bidirectional transmission lock core device.

[0012] Compared to existing technology, the advantage of the present invention lies in the placement of the mounting hole guide devices inside the mounting holes. The mounting hole guide devices greatly increase the convenience of door and window lock installation, and installers can very conveniently find the location of the installation hole, thus saving manpower and time, and increasing the efficiency of lock body installation. The mounting hole guide devices are composed of guide screws that screw onto the guide base, and there are guide holes configured in the guide screws that permit the penetration of the mounting screws. The springs placed at the bottom of the mounting holes regulate the configuration of the guide device into a two-stage length, and the required regulated length can be obtained based on requirements. When the guide base and the guide screws extend out for a sufficient length, this is the same as

increasing the width of the lock body and can prevent the occurrence of slanting and shifting of the lock body during the mounting process, thereby increasing the installation efficiency of the lock body. Using the lugs to form the locking grooves reduces the difficulty in manufacturing.

**[0013]** The second technical problem that the present invention must resolve is to provide an improved bidirectional door and window lock actuator with a high resistance to torsional force and a long lifespan.

**[0014]** The technical program that is adopted by the present invention to resolve the above-described problem is: An improved bidirectional door and window lock actuator, comprising a housing, drive gear, first drive rail, second drive rail and track piece, the first drive rail as a unit being configured with a first rack, the second drive rail as a unit being configured with a second rack, the first and the second racks being placed in parallel beneath the drive gear, the teeth of the drive gear intermeshing with the teeth of the first rack, there being a commutating transmission gear placed between the drive gear and the second rack, the commutating transmission gear axle being connected onto the housing, and the teeth of the commutating transmission gear intermeshing with, respectively, the teeth of the second rack and the teeth of the drive gear.

**[0015]** A mounting boss is placed inside the housing, there being a drive gear mounting piece placed and affixed onto the mounting boss, one end of the axle of the center axle of the commutating transmission gear being connected onto the housing, the other end of center axle of the commutating transmission gear being connected onto the mounting piece of the transmission gear.

**[0016]** The transmission gear mounting piece is riveted onto the mounting boss.

**[0017]** The transmission gear mounting piece is riveted by two rivets onto the mounting boss.

**[0018]** Compared to existing technology, the advantage of the present invention lies in the placement of a commutating transmission gear between the drive gear and the second rack, the commutating transmission gear axle being connected onto the housing, the teeth of the commutating transmission gear intermeshing with, respectively, the teeth of the second rack and the teeth of the drive gear, and in this manner both of the drive rails can directly apply force onto

the drive gear, the force being uniform and symmetrical, whereas when the commutating transmission gear is rotating it has a fixed point where force is applied, resulting in a substantial increase in the firmness of the structure inside the lock set, the resistance to torsional force of the lock set is also further improved and can reach more than  $6\text{N}\cdot\text{M}$ , and can thereby also increase the useful lifespan of the lock set.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0019] Figure 1 is a three-dimensional structural exploded diagram of a lock actuator in one embodiment of the present invention.

[0020] Figure 2 is a three-dimensional structural diagram of the lock actuator of Figure 1 in one embodiment of the present invention.

[0021] Figure 3 is a three-dimensional structural diagram of a guide base in the lock actuator of Figure 1 in one embodiment of the present invention.

[0022] Figure 4 is a three-dimensional structural diagram of a front lock body frame of the lock actuator in Figure 1 in one embodiment of the present invention.

[0023] Figure 5 is a three-dimensional structural exploded diagram of a lock actuator in another embodiment of the present invention.

[0024] Figure 6 is a three-dimensional structural diagram of front and rear lock body frames of the lock actuator in Figure 5 in one embodiment of the present invention.

[0025] Figure 7 is a cross-sectional diagram of front and rear mounting holes of the lock actuator in Figure 5 in one embodiment of the present invention.

[0026] Figure 8 is a three-dimensional exploded structural view of a bidirectional lock actuator in one embodiment of the invention.

[0027] Figure 9 is a three-dimensional exploded structural view of a bidirectional lock actuator in another embodiment of the invention.

[0028] Use of the same reference numbers in different figures indicates similar or identical elements.

## DETAILED DESCRIPTION OF THE INVENTION

[0029] The following is a more detailed description of the present invention in conjunction with the attached diagrams.

[0030] A door and window lock actuator includes a front lock body frame 2 and a rear lock body frame 1. A unidirectional transmission lock core device is placed between the front lock body frame 2 and the rear lock body frame 1. The unidirectional transmission lock core device includes a toothed drive rail 3 and a central gear 4.

[0031] Front mounting holes 21 are placed on the front lock body frame 2 and rear mounting holes 11 are placed on the rear lock body frame 1. The front mounting holes 21 are through-holes and the rear mounting holes 11 are sunken holes. Mounting screw holes 7 are placed at the bottom of the rear mounting holes 11.

[0032] First recessed grooves 22 are configured on the front mounting holes 21, and second recessed grooves 12 are configured on the rear mounting holes 11. First lugs 23 are placed on the front lock body frame 2, and second lugs 13 are placed on the rear lock body frame 1. The first lugs 23 are inserted into the second recessed grooves 12, and the second lugs 13 are inserted into the first recessed grooves 22.

[0033] Guide bases 8 (also called “sprocket casings”) are placed inside the front mounting holes 21 and rear mounting holes 11. Threaded holes 81 are placed on the guide base 8. Guide screws 5 (also called “sprocket screws”) are placed inside the screw holes 81. Guide holes are configured in the guide screws 5 that allow the mounting screws to penetrate. Springs 6 are placed at the bottom of the rear mounting holes 11. One end of the springs 6 is connected to the bottom surface of the rear mounting holes 11, and the other end of the springs 6 is connected onto the end surface of the guide screws 5. Locking blocks 82 are placed on the outer surface of the guide bases 8.

[0034] The sum of the length of the first lug 23 and the thickness of the locking block 82 is less

than the depth of the second recessed groove 12, thus forming a first locking groove (not shown in the diagrams). After rotating, the locking block on 82 the guide base 8 can be locked at the end surface of the bottom of the first lug 23. The sum of the length of the second lug 13 and the thickness of the locking block 82 is less than the depth of the first recessed groove 22, thus forming a second locking groove (not shown in the diagrams) between the second lug 13 and the upper end of the first recessed groove 22. After a guide base 8 is sprung outward by a spring 6, rotating the guide base 8 can cause a locking block 82 to lock at the top end surface of a second lug 13 and not retract.

[0035] The first locking groove can also be directly rotary cut inside the rear mounting hole 11 and the second locking groove can also be directly rotary cut inside the front mounting hole 21.

[0036] The lock core device can also be configured as a bidirectional transmission lock core device.

[0037] During installation of the door lock, the actuator is placed into the lock location hole that was drilled in advance in the door, and rotating of the guide screw 5 moves the guide base 8 away from the first locking groove. At this time the guide base 8 extends outward with the action of the spring 6. Should the distance still be insufficient, then the guide screw 5 can be rotated to cause it to gradually extend out of the guide base 8. At this time the installer can conveniently cause the mounting screw to penetrate through the guide hole 51 and screw onto and be mounted in the threaded hole 7.

[0038] Figure 5 illustrates a lock actuator 500 in one embodiment of the invention. Actuator 500 is similar to the lock actuator in Figures 1 to 4 except for the following.

[0039] Drive rail 3 now has teeth recessed into the body of rod instead of teeth that extend from the body of the rod.

[0040] A set screw 9 is provided to temporarily hold actuator 500 in the mounting hole. Threaded holes 91 and 92 are provided in front lock body frame 2 and rear lock body frame 1, respectively, to receive set screw 9. Holes 91 and 92 are aligned and angled so set screw 9 can be extended from front lock body frame 2 to temporarily pin actuator 500 against the sidewalls of the mounting hole.

[0041] The bottom surface of each rear mounting hole 11 now has a circular projection 71 that receives and secures spring 6. Circular projection 71 defines the threaded hole 7 for receiving the mounting screw that secures lock actuator 500 to the door or window.

[0042] Referring to Figure 6, the sidewall of each front mounting hole 21 now defines a recessed groove 22A opposite the recessed groove 22. Recessed groove 22A may partially penetrate the top surface of front lock body frame 2. Around each front mounting hole 21, front lock body frame 2 now includes a lug 22A opposite the lug 22.

[0043] Referring back to Figure 5, the sidewall of each rear mounting hole 11 now defines a recessed groove 12A opposite the recessed groove 12. Recessed groove 12A may partially penetrate the top surface of rear lock body frame 1. Around each rear mounting hole 11, rear lock body frame 1 now includes a lug 13A opposite the lug 13. The exterior surface of each guide base 8 now includes a locking block 82A opposite the locking block 82.

[0044] As described above, when front lock body frame 2 and rear lock body frame 1 are assembled, lug 23 inserts into recessed groove 12 and lug 13 inserts into recessed groove 22 to form the first and the second locking grooves for receiving locking block 82. Similarly, lug 23A inserts into recessed groove 12A and lug 13A inserts into recessed groove 22A to form additional first and second locking grooves for receiving locking block 82A. Referring to Figure 7, an additional first locking groove 120 is formed between lug 23A and the interior end of the recessed groove 12A, and an additional second locking groove 220 is formed between lug 13A and the interior end of recessed groove 22A.

[0045] Initially guide base 8 is locked in a retracted position when locking blocks 82 and 82A are in their first locking grooves and abutting lugs 23 and 23A, respectively. Turning guide base 8, locking blocks 82 and 82A slide past lugs 23 and 23A in the first locking grooves. This allows spring 6 to push screw guide 5 and guide base 8 outward from front lock body frame 2. After being extended, further turning guide base 8 locks it in an extended position when locking blocks 82 and 82A slide into the second locking grooves and abut lugs 13 and 13A, respectively. Screw guide 5 can be further rotated to unscrew it from guide base 8 for additional extension of the assembly.

[0046] When guide base 8 and screw guide 5 are extended, they push against one sidewall of the hole in which actuator 500 is placed in and hold actuator 500 steady against the opposing sidewall of the hole. This prevents actuator 500 from tilting or otherwise moving when a mounting screw is tightened to secure actuator 500 to the door or window. When guide base 8 and screw guide 5 are extended, they also makes it easier to insert the mounting screw into actuator 500.

[0047] Fig. 8 illustrates a bidirectional door and window lock actuator in one embodiment of the invention. The bidirectional lock actuator includes housings 10 and 20, a drive gear 4, a first drive rail 30, second drive rail 40, and transmission gear 4. First drive rail 30 is configured as a unit with a first rack 31, and second drive rail 40 is configured as a unit with a second rack 41. First rack 30 and second rack 40 are placed in parallel beneath drive gear 4 so the teeth of drive gear 4 intermesh with the teeth of first rack 31. A commutating transmission gear 4A is placed between drive gear 4 and second rack 41. The teeth of commutating transmission gear 4A intermesh with, respectively, the teeth of second rack 41 and the teeth of drive gear 4. A mounting boss 110 is formed on the inside housing 10, and a transmission gear mounting piece 60 is fixed onto mounting boss 110. One end of the center axis of commutating transmission gear 4A is inserted into a hole 150 on housing 10, and the other end of the center axle of commutating transmission gear 4A is inserted into transmission gear mounting piece 60. Transmission gear mounting piece 6 is fixed by two rivets onto mounting boss 11.

[0048] Fig. 9 illustrates a bidirectional lock actuator in one embodiment of the invention. Essentially this lock actuator is lock actuator 500 in Fig. 5 with a bidirectional locking mechanism. Specifically, drive rail 3 is replaced by an upper drive rail 40A, a lower drive rail 30A below upper drive rail 40A, and an intermediate gear 4A that sits between drive rails 40A and 30A. Upper drive rail 40A includes a rack 41A that has recessed teeth that protrude to the bottom side of the drive rail. The teeth of drive gear 4 engage the teeth of rack 41A from above, and intermediate gear 4A engages the teeth of rack 41A from below. The teeth of intermediate gear 4A also engage rack 31A on lower drive rail 30 from above. When drive gear 4 rotates, it translates drive rails 40A and 30A in opposite directions.

[0049] Various other adaptations and combinations of features of the embodiments disclosed are

within the scope of the invention. Numerous embodiments are encompassed by the following claims.

## CLAIMS

Claim 1: A lock actuator, comprising:

a front lock body frame and a rear lock body defining mounting holes;

a lock mechanism between the front and the rear lock body frames; and

a mounting hole guide in the mounting holes, the mounting hole guide being extendible from the front lock body frame to hold the actuator against sidewalls of a mounting hole.

Claim 2: The actuator of claim 1, wherein:

the mounting holes define portions of a first locking groove and a second locking groove; and

the mounting hole guide comprises:

a guide base defining a threaded hole, the guide base comprising an outer surface with a locking block, the locking block engaging the first locking groove when the guide base is in a retracted position, the locking block engaging the second locking groove when the guide base is in an extended position;

a guide screw received in the threaded holes, the guide screw defining a guide hole for receiving a mounting screw; and

a spring having a first end against a bottom surface of one of the mounting holes, and a second end against an end surface of the guide screw.

Claim 3: The actuator of claim 2, wherein the mounting holes comprises a front mounting hole on the front lock body frame and a rear mounting hole on the rear lock body frame, the front mounting hole being a through-hole, the rear mounting holes being a sunken hole, the rear mounting hole having the bottom surface defining a mounting threaded hole for receiving the mounting screw.

Claim 4: The actuator of claim 3, wherein:

the front mounting hole has an inner surface with a first recessed groove;

the rear mounting hole has an inner surface with a second recessed groove;

the front lock body frame further comprises a first lug inserted into the second recessed groove to define the first locking groove, a sum of a length of the first lug and a thickness of the locking block being less than a depth of the second recessed groove; and

the rear lock body frame further comprises a second lug inserted into the first recessed groove to define the second locking groove, a sum of a length of the second lug and the thickness of the locking block being less than a depth of the first recessed groove.

Claim 5: The actuator of claim 1, wherein:

the mounting holes define portions of first locking grooves and second locking grooves;  
and

the mounting hole guide comprises:

a guide base defining a threaded hole, the guide base comprising an outer surface with two opposing locking blocks, each locking block engaging a corresponding first locking groove when the guide base is in a retracted position, each locking block engaging a corresponding second locking groove when the guide base is in an extended position;

a guide screw received in the threaded holes, the guide screw defining a guide hole for receiving a mounting screw; and

a spring having a first end against a bottom surface of one of the mounting holes, and a second end against an end surface of the guide screw.

Claim 6: The actuator of claim 5, wherein the mounting holes comprises a front mounting hole on the front lock body frame and a rear mounting hole on the rear lock body frame, the front mounting hole being a through-hole, the rear mounting holes being a sunken hole, the rear mounting hole having the bottom surface defining a mounting threaded hole for receiving the

mounting screw.

Claim 7: The actuator of claim 6, wherein:

the front mounting hole has an inner surface with first recessed grooves;

the rear mounting hole has an inner surface with second recessed grooves;

the front lock body frame further comprises first lugs inserted into the second recessed grooves to define the first locking grooves; and

the rear lock body frame further comprises second lugs inserted into the first recessed grooves to define the second locking grooves.

Claim 8: The actuator of claim 7, wherein the bottom surface having a circular projection for receiving the spring, the circular projection defining the mounting threaded hole for receiving the mounting screw.

Claim 9: The actuator of claim 1, further comprising a set screw in angled and aligned thread holes formed in the front and the rear lock body frames, wherein the set screw is extended to temporarily hold the actuator against the sidewalls of the mounting hole.

Claim 10: The actuator of claim 1, wherein the lock mechanism is a unidirectional lock.

Claim 11: The actuator of claim 1, wherein the lock mechanism is a bidirectional lock.

Claim 12: The actuator of claim 11, wherein the bidirectional lock comprises:

a first drive rail comprising a first rack;

a drive gear engaging the first rack from above;

a second drive rail comprising a second rack, the second drive rail being located below the first drive rail; and

an intermediate gear mounted between the first and the second drive rails, the intermediate gear engaging the first rack from below and the second racks from above so

the drive gear translates the first and the second drive rails in opposite directions.

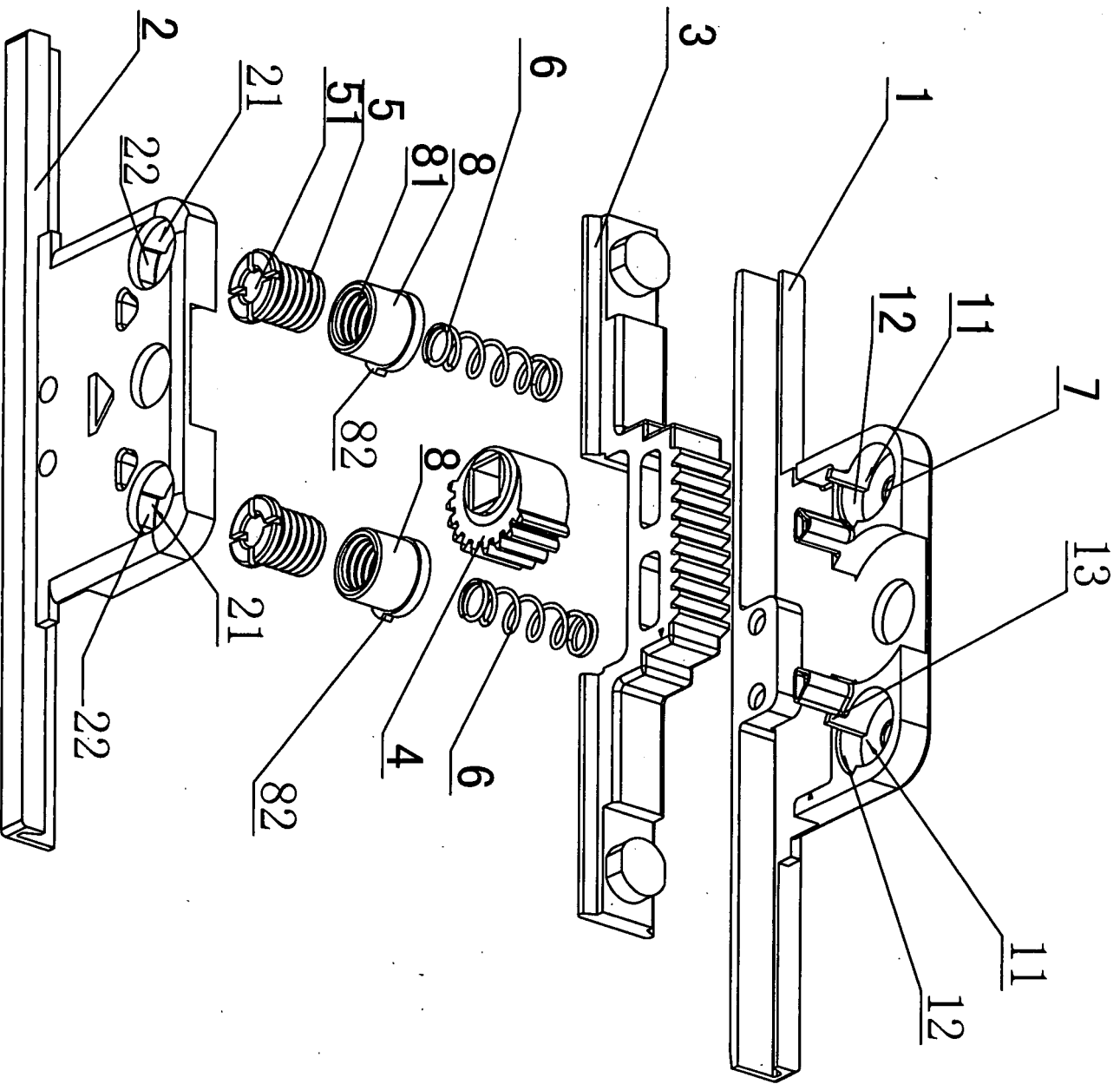
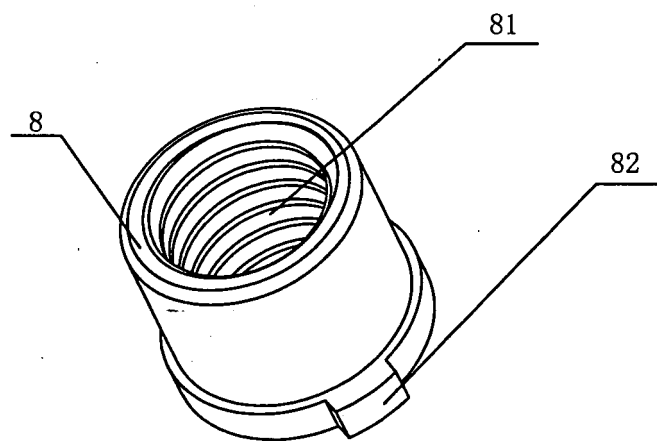
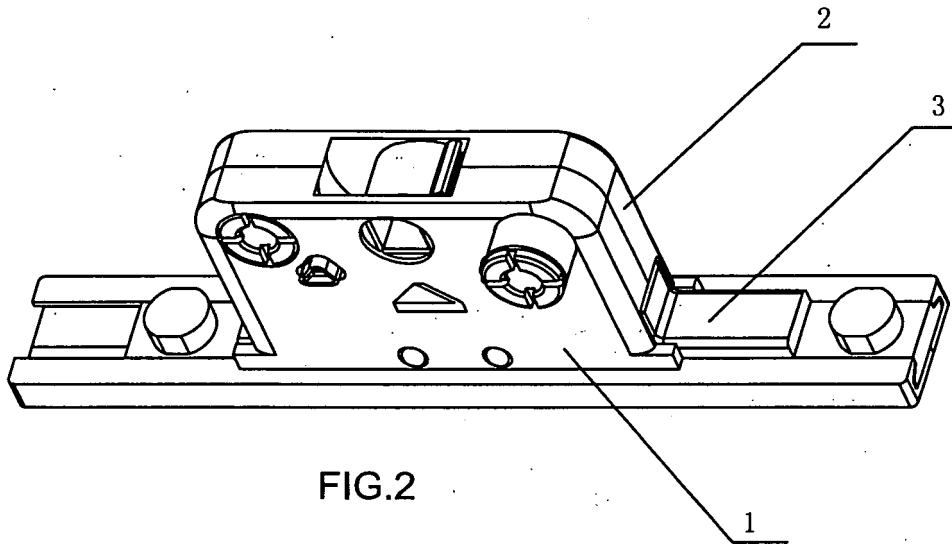


FIG. 1



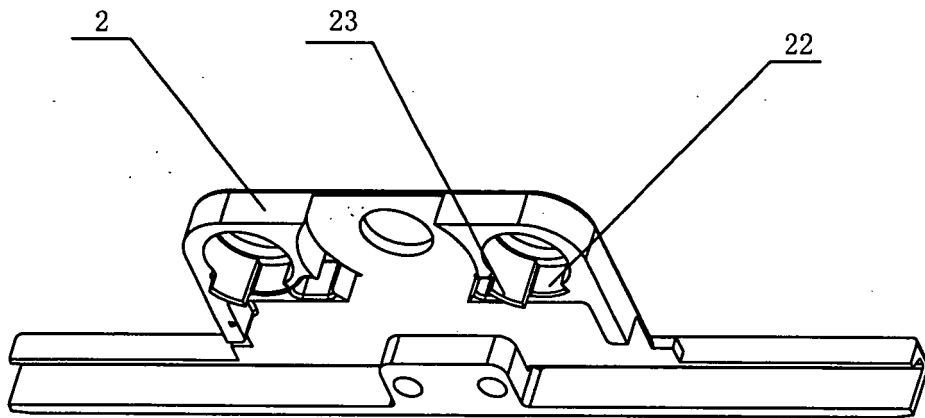


FIG.4

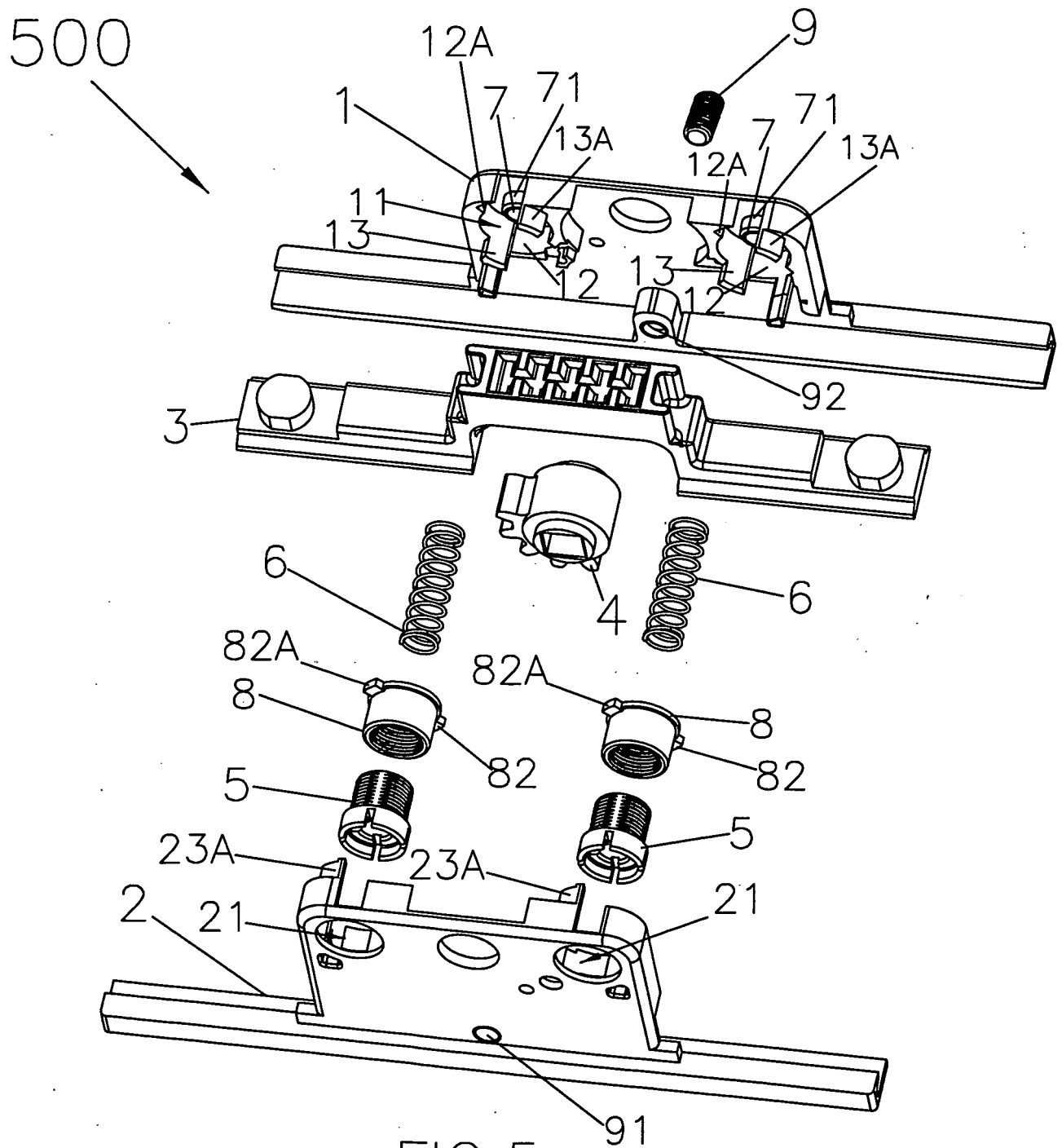


FIG.5

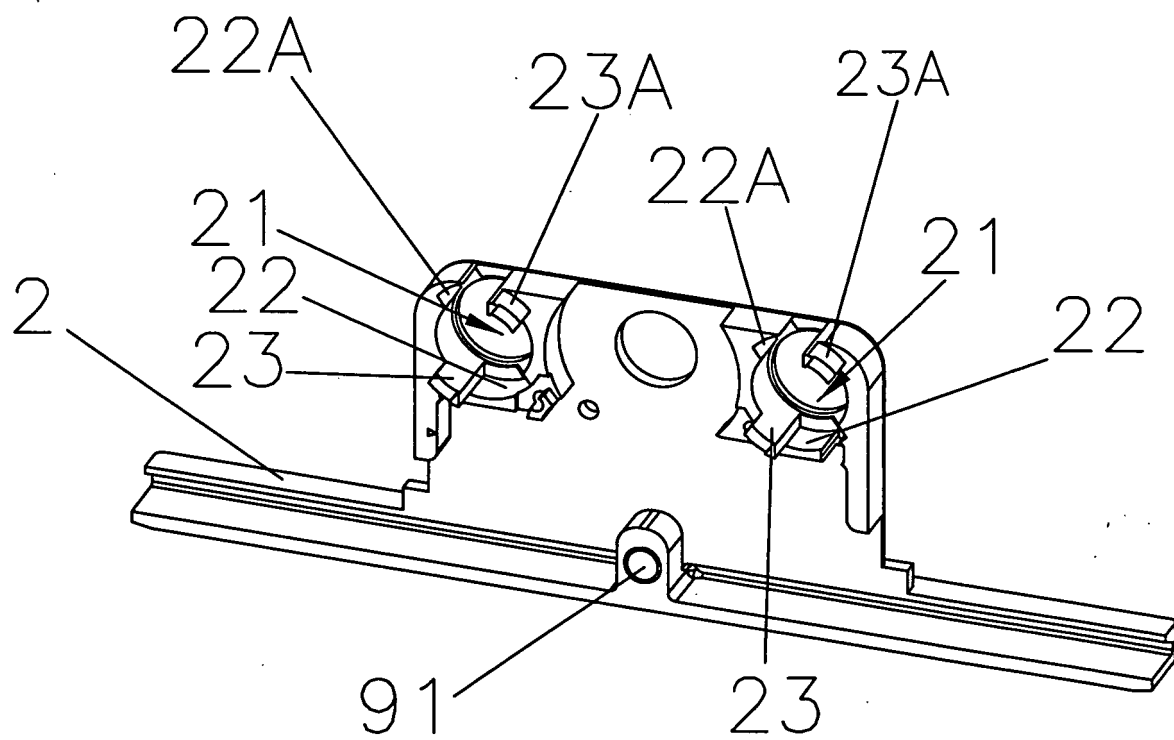


FIG. 6

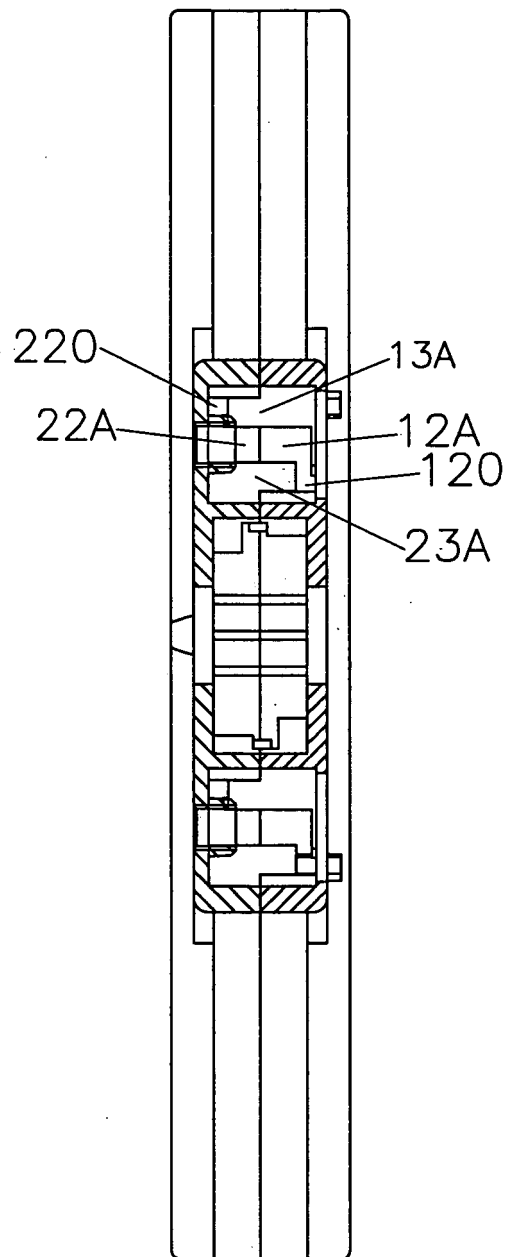


FIG.7

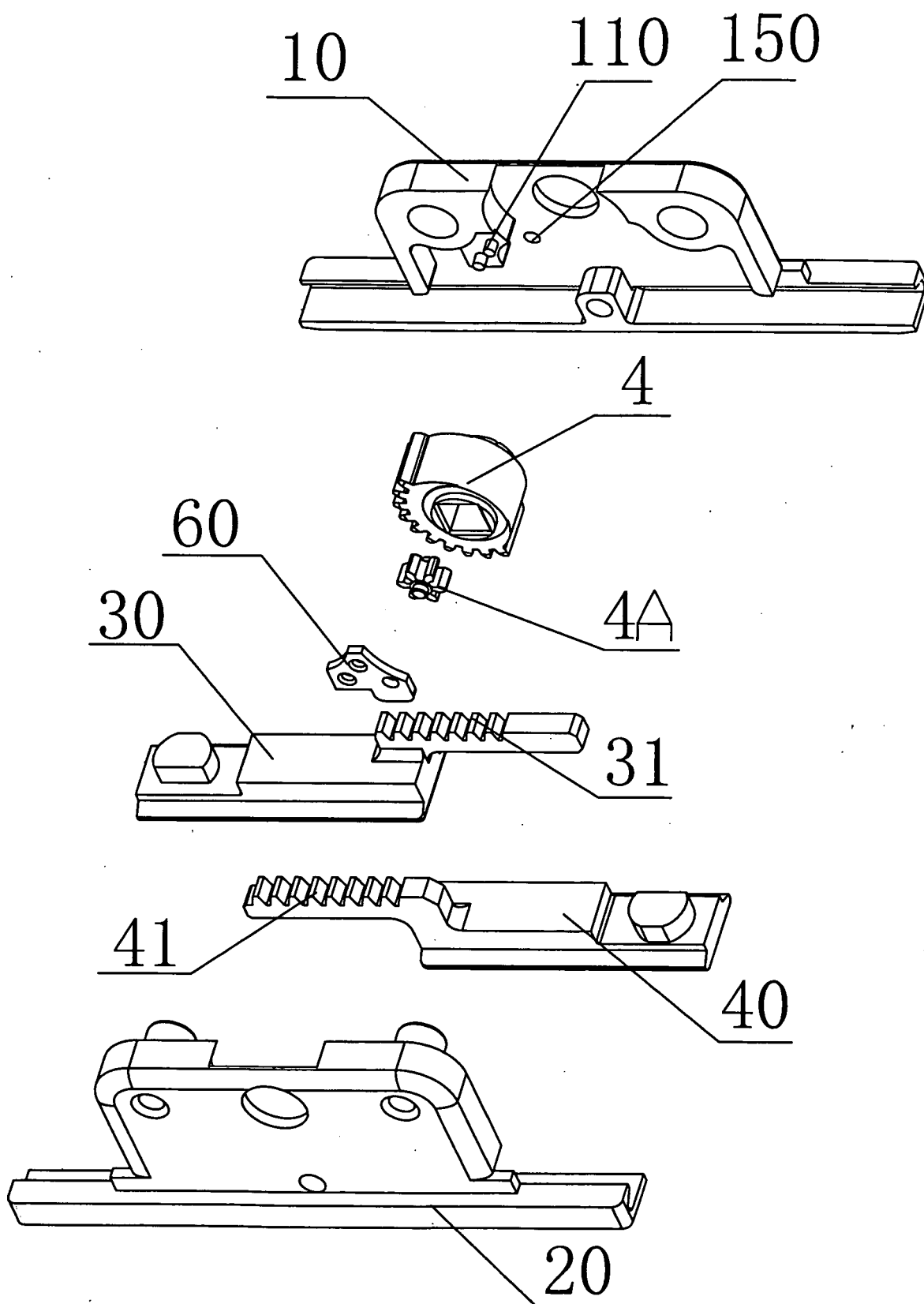


FIG. 8

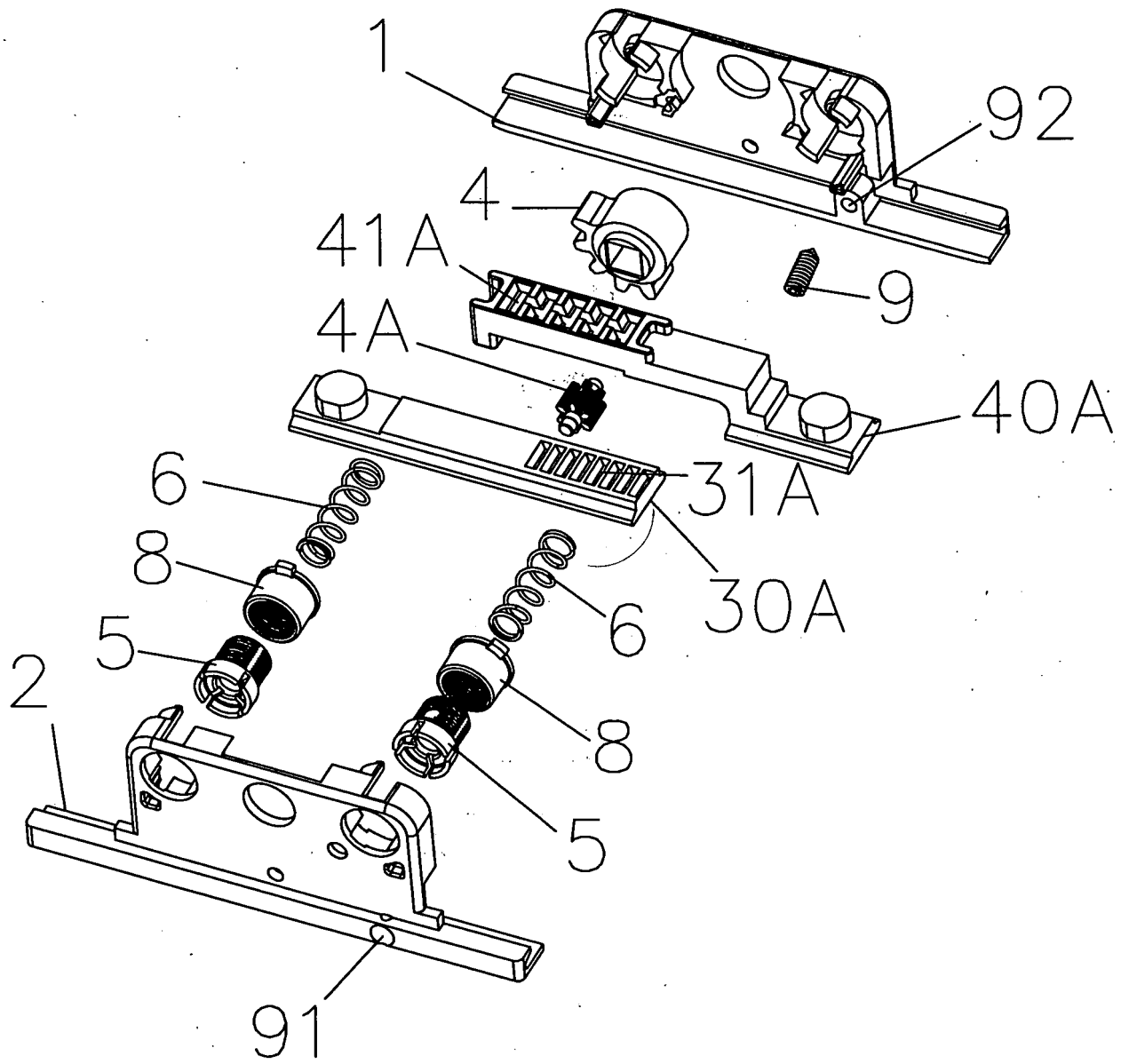


FIG.9