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(54) **ASSIST DEVICE FOR MOVABLE BODY**

(57) A forcible moving mechanism includes a first urging body to apply an urging force toward a drawn-in position to a latch body in a standby position. A striker body is captured at a prescribed position by the latch body held in the standby position, and a movable body is moved up to a position at end of movement by relative movement of the latch body to the drawn-in position by release of the hold on the occasion of the capture. A damping mechanism includes a contact part to contact with the latch body constituting the forcible moving mechanism and a second urging body to urge the contact part in an advancing direction. The damping mechanism is constituted so as to apply a resistance to a retraction of the contact part accompanying the movement of the latch body to the drawn-in position.

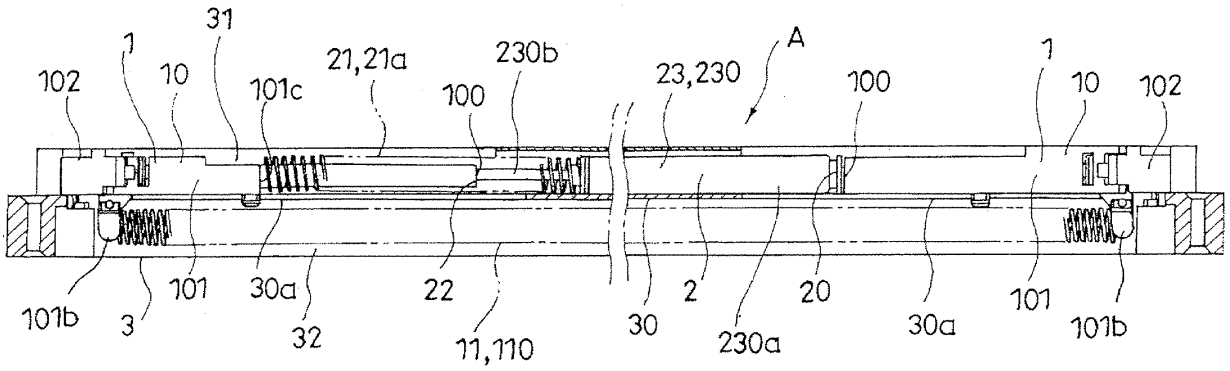


Fig. 5

EP 2 455 571 A1

Description

TECHNOLOGICAL FIELD

[0001] This invention relates to an improvement of an apparatus for forcibly moving various kinds of movable bodies from a prescribed position up to a position at end of movement, and for applying a damping force to this forcible movement.

BACKGROUND TECHNOLOGY

[0002] An example of a movement-assisting and shock-absorbing mechanism (assisting apparatus) of a sliding door using a so-called piston damper is given in Patent Document 1. In this mechanism, contacting bodies, for contacting with contacted bodies provided respectively on the left and right on an upper part of a door frame, are provided respectively on a leading end of a piston rod and a rear end of a cylinder, and a tension coil spring for normally urging in a direction narrowing a space between both contacting bodies is provided. When the sliding door is in a neutral position not being completely closed on the left side or the right side of the door frame, both contacting bodies are held by magnetic force of holding bodies in a state in which the spring is stretched to the limit. When the sliding door is moved from the neutral position to the left side, the contacting body collides with the contacted body at mid-course and is attracted thereto, and holding by the holding body is released. When the holding is released, the contacting body on the left side is relatively moved to the right side by the action of the spring, and the sliding door is forcibly moved to the left side in the amount of this movement. The piston of the piston damper is pushed in at this time, and a damping force based on a fluid resistance inside the piston damper is applied to this movement. When the door having been completely moved to the left side is operated to open, the contacting body attracted to the contacted body is relatively moved to the left side while stretching the spring, and is again attracted to and held by the holding body, and the attraction-capture of the contacted body is released. Movement of the sliding door to the right side thereby becomes free. The same operation is performed via the contacting body, contacted body, and holding body on the right side when the sliding door is moved from the neutral position to the right side.

[0003] However, in this conventional movement-assisting and shock-absorbing mechanism, when the sliding door completely closed on the left side or right side of the door frame is opened, the spring must be stretched and the piston constituting the piston damper must be moved in the direction of drawing out while undergoing fluid resistance inside the piston damper. Although the resistance of the spring is uniform, the fluid resistance becomes greater proportionally to the speed of the piston, that is, of opening of the sliding door, and the conventional movement-assisting and shock-absorbing mechanism therefore ends up functioning so as to impede a smooth opening operation in opening of the sliding door.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0004] Patent Document 1: Patent No. 3984645

OUTLINE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0005] A main problem to be solved by this invention is to ensure that a return operation of a movable body having been forcibly moved to a position at end of movement can be performed as smoothly as possible in this kind of assisting apparatus of a movable body.

MEANS FOR SOLVING THE PROBLEM

[0006] In order to solve the aforementioned problem, in this invention, an assisting apparatus of a movable body is made as an assisting apparatus of a movable body, provided on either one of a support body and a movable body supported to be moving slidably on the support body, and being used for capturing a striker body provided on the other of these bodies when the movable body reaches a prescribed position and forcibly moving the movable body up to a position at end of movement, comprising a forcible moving mechanism and a damping mechanism.

The forcible moving mechanism includes a latch body supported to move slidably between a standby position and a drawn-in position on an apparatus base body, and a first urging body for applying an urging force toward the drawn-in position to the latch body in the standby position, and is configured so that the striker body is captured at the prescribed position by the latch body held in the standby position, the movable body is moved up to the position at end of movement by movement or relative movement of the latch body to the drawn-in position by release of the hold on the occasion of the capture, and the latch body releases the striker body at the prescribed position and is held again in the standby position during return movement of the movable body.

The damping mechanism includes a contact part for contacting with the latch body constituting the forcible moving mechanism, constituted so as to apply a resistance to a retraction of the contact part accompanying the movement of the latch body to the drawn-in position, and includes a second urging body for urging the contact part in an advancing direction.

[0007] When the movable body is forcibly moved from the prescribed position toward the position at end of movement, the latch body having captured the striker body is relatively moved to the drawn-in position by the

urging of the first urging body whereby the contact part is retracted, and the fluid resistance of the damping mechanism is applied as a damping force to the forcible movement of the movable body. At this time, the second urging body urges the contact part in the advancing direction to the extent that the contact part is retracted, and the urging force of the second urging body also is applied as a damping force on the forcible movement of the movable body. Accordingly, although the movable body at the position at end of movement must be moved to return with a force sufficient to bring about force accumulation in the first urging body, during the return movement of the movable body, the contact part is advanced by the urging of the second urging body in the amount that the latch body moved toward the standby position, and the fluid resistance of the damping mechanism is therefore not applied to the return operation of the movable body.

[0008] Two forcible moving mechanisms may be provided, and the two forcible moving mechanisms may be arranged so that rear end sides of the latch bodies are brought to face opposite each other;
the damping mechanism may be interposed between the rear ends of the latch bodies of the two forcible moving mechanisms, so that the contact part contacts the rear end of the latch body of one forcible moving mechanism and an opposite part opposite the contact part contacts or connects to the rear end of the latch body of the other forcible moving mechanism; and
a fluid resistance of the damping mechanism may be applied to a retraction or relative retraction of the contact part narrowing a space between the contact part and the opposite part.

[0009] In such case, a damping force can be applied through the fluid resistance to the forcible movement by the urging of the first urging body ahead from the prescribed position, both when the movable body is moved to slide to the one side and when the movable body is moved to slide to the opposite other side.

[0010] A resistance-producing body in the damping mechanism may be a damper in which a fluid resistance of a fluid inside a cylinder is applied to a retraction or relative retraction of a piston, and the contact part may be formed on a projecting end part of a piston rod in the damper or on an outer end part of the cylinder opposite the projecting side of the piston rod.

[0011] In this case, the second urging body may be interposed between an inner depth part of the cylinder and the piston inside the cylinder, or between the cylinder and the latch body connected to the projecting end part of the piston rod outside the cylinder.

[0012] In such case, the piston is moved accompanying the movement to the drawn-in position of the latch body constituting the forcible moving mechanism after capturing the striker body, whereby the damping force of the damper can be applied to this movement as well as to the movement of the movable body.

[0013] Also, in the case when the second urging body is interposed in the aforementioned manner, during the return movement of the movable body, the piston can be returned to the position before retraction by such second urging body, and the contact part of the damping mechanism can again contact or approach the rear end of the latch body being held again in the standby position.

[0014] The same kind of function as mentioned above can be exhibited even in the case when a resistance-producing body in the damping mechanism is a damper in which a fluid resistance of a fluid inside a stator is applied to rotation or relative rotation of a rotor

EFFECT OF THE INVENTION

[0015] With the assisting apparatus of a movable body according to this invention, in forward movement of the movable body, the movable body can be forcibly moved from a prescribed position and a damping force can be applied to this movement, and in return operation of the movable body from a position at end of movement, this return movement can be performed as smoothly as possible without action of the damping mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a front view of a structural diagram illustrating a state in which a sliding door (movable body) equipped with an assisting apparatus is in a neutral position.
FIG. 2 is a front view of the structural diagram illustrating a state in which the sliding door (movable body) equipped with the assisting apparatus has been completely moved from the state in FIG. 1 to a position at the end of movement on the right side.
FIG. 3 is a front view of the structural diagram illustrating a state in which the sliding door (movable body) equipped with the assisting apparatus has been completely moved from the state in FIG. 1 to a position at the end of movement on the left side.
FIG. 4 is a perspective view of the structural diagram of the assisting apparatus.
FIG. 5 is a vertical cross-sectional view of the structural diagram of the assisting apparatus, and the left and right latch bodies both are in the standby positions.
FIG. 6 is a partially cutaway plan view of the structural diagram of the assisting apparatus, and the left and right latch bodies both are in the standby positions.
FIG. 7 is a partially cutaway perspective view of the structural diagram of the latch body.
FIG. 8 is a perspective view of the structural diagram of the striker body and the latch body.
FIG. 9 is a perspective view of the structural diagram of the essential parts on the left end of the apparatus base body.
FIG. 10 is a horizontal cross-sectional view of the structural diagram of the left end of the assisting ap-

paratus, and the latch body is in the standby position.

FIG. 11 is a horizontal cross-sectional view of the structural diagram of the left end of the assisting apparatus, and the latch body is in the course of relative movement toward the drawn-in position.

FIG. 12 is a partially cutaway perspective view of the structural diagram of an example having a partial change in the constitution of the assisting apparatus illustrated in FIGS. 1 to 11.

EMBODIMENTS OF THE INVENTION

[0017] Typical embodiments of this invention are described below based on FIGS. 1 to 12. An assisting apparatus A of a movable body M according to this embodiment is used for forcibly moving various kinds of movable bodies M from a prescribed position up to a position at end of movement, and for applying a damping force to this forcible movement. That is, such assisting apparatus A includes a forcible moving mechanism 1 and a damping mechanism 2. Also, such assisting apparatus A is provided and used on the side of such movable body M or on the side of a support body F for supporting the movable body M to move slidably. A striker body S is provided on the side where the assisting apparatus A is not provided, between the movable body M and the support body F.

[0018] In the illustrated example, the assisting apparatus A is constituted with a forcible moving mechanism 1 and a damping mechanism 2 housed in an apparatus base body 3 having a long and slender case form and an open upper face. The long direction of the apparatus base body 3 coincides with a direction x of sliding movement of the movable body M. In this embodiment, an example is given in which the movement of a sliding door Ma as the movable body M is assisted by the assisting apparatus A. In the illustrated example, the assisting apparatus A is provided on an upper end part of the sliding door Ma as the movable body M. Also, the striker body S is provided inside an upper sliding door groove Fb of a door frame Fa as the support body F for supporting the upper end part of the sliding door Ma.

[0019] The forcible moving mechanism 1 includes a latch body 10 supported movably slidably between a standby position and a drawn-in position on the apparatus base body 3, and a first urging body 11 for applying an urging force toward the drawn-in position to the latch body 10 in the standby position. Also, the striker body S is captured at the prescribed position by the latch body 10 held in the standby position, and the movable body M is moved up to the position at end of movement by relative movement by the first urging body 11 of the latch body 10 to the drawn-in position by release of the hold on the occasion of the capture. In addition, the latch body 10 releases the striker body S at the prescribed position and is held again in the standby position during return movement of the movable body M.

[0020] In this embodiment, a groove Mb is formed on the upper end part of the sliding door Ma as the movable body M, spanning the length of the upper end part, and the apparatus base body 3 is received at a position roughly in the middle of the long direction of the groove Mb, whereby the assisting apparatus A is disposed at a position roughly in the middle of the left-to-right direction of the sliding door Ma.

[0021] Also, in this embodiment, the assisting apparatus A is constituted with two forcible moving mechanisms 1 and 1 and one damping mechanism 2. The damping mechanism 2 is arranged between the two forcible moving mechanisms 1 and 1, in the illustrated example, left and right forcible moving mechanisms 1 and 1. Meanwhile, striker bodies S are provided one each respectively on both sides surrounding the position roughly in the middle of the left-to-right direction of the door frame Fa inside the upper sliding door groove Fb. The dimension in the left-to-right direction of the door frame Fa is a dimension in an amount of about two times that of the sliding door Ma. The sliding door Ma is positioned between the left and right striker bodies S, and the latch bodies 10 of the left and right forcible moving mechanisms 1 both are held in the standby positions, in a state in which equal spaces are opened between the right end of the sliding door and a doorstop Fc on the right side of the door frame Fa and between the left end of the sliding door Ma and a doorstop Fc on the left side of the door frame Fa (a state in which the sliding door Ma is in a neutral position) (FIG. 1). The striker body S enters inside the assisting apparatus A through the groove Mb and comes out from the sliding door Ma through the groove Mb by movement of the sliding door Ma.

[0022] The latch body 10 of the forcible moving mechanism 1 on the right side is held on the right end of the apparatus base body 3 in the standby position, captures the striker body S on the right side at the prescribed position during movement of the sliding door Ma to the right side, and is relatively moved to the drawn-in position on this occasion, whereby the sliding door Ma is forcibly moved to the right side up to the position at end of movement where the right end of the sliding door Ma is caused to collide with the doorstop Fc on the right side of the door frame Fa (FIG. 1 to FIG. 2). When the sliding door Ma is moved to return, that is, to the left side from this position at end of movement on the right side, the latch body 10 of the forcible moving mechanism 1 on the right side is relatively moved toward the standby position while causing force to accumulate in the first urging body 11, releases the striker body S on the right side at the prescribed position, and is held again on the right end of the apparatus base body 3. During this time, the latch body 10 of the forcible moving mechanism 1 on the left side continues to be held on the left end of the apparatus base body 3 in the standby position.

[0023] Also, the latch body 10 of the forcible moving mechanism 1 on the left side is held on the left end of the apparatus base body 3 in the standby position, captures the striker body S on the left side at the prescribed position during movement of the sliding door Ma to the

left side, and is relatively moved to the drawn-in position on this occasion, whereby the sliding door Ma is forcibly moved to the left side up to the position at end of movement where the left end of the sliding door Ma is caused to collide with the doorstop Fc on the left side of the door frame Fa (FIG. 1 to FIG. 3). When the sliding door Ma is moved to return, that is, to the right side from this position at end of movement on the left side, the latch body 10 of the forcible moving mechanism 1 on the left side is relatively moved toward the standby position while causing force to accumulate in the first urging body 11, releases the striker body S on the left side at the prescribed position, and is held again on the left end of the apparatus base body 3. During this time, the latch body 10 of the forcible moving mechanism 1 on the right side continues to be held on the right end of the apparatus base body 3 in the standby position.

[0024] Meanwhile, the damping mechanism 2 includes a contact part 20 for contacting with the latch body 10 constituting the forcible moving mechanism 1, and is constituted so as to apply a resistance to a retraction of the contact part 20 accompanying the movement of the latch body 10 to the drawn-in position. In addition, the damping mechanism 2 includes a second urging body 21 for urging the contact part 20 in an advancing direction.

[0025] In this embodiment, the damping mechanism 2 is interposed between the rear ends 100 of the latch bodies 10 of the two forcible moving mechanisms 1 and 1, so that the contact part 20 contacts the rear end 100 of the latch body 10 of one forcible moving mechanism 1, in the illustrated example, the latch body 10 of the forcible moving mechanism 1 on the right side, and an opposite part 22 opposite the contact part 20 is connected to the rear end 100 of the latch body 10 of the other forcible moving mechanism 1, in the illustrated example, the latch body 10 of the forcible moving mechanism 1 on the left side. Also, a fluid resistance of the damping mechanism 2 is applied to a retraction or relative retraction of the contact part 20 narrowing a space between the contact part 20 and the opposite part 22. Here, relative retraction means that the contact part 20 does not move but the opposite part 22 moves in a direction approaching the contact part 20.

[0026] By this, in this embodiment, a damping force can be applied through the fluid resistance to the forcible movement by the urging of the first urging body 11 ahead from the prescribed position, both when the sliding door Ma as the movable body M is moved to slide to the one side and when the sliding door is moved to slide to the opposite other side.

[0027] When the movable body M is forcibly moved from the prescribed position up to the position at end of movement, the latch body 10 having captured the striker body S is relatively moved to the drawn-in position by the urging of the first urging body 11 whereby the contact part 20 is retracted, and the fluid resistance of the damping mechanism 2 is therefore applied as a damping force to the forcible movement of the movable body M. At this time, the second urging body 21 urges the contact part 20 in the advancing direction to the extent that the contact part 20 is retracted, and the urging force of the second urging body 21 also is applied as a damping force on the forcible movement of the movable body M. Accordingly, the movable body M at the position at end of movement must be moved to return with a force sufficient to bring about force accumulation in the first urging body 11. In the illustrated example, the sliding door Ma having the right side or left side abutted to the doorstop Fc on the right side or left side cannot be opened unless a force sufficient to bring about force accumulation in the first urging body 11 is applied. In this embodiment, the contact part 20 is advanced by the urging of the second urging body 21 in the amount that the latch body 10 moved toward the standby position during the return movement of the movable body M, and the fluid resistance of the damping mechanism 2 is therefore not applied to the return operation of the movable body M when the contact part 20 is caused to advance.

[0028] In the case when the assisting apparatus A is provided on the side of the door frame Fa as the support body F differently from the illustrated example, the striker bodies S come to be provided on the left and right of the upper end part of the sliding door Ma as the movable body M. Also, in this case, when the sliding door Ma is completely closed on the right side, the latch body 10 on the left side of the assisting apparatus A captures the striker body S on the left side of the sliding door Ma at the prescribed position, and the sliding door Ma is forcibly moved to the right side by the urged movement of the latch body 10 to the right side by the first urging body 11. Also, when the sliding door Ma is completely closed on the left side, the latch body 10 on the right side of the assisting apparatus A captures the striker body S on the right side of the sliding door Ma at the prescribed position, and the sliding door Ma is forcibly moved to the left side by the urged movement of the latch body 10 to the left side by the first urging body 11.

[0029] In the illustrated example, the latch body 10 constituting the forcible moving mechanism 1 includes a latch base 101, a catcher 102, and a plunger 103. Each constituent element is substantially identical between the latch body 10 of the forcible moving mechanism 1 on the right side and the latch body 10 of the forcible moving mechanism 1 on the left side. Therefore, in FIGS. 7, 8, 10, and 11, only the latch body 10 on the left side is represented, and illustration of the latch body 10 on the right side is omitted.

[0030] In the illustrated example, the apparatus base body 3 is partitioned by a dividing part 30 formed at a position roughly in the middle of the vertical direction into an upper chamber 31 having the dividing part 30 as a bottom face and a lower chamber 32 having the dividing part 30 as a top surface. Both ends respectively on the left and right of the upper chamber 31 are opened outward. The striker body S thereby enters inside the upper chamber 31 at the prescribed position through the groove

Mb formed on the upper end part of the sliding door Ma, and is captured by the latch body 10 in the standby position, specifically, by the catcher 102 thereof. The latch base 101 has a width to fit with little gap between a pair of side walls 33 and 33 (side walls 33 in a direction orthogonal to the direction of sliding movement of the latch body 10) forming the upper chamber 31 of the apparatus base body 3. Also, a side to the front from a position roughly in the middle of the length direction of the latch base 101 (the side positioned on the right end of the apparatus base body 3 in the case of the latch body 10 of the forcible moving mechanism 1 on the right side, and the side positioned on the left end of the apparatus base body 3 in the case of the latch body 10 of the forcible moving mechanism 1 on the left side) serves as an incorporating part 101a for the catcher 102 and the plunger 103.

[0031] A split groove 30a following a center line y of movement of the latch body 10 is formed on the dividing part 30. Meanwhile, an attachment part 101b for inserting inside the lower chamber 32 through the split groove 30a is provided on the latch base 101. In the illustrated example, the attachment part 101b of the latch base 101 constituting the latch body 10 of the forcible moving mechanism on the right side, and the attachment part 101b of the latch base 101 constituting the latch body 10 of the forcible moving mechanism on the left side are linked by a tension coil spring 110 housed inside the lower chamber 32 (FIG. 5). By this tension coil spring 110, the latch body 10 of the forcible moving mechanism 1 on the right side is relatively moved in a direction approaching the latch body 10 of the forcible moving mechanism 1 on the left side when the hold is released on the occasion of capturing the striker body S, and the latch body 10 of the forcible moving mechanism 1 on the left side is relatively moved in a direction approaching the latch body 10 of the forcible moving mechanism 1 on the right side when the hold is released on the occasion of capturing the striker body S. That is, in the illustrated example, such tension coil spring 110 functions as the first urging body 11.

[0032] Also, in the illustrated example, the catcher 102 is constituted by a pair of holding pieces 102a and 102a combined rotatably on the front end of the latch base 101. Each of the pair of holding pieces 102a and 102a is constituted to have a plate form long in the direction of sliding movement of the latch body 10, that is, in the direction x of sliding movement of the movable body M, and is combined rotatably on the front end of the latch base 101 by a vertical shaft 102b at a position roughly in the middle of the length direction.

[0033] Meanwhile, the plunger 103 is supported on the incorporating part 101a to be capable of reciprocal movement between the pair of holding pieces 102a and 102a. The plunger 103 includes engaging parts 103a between front and rear ends thereof, corresponding to engaged parts 102c formed in places positioned rearward from the center of rotation on the pair of holding pieces 102a and 102a. Also, such plunger 103 is normally subject to a forward urging force by a compression coil spring 104 housed in the incorporating part 101a. Also, a place (front end 103b) positioned forward from the engaging parts 103a on such plunger 103 is normally positioned between the front end parts of the pair of holding pieces 102a and 102a (FIGS. 10 and 11) .

[0034] Window holes 34 into which the front end parts of the pair of holding pieces 102a and 102a are received are formed respectively on both side walls 33 and 33 of the upper chamber 31 respectively on both end parts on the left and right of the apparatus base body 3. In addition, the split groove 30a is widened respectively on both ends parts on the left and right of the apparatus base body 3, and catch-coupling parts 30c in a direction orthogonal to the direction of sliding movement of the latch body 10 are formed from this wide part 34b respectively on both sides surrounding the center line y of movement of the latch body 10.

[0035] Also, in the illustrated example, in the state when the latch body 10 is in the standby position, the engaged parts 102c are pressed from the rear by the engaging parts 103a of the plunger 103 normally being urged as previously mentioned, the front end parts of the pair of holding pieces 102a and 102a constituting the catcher 102 are received in the window holes 34 and the space between the pair of holding pieces 102a and 102a is widened while going toward the front ends, and the pair of holding pieces 102a and 102a is held in a posture in which the space between is narrowed while going toward the rear ends (FIG. 11). Also, in this state, the catch-coupled parts 102e formed on the front ends of the pair of holding pieces 102a and 102a are positioned to the front of the catch-coupling parts 30c and are caught thereon by the urging of the first urging body 11. The state in which the latch body 10 is in the standby position is thereby held.

[0036] Also, when the sliding door Ma as the movable body M is moved up to the prescribed position from the state in which the latch body 10 is thus in the standby position, in other words, when the sliding door Ma is moved to the right side and the striker body S placed on the right side of the assisting apparatus A is captured by the latch body 10 held in the standby position on the right side, or when the sliding door Ma is moved to the left side and the striker body S placed on the left side of the assisting apparatus A is captured by the latch body 10 held in the standby position on the left side, the plate-form striker body S, being formed so that the plate face is arranged following the direction of movement of the movable body M, enters between the pair of holding pieces 102a and 102a constituting the catcher 102, and presses the front end 103b of the plunger 103. Also, the plunger 103 retracts by this pressing while causing force to accumulate in the compression coil spring 104, the rear end sides of the pair of holding pieces 102a and 102a are pressed by the contact part 20 of the plunger 103 thus retracted, and the pair of holding pieces 102a and 102a

is rotated in a direction closing the front end sides between both holding pieces 102a and 102a (FIG. 10 to FIG. 11). In the illustrated example, hook parts 102d are formed on the insides of the front ends of the pair of holding pieces 102a and 102a, and hole parts Sa into which the hook parts 102d enter and are caught are formed on the striker body S, so that the hook parts 102d of the holding pieces 102a are catch-coupled in the hole parts Sa of the striker body S having entered between the front end sides of the pair of holding pieces 102a and 102a when the front end sides of the pair of holding pieces 102a and 102a are closed. The striker body S is thereby captured by the latch body 10 in the prescribed position.

[0037] In the illustrated example, when the striker body S is thus captured by the latch body 10, the catch-coupled parts 102e formed on the front ends of the pair of holding pieces 102a and 102a respectively are moved on the center line y of movement of the latch body 10, and the catch-coupled parts 102e reach the position entering into the split groove 30a (FIG. 11). The catch-coupling between the catch-coupling parts 30c and the catch-coupled parts 102e is thereby released, in other words, the hold of the latch body 10 in the standby position is released. When the catch-coupled parts 102e reach the position entering into the split groove 30a, the latch body 10 is relatively moved up to the drawn-in position by the urging of the first urging body 11, and the pair of holding pieces 102a and 102a is held between the side walls 33 of the upper chamber 31 of the apparatus base body 3 and is held in a state in which the front end sides are closed. The pair of holding pieces 102a and 102a is such that the sliding door Ma is moved forward until reaching the position at end of movement in the amount of this movement.

[0038] When the sliding door Ma having reached the position at end of movement is moved to return, the latch body 10 having captured the striker body S is relatively moved toward the standby position while causing force to accumulate in the first urging body 11. When the sliding door Ma again reaches the prescribed position by this return movement, the striker body S becomes subject to a force in a direction of coming out from between the pair of holding pieces 102a and 102a, and advance of the plunger 103 is therefore allowed by the urging of the compression coil spring 110. The front end parts of the pair of holding pieces 102a and 102a constituting the catcher 102 are received in the window holes 34 by the advance of the plunger 103 and the front end side is opened, the striker body S is released, the catch-coupled parts 102e are caught again on the catch-coupling parts 30c, and the latch body held in the standby position (FIG. 11 to FIG. 10).

[0039] In the example illustrated in FIGS. 1 to 11, a resistance-producing body 23 in the damping mechanism 2 is a damper 230 in which a fluid resistance of a fluid inside a cylinder 230a is applied to a retraction or relative retraction of a piston not illustrated. Such damper 230 is referred to as "piston damper, or the like." Silicon oil or other viscous fluid is typically used as such fluid, but it doesn't matter even if this is a gas. Such piston is received inside the cylinder 230a so as to move reciprocally on the center line y of movement of the latch body 10. A piston rod 230b is connected to this piston. Also, in this example, an outer end part of the cylinder 230a opposite the projecting side of the piston rod 230b in the damper serves as the contact body 20 for contacting with the rear end 100 of one latch body 10 (the latch body 10 on the right side in FIG. 5) of the two forcible moving mechanisms 1 and 1. Also, in this example, the leading end of the piston rod 230b serves as the opposite part 22 connected to the rear end of the other latch body 10 (the latch body 10 on the left side in FIG. 5) of the two forcible moving mechanisms 1 and 1.

[0040] By this, in this example, the piston is moved accompanying movement of one latch body 10 of the two forcible moving mechanisms 1 and 1 to the drawn-in position after capturing the striker body S, whereby the damping force of such damper 230 is applied to this movement as well as to the movement of the movable body M.

[0041] Also, in this example, the second urging body 21 is interposed between the cylinder 230a and the latch body 10 connected to the projecting end part of the piston rod 230b outside the cylinder 230a. In this example, such second urging body 21 is a compression coil spring 21a with one end of the spring being abutted to an outer end part of the projecting side of the piston rod 230b and the other end of the spring being abutted to a step part 101c formed at a position roughly in the middle of the length direction of the latch base 101 of the latch body 10 positioned on the left side in FIG. 5 with the piston rod 230b being passed through inside.

[0042] By this, in this example, during return movement of the movable body M, the piston is returned to the position prior to retraction by such second urging body 21, and the contact part 20 of the damping mechanism 2 can again contact or approach the rear end 100 of the latch body 10 held again in the standby position.

[0043] The second urging body 21 can also be a compression coil spring arranged between an inner depth part of the cylinder 230a and the piston inside the cylinder 230a differently from the illustrated example.

[0044] In the example illustrated in FIG. 12, a resistance-producing body 23 in the damping mechanism 2 is a damper 231 in which a fluid resistance of a fluid inside a stator 231a is applied to a rotation or relative rotation of a rotor not illustrated. Such damper 231 is referred to as "rotary damper, or the like." In this example, the damping mechanism 2 includes a long and slender first member 24 of which a front end serves as the contact part 20 for contacting with the rear end 100 of one latch body 10 (the latch body 10 on the right side in FIG. 12) of the two forcible moving mechanisms 1 and 1, and a second member 25 of which a front end serves as the opposite part 22 connected to the rear end of the other latch body (the latch body 10 on the left side in FIG. 12) of the two forcible

moving mechanisms 1 and 1. Both members 24 and 25 are housed movably inside the apparatus base body 3 following the center line y of movement of the latch body 10. In this example, a compression coil spring 21a serving as the second urging body 21 is interposed between a rear end 24a of the first member 24 and the rear end 100 of the other latch body 10 of the two forcible moving mechanisms 1 and 1. Also, the stator 231a of the damper 231 is fixed to a rear end of the second member 25 so that the rotating shaft of the rotor is arranged in a direction orthogonal to the center line y of movement and in a horizontal direction. A pinion 231b is provided on the other end of the rotor. Meanwhile, a rack 24b for engaging with a lower end of the pinion 231b is formed between the front end and rear end 24a of the first member 24. When one latch body 10 (the latch body 10 on the right side in FIG. 12) of the two forcible moving mechanisms 1 and 1 is relatively moved to the drawn-in position, the other latch body 10 (the latch body 10 on the left side in FIG. 12) held in the standby position does not move, and the damping force of the damper 231 is therefore applied to the relative movement of this one latch body 10 to the left side in FIG. 12, in other words, to the forward movement of the movable body M to the right side in FIG. 12. When the movable body M at the position at end of movement is moved to return toward the left side in FIG. 12, the latch body 10 is relatively moved to the right side in FIG. 12 while causing force to accumulate in the first urging body 11, and the first member 24 also is moved to the right side in FIG. 12 by the urging force of the second urging body 21 at this time. The same kind of operation, in which the direction is reversed to that of the operation of the latch body 10 on the right side in FIG. 12 above, is performed by the other latch body 10 (the latch body 10 on the left side in FIG. 12) of the two forcible moving mechanisms 1 and 1 during forward movement of the movable body M to the left side in FIG. 12 and during return movement from the position at end of movement.

The entire contents of the specification, claims, drawings, and abstract of Japanese Patent Application No. 2009-168474 filed on July 17, 2009 are incorporated by reference herein as a disclosure of the specification of the present invention.

Claims

1. An assisting apparatus for a movable body adapted to be provided on either one of a support body or the movable body supported movably slidably on the support body, to capture a striker body provided on the other of these bodies when the movable body reaches a prescribed position and to forcibly move the movable body to a position at an end of movement, comprising:

   a forcible moving mechanism and a damping mechanism;

   characterized in that the forcible moving mechanism includes a latch body supported on an apparatus base body movably slidably between a standby position and a drawn-in position, and a first urging body for applying an urging force toward the drawn-in position to the latch body in the standby position, wherein the striker body is captured at said prescribed position by the latch body held in the standby position, the movable body is moved to the position at the end of movement by movement or relative movement of the latch body to the drawn-in position due to releasing of holding upon occasion of the capture, and the latch body releases the striker body at said prescribed position and is held again in the standby position during return movement of the movable body; and

   the damping mechanism includes a contact part to contact the latch body constituting the forcible moving mechanism and a second urging body to urge the contact part in an advancing direction, said damping mechanism being constituted to apply a resistance to a retraction of the contact part accompanying a movement of the latch body to the drawn-in position.

2. An assisting apparatus for a movable body according to claim 1, **characterized in that**:

   two forcible moving mechanisms are arranged to face rear end sides of the latch bodies each other;

   the damping mechanism is interposed between rear ends of the latch bodies of the two forcible moving mechanisms, to contact the contact part to the rear end of the latch body of one forcible moving mechanism, and to contact or connect an opposite part opposite the contact part to the rear end of the latch body of the other forcible moving mechanism; and

   a fluid resistance of the damping mechanism is applied to retraction or relative retraction of the contact part narrowing a space between the contact part and the opposite part.

3. An assisting apparatus of a movable body according to claim 1 or 2, **characterized in that** a resistance-producing body in the damping mechanism is a damper applying the fluid resistance of a fluid inside a cylinder to the retraction or relative retraction of a piston, and the contact part is formed on a projecting end part of a piston rod in the damper or on an outer end part of the cylinder facing a projecting side of the piston rod.

4. An assisting apparatus of a movable body according to claim 3, **characterized in that** the second urging

body is interposed either inside the cylinder between an inner depth part of the cylinder and the piston, or outside the cylinder between the cylinder and the latch body connected to the projecting end part of the piston rod.

5. A assisting apparatus of a movable body according to claim 1 or 2, **characterized in that** a resistance-producing body in the damping mechanism is a damper applying the fluid resistance of a fluid inside a stator to a rotation or a relative rotation of a rotor.

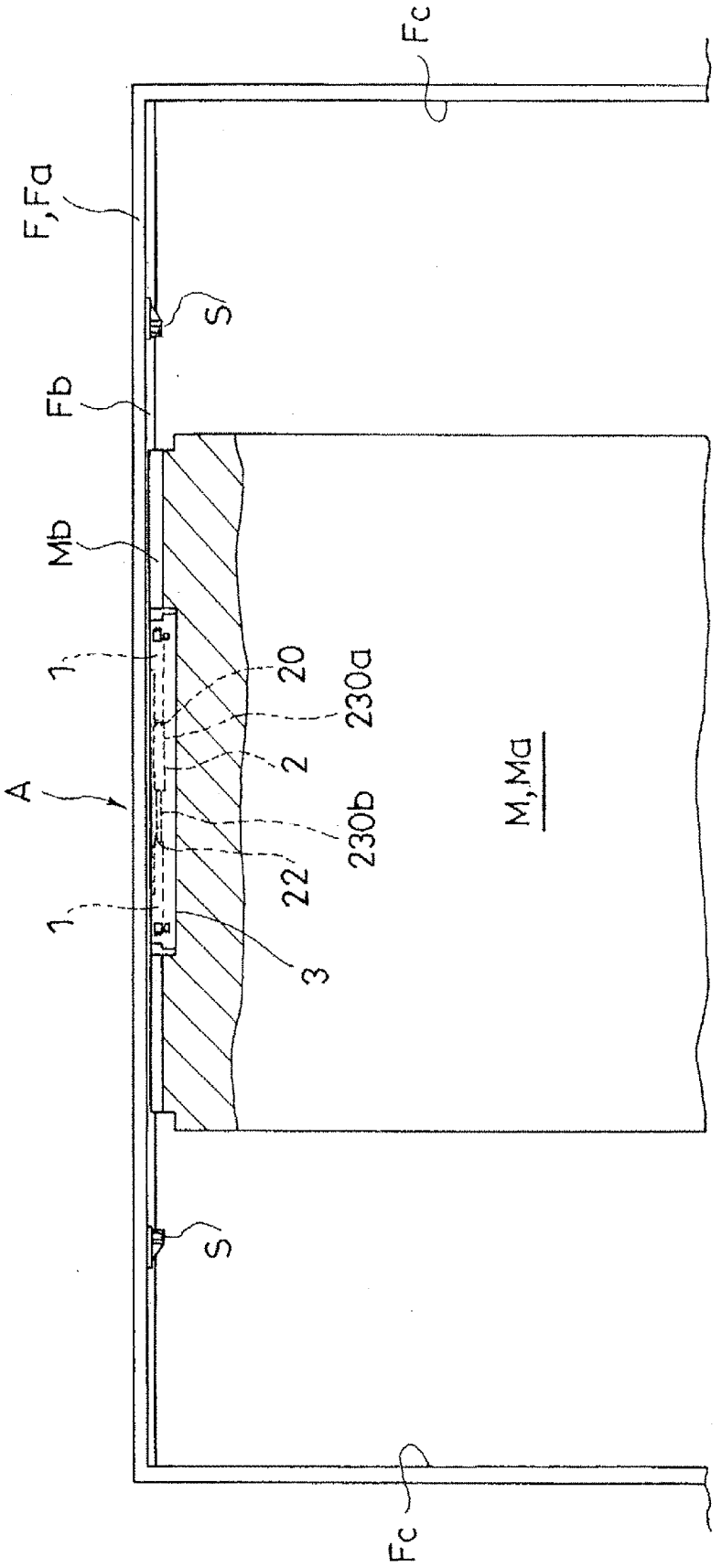


Fig. 1

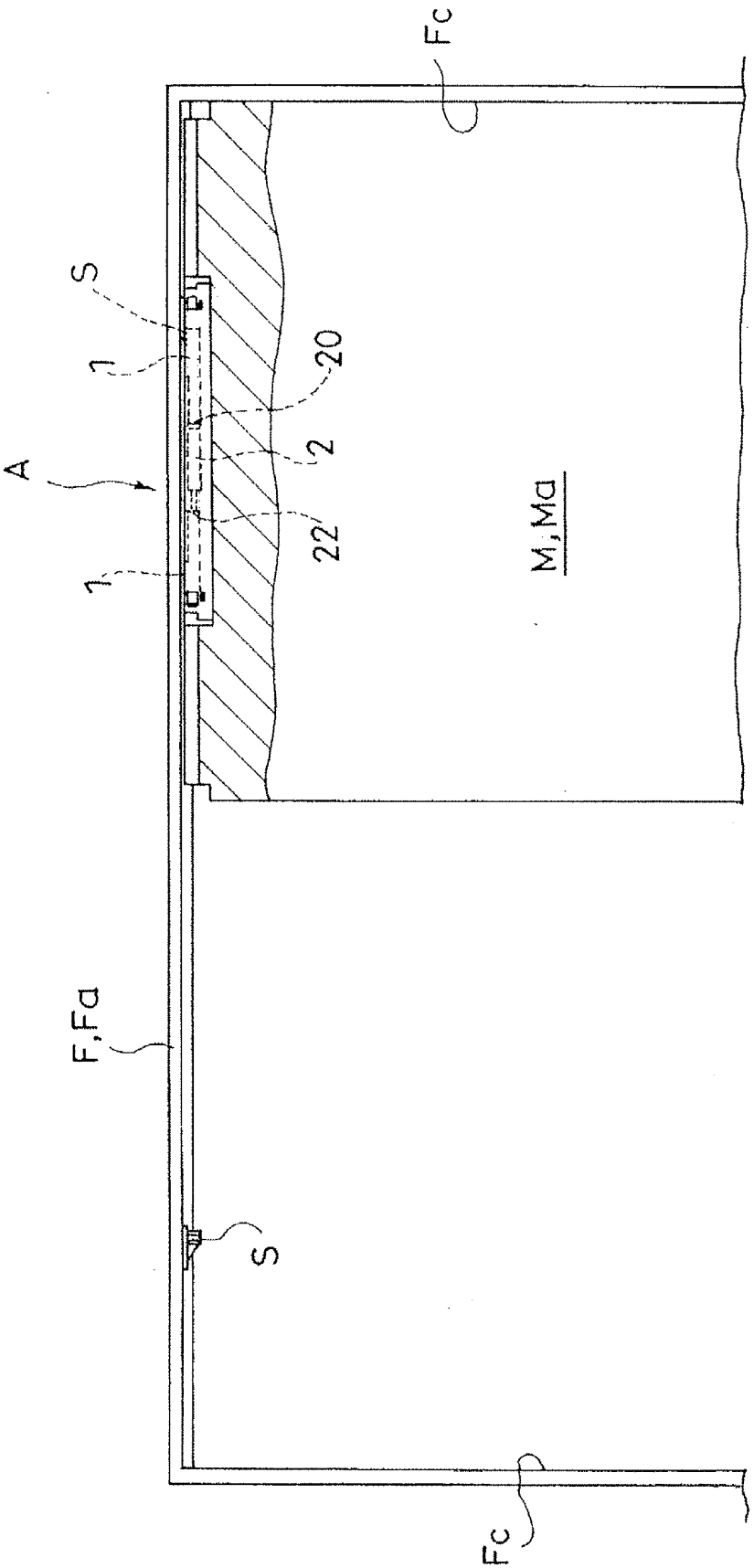


Fig. 2

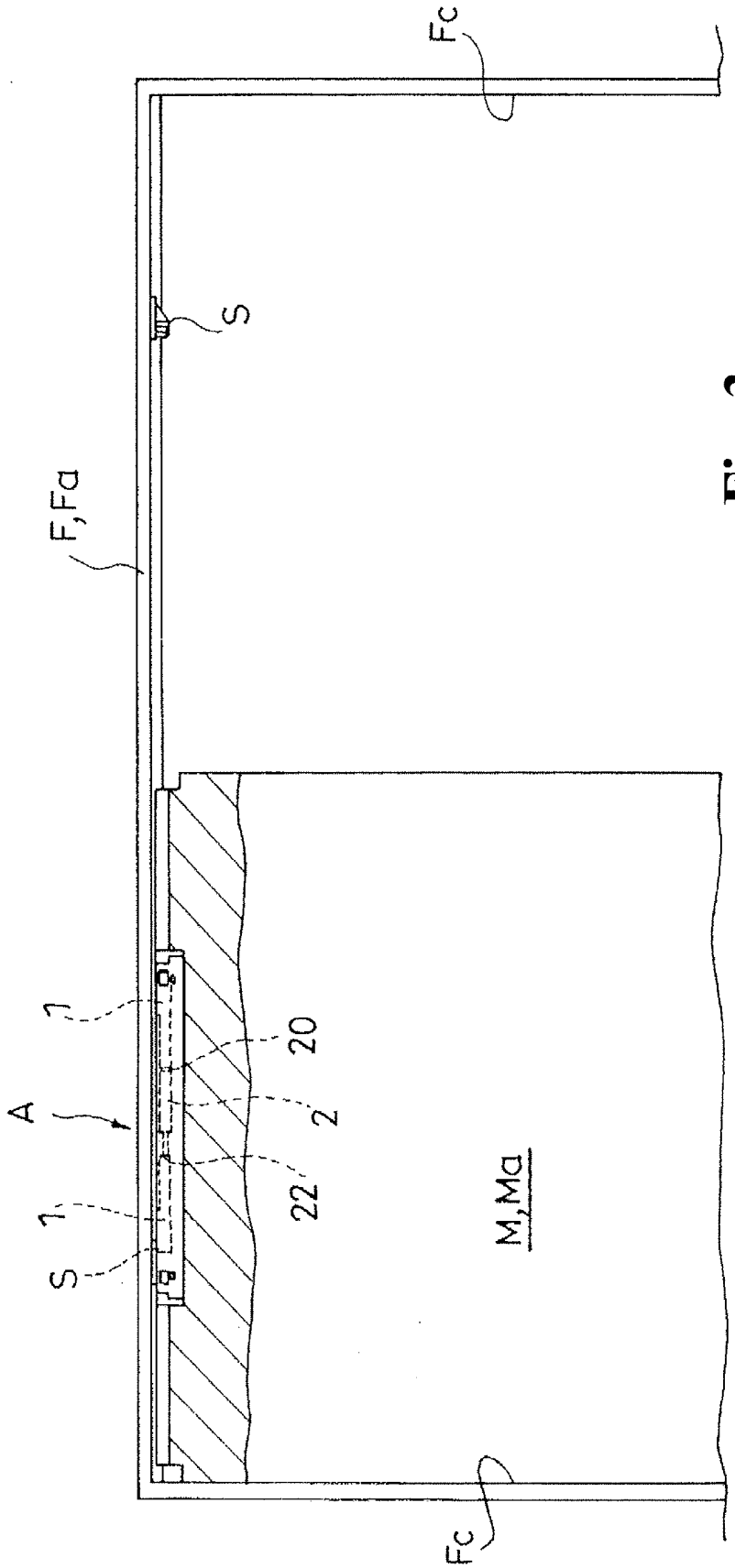
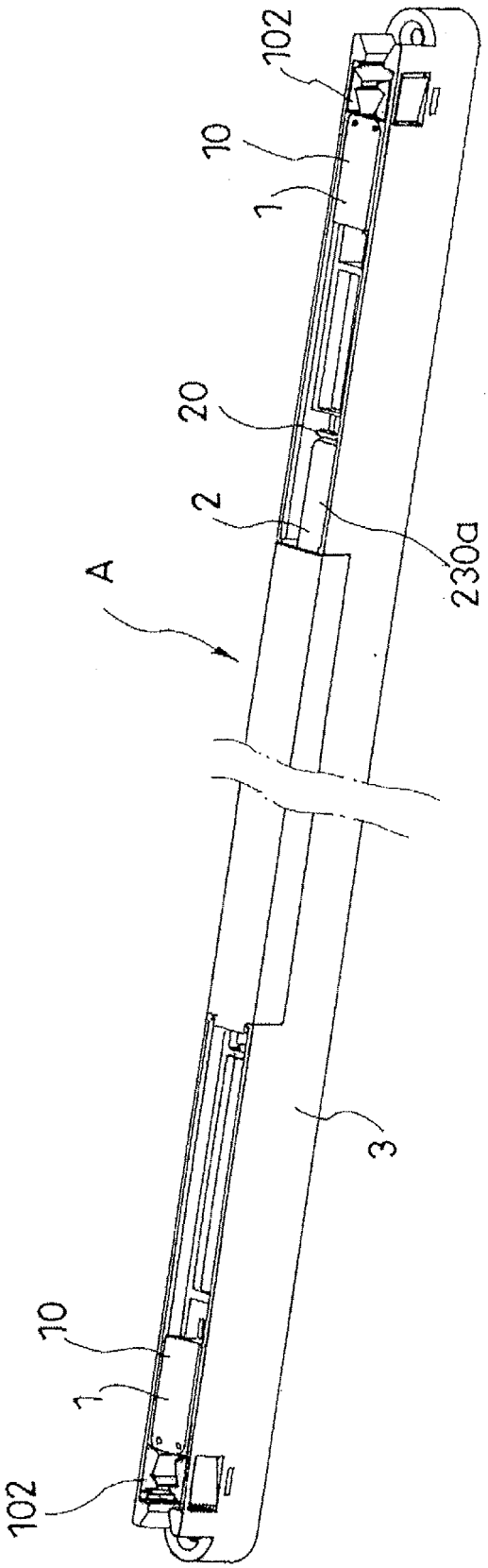


Fig. 3



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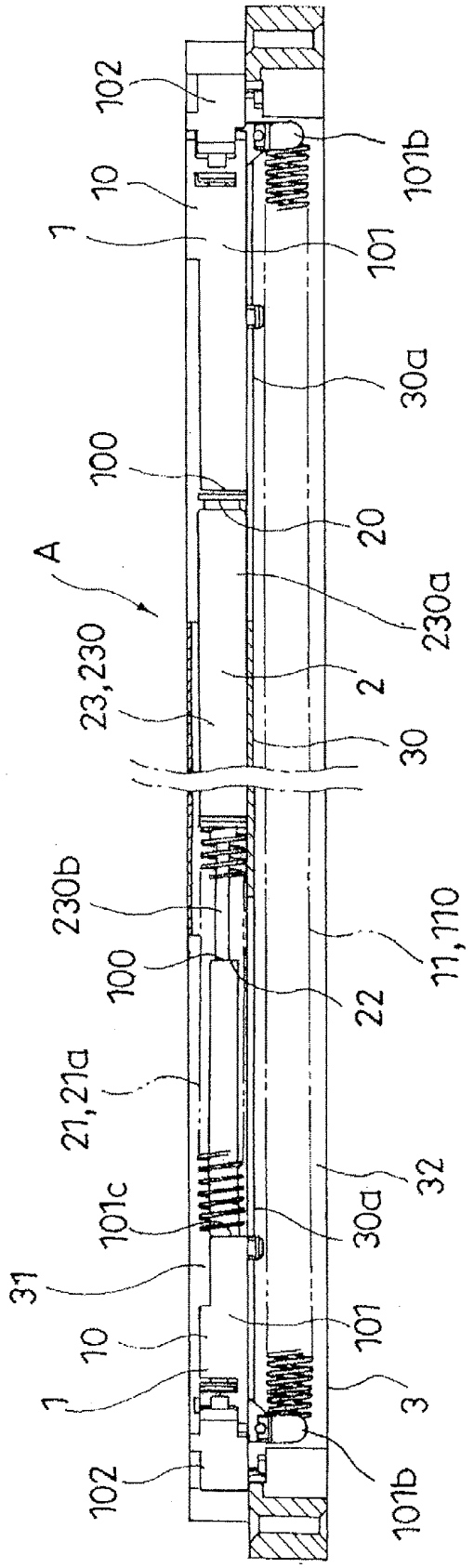
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Fig. 5

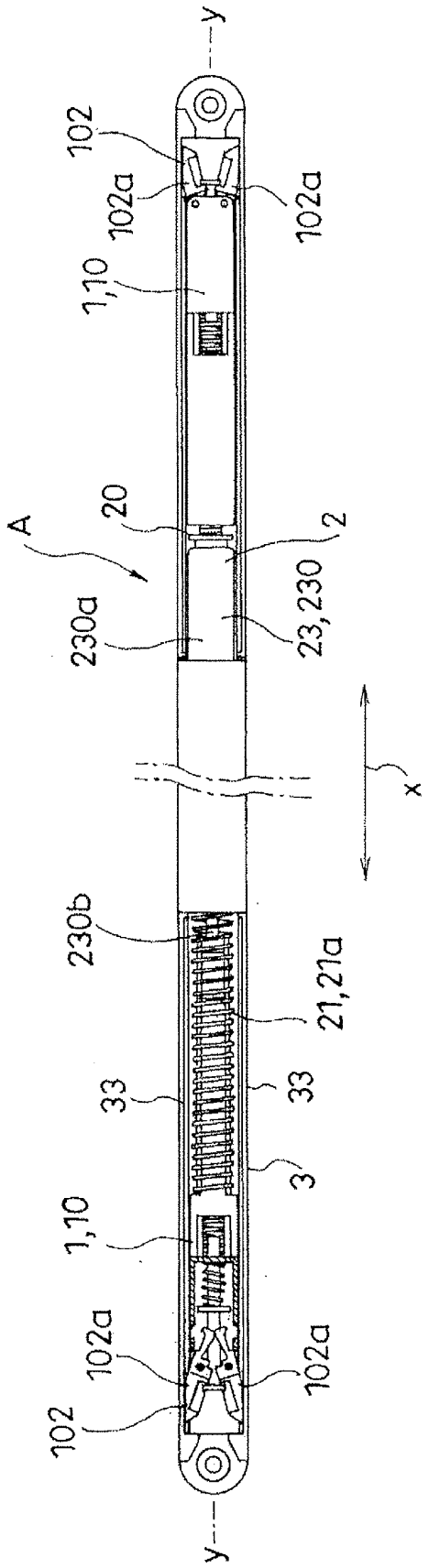
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Fig. 6

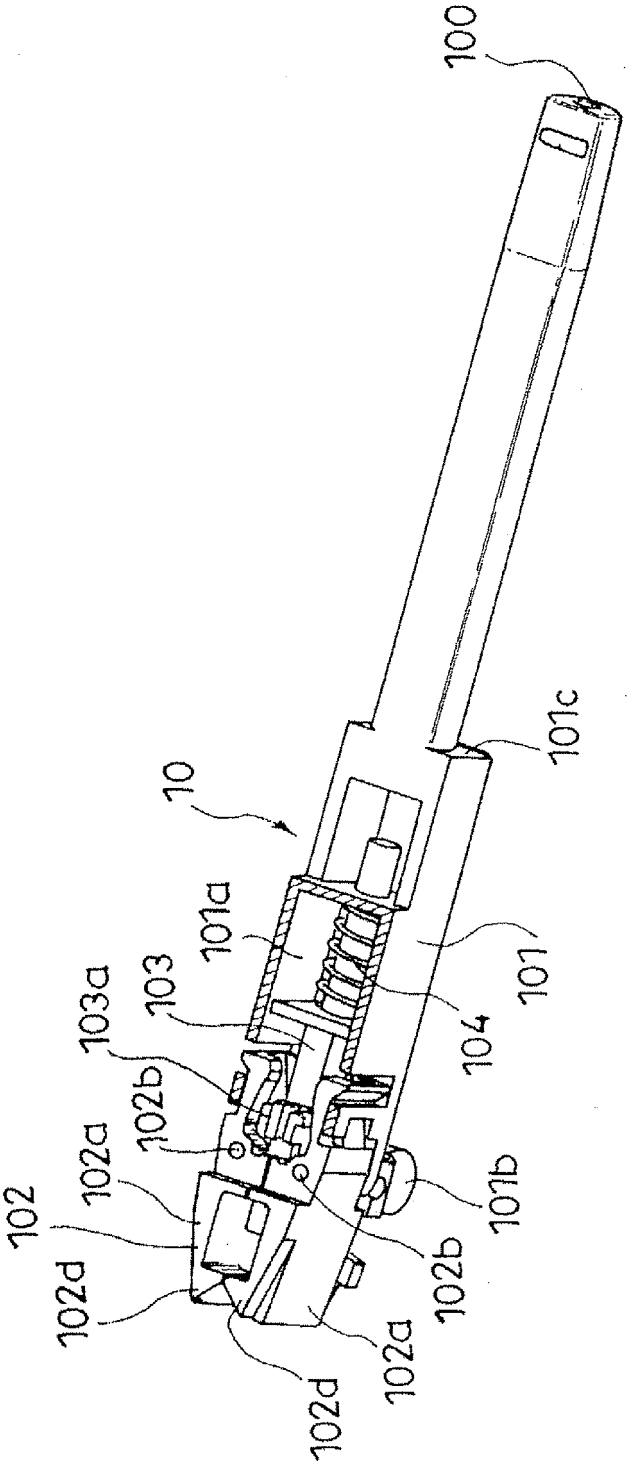
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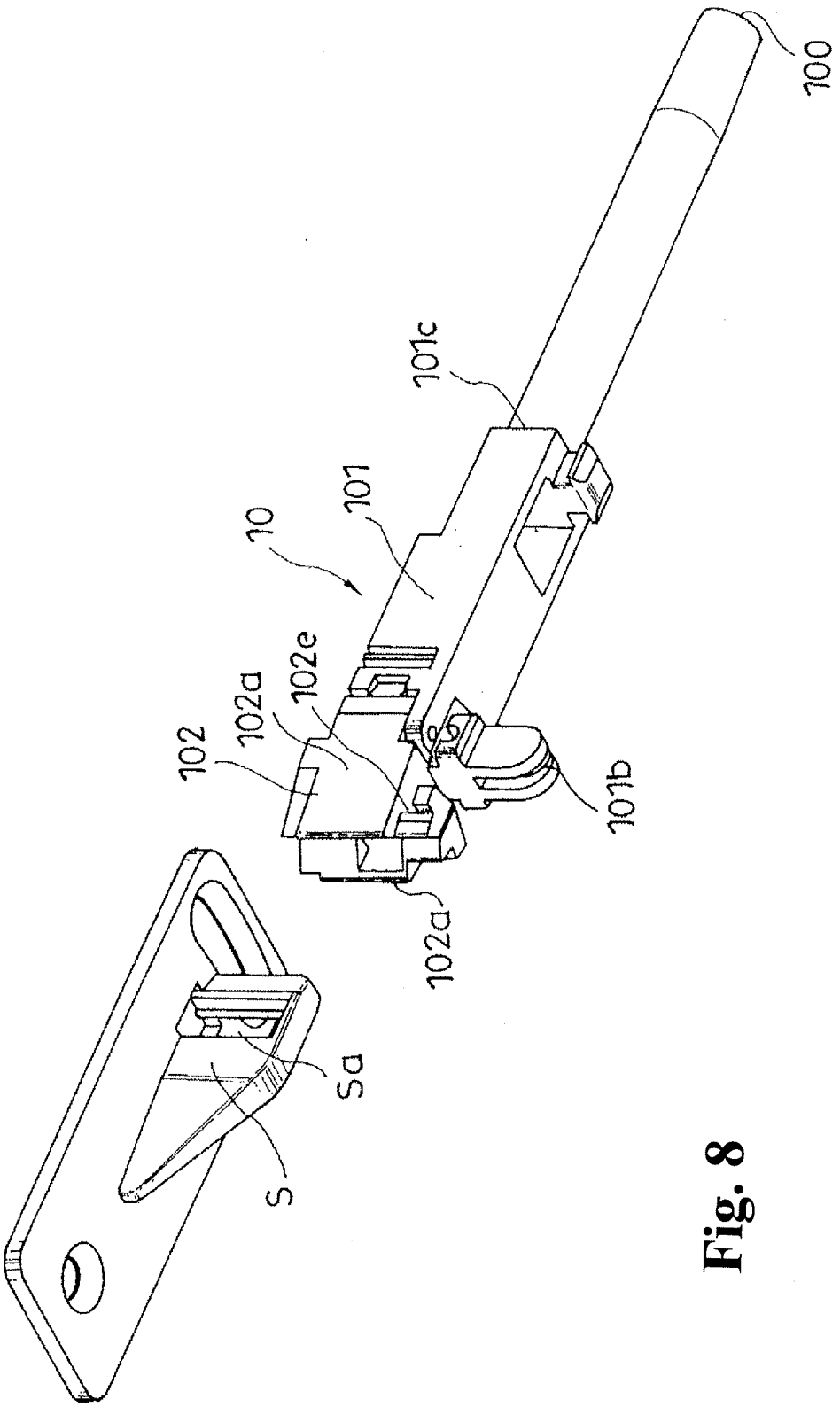
Fig. 7



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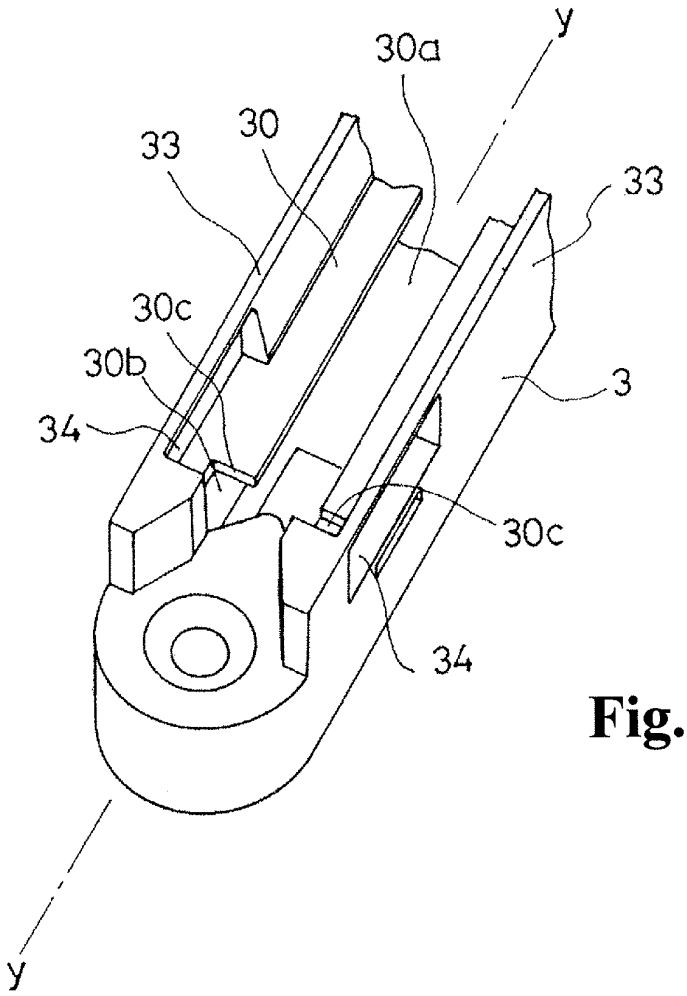
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Fig. 9

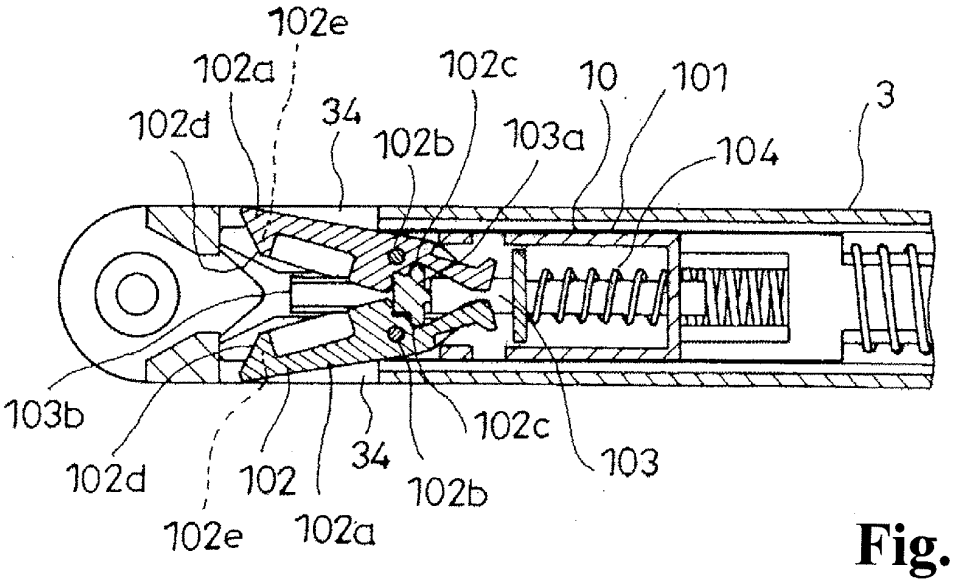
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Fig. 10

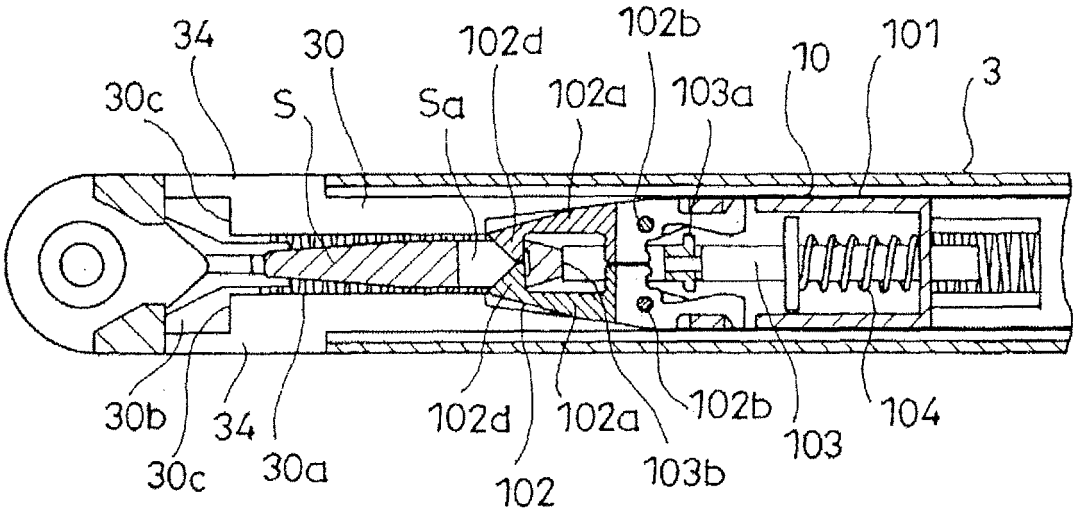
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Fig. 11

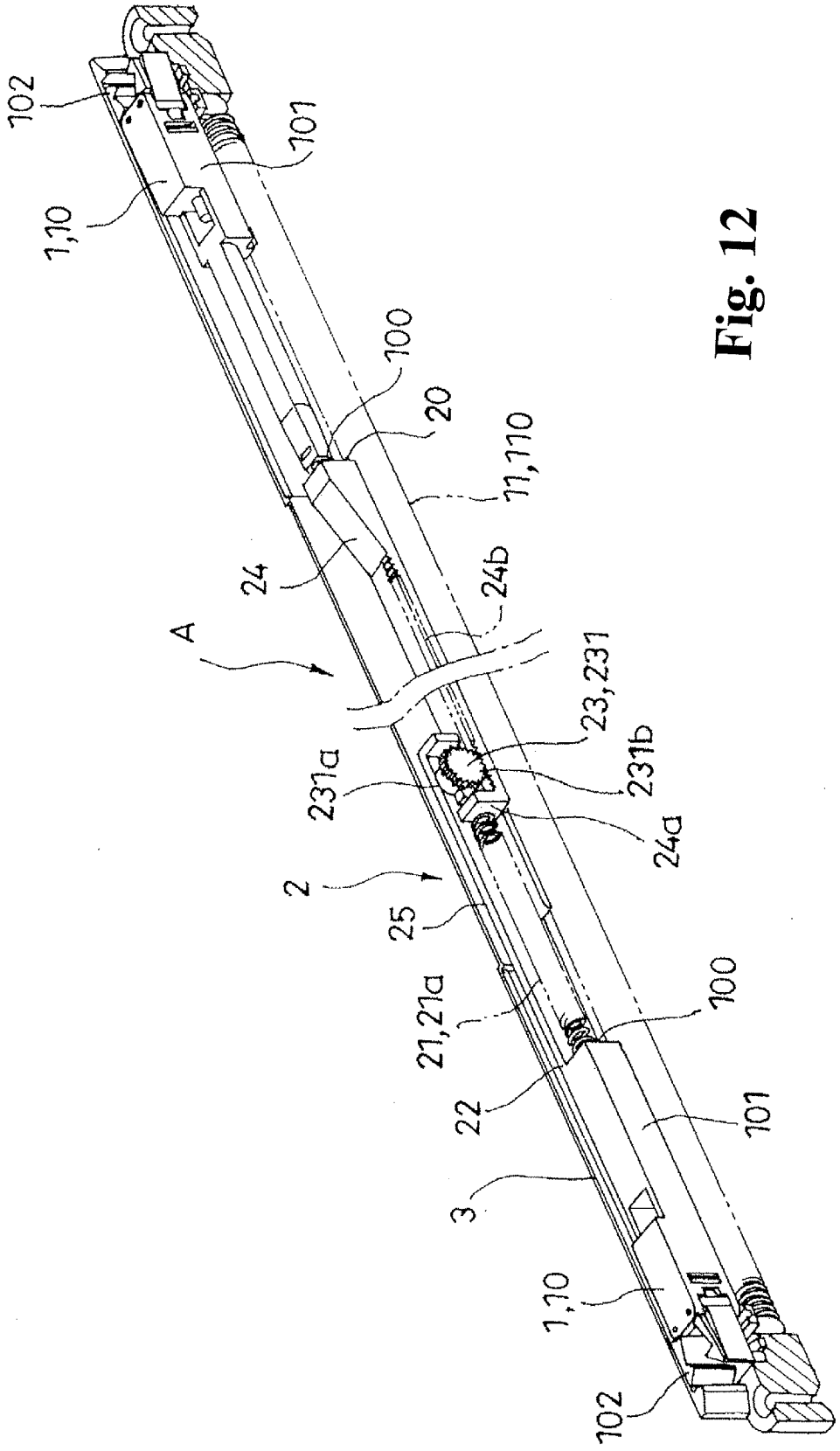
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Fig. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/061714

A. CLASSIFICATION OF SUBJECT MATTER
E05F5/02(2006.01)i, *E05F1/16*(2006.01)i, *E05F3/00*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E05F5/02, E05F1/16, E05F3/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2010
Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2009-127293 A (Kabushiki Kaisha Shimodaira), 11 June 2009 (11.06.2009), entire text; fig. 1 to 13 (Family: none)	1-5
Y	JP 2007-92386 A (Kabushiki Kaisha Shimodaira), 12 April 2007 (12.04.2007), entire text; fig. 1 to 19 (Family: none)	1-5
Y	JP 2006-348553 A (Tostem Corp.), 28 December 2006 (28.12.2006), entire text; fig. 1 to 44 (Family: none)	5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 August, 2010 (03.08.10)	24 August, 2010 (24.08.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/061714

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006-299578 A (Kabushiki Kaisha Meiko), 02 November 2006 (02.11.2006), entire text; fig. 1 to 13 (Family: none)	5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009168474 A **[0044]**