



(11) **EP 2 420 641 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
22.02.2012 Bulletin 2012/08

(51) Int Cl.:
E05B 37/02 (2006.01) E05B 1/00 (2006.01)

(21) Application number: **10764533.5**

(86) International application number:
PCT/JP2010/056847

(22) Date of filing: **16.04.2010**

(87) International publication number:
WO 2010/119951 (21.10.2010 Gazette 2010/42)

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

(72) Inventors:
• **OKABE, Gen**
Osaka-shi
Osaka 537-8686 (JP)
• **HAYASHI, Katsuaki**
Osaka-shi
Osaka 537-8686 (JP)

(30) Priority: **17.04.2009 JP 2009101449**
05.06.2009 JP 2009136725

(71) Applicant: **Kokuyo Co., Ltd.**
Osaka 537-8686 (JP)

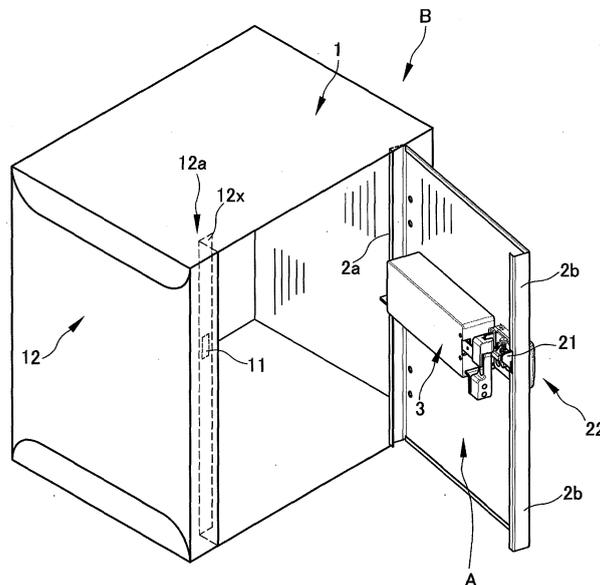
(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **LOCKING AND UNLOCKING APPARATUS AND STORAGE CABINET USING THE SAME**

(57) Provided is a locking and unlocking apparatus with a dial lock which can easily be installed between a cabinet and an open/close member and operates reliably so that the locking and unlocking of the open/close member is appropriately conducted through a simple operation. When a door (2) is in the closed position and a dial lock (3) is in the unverified state, a locked state in which an engaging part (21) is engaged with an engaged part

(11) is held. After the dial lock (3) is verified, the engaging part (21) is moved to an unlocked state by an operation of an operating part (22), the engagement of the engaging part (21) with the engaged part (11) is released, and the dial lock (3) is reset to the unverified state. When the door (2) is closed again, the locking and unlocking apparatus (A) automatically reverts to the locked state in which the engaging part (21) is engaged with the engaged part (11).

Fig. 2



EP 2 420 641 A1

Description**FIELD OF THE ART**

[0001] This invention relates to a locking and unlocking apparatus and a storage cabinet using the same, wherein an open/close member of a drawer or a door is held at a closed position by engaging an engaging part with an engaged part, which can appropriately lock and unlock the open/close member with a simple operation by appropriately relating a dial lock or an operating part to the engaged part with a simple built-in arrangement.

BACKGROUND ART

[0002] Generally, a locking and unlocking apparatus that makes use of this kind of a dial lock is attached to a door or the like having an engaging part such as a latch, and an operation of an operating part is prohibited by making the dial lock in an unverified state so that the engaging part is restricted from being operated, and in case of opening the door, the dial lock is verified so as to allow the operation of the operating part.

[0003] In addition, it is preferable that the dial lock is again reset to the unverified state at a time of opening the door after the dial lock is verified. As a reference to this case known is a dial lock having an arrangement as shown in the patent document 1 wherein an input of a personal identification number and zero-reset of the dial lock are conducted by verifying the dial lock at a desired personal identification number and rotating a knob.

Patent document 1: Japanese Examined Patent Application Publication No. 6-60544

DISCLOSURE OF THE INVENTION**PROBLEMS TO BE SOLVED BY THE INVENTION**

[0004] However, with the conventional arrangement, at least two steps of operations are required such as an operation of verifying the dial lock and an operation of rotating the knob at a time of opening the door or the like. In addition, if an operation to reset the number of the dial lock is added after opening the door, the number of the operations will become furthermore increased. If an idea to zero-reset like the patent document 1 is appropriately combined with the conventional arrangement, it can be expected that the process becomes simplified. However, after rotating the knob so as to reset to zero, if an operation of rotating the knob to return to the original position, an operation of opening the door by operating an additional handle and an operation of rotating the knob at a time of closing the door are added, the operation will also become troublesome.

[0005] Meanwhile, in order to reduce the number of processes by automatically reset the dial lock, it may be an effective measure to install an operating rod that at-

taches to the dial lock between the door and the cabinet so as to reset the dial lock by making use of a relative movement of the door to the cabinet. However, in order to adopt this structure, relatively high accuracy is required in installing the dial lock between the door and the cabinet and additional consideration is furthermore required to put the structure into practice stably and securely for a long period of time.

[0006] On the other hand, in order to make it unnecessary to operate the knob at a time of closing the door, it can be conceived to be effective that the engaging part in the door side automatically engages with the engaged part in the cabinet side together with the movement of closing the door. However, if the engaging part is, for example, in a falciform shape facing the side direction, the movement of opening and closing the door interferes with the operation of the engaging part so that it is required to open and close the door appropriately in conjunction with the movement of the engaging part.

[0007] The present claimed invention intends to solve all of the problems and a main object of this invention is to provide a locking and unlocking apparatus which can easily be installed between a cabinet and an open/close member and operates reliably so that the locking and unlocking of the open/close member such as a door can be conducted through a less number of procedures as much as possible and a storage cabinet to which the locking and unlocking apparatus is applied.

MEANS TO SOLVE THE PROBLEMS

[0008] In order to attain the object, the present claimed invention takes the following measures.

[0009] More specifically, the locking and unlocking apparatus comprises a cabinet, an open/close member that opens or closes an opening of the cabinet, a dial lock, an operating part and an engaging part arranged on either one of the cabinet and the open/close member, and an engaged part arranged on either the other of the cabinet and the open/close member, and holding the open/close member at a closed position by engaging the engaging part with the engaged part, and is characterized by that the operating part switches the position of the engaging part relative to the engaged part from a locked position to an unlocked position by receiving an unlock operation, the dial lock is related at least to the operating part through a relating part so as to prohibit an unlock operation of the operating part at a time when the dial lock is unverified and to allow an unlock operation of the operating part and to reset the dial lock to the unverified state in conjunction with a subsequent unlock operation at a time when the dial lock is verified, the engaging part automatically moves to the locked position so as to make an engagement with the engaged part while starting from a time when the operating part is released after the unlock operation of the operating part is conducted to a time when the open/close member moves to the closed position again.

[0010] In accordance with this arrangement, when the open/close member locates at the closed position and the dial lock is unverified, the unlock operation of the operating part is prohibited by the dial lock so that the engaging part will not move to the unlocked position. Next, when the dial lock is verified, the restricted state of the operating part is released so that the unlock operation is allowed. When the operating part is operated to unlock, the engaging part moves from the locked position to the unlocked position so that the open/close member is in a state of being able to open. In addition, the dial lock is reset to the unverified state due to the unlock operation. After the open/close member is open, if the open/close member is moved to the closed position again, it possible to engage the engaging part with the engaged part only by this movement. At this time, since the dial lock is in the unverified state and the unlock operation of the operating part is prohibited, the operating part will never be operated again unless the dial lock is verified.

[0011] As mentioned, since the operating part becomes free after the dial lock is verified, the engaging part is switched from the locked position to the unlocked position and the dial lock is reset to the unverified state just by conducting the subsequent unlock operation of the operating part, and the engaging part becomes in the locked state just by moving the open/close member to the closed position, it is possible to put this locking and unlocking apparatus into use with less number of procedures as much as possible.

[0012] Furthermore, since the dial lock is reset to the unverified state in conjunction with the operation of the operating part, it is possible to realize the locking and unlocking apparatus that can work securely with a simple assembling procedure, namely without a complicated procedure of incorporating the dial lock between the cabinet and the open/close member with high accuracy, for example, compared with a case that the dial lock is reset by making use of a relative movement of the open/close member to the cabinet.

[0013] In order to avoid interference with a movement of the operating part returning to the lock direction after the dial lock is reset to the unverified state, it is preferable that the relating part is of a ratchet structure that allows the operating part to make a returning movement toward the lock direction and that prohibits an unlock operation of the operating part again in case that the operating part is released after the dial lock is reset to the unverified state by the unlock operation of the operating part.

[0014] In order to simplify the procedure after the unlock operation of the operating part, it is preferable that an elastic force in the lock direction is applied to the operating part, and the operating part moves toward the lock direction by disappearing an operating force of the unlock operation.

[0015] In order to work the unlock operation smoothly with the subsequent operation of opening the open/close member, it is preferable that the operating part also serves as a grip to open and close the open/close mem-

ber.

[0016] As a concrete embodiment represented is that the dial lock comprises a lever that is elastically urged to one direction and moves to a predetermined position and is held at this position against the elastic force at a time when a dial lock is verified and that releases the holding force at a time when the dial lock is unverified, and an acting body that resets the dial lock to the unverified state by acting toward one direction and that makes the dial lock in a reset waiting state by acting toward the other direction, the lever and the operating part are related through a first relating part and an unlock operation of the operating part is prohibited at a time of the unverified state and the unlock operation of the operating part is allowed at a time of the verified state, and the acting body and the operating part are related through a second relating part, and the dial lock is reset to the unverified state in accordance with the unlock operation of the operating part after the verified state.

[0017] As a structure to apply the locking and unlocking apparatus to a storage cabinet such as a locker it is preferable that the engaging part and the engaged part are in a relationship that either one of the engaging part and the engaged part projects in a falciform shape and the other receives the falciform shape.

[0018] In this case, in order to engage the engaging part with the engaged part with avoiding interference between the engaging part and the engaged part in case of closing the open/close member, it is preferable that the engaging part elastically moves to the locked position by releasing the operating part after the dial lock is verified and the unlock operation of the operating part is conducted, and then engages with the engaged part after temporarily making an interference avoiding movement against the elastic force by making an abutting contact with the engaged part immediately before the open/close member reaches the closed position.

[0019] At this time, in order to make the movement smoothly, it is preferable that the engaging part is so arranged to be able to conduct the interference avoiding movement without dragging the operating part.

[0020] This arrangement is especially preferable to be applied to an arrangement wherein either one of the engaging part and the engaged part extends in an open-close direction of the open/close member at the closed position and has a curved nail part at its distal end.

[0021] If the locking and unlocking apparatus is applied to between the open/close member and the cabinet, it is possible to stably and securely actuate the locking and unlocking apparatus for a long period of time and to effectively improve the usability of the storage cabinet to which the locking and unlocking apparatus is applied.

[0022] In addition, in order to attain the above-mentioned object, the present claimed invention takes the following measures.

[0023] More specifically, the locking and unlocking apparatus comprises a cabinet, an open/close member that opens or closes an opening of the cabinet, a dial lock,

an operating part and an engaging part arranged either one of the cabinet and the open/close member, and an engaged part arranged either the other of the cabinet and the open/close member, and holding the open/close member at a closed position by engaging the engaging part with the engaged part, and is characterized by that the operating part switches the position of the engaging part relative to the engaged part from a locked position to an unlocked position by receiving an unlock operation, the dial lock is related at least to the operating part through a relating part at least at a time when the open/close member is closed so as to prohibit an unlock operation of the operating part at a time when the dial lock is unverified and to allow an unlock operation of the operating part and to reset the dial lock to the unverified state in conjunction with a subsequent unlock operation at a time when the dial lock is verified, the engaging part is held at the unlocked position with accumulating an acting force toward the locked position when the operating part is released after the unlock operation of the operating part is conducted and the open/close member is open and automatically moves to the locked position so as to make an engagement with the engaged part by releasing the acting force at a stage that the open/close member moves again to the closed position.

[0024] In accordance with this arrangement, when the open/close member locates at the closed position and the dial lock is unverified, the unlock operation of the operating part is prohibited by the dial lock so that the engaging part will not move to the unlocked position. Next, when the dial lock is verified, the restricted state of the operating part is released so that the unlock operation is allowed. When the operating part is operated to unlock, the engaging part moves from the locked position to the unlocked position so that the open/close member is in a state of being able to open. In addition, the dial lock is reset to the unverified state in accordance with the unlock operation. After the open/close member is open, even though the operating part is released, the engaging part is held at the unlock position with accumulating the acting force toward the lock position. Then at a stage that the open/close member is moved to the closed position again, the engaging part automatically engages with the engaged part by releasing the accumulated acting force. At this time, since the dial lock is in the unverified state and the unlock operation of the operating part is prohibited, the operating part will never be operated again unless the dial lock is verified.

[0025] As mentioned, since the operating part becomes free after the dial lock is verified, the engaging part is switched from the locked position to the unlocked position and the dial lock is reset to the unverified state just by conducting the subsequent unlock operation of the operating part, and the engaging part becomes in the locked state just by moving the open/close member to the closed position, it is possible to put this locking and unlocking apparatus into use with less number of procedures as much as possible.

[0026] Furthermore, since the dial lock is reset to the unverified state in conjunction with the operation of the operating part, it is possible to realize the locking and unlocking apparatus that can work securely with a simple assembling procedure, namely without a complicated procedure of incorporating the dial lock between the cabinet and the open/close member with high accuracy, for example, compared with a case that the dial lock is reset by making use of a relative movement of the open/close member to the cabinet.

[0027] Furthermore, even though the operating force to the operating part is released after the open/close member is open, since the engaging part is held at the unlocked position and the engaging part moves to the locked position at a stage that the open/close member moves to the closed position, it is possible to secure an appropriate and reliable operation without requiring strict accuracy by avoiding an interference between the movement of the engaging part and the open/close member irrespective of the shape of the engaging part or the engaged part such that the engaging part or the engaged part is in a falciform shape or a bar shape.

[0028] In this case, to prohibit the unlock operation of the operating part at a time of the unverified state includes a structure wherein the position of the engaging part is not switched due to a loose contact even though the operating part is operated at a time of the unverified state.

[0029] In order to detect whether or not the open/close member reaches at the closed position without fail, it is preferable that a detecting device to detect whether the open/close member locates at the closed position or not is arranged between the cabinet and the open/close member.

[0030] In order to appropriately interlock the detection of the closed position due to the detecting device with the release of the acting force to the engaging part, it is preferable to comprise an acting force accumulating member that accumulates the acting force to move the engaging part from the unlocked position to the locked position while the engaging part moves from the locked position to the unlocked position due to an operation of the operating part and then the open/close member is open so as to release the operating force to the operating part and a restraint member that restrains the acting force accumulating member at an acting force accumulating position, and to be so arranged that a holding force by the restraint member is released at a time when the detecting device detects that the open/close member again moves to the closed position so that the engaging part is moved from the unlocked position to the locked position by the accumulated acting force of the acting force accumulating member.

[0031] As a concrete embodiment of the detecting device represented is that the detecting device contains a displacement part arranged in either one of the cabinet and the open/close member, and the displacement part changes its position by making contact with the other of the cabinet or the open/close member so that the restraint

member is moved from a restraining position for restraining the acting force accumulating member to a non-restraining position.

[0032] In order to prevent interference with the operating part from making the returning movement in the lock direction after the dial lock is reset to the unverified state, it is preferable that the relating part is of a ratchet structure that allows the operating part to make a returning movement toward the lock direction in case that the operating part is released after the dial lock is reset to the unverified state by the unlock operation of the operating part and that prohibits an unlock operation of the operating part after the door is closed again.

[0033] In order to simplify a process after the unlock operation of the operating part, it is preferable that an elastic force in the lock direction is applied to the operating part, and the operating part moves toward the lock direction by disappearing an operating force of the unlock operation.

[0034] In order to link the unlock operation and its subsequent operation of opening the open/close member smoothly, it is preferable that the operating part also serves as a grip to open and close the open/close member.

[0035] As a concrete embodiment represented is that the dial lock comprises a lever that is elastically urged to one direction and moves to a predetermined position and is held at this position against the elastic force at a time when a dial lock is verified and that releases the holding force at a time when the dial lock is unverified, and an acting body that resets the dial lock to the unverified state by acting toward one direction and that makes the dial lock in a reset waiting state by acting toward the other direction, the lever and the operating part are related through a first relating part and an unlock operation of the operating part is prohibited at a time of the unverified state and the unlock operation of the operating part is allowed at a time of the verified state, and the acting body and the operating part are related through a second relating part, and the dial lock is reset to the unverified state in accordance with the unlock operation of the operating part after the verified state.

[0036] As a structure to apply the locking and unlocking apparatus to a storage cabinet such as a locker or the like it is preferable that either one of the engaging part and the engaged part projects in a falciform shape or a bar shape and the other is in relation of receiving the falciform shape or the bar shape.

[0037] Especially this structure can be preferably applied to a case that either one of the engaging part and the engaged part extends in a direction that is orthogonal to a direction of opening and closing the open/close member at the closed position.

[0038] If the locking and unlocking apparatus of this embodiment is applied between the open/close member and the cabinet, it is possible to stably and securely actuate the locking and unlocking apparatus for a long period of time and to effectively improve the usability of the

storage cabinet.

EFFECT OF THE INVENTION

5 **[0039]** In accordance with the above-mentioned arrangement of the present claimed invention, for a storage cabinet whose open/close member is locked to the cabinet by means of the engaging part and the engaged part, it is possible to open the open/close member and to reset
10 the verified state of the dial lock just by verifying the dial lock and operating the operating part, and the open/close member can be held at the closed position just by pressing the open/close member in the cabinet. With this arrangement it is possible to utilize the locking and unlocking
15 apparatus with less number of operations as much as possible. In addition, it is possible to configure the storage cabinet such as a locker or the like by incorporating the dial lock easily without requiring high accuracy to between the open/close member and the cabinet. With
20 this arrangement, it is possible to stably and securely actuate the locking and unlocking apparatus for a long period of time and to effectively improve the usability of the storage cabinet such that personal belongings can be taken in and out quickly and easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040]

30 Fig. 1 is a perspective view of a storage cabinet, in a state that a door is closed, to which a locking and unlocking apparatus in accordance with a first embodiment of this invention is applied.

35 Fig. 2 is a perspective view showing the storage cabinet in accordance with the embodiment in a state that the door is open.

40 Fig. 3 is a partially enlarged perspective view of a back surface of the door constituting the storage cabinet together with an operation of the locking and unlocking apparatus.

45 Fig. 4 is a partially enlarged perspective view of the back surface of the door constituting the storage cabinet together with the operation of the locking and unlocking apparatus.

50 Fig. 5 is a partially enlarged perspective view of the back surface of the door constituting the storage cabinet together with the operation of the locking and unlocking apparatus.

55 Fig. 6 is an explanatory view of a principal part of the locking and unlocking apparatus of this embodiment.

Fig. 7 is a function explanatory view of the locking and unlocking apparatus of this embodiment.

Fig. 8 is a function explanatory view of the locking and unlocking apparatus of this embodiment.

Fig. 9 is a function explanatory view of the locking and unlocking apparatus of this embodiment.

Fig. 10 is a perspective view of a storage cabinet, in a state that a door is closed, to which a locking and

unlocking apparatus in accordance with a second embodiment of this invention is applied.

Fig. 11 is a perspective view showing the storage cabinet in accordance with the embodiment in a state that the door is open.

Fig. 12 is a partially exploded perspective view viewed from an oblique front of a principal part of the locking and unlocking apparatus.

Fig. 13 is a partially exploded perspective view viewed from an oblique back of the principal part of the locking and unlocking apparatus.

Fig. 14 is a pattern diagram showing the other principal part of the locking and unlocking apparatus together with its operation.

Fig. 15 is a partially enlarged perspective view showing a back surface of the door constituting the storage cabinet together with a state of the locking and unlocking apparatus at a time when the door is closed.

Fig. 16 is a partially broken back view corresponding to Fig. 15.

Fig. 17 is a partially enlarged perspective view showing the back surface of the door constituting the storage cabinet together with an operation of verification to a dial lock of the locking and unlocking apparatus.

Fig. 18 is a partially broken back view corresponding to Fig. 17.

Fig. 19 is a partially enlarged perspective view showing the back surface of the door constituting the storage cabinet together with an unlocking operation to a operating part of the locking and unlocking apparatus.

Fig. 20 is a partially broken back view corresponding to Fig. 19.

Fig. 21 is a partially enlarged perspective view showing the back surface of the door constituting the storage cabinet together with a movement of the locking and unlocking apparatus at a time of opening the door.

Fig. 22 is a partially broken back view corresponding to Fig. 21.

Fig. 23 is a partially enlarged perspective view showing the back surface of the door constituting the storage cabinet together with a movement of the locking and unlocking apparatus at a time when an operation to the operating part is removed.

Fig. 24 is a partially broken back view corresponding to Fig. 23.

BEST MODES OF EMBODYING THE INVENTION

(First embodiment)

[0041] A first embodiment of this invention will be explained with reference to Fig. 1 through Fig. 6.

[0042] Fig. 1 through Fig. 3 show a storage cabinet (B) to which a locking and unlocking apparatus (A) of this embodiment is applied. The storage cabinet (B) has an arrangement wherein a door 2 as being an open/close

member is arranged at a position to open and close a storage space of a cabinet 1, and the locking and unlocking apparatus (A) is applied to between the door 2 and the cabinet 1. The locking and unlocking apparatus (A) is so arranged that an engaging part 21 and a dial lock 3 are installed into the door 2, an engaged part 11 is arranged on the cabinet 1 side, the door 2 is held in a locked state at a closed position relative to the cabinet 1 by engaging the engaging part 21 with the engaged part 11 so as to be in a locked state just by pushing the door 2 against the cabinet 1, the engagement of the engaging part 21 with the engaged part 11 is released by verifying the dial lock 3 arranged on the door 2 so that the door 2 can be open, and the verified state of the dial lock 3 is reset by making use of a movement of rotating a knob part 22a, as being a subsequent first operation to open the door 2.

[0043] If explained concretely, an edge part 2a at a hinge side of the door 2 is supported by a side board 12 of the cabinet 1 through a hinge mechanism (H) so that the door 2 can be open and closed, a step part 12a to be a concave facing the front is formed on a front surface of the side board 12 locating at the opposite side of the hinge mechanism (H), and a thickness part of an edge part 2b in a side opposite to the hinge side of the door 2 is housed in the step part 12a as being the concave. On a front surface of the door 2 provided is an operating part 22 that can conduct an unlock operation. The operating part 22 has the knob part 22a that can be grasped and operated by hands and fingers, and also has a function of a handle to grasp to open the door 2. In this embodiment, an engagement of the engaging part 21 with the engaged part 11 is released by grasping the operating part 22 and rotating it counterclockwise (a direction to unlock) generally at a right angle, and the operating part 22 elastically rotates clockwise (a direction to lock) when the hands and fingers are removed from the operating part 22.

[0044] The engaging part 21 is of a vertically movable falciform shape projecting rearward from a back surface near an edge part 2b in the side opposite to the hinge side of the door 2, and the engaged part 11 is of a slit arranged at a position corresponding to the engaging part 21 in an abutting surface 12x locating inside back of the step part 12a formed on the cabinet 1. The falciform engaging part 21 is made of steel in a general "L" character plate shape, and has a nail part 21a whose distal end bends downward.

[0045] A movable member 23 is arranged in a vertically movable manner on the back surface of the door 2, as shown in Fig. 3 and Fig. 6, and the engaging part 21 is integrally formed on a part of the movable member 23, and a cam part 22b arranged on a back surface of the operating part 22 makes an engagement with the movable member 23. More specifically, the cam part 22b is arranged at a position supporting a lower surface 23a of the movable member 23. The movable member 23 is not lifted in a state that the operating part 22 rotates in the

lock direction shown by a solid line in Fig. 6(a) and the engaging part 21 is kept at the locked position locating down. When the operating part 22 is operated to the unlock direction shown by an arrow in Fig. 6(a), the cam part 22b lifts up the bottom surface 23a of the movable member 23 so that the engaging part 21 is moved upward until it reaches the unlocked position.

[0046] As shown in Fig. 3, the dial lock 3 is so arranged that a lever 31 and an acting body 4 project in a direction heading from a dial lock body 30 in a box shape to a back surface of the operating part 22.

[0047] If explained concretely, the lever 31 is so arranged that a portion displaced from a fulcrum (n) is urged downward as being one direction by a spring 32. When the dial lock 3 is verified, the lever 31 is held in a generally horizontal state at an upward turning position shown in Fig. 4. When the dial lock 3 is unverified, the force to hold the lever 31 is released. When the force to hold the lever 31 is released, the lever 31 moves to a downward turning position shown in Fig. 3 due to the spring 32 if there is no other interfering member.

[0048] In addition, inside of the dial lock body 30, a proximal end of the acting body 4 is urged in a projecting direction by a spring 30a. The acting body 4 moves in a direction of going inside of the dial lock body 30 with accumulating an elastic force when a distal end of the acting body 4 is pushed toward one direction, and the acting body 4 projects toward the other direction when the pushing force is released.

[0049] In case that the acting body 4 projects from the dial lock body 30, the dial lock body 30 does not influence the dial state of the dial lock 3. In case that the acting body 4 goes inside of the dial lock body 30, the dial of the dial lock 3 is reset to zero. In other words, when the dial is verified, the lever 31 rotates from a state shown in Fig. 3 to the horizontally upward turning position shown in Fig. 4 and is held at this position. When the acting body 4 is pushed from a state shown in Fig. 4 to a state shown in Fig. 5, the dial is reset to zero and the force to hold the lever 31 is released so that the lever 31 moves from the state shown in Fig. 5 to the downward turning position shown in Fig. 3 due to the spring 32. Since various kinds of a reset structure of the dial lock 3 have been already known, an explanation of the internal structure is omitted.

[0050] The lever 31 and the operating part 22 are related through a first relating part (C) and a state of being able to operate the operating part 22 and a state of prohibiting operation of the operating part 22 are switched in accordance with a verified state of the dial. The first relating part (C) comprises a block body 51 that locates at a rotating end of the lever 31 and that makes an up and down movement in conjunction with the vertically turning movement of the lever 31, and a moving body 52 that moves in a direction of approaching the block body 51 (a direction of approaching the dial lock body 30) in accordance with a rotating operation of the operating part 22 toward the lock direction. In the unverified state, in case that the moving body 52 tries to move in accordance

with the unlock operation of the operating part 22 in a state that the block body 51 locates at a descending position shown in Fig. 3, a side wall 51a of the block body 51 blocks the moving body 52. In the verified state, in case that the moving body 52 tries to move in accordance with the unlock operation of the operating part 22 in a state that the block body 51 moves to the ascending position according to a rotational movement of the lever 31 as shown by an arrow in Fig. 4, the block body 51 and the moving body 52 are mutually related to allow the movement of the moving body 52. As a result of this, the moving body 52 can move to the position where the moving body 52 gets into under the lower surface 51b of the block body 51 as shown in Fig. 5.

[0051] In addition, the acting body 4 and the operating part 22 are related through a second relating part (D), and the dial lock body 30 is reset to zero in accordance with an operating state of the operating part 22. The second relating part (D) is so configured that the moving body 52 that moves in a direction to approach the dial lock body 30 in accordance with a rotational operation of the operating part 22 is mounted on a standing surface 4a formed on a projecting end part of the acting body 4. Then the acting body 4 moves in the direction of going inside of the dial lock body 30 through the moving body 52 in accordance with the unlock operation of the operating part 22 in the direction shown by an arrow in Fig. 6 (b).

[0052] As shown in Fig. 3 and Fig. 6(b), a shaft 22c projects at a position displaced from a rotational center on the back surface of the operating part 22, and the shaft 22c is inserted into a vertically elongated bore 52c arranged on the moving body 52. The shaft 22c and the elongated bore 52c interlock the rotating operation of the operating part 22 with the back and forth movement of the moving body 52.

[0053] In addition, a spring 24a that gives an elastic force in the downward direction to the movable member 23 is elastically arranged between the movable member 23 and a fixing member 24 arranged near the movable member 23. The spring 24a performs a role to push the engaging part 21 downward (the lock direction). In addition, an elastic force is applied to the operating part 22 in the lock direction as being a reverse direction to the arrow shown in Fig. 6(b) by a spring 30a that acts on the acting body 4. Then when the operating force in the unlock direction applied to the operating part 22 disappears, the operating part 22 acts in the lock direction. When the operating part 22 moves to the lock direction, the movable member 23 goes down in the direction opposite to the direction shown by the arrow in Fig. 6(a) due to the spring 24a and the engaging part 21 returns to the locked position. In case that an upward external force acts from the engaging part 21 side when the door 2 is closed, it is possible for the movable member 23 to conduct an upward movement with the spring 24a compressed without dragging the operating part 22.

[0054] As mentioned above, the moving body 52 con-

stituting the first relating part (C) is in a state of going under the block body 51 in the state shown in Fig. 5 after the unlock operation is conducted. Then, when the dial is reset to the unverified state by the unlock operation of the operating part 22, since the lever 31 turns downward so that the block body 51 is urged in the downward direction, the projecting movement of the acting body 4 due to the spring 30a interferes with the movement of the moving body 52 returning to the original position in case of releasing the operation of the operating part 22. Then, a guide surface 52d of a curved shape is arranged at a portion of the moving body 52 that makes contact with the block body 51, and the moving body 52 moves under the block body 51 along the guide surface 52d with lifting up the block body 51 and then returns to the portion corresponding to the projecting position of the acting body 4. With this movement, the lever 31 and the block body 51 are offset at the descending position in Fig. 3. Later, since the unlock operation of the operating part 22 is prohibited unless the dial is verified again, the first relating part (C) is, so called, of a ratchet structure.

[0055] Next, an operation of this embodiment will be explained.

[0056] First, if the door 2 locates at the closed position as shown in Fig. 7(a) and the dial lock 3 is in the unverified state, the force to hold the lever 31 is released so that the lever 31 locates at the downward turning position in a state of being urged by the spring 32. At this time, the operation of the operating part 22 is prohibited by the first relating part (C) and the engaging part 21 is in the locked position where the engaging part 21 engages with the engaged part 11. Next, if the dial lock 3 is verified, the lever 31 moves to the upward turning position as shown by an arrow in Fig. 7(b) due to the function of the dial lock 3 and is held at the position so that the prohibited state of the operating part 22 due to the first relating part (C) is released. As a result, the engaging part 21 is lifted up to the unlocked position where the engagement of the engaging part 21 with the engaged part 11 is released by operating the knob part 22a of the operating part 22 as shown in Fig. 8(a), and the dial is reset to zero by pushing the acting body 4 toward the dial lock 3 due to the second relating part (D). With this state kept, when the door 2 is open, the storage space of the cabinet 1 is open as shown in Fig. 8(b). At the time of zero-reset, the force of holding the lever 31 is released and the lever 31 tries to turn toward the downward turning position due to the spring 32. If the operating force to the operating part 22 is released, the operating part 22 rotates in the lock direction due to the elastic force. In accordance with this movement, the engaging part 21 moves downward to the locked position as shown in Fig. 9. Similar to Fig. 7(a), the state of the dial lock 3 at this time is that the first relating part (C) is again in the operation prohibiting state and the acting body 4 projects so as to be in the reset waiting state ready for a subsequent movement.

[0057] As shown in Fig. 9, in case of closing the door 2, since the engaging part 21 locates at the locked posi-

tion, the engaging part 21 interferes with an opening edge of the engaged part 11 if the engaging part 21 approaches the closed state as it is. However, since the engaging part 21 can move upward with compressing the spring 24a through the movable member 23 without dragging the operating part 22 even though the operating part 22 is unable to be operated (refer to Fig. 6(a)), the engaging part 21 moves on the opening edge of the engaged part 11 as shown by the arrow in Fig. 9 against the elastic force of the spring 32 in order to temporarily avoid the interference between the engaging part 21 and the engaged part 11, and then the engaging part 21 moves downward again due to the spring 32 so as to be returned to the locked position in Fig. 7(a). At this time, the nail part 21a of the engaging part 21 engages with the back surface near the opening of the engaged part 11, and the dial lock 3 keeps the zero-reset state.

[0058] As mentioned, the locking and unlocking apparatus (A) of this embodiment comprises the cabinet 1, the door 2 as being the open/close member that opens or closes the opening 11 of the cabinet 1, the dial lock 3, the operating part 22 and the engaging part 21 arranged on the door 2, and the engaged part 11 arranged on the cabinet 1. The locking and unlocking apparatus (A) holds the door 2 at the closed position by engaging the engaging part 21 with the engaged part 11.

[0059] The operating part 22 is so arranged to be able to switch the position of the engaging part 21 relative to the engaged part 11 from the locked position to the unlocked position by receiving the unlock operation. The dial lock 3 is related at least to the operating part 22 through the relating parts (C), (D) so that the unlock operation of the operating part 22 is prohibited at a time of unverified state, and the unlock operation of the operating part 22 is allowed and the dial lock 3 is reset to the unverified state in conjunction with the subsequent unlock operation at a time of verified state. And the engaging part 21 automatically moves to the locked position and makes an engagement with the engaged part 11 during a period from a time when the operating part 22 is released after the unlock operation of the operating part 22 is conducted to a time when the door 2 again moves to the closed position.

[0060] As mentioned, since the operating part 22 becomes free after the dial lock 3 is verified, the engaging part 21 is switched from the locked position to the unlocked position and the dial lock 3 is reset to the unverified state just by conducting the subsequent unlock operation of the operating part 22, and the dial lock 3 becomes in the locked state just by moving the door 2 to the closed position, it is possible to put this locking and unlocking apparatus (A) into use with less number of procedures as much as possible.

[0061] Furthermore, since the dial lock 3 is reset to the unverified state in conjunction with the operation of the operating part 22, it is possible to realize the locking and unlocking apparatus (A) that can work securely with a simple assembling procedure, namely without a compli-

cated procedure of incorporating the dial lock 3 between the cabinet 1 and the door 2 with high accuracy, for example, compared with a case that the dial lock 3 is reset by making use of a relative movement of the door 2 to the cabinet 1.

[0062] In addition, since the relating part (C) is of the ratchet structure that allows the operating part 22 to make a returning movement in the lock direction and prohibits the unlock operation of the operating part 22 again in case that the operating part 22 is released after the dial lock 3 is reset to the unverified state by the unlock operation of the operating part 22, it is possible to effectively prevent the operating part 22 from being hampered to make the returning movement in the lock direction after the dial lock 3 is reset to the unverified state.

[0063] Furthermore, since the elastic force in the lock direction is applied to the operating part 22 and the operating part 22 moves in the lock direction when the operating force in accordance with the unlock operation disappears, it is possible to automatically move the operating part 22 back in the lock direction just by leaving the hands from the operating part 22.

[0064] Especially, since the operating part 22 also serves as a knob to open/close the door 2, it is possible to conduct the unlock operation and the subsequent operation to open the door 2 smoothly in the same motion.

[0065] As a concrete embodiment, the dial lock 3 comprises the lever 31 that is elastically urged to one direction and that moves to the predetermined position and is held at this position against the elastic force at a time when a dial lock body 30 is verified and that releases the holding force at a time when the dial lock body 30 is unverified, and the acting body 4 that resets the dial lock body 30 to the unverified state by acting toward one direction and that makes the dial lock body 30 in a reset waiting state by acting toward the other direction. Since the lever 31 and the operating part 22 are related through the first relating part (C) so that the unlock operation of the operating part 22 is prohibited at a time of the unverified state and the unlock operation is allowed at a time of the verified state, and the acting body 4 and the operating part 22 are related through the second relating part (D) so that the dial lock body 30 is reset to the unverified state in accordance with the unlock operation of the operating part 22 after the verified state, the lever 31, the acting body 4 and the operating part 22 can be appropriately operated in conjunction with each other.

[0066] In addition, in the above-mentioned embodiment, since the engaging part 21 projects in the falciform shape and the engaged part 11 is in relation of receiving the falciform shape, it is possible to drive the engaging part 21 directly by applying to an object to be applied, for example, a locker, having thus engaging structure.

[0067] In this case, when the door 2 is closed, the engaging part 21 interferes with the engaged part 11. However, since the engaging part 21 elastically moves to the locked position by releasing the operating part 22 after the dial lock 3 is verified and the unlock operation of the

operating part 22 is conducted, the engaging part 21 temporarily makes an interference avoiding movement against the elastic force by making an abutting contact with the engaged part 11 immediately before the door 2 reaches the closed position, and then the engaging part 21 engages with the engaged part 11, it is possible to effectively realize an arrangement that can be in the locked state automatically just by closing the door 2. As a result, it is possible to simplify the operational procedure and consequently usability is improved.

[0068] In addition, since the engaging part 21 is so arranged that can conduct the interference avoiding movement without dragging the operating part 22, it is possible to conduct a movement of closing the door 2 smoothly.

[0069] Especially, the engaging part 21 extends in the direction of opening/closing of the door 2 at the closed position and has the flexural nail part 21a at its distal end, and the nail part 21a securely engages with the engaged part 11 locating at the inside back so that it is possible to realize the above-mentioned engaging structure securely, which enables the closed state of the door 2.

[0070] Then, if the locking and unlocking apparatus (A) of this embodiment is applied to between the door 2 and the cabinet 1, it is possible to configure the storage cabinet (B) such as a locker or the like by incorporating the dial lock 3 easily without requiring high accuracy to between the door 2 and the cabinet 1. With this arrangement, it is possible to stably and securely actuate the locking and unlocking apparatus (A) for a long period of time and to effectively improve the usability of the storage cabinet (B) such that personal belongings can be taken in and out quickly and easily.

[0071] A concrete configuration of each component is not limited to the above-mentioned embodiment.

[0072] For example, the open/close member may be a drawer, in addition to the door. It is also possible to arrange the dial lock, the operating part and the engaging part on the cabinet, and to arrange the engaged part on the open/close member.

[0073] In addition, it is also possible to configure that the engaged part projects in a falciform shape and the engaging part is in relation of receiving the falciform shape.

[0074] Furthermore, it is also possible that the engaging part projects laterally that is a direction orthogonal to an opening and closing direction of the door and engages the cabinet. With this arrangement, in case that the engaging part is in a falciform shape, it is also possible to utilize the engaging part in a shape of a crossbar without a nail part at its distal end.

[0075] In addition, to reset the dial lock to the unverified state in accordance with the unlock operation of the operating part after the verified state through the second relating part includes to be reset at a time when the unlock operation of the operating part is released.

[0076] Other configuration may be variously modified without departing from a spirit of this invention.

(Second embodiment)

[0077] A second embodiment of this invention will be explained with reference to drawings.

[0078] Fig. 10 and Fig. 11 show a storage cabinet 100B to which a locking and unlocking apparatus 100A of this embodiment is applied. The storage cabinet 100B has an arrangement wherein a door 102 as being an open/close member is arranged at a position to open and close a storage space of a cabinet 101, and the locking and unlocking apparatus 100A is applied to between the door 102 and the cabinet 101. The locking and unlocking apparatus 100A is so arranged that an engaging part 121 and a dial lock 103 are installed into the door 102, an engaged part 111 is arranged on the cabinet 101 side, the door 102 is held in a locked state at a closed position relative to the cabinet 101 by engaging the engaging part 121 with the engaged part 111 so as to be in a locked state just by pushing the door 102 against the cabinet 101, the engagement of the engaging part 121 with the engaged part 111 is released by verifying the dial lock 103 arranged on the door 102 so that the door 102 can be open, and the verified state of the dial lock 103 is reset by making use of a movement of rotating a knob part 122a, as being a subsequent first operation to open the door 102.

[0079] If explained concretely, an edge part 102a at a hinge side of the door 102 is supported by a side board 112 of the cabinet 101 through a hinge mechanism 100H so that the door 102 can be open and closed, a step part 112a to be a concave facing the front is formed on a front surface of the side board 112 locating at the opposite side of the hinge mechanism 100H, and a thickness part of an edge part 102b in a side opposite to the hinge side of the door 102 is housed in the step part 112a as being the concave. On a front surface of the door 102 provided is an operating part 122 that can conduct an unlock operation. The operating part 122 has the knob part 122a that can be grasped and operated by hands and fingers, and also has a function of a handle to grasp to open the door 102. In this embodiment, an engagement of the engaging part 121 with the engaged part 111 is released by grasping the operating part 122 and rotating it counterclockwise (an unlock direction) in a front view generally at 60 degrees, and the operating part 122 elastically rotates clockwise (a lock direction) when the hands and fingers are released from the operating part 122.

[0080] The engaging part 121 is of a vertically movable falciform shape facing upward with projecting or receding in a lateral direction through a slit 102c arranged on an edge part 102b in the side opposite to the hinge side of the door 102, and the engaged part 111 is of a slit arranged at a position corresponding to a projecting or receding moving region of the engaging part 121 in a side surface 112y orthogonal to an abutting surface 112x locating inside back of the step part 112a formed on the cabinet 101. The falciform engaging part 121 is made of steel in a general "L" character plate shape, and has a

nail part 121a whose distal end bends upward (refer to Fig. 12 or the like).

[0081] As shown in Fig. 12, Fig. 13 and Fig. 15, a first rotation body 23 is arranged on the back surface of the door 102, a proximal end side of the engaging part 121 is mounted in an integrally rotatable manner on a concave part 23p generally corresponding to a thickness of the engaging part 121 arranged on a side surface of the first rotation body 23, and a supporting shaft 122x arranged on the back surface of the operating part 122 and a pin 122y arranged in parallel to the supporting shaft 122x at a position displaced from the supporting shaft 122x are inserted into the first rotation body 23. More concretely, a bore 23x into which the supporting shaft 122x is inserted is arranged on a center of the first rotation body 23, and an elongated bore 23y in a cocoon shape into which the pin 122y is inserted is formed to surround the center at a position displaced from the center of the first rotation body 23. In a state shown in Fig. 15 and Fig. 16 where the operating part 122 rotates in the lock direction, the engaging part 121 is held in a generally horizontal posture at the locked position. When the operating part 122 is operated in the unlock direction as shown by an arrow in Fig. 19 and Fig. 20, the pin 122y presses one end part of the elongated bore 23y so as to rotate the first rotation body 23 and the engaging part 121 is rotated to the obliquely downward unlocked position where the engaging part 121 is pulled out of the engaged part 111 and inserted into the edge part 102b in the side opposite to the hinge side of the door 102.

[0082] As shown in Fig. 15, the dial lock 103 is so arranged that a lever 131 and an acting body 104 project in a direction heading from a dial lock body 130 in a box shape to a back surface of the operating part 122.

[0083] If explained concretely, the lever 131 is so arranged that a portion displaced from a fulcrum, not shown in drawings, and arranged inside of the dial lock body 130 is urged downward as being one direction by a spring 132. When the dial lock 103 is verified, the lever 131 is held in a generally horizontal state at an upward turning position shown in Fig. 17 and Fig. 18. When the dial lock 103 is unverified, the force to hold the lever 131 is released as shown in Fig. 15 and Fig. 16. When the force to hold the lever 131 is released, the lever 131 is urged by the spring 132 and moves to a downward turning position.

[0084] In addition, a proximal end of the acting body 104 is urged in a direction to project by a spring 130a inside of the dial lock body 130. When a distal end of the acting body 104 is pushed toward one direction, the acting body 104 moves in a direction of going inside of the dial lock body 130 with accumulating an elastic force, and the acting body 104 projects toward the other direction when the pushing force is released.

[0085] In case that the acting body 104 projects from the dial lock body 130, the dial lock body 130 does not influence the dial state of the dial lock 103. In case that the acting body 104 moves in a direction of going inside

of the dial lock body 130, the dial of the dial lock 103 is reset to zero. In other words, when the dial is verified, the lever 131 rotates from a state shown in Fig. 15 and Fig. 16 to the horizontally upward turning position shown in Fig. 17 and Fig. 18 and is held at this position. When the acting body 104 is pushed from a state shown in Fig. 17 and Fig. 18 to a state shown in Fig. 19 and Fig. 20, the dial is reset to zero and the force to hold the lever 131 is released so that the lever 131 moves to the downward turning position due to the spring 132. Since various kinds of a reset structure of the dial lock 103 have been already known, an explanation of the internal structure is omitted.

[0086] As shown in Fig. 15, the lever 131 and the operating part 122 are related through a first relating part 100C and a state of being able to operate the operating part 122 and a state of prohibiting operation of the operating part 122 are switched in accordance with a verified state of the dial. The first relating part 100C mainly comprises a block body 151 that locates at a rotating end of the lever 131 and that makes an up and down movement in conjunction with the vertically turning movement of the lever 131 through an elongated bore and a pin, and the first rotation body 23. A downward facing nail part 151 as shown in Fig. 13 and Fig. 15 is arranged at a distal end of the block body 151, and a restriction part 23k projecting in the radial direction is arranged on a corresponding outer circumference of the first rotation body 23. With this arrangement, the operating part 122 is prohibited from being operated in the unlock direction shown by the arrow in Fig. 19 and Fig. 20 by engaging the nail part 151a with the restriction part 23k because the block body 151 goes down at a time when the lever 131 turns downward (at a time when the dial lock 103 is unverified) as shown in Fig. 15 and Fig. 16. And the operating part 122 is allowed to be operated in the unlock direction shown by the arrow in Fig. 19 and Fig. 20 by releasing the engagement of the nail part 151a with the restriction part 23k because the block body 151 goes upward at a time when the lever 131 turns upward (at a time when the dial lock 103 is verified) as shown in Fig. 17 and Fig. 18.

[0087] In addition, the moving body 104 and the operating part 122 are related through a second relating part 100D as shown in Fig. 15, and the dial lock body 130 is reset to zero in accordance with the operating state of the operating part 122. As shown in Fig. 13 and Fig. 15, the second relating part 100D mainly comprises a second rotation body 25 that overlaps with the first rotation body 23 through the engaging part 121 arranged between the second rotation body 25 and the first rotation body 23. The second rotation body 25 has shaft bores 25x, 25y into which the supporting shaft 122x and the pin 122y of the operating part 122 are inserted respectively, and rotates integrally with the operating part 122 on a constant basis. The second rotation body 25 has a pin 122c that projects at a position displaced from a rotational center on the back surface of the operating part 122, and the

pin 122c engages with a vertically elongated bore 104c formed on a projecting end part of the acting body 104 shown in Fig. 15. The pin 122c is moved together with a rotational movement of the first rotation body 23 in accordance with an unlock operation of the operating part 122 shown by the arrow in Fig. 19 and Fig. 20 from a state in Fig. 17 and Fig. 18 where the operation of the operating part 122 is allowed so that the acting body 104 moves in the direction of going inside of the dial lock body 130. The second rotation body 25 and the operating part 122 move in conjunction with the movement (a projecting movement) in the opposite direction of the acting body 104.

[0088] In addition, as shown in Fig. 12 and Fig. 13, between the first rotation body 23 and the second rotation body 25 elastically arranged is a spring 124 that accumulates an operating force to move the engaging part 121 in the lock direction, namely a dropping posture to a horizontal posture in the engaging part 121 through the first rotation body 23. Concretely, the spring 124 is a torsion coil spring whose center part is mounted on the supporting shaft 122x. One end 124a of the spring 124 is elastically arranged on a side wall 25s of the sectorial concave part 25p arranged on the second rotation body 25, and the other end 124b is elastically arranged on the bottom of the projecting part 23s projecting from the side surface of the first rotation body 23. The spring 124 pushes the first rotation body 23 in a direction so that the engaging part 121 mounted on the first rotation body 23 moves to the locked position by making use of the second rotation body 25 as a foothold.

[0089] Furthermore, a restraint member 6 shown in Fig. 16 is arranged in order to restrain the engaging part 121 at the unlocked position through the first rotation body 23, and a detecting device 7 is arranged to release the restraining state of the restraint member 6 at a time when the door 102 locates at the closed position, and to move the restraint member 6 to the restraining position at a time when the door 102 is open.

[0090] As shown in Fig. 12, Fig. 13 and Fig. 16, a proximal end of the restraint member 6 is rotatably mounted on the shaft 6x that is parallel to the supporting shaft 122x of the operating part 122 and at a distal end of the restraint member 6 provided is a nail part 61 bending toward the first rotation body 23. As shown in Fig. 16 and Fig. 24, on a corresponding outer circumference of the first rotation body 23 provided is a cutout 23m having a wall part such that the first rotation body 23 engages with the wall part of the nail part 61 at a time when the first rotation body 23 tries to rotate so as to move the engaging part 121 in the lock direction. In addition, as shown in Fig. 11, Fig. 14 and Fig. 21, the detecting device 7 comprises a pressing member 71 arranged to project from the abutting surface 112x of the cabinet 101 and a displacement part 72 that is mounted in the edge part 102b in the side opposite to the hinge side of the door 102 around the shaft 72a that is parallel to the edge part 102b and that rotates and is displaced by being pushed by the pressing

member 71 at a time when the door 102 is at the closed position. A pressing surface 72b, shown in Fig. 14, that projects in a side direction because of a rotational movement of the displacement part 72 pushes a pressure receiving surface 6b arranged at a displaced position from the shaft 6x of the restraint member 6. With this movement, the restraint member 6 has an arrangement, as shown in Fig. 14(a) to Fig. 14(b), that the nail part 61 rotates to be separated from the cutout 23m so as to move to the non-restraining position, as shown in Fig. 24 to Fig. 16. The restraint member 6 is urged to move to the restraining position again by a spring, not shown in drawings, when the pressing force from the pressing member 71 to the displacement part 72 is released. An acting force due to the spring 124 is previously accumulated for the first rotation body 23 as will be mentioned next. Then when the nail part 61 is released, the accumulated acting force rotates the first rotation body 23 so that the engaging part 121 moves to a direction toward the locked position.

[0091] The acting force due to the spring 124 is accumulated when the first rotation body 23 and the second rotation body 25 make a relative rotational movement. More specifically, when the operating part 122 is operated from a state as shown in Fig. 17 and Fig. 18 wherein the dial lock 103 is verified to a state as shown in Fig. 19 and Fig. 20 wherein the operating part 122 is further operated to the unlock side, the first rotation body 23 rotates so that the cutout 23m moves to a position facing the nail part 61 of the restraint member 6. At this time, the second rotation body 25 also rotates. Next, when the door 102 opens as shown in Fig. 21 and Fig. 22, since the detecting device 7 detects the state that the door 102 is open and moves the restraint member 6 to the restraining position, a rotational movement of the first rotation body 23 is restricted. Later, when the operation force to the operating part 122 is released, the acting body 104 is urged by a spring 130a and projects as shown by an arrow in Fig. 23 and Fig. 24 and only the second rotation body 25 rotates in a state that the first rotation body 23 is restrained by the restraint member. With this arrangement, because the spring 130a is compressed between the first rotation body 23 and the second rotation body 25, the first rotation body 23 accumulates the acting force to move the engaging part 121 from the unlocked position shown in Fig. 23 and Fig. 24 to the locked position shown in Fig. 15 and Fig. 16. The first rotation body 23 functions as an acting force accumulating member in this invention. It is a matter of course that it does not exclude an arrangement that a predetermined preload is given to the spring 130a. When the second rotation body 25 rotates together with the operating part 122 in a state that the first rotation body 23 is restrained, the pin 122y of the operating part 122 moves freely in the elongated bore 23y of the first rotation body 23 as shown in Fig. 24.

[0092] Next, an operation of whole of this embodiment including an operation that has already been described will be explained.

[0093] First, if the door 102 locates at the closed position as shown in Fig. 15 and Fig. 16 and the dial lock 103 is in the unverified state, the force to hold the lever 131 is released so that the lever 131 locates at the downward turning position in a state that the lever 131 is urged by the spring 132f. At this time, the operation of the operating part 122 is prohibited by the first relating part 100C and the engaging part 121 is in the locked position where the engaging part 121 engages with the engaged part 111. The pin 122y of the operating part 122 locates at one end side of the elongated bore 23y of the first rotation body 23, and the restraint member 6 is held at the non-restraining position relative to the first rotation body 23 because the detecting device 7 detects that the door 102 is at the closed position. Next, if the dial lock 103 is verified, the lever 131 moves to the upward turning position as shown by the arrow in Fig. 17 due to the function of the dial lock 103 and is held at the position, and the block body 151 moves upward and the prohibited state of the operating part 122 due to the first relating part 100C is released so that the second rotation body 25 becomes in a state of being able to move together with the operating part 122 and the acting body 104. Then, when the knob part 122a of the operating part 122 is operated as shown by the arrow in Fig. 19 and Fig. 20, the pin 122y urges and rotates the first rotation body 23 through one end of the elongated bore 23y of the first rotation body 23, resulting in that the engaging part 121 is separated from the engaged part 111 so as to be rotated downward from the locked position to the unlocked position and the acting body 104 is pushed toward the dial lock body 130 with the spring 130a compressed by the second relating part 100D including the pin 122c of the second rotation body 25 and the elongated bore 104c of the acting body 104 and finally the dial is reset to zero. At a time of zero-reset, the force to hold the lever 131 is released so that the lever 131 rotates in the downward turning position due to the spring 132. Assume that the operating force of the operating part 122 is released with this state kept, the first rotation body 23 rotates the engaging part 121 again to the locked position shown in Fig. 15 and Fig. 16 and the first rotation body 23 just returns to the locked state again. Contrarily, if the door 102 is open as shown in Fig. 21 and Fig. 22 with the knob part 122a of the operating part 122 is continuously grasped from the state in Fig. 19 and Fig. 20, the displacement part 72 of the detecting device 7 is released from the pressed state. Then the restraint member 6 rotates in a direction that the nail part 61 approaches the first rotation body 23 as shown in Fig. 14 (b) to Fig. 14(a) so that the rotation of the first rotation body 23, namely the rotation of the engaging part 121 is restrained as shown in Fig. 22 and the storage space of the cabinet 101 is open as shown in Fig. 21 and Fig. 22. When the operation to the operating part 122 is released, since the acting body 104 is urged in the projecting direction by the spring 130a and the force to urge the acting body 104 is transmitted also to the second rotation body 25 and the operating part 122, the second rotation body

25 rotates together with the operating part 122 while the acting body 104 makes a projecting movement and the pin 122y of the operating part 122 moves freely in the elongated bore 23y of the first rotation body 23 with the rotation of the first rotation body 23 restrained by the restraint member 6 as shown in Fig. 23 and Fig. 24. At this time, the spring 124 arranged between the first rotation body 23 and the second rotation body 25 is compressed and the engaging part 121 is held at the unlocked position and the acting body 104 projects in a reset waiting state to be ready for the next movement in a direction of going inside of the dial lock body 130. Even though the operating part 122 is again operated in this state, the pin 122y just moves freely inside of the elongated bore 23y of the first rotation body 23 and the engaging part 121 is not affected.

[0094] Finally, when the door 102 is operated from the state shown in Fig. 23 and Fig. 24 to the closed position shown in Fig. 15 and Fig. 16, at a time when the door 102 reaches at the closed position, the pressing member 71 of the detecting device 7 pushes the displacement part 72. With this movement, the restraint member 6 is lifted up at the position shown in Fig. 15 and Fig. 16 so that the first rotation member 23 is released from the restricted state. Then the first rotation member 23 rotates the engaging part 121 to the locked position as shown in Fig. 15 and Fig. 16 due to the acting force accumulated in the spring 124. As a result of this, the nail part 121a of the engaging part 121 engages with the back surface near the opening of the engaged part 111 so that the locking and unlocking apparatus 100A is returned to the locked state. At this time, the restricting part 23k shown in Fig. 13 passes under the nail part 151a with temporarily lifting up the block body 151 and the restricting part 23k again engages with the nail part 151a. Then the locking and unlocking apparatus 100A returns to be in the operation prohibited state wherein the rotation of the first rotation body 23 is restricted so as to be unable to operate the operating part 122 even though the operating part 122 is tried to be operated.

[0095] As mentioned, the locking and unlocking apparatus 100A of this embodiment comprises the cabinet 101, the door 102 as being the open/close member that opens and closes the opening 11 of the cabinet 101, the dial lock 103, the operating part 122 and the engaging part 121 arranged on the door 102, and the engaged part 111 arranged on the cabinet 101. The locking and unlocking apparatus 100A holds the door 102 at the closed position by engaging the engaging part 121 with the engaged part 111.

[0096] The operating part 122 is so arranged to be able to switch the position of the engaging part 121 relative to the engaged part 111 from the locked position to the unlocked position by receiving the unlock operation. At a time when the door 102 is closed, the dial lock 103 is related at least to the operating part 122 through the relating parts 100C, 100D so that the unlock operation of the operating part 122 is prohibited at a time of unverified

state, and the unlock operation of the operating part 122 is allowed and the dial lock 103 is reset to the unverified state in conjunction with the subsequent unlock operation at a time of verified state. At a time when the operating part 122 is released after the unlock operation of the operating part 122 is conducted and the door 102 is open, the engaging part 121 is held at the unlocked position with accumulating the acting force toward the locked position. When the door 102 moves to the closed position again, the operating force is released so that the engaging part 121 automatically moves to the locked position and is engaged with the engaged part 111.

[0097] As mentioned, since the operating part 122 becomes free after the dial lock 103 is verified, the engaging part 121 is switched from the locked position to the unlocked position and the dial lock 103 is reset to the unverified state just by conducting the unlock operation of the operating part 122, and the dial lock 103 becomes in the locked state just by moving the door 102 to the closed position after the door 102 is open, it is possible to put this locking and unlocking apparatus 100A into use with less number of procedures as much as possible.

[0098] Furthermore, since the dial lock 103 is reset to the unverified state in conjunction with the operation of the operating part 122, it is possible to realize the locking and unlocking apparatus 100A that can work securely with a simple assembling procedure, namely without a complicated procedure of incorporating the dial lock 103 between the cabinet 101 and the door 102 with high accuracy, for example, compared with a case that the dial lock 103 is reset by making use of a relative movement of the door 102 to the cabinet 101.

[0099] Furthermore, even though the operating force to the operating part 122 is released after the door 102 is open, the engaging part 121 is held at the unlocked position and the engaging part 121 moves to the locked position at a time when the door 102 moves to the closed position. With this arrangement, it is possible to realize the closed state and the locked state appropriately and securely with avoiding an interference between the movement of the engaging part 121 and the closing movement of the door 102 without requiring a high accuracy for the engaging part 121 and the engaged part 111 even though the engaged state between the engaging part 121 and the engaged part 111 is, so called, a sideward falciform state.

[0100] In addition, since the detecting device 7 that detects whether the door 102 locates at the closed position or not is arranged between the cabinet 101 and the door 102, it is possible to operate the engaging part 121 by certainly detecting whether the door 102 reaches the closed position or not so that an interference between the engaging part 121 and the open and close movement of the door 102 can be appropriately avoided.

[0101] Furthermore, since the locking and unlocking apparatus 100A has the first rotation body 23 as being the acting force accumulating member that accumulates the acting force to move the engaging part 121 from the

unlocked position to the locked position while the engaging part 121 moves from the locked position to the unlocked position due to the operation of the operating part 122 and then the operating force to the operating part 122 is released after the door 102 is open and the restraint member 6 that restrains the first rotation body 23 at the acting force accumulating position, and the holding force by the restraint member 6 is released at a time when the detecting device 7 detects that the door 102 moves to the closed position again so that the engaging part 121 is moved from the unlocked position to the locked position by the accumulated acting force of the first rotation body 23, it is possible to interlock the detection by the detecting device 7 that the door 102 locates at the closed position and the release of the acting force from the engaging part 12 appropriately.

[0102] Furthermore, since the detecting device 7 contains the displacement part 72 arranged in the door 102, and the displacement part 72 changes its position by making contact with the pressing member 71 arranged in the cabinet 101 so that the restraint member 6 is moved from a restraining position for restraining the first rotation body 23 to a non-restraining position, and especially the displacement part 72 and the pressing member 71 make contact each other or are separated from each other in the edge part 102b in the side opposite to the hinge side of the door 102, it is possible to produce a mechanical displacement precisely with a compact arrangement.

[0103] In addition, since the relating part 100C is of the ratchet structure that allows the operating part 122 to make a returning movement in the lock direction and prohibits the unlock operation of the operating part 122 after the door 102 is closed again in case that the unlock operation is released after the dial lock 103 is reset to the unverified state by the unlock operation of the operating part 122, it is possible to effectively prevent the operating part 122 from being hampered to make the returning movement in the lock direction after the dial lock 103 is reset to the unverified state.

[0104] Furthermore, since the elastic force in the lock direction is applied to the operating part 122 and the operating part 122 moves in the lock direction when the operating force in accordance with the unlock operation disappears, it is possible to automatically move the operating part 122 back to the lock direction just by leaving the hands from the operating part 122.

[0105] Especially, since the operating part 122 also serves as a knob to open and close the door 102, it is possible to conduct the unlock operation and the subsequent operation to open the door 102 smoothly in the same motion.

[0106] As a concrete embodiment, the dial lock 103 comprises the lever 131 that is elastically urged to one direction and that moves to the predetermined position and is held at this position against the elastic force at a time when a dial lock body 130 is verified and that releases the holding force at a time when the dial lock body 130 is unverified, and the acting body 104 that resets the

dial lock body 130 to the unverified state by acting toward one direction and that makes the dial lock body 130 in a reset waiting state by acting toward the other direction. Since the lever 131 and the operating part 122 are related through the first relating part 100C so that the unlock operation of the operating part 122 is prohibited at a time of the unverified state and the unlock operation is allowed at a time of the verified state, and the acting body 104 and the operating part 122 are related through the second relating part 100D so that the dial lock body 130 is reset to the unverified state in accordance with the unlock operation of the operating part 122 after the verified state, the lever 131, the acting body 104 and the operating part 122 can be appropriately operated in conjunction with each other.

[0107] In addition, in the above-mentioned embodiment, since the engaging part 121 projects in the falciform shape and the engaged part 111 is in relation of receiving the falciform shape, it is possible to drive the engaging part 121 directly by applying to an object to be applied, for example, a locker, having thus engaging structure.

[0108] Especially, the engaging part 121 extends in the direction orthogonal to the opening/closing direction of the door 102 at the closed position and has the flexural nail part 121a at its distal end, and the nail part 121a securely engages the engaged part 111 locating at the inner side surface through the above-mentioned engaging structure so that the closed state of the door 102 can be put into practical use.

[0109] Then, if the locking and unlocking apparatus 100A of this embodiment is applied to between the door 102 and the cabinet 101, it is possible to configure the storage cabinet 100B such as a locker or the like by incorporating the dial lock 103 easily without requiring high accuracy to between the door 102 and the cabinet 101. With this arrangement, it is possible to stably and securely actuate the locking and unlocking apparatus 100A for a long period of time and to effectively improve the usability of the storage cabinet 100B such that personal belongings can be taken in and out quickly and easily.

[0110] A concrete configuration of each component is not limited to the above-mentioned embodiment.

[0111] For example, the detection of the detecting device may be conducted electrically. In this case, it is effective to drive the restraint member by means of a solenoid.

[0112] In addition, the open/close member may be a drawer, in addition to the door. It is also possible to arrange the dial lock, the operating part and the engaging part on the cabinet, and to arrange the engaged part on the open/close member.

[0113] Furthermore, since the locking and unlocking apparatus 100A is not affected by a configuration such as a shape of the engaging part and the engaged part, it is also possible to configure that the engaged part projects in a cross bar shape and the engaging part is in relation of receiving the crossbar shape.

[0114] In addition, it is also possible that the engaging

part projects in the opening/closing direction of the door and engages the cabinet.

[0115] In addition, to reset the dial lock to the unverified state in accordance with the unlock operation of the operating part after the verified state through the second relating part includes to be reset at a time when the operating part is released after the unlock operation of the operating part is conducted.

[0116] Other configuration may be variously modified without departing from a spirit of this invention.

POSSIBLE APPLICATIONS IN INDUSTRY

[0117] In accordance with the above-mentioned present claimed invention, it is possible to provide the locking and unlocking apparatus wherein the dial lock can be installed between the cabinet and the open/close member with ease and the dial lock can be securely operated so that locking and unlocking of the open/close member can be appropriately conducted with a simple operation.

Claims

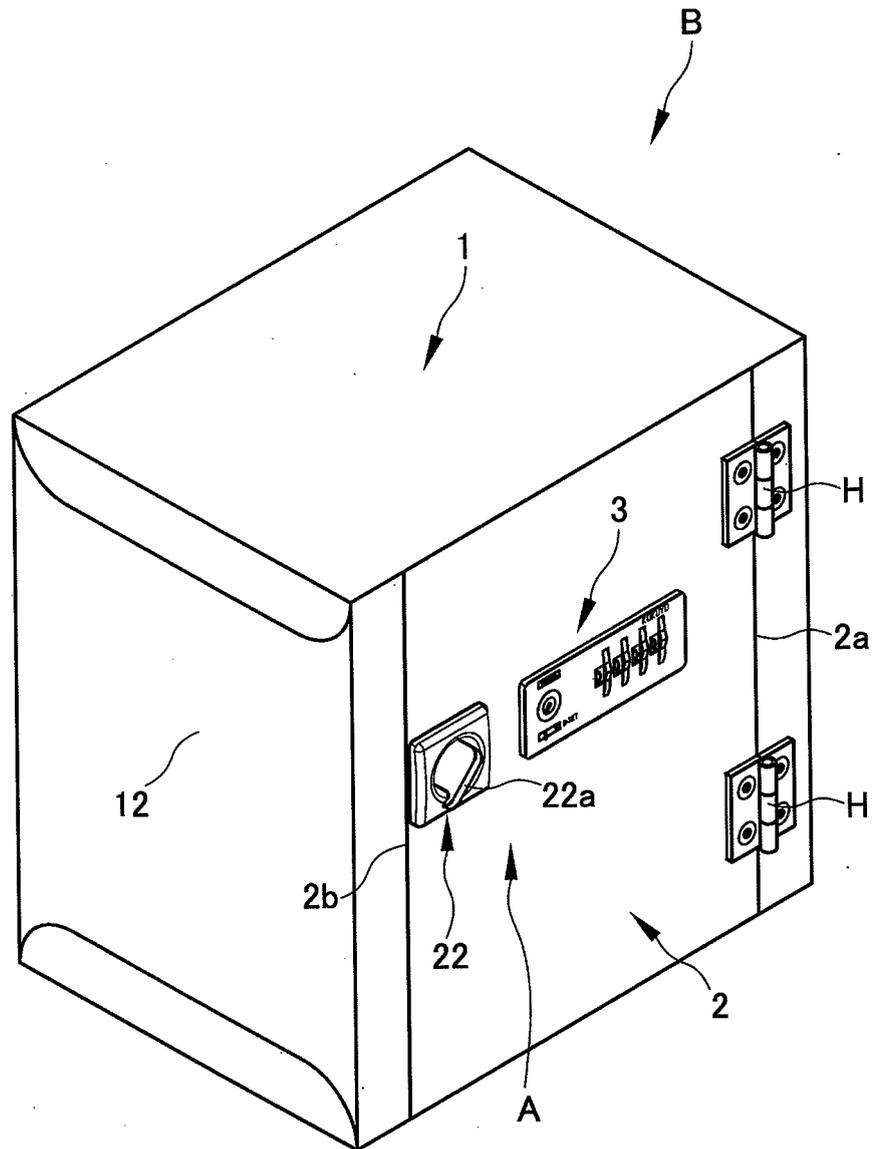
1. A locking and unlocking apparatus comprising a cabinet, an open/close member that opens or closes an opening of the cabinet, a dial lock, an operating part and an engaging part arranged on either one of the cabinet and the open/close member, and an engaged part arranged on either the other of the cabinet and the open/close member, and holding the open/close member at a closed position by engaging the engaging part with the engaged part, wherein the operating part switches the position of the engaging part relative to the engaged part from a locked position to an unlocked position by receiving an unlock operation, the dial lock is related at least to the operating part through a relating part so as to prohibit an unlock operation of the operating part at a time when the dial lock is unverified and to allow an unlock operation of the operating part and to reset the dial lock to the unverified state in conjunction with a subsequent unlock operation at a time when the dial lock is verified, the engaging part automatically moves to the locked position so as to make an engagement with the engaged part while starting from a time when the unlock operation to the operating part is released to a time when the open/close member moves to the closed position again.
2. The locking and unlocking apparatus described in claim 1, wherein the relating part is of a ratchet structure that allows the operating part to make a returning movement toward the lock direction and that prohibits an unlock

operation of the operating part again in case that the operating part is released after the dial lock is reset to the unverified state by the unlock operation of the operating part.

3. The locking and unlocking apparatus described in claim 2, wherein an elastic force in the lock direction is applied to the operating part, and the operating part moves toward the lock direction by disappearing an operating force of the unlock operation.
4. The locking and unlocking apparatus described in either of claim 1 through 3, wherein the dial lock comprises a lever that is elastically urged to one direction and moves to a predetermined position and is held at this position against the elastic force at a time when the dial lock is verified and that releases the holding force at a time when the dial lock is unverified, and an acting body that resets the dial lock to the unverified state by acting toward one direction and that makes the dial lock in a reset waiting state by acting toward the other direction, the lever and the operating part are related through a first relating part and an unlock operation of the operating part is prohibited at a time of the unverified state and the unlock operation of the operating part is allowed at a time of the verified state, and the acting body and the operating part are related through a second relating part, and the dial lock is reset to the unverified state due to the unlock operation of the operating part after the verified state.
5. The locking and unlocking apparatus described in either of claim 1 through 4, wherein the engaging part and the engaged part are in a relationship that either one of the engaging part and the engaged part projects in a falciform shape and the other receives the falciform shape.
6. The locking and unlocking apparatus described in claim 5, wherein the engaging part elastically moves to the locked position by releasing the operating part after the dial lock is verified and the unlock operation of the operating part is conducted, and then engages with the engaged part after temporarily making an interference avoiding movement against the elastic force by making an abutting contact with the engaged part immediately before the open/close member reaches the closed position.
7. A locking and unlocking apparatus comprising a cabinet, an open/close member that opens or closes an opening of the cabinet, a dial lock, an operating part and an engaging part arranged either one of the cabinet and the open/close member, and an engaged part arranged either the other of the cabinet and the

- open/close member, and holding the open/close member at a closed position by engaging the engaging part with the engaged part, wherein the operating part switches the position of the engaging part relative to the engaged part from a locked position to an unlocked position by receiving an unlock operation,
- the dial lock is related at least to the operating part through a relating part at least at a time when the open/close member is closed so as to prohibit an unlock operation of the operating part at a time when the dial lock is unverified and to allow an unlock operation of the operating part and to reset the dial lock to the unverified state in conjunction with a subsequent unlock operation at a time when the dial lock is verified,
- the engaging part is held at the unlocked position with accumulating an acting force toward the locked position when the operating part is released after the unlock operation of the operating part is conducted and the open/close member is open and automatically moves to the locked position so as to make an engagement with the engaged part by releasing the acting force at a stage that the open/close member moves again to the closed position.
8. The locking and unlocking apparatus described in claim 7, wherein
a detecting device to detect whether the open/close member locates at the closed position or not is arranged between the cabinet and the open/close member.
9. The locking and unlocking apparatus described in claim 8, and comprising an acting force accumulating member that accumulates the acting force to move the engaging part from the unlocked position to the locked position while the engaging part moves from the locked position to the unlocked position due to an operation of the operating part and then the operating force to the operating part is removed after the open/close member is open and a restraint member that restrains the acting force accumulating member at an acting force accumulating position, a holding force by the restraint member is released at a time when the detecting device detects that the open/close member again moves to the closed position so that the engaging part is moved from the unlocked position to the locked position by the accumulated acting force of the acting force accumulating member.
10. The locking and unlocking apparatus described in claim 9, wherein
the detecting device contains a displacement part arranged in either one of the cabinet and the open/close member, and the displacement part changes its position by making contact with the other of the cabinet or the open/close member so that the restraint member is moved from a restraining position for restraining the acting force accumulating member to a non-restraining position.
11. The locking and unlocking apparatus described in either of claim 7 through 10, wherein
the relating part is of a ratchet structure that allows the operating part to make a returning movement toward the lock direction in case that the the operating part is released after the dial lock is reset to the unverified state by the unlock operation of the operating part and that prohibits an unlock operation of the operating part after the door is closed again.
12. The locking and unlocking apparatus described in claim 11, wherein
an elastic force in the lock direction is applied to the operating part, and the operating part moves toward the lock direction by disappearing an operating force of the unlock operation.
13. The locking and unlocking apparatus described in either of claim 7 through 12, wherein
the dial lock comprises a lever that is elastically urged to one direction and moves to a predetermined position and is held at this position against the elastic force at a time when a dial lock is verified and that releases the holding force at a time when the dial lock is unverified, and an acting body that resets the dial lock to the unverified state by acting toward one direction and that makes the dial lock in a reset waiting state by acting toward the other direction, the lever and the operating part are related through a first relating part and an unlock operation of the operating part is prohibited at a time of the unverified state and the unlock operation of the operating part is allowed at a time of the verified state, and the acting body and the operating part are related through a second relating part, and the dial lock is reset to the unverified state in accordance with the unlock operation of the operating part after the verified state.
14. The locking and unlocking apparatus described in either of claim 1 through 13, wherein
the operating part also serves as a grip to open and close the open/close member.
15. A storage cabinet **characterized by** applying the locking and unlocking apparatus described in either of claim 1 through 14 between the open/close member and the cabinet.

Fig. 1



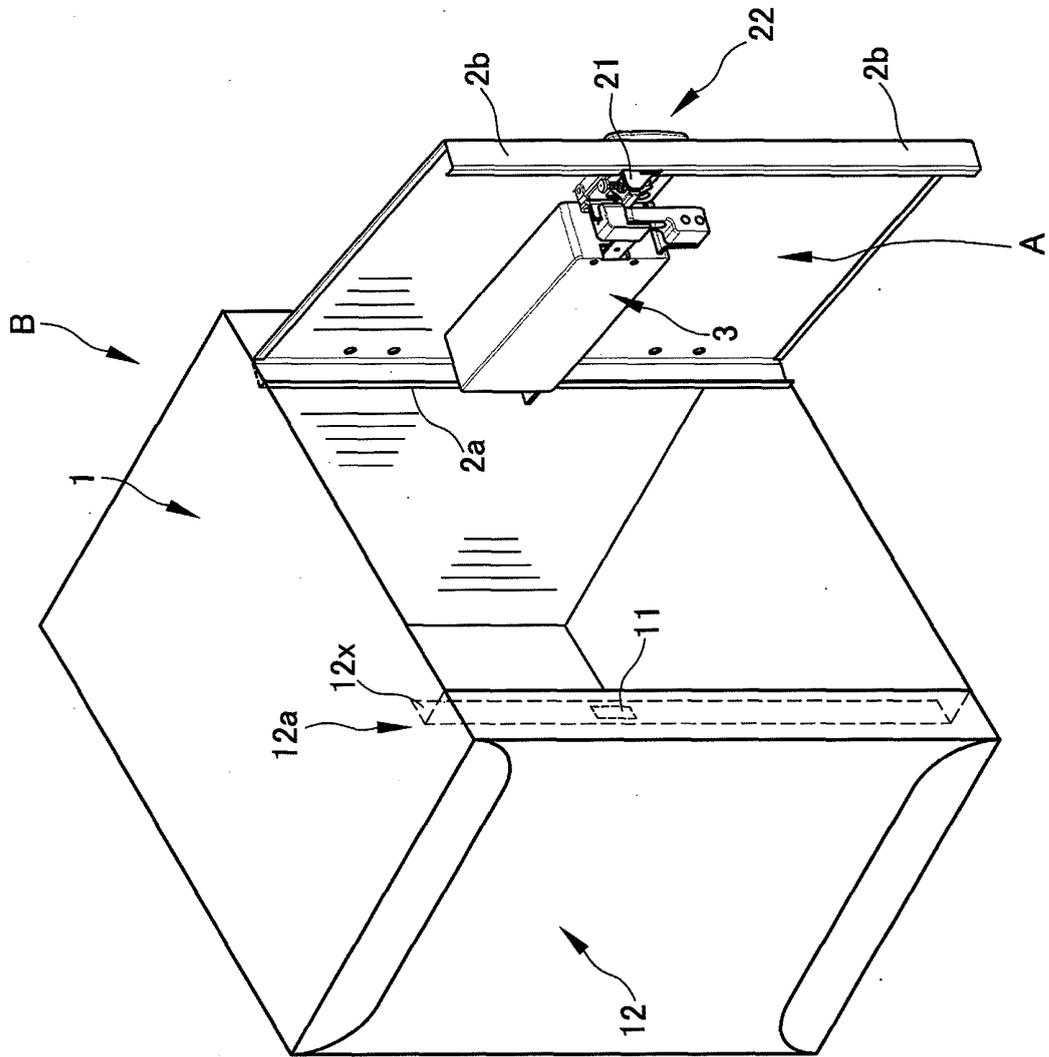


Fig. 2

Fig. 4

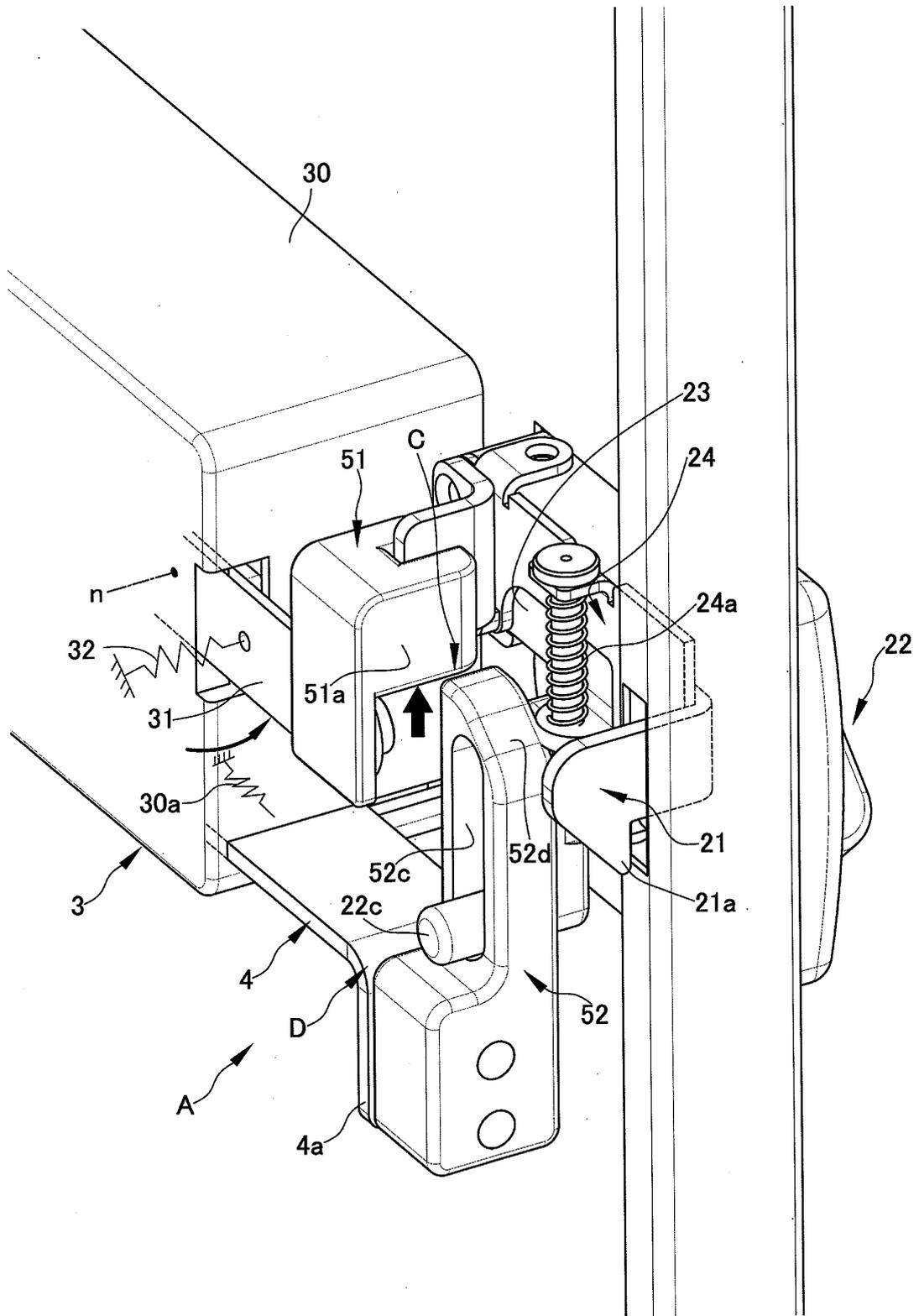


Fig. 5

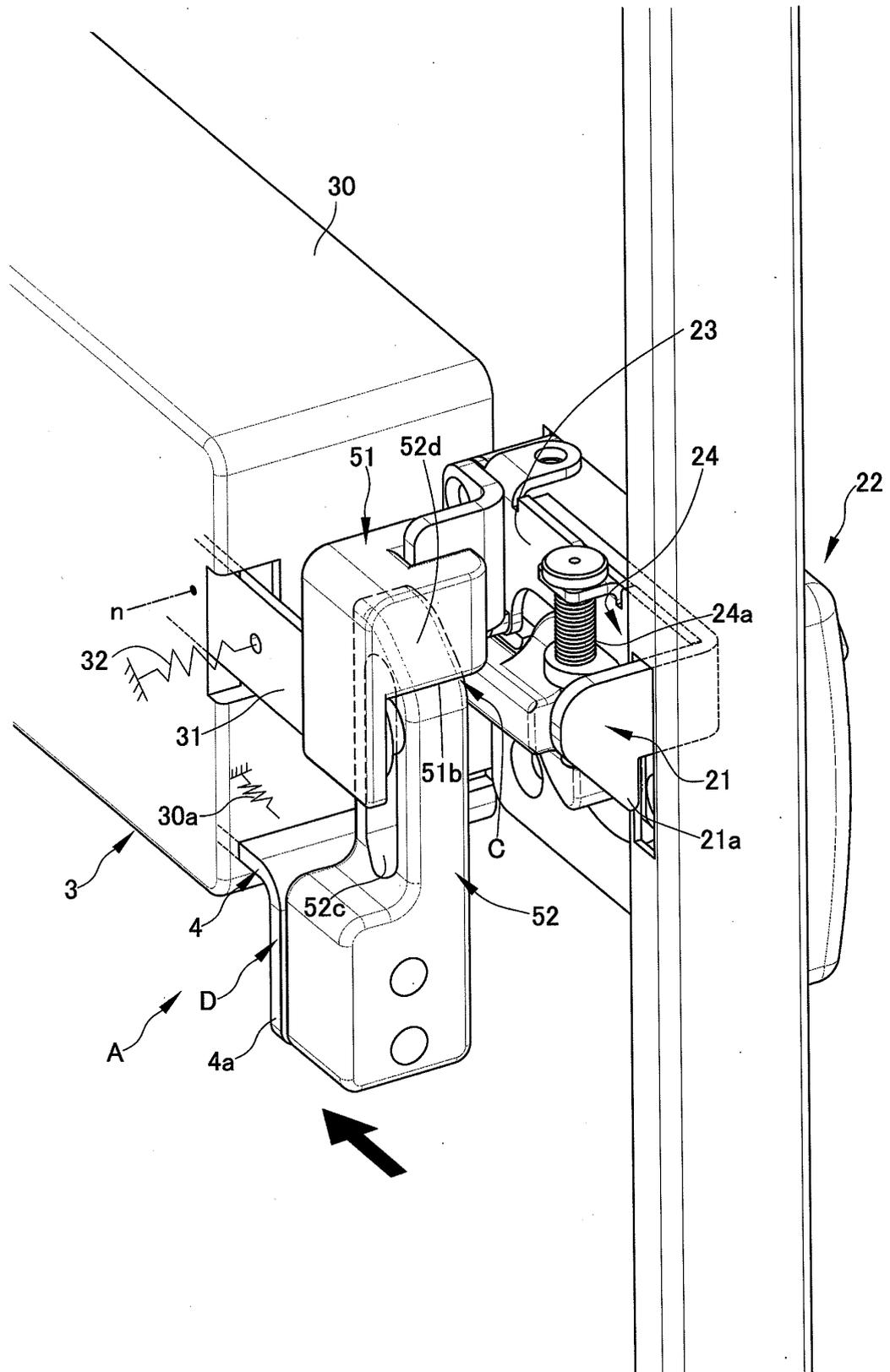
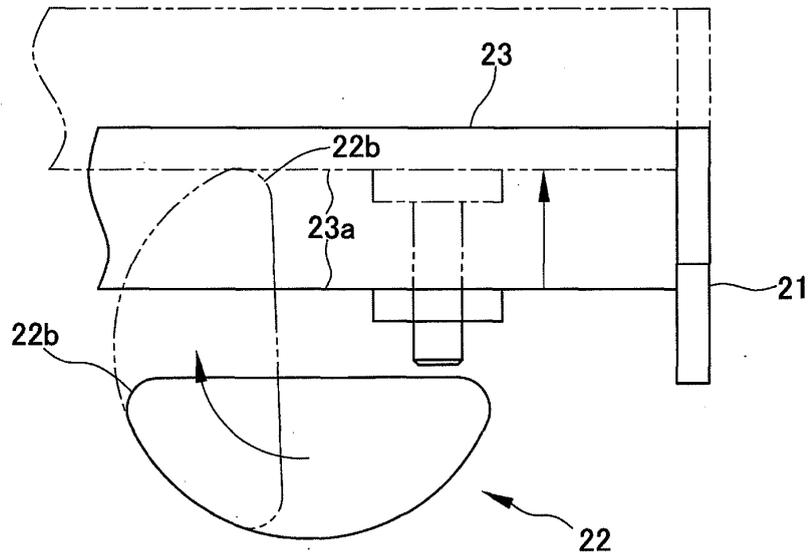


Fig. 6
(a)



(b)

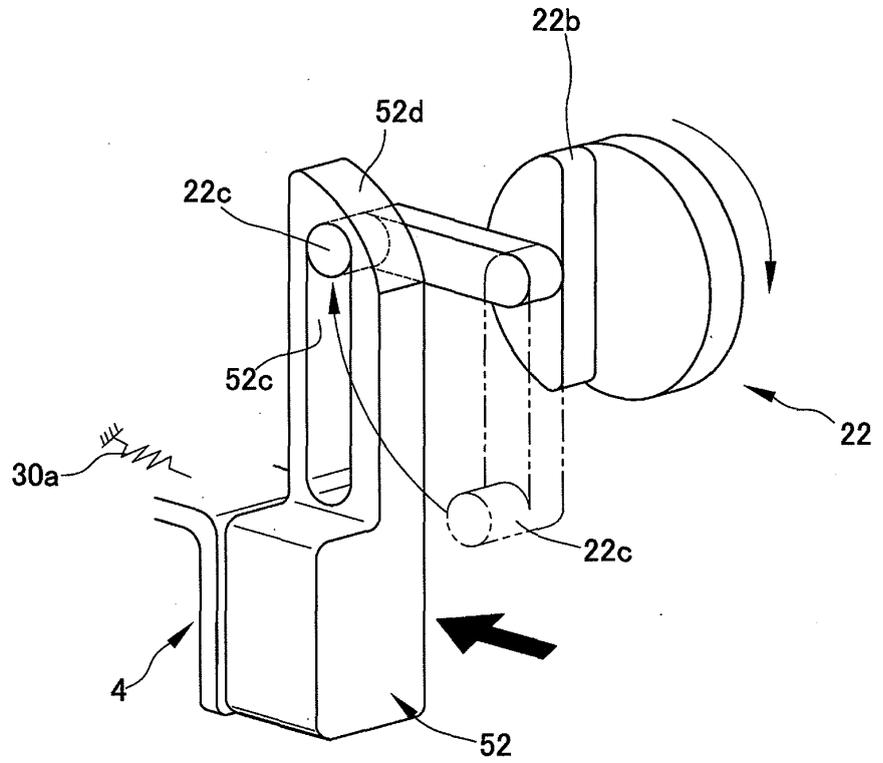


Fig. 7

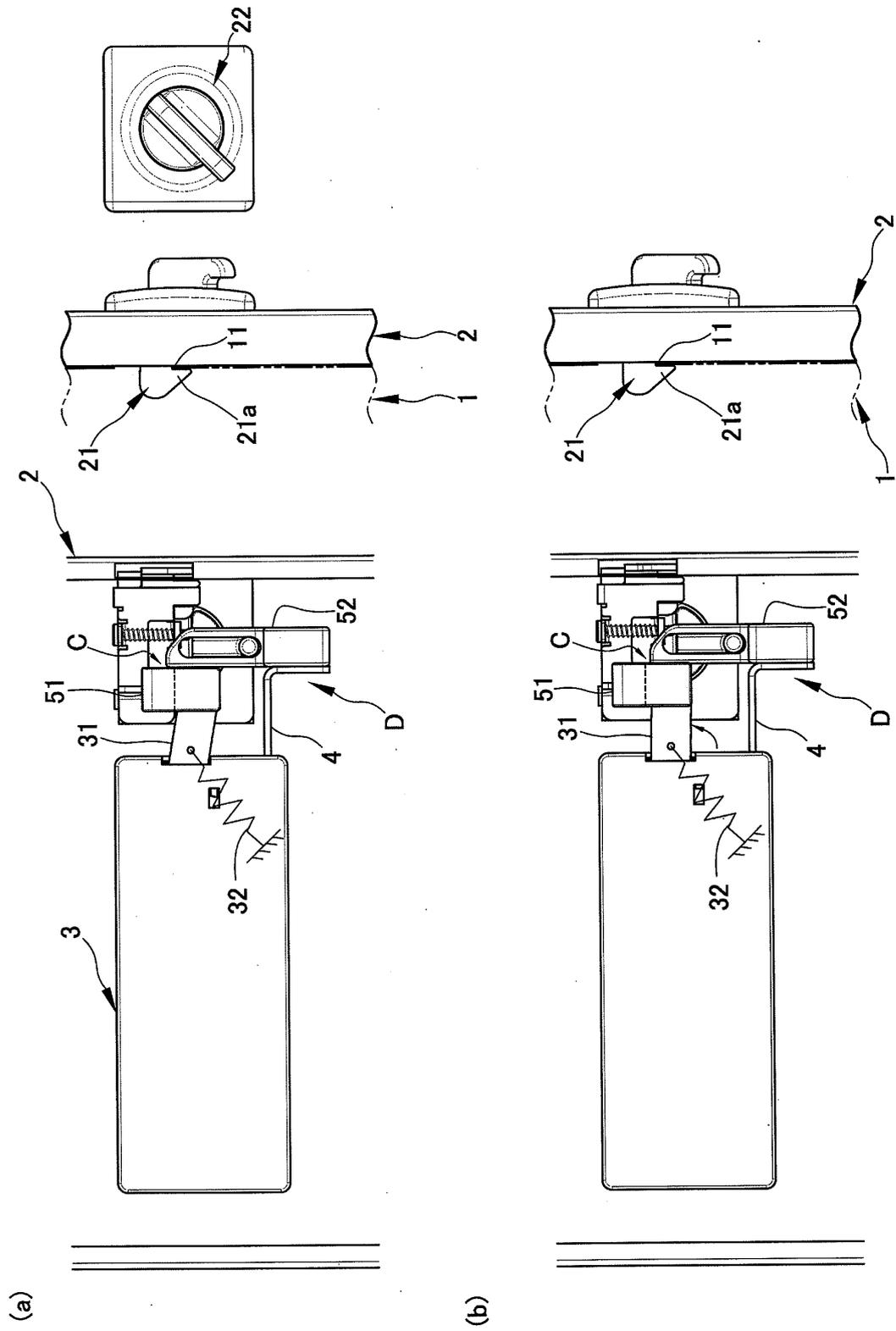


Fig. 8

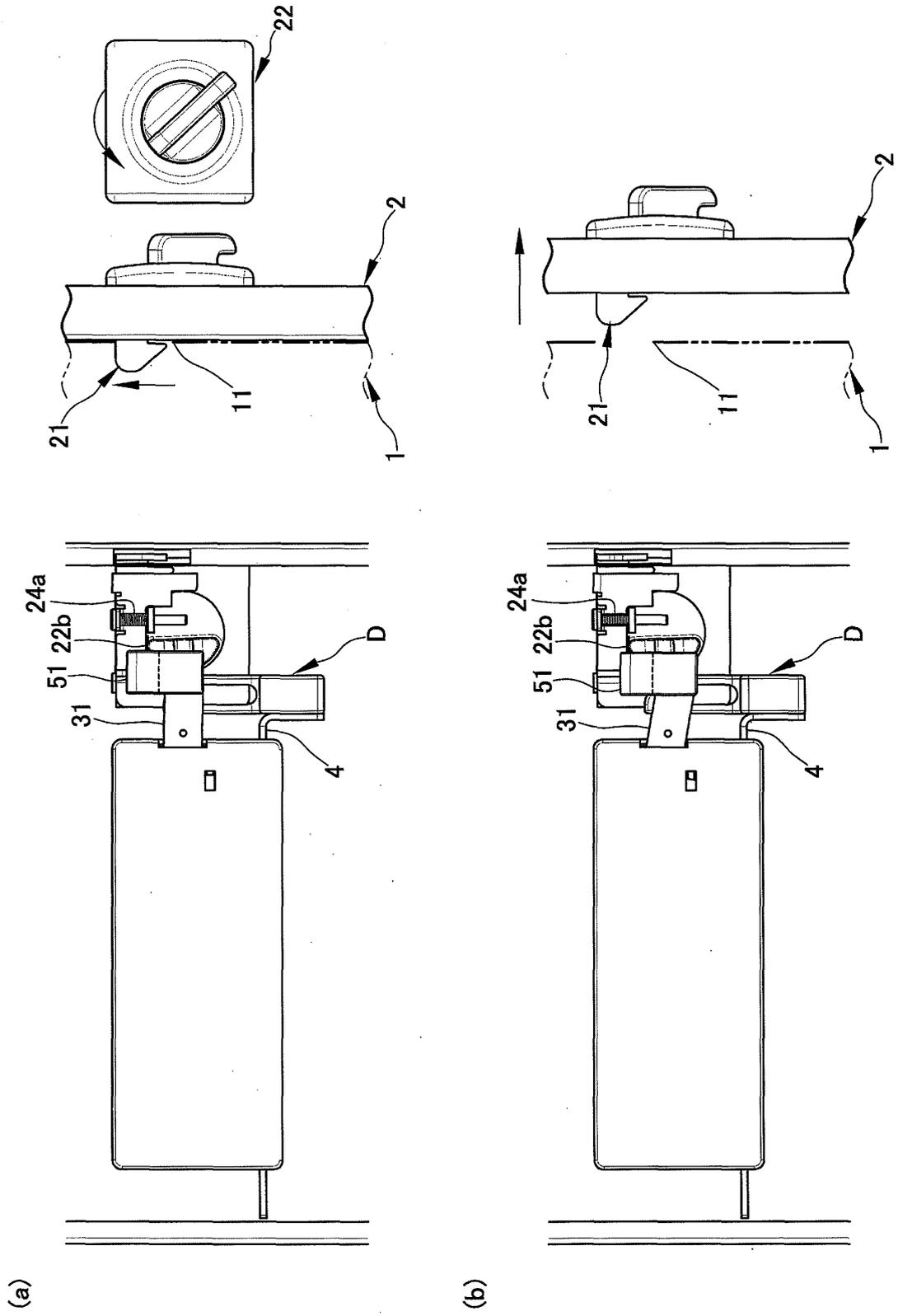


Fig. 9

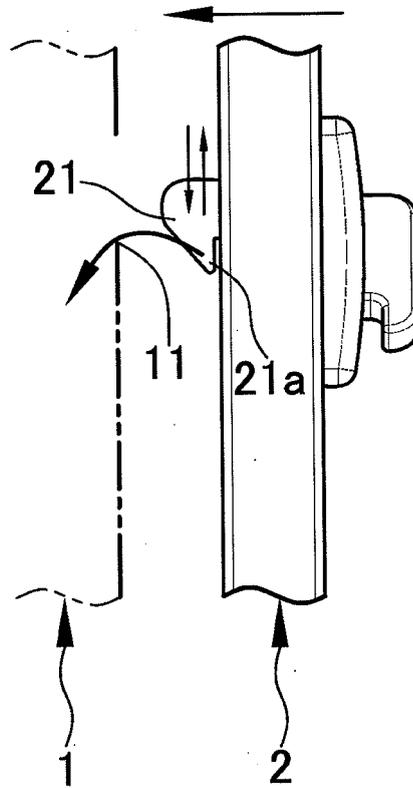


Fig. 10

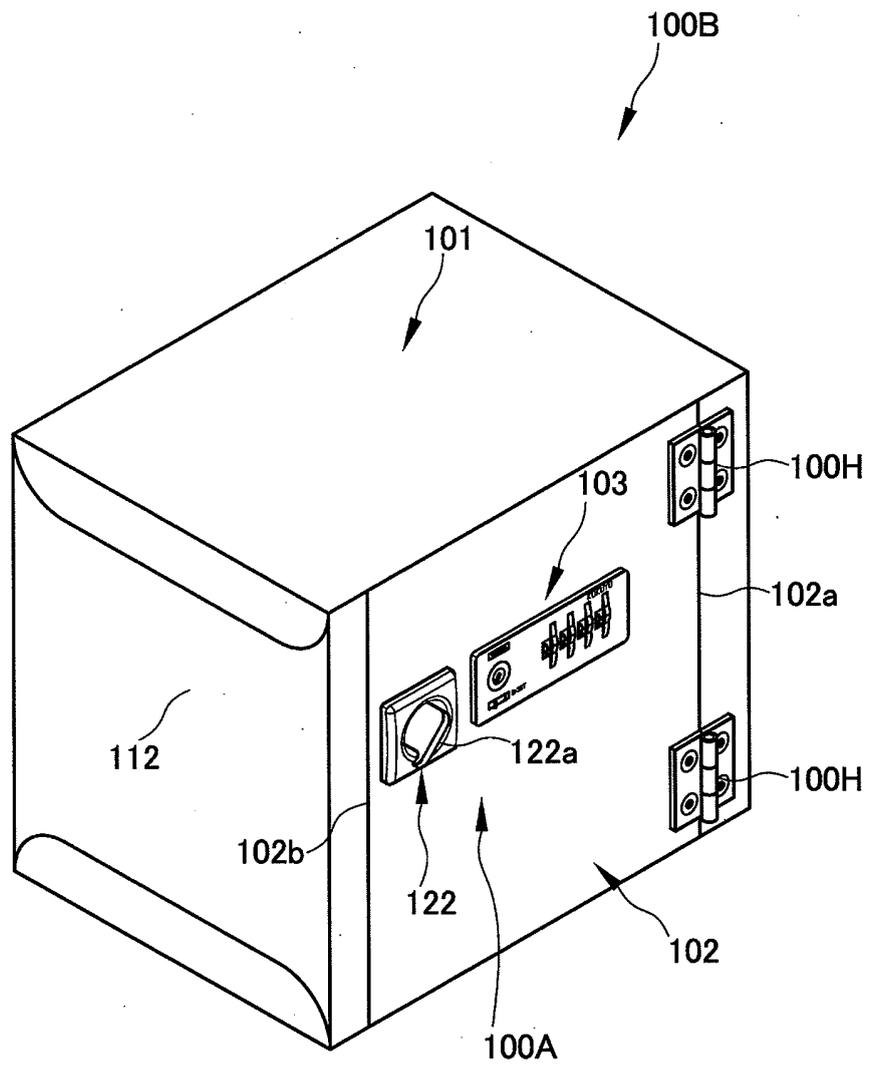


Fig. 11

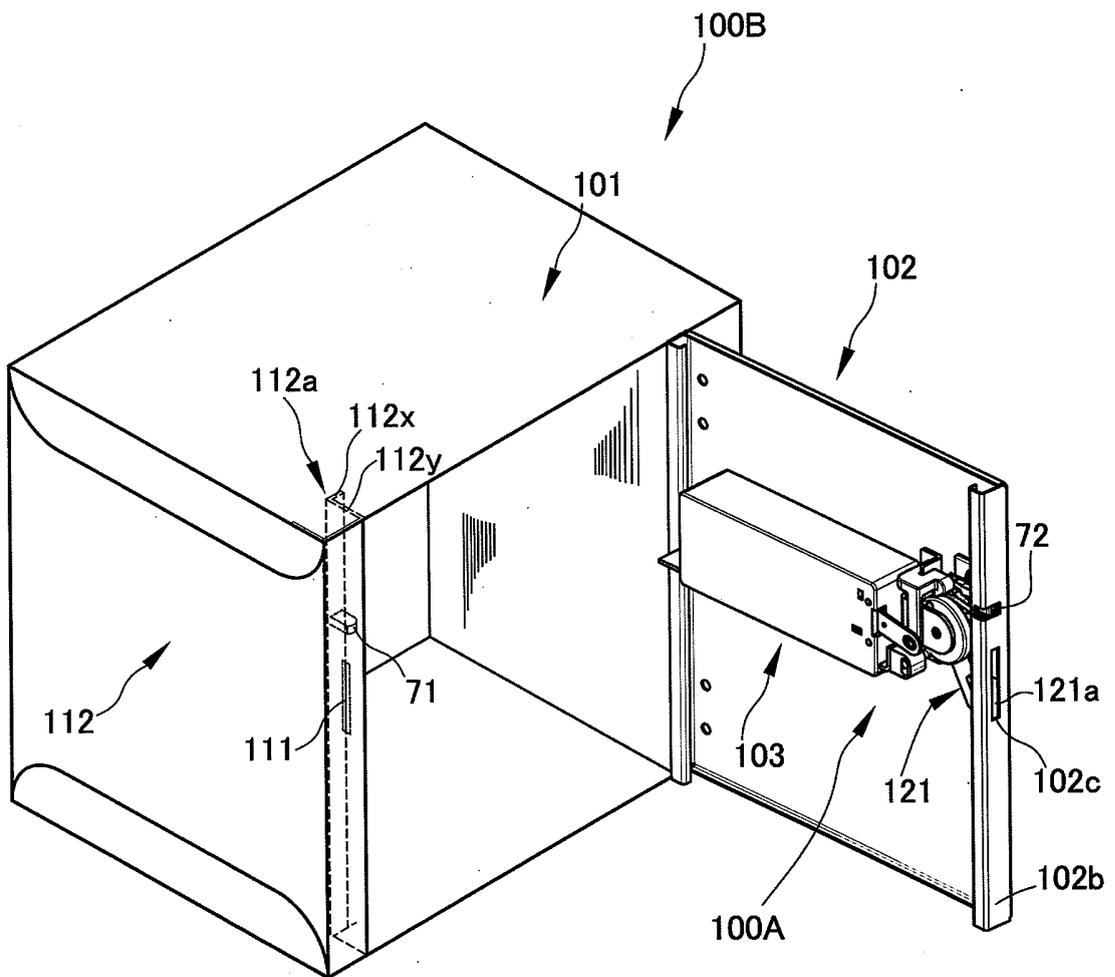


Fig. 12

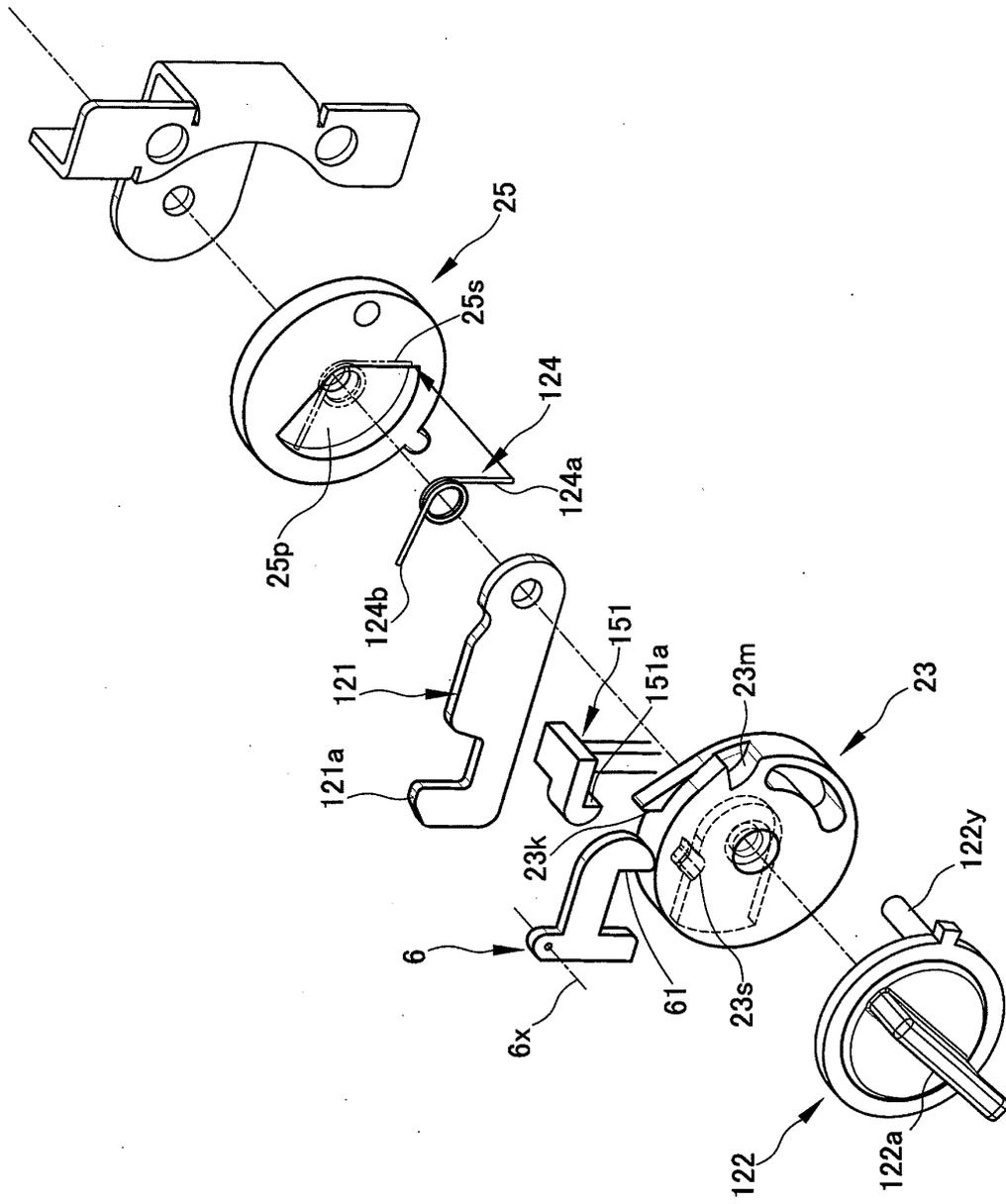


Fig. 13

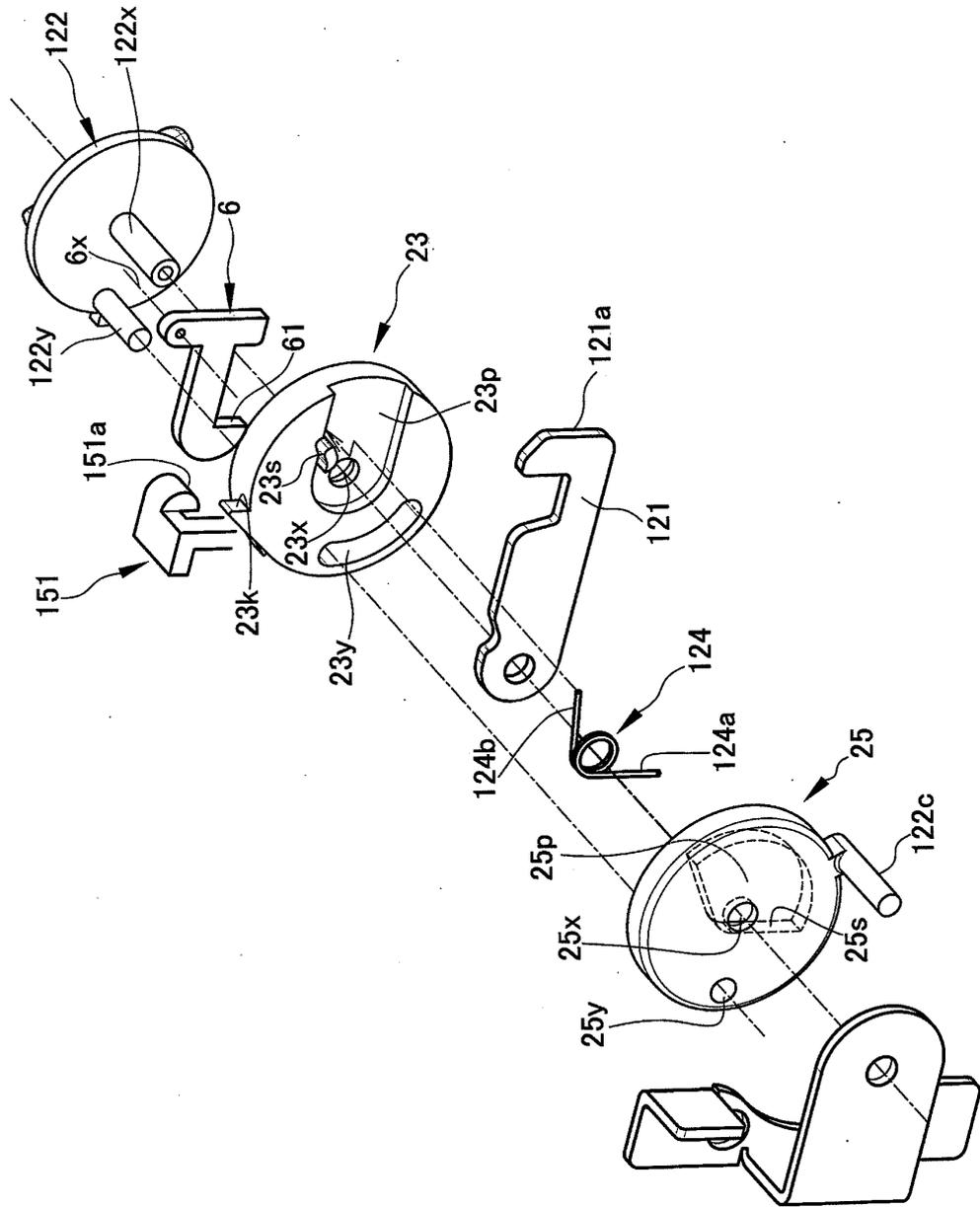
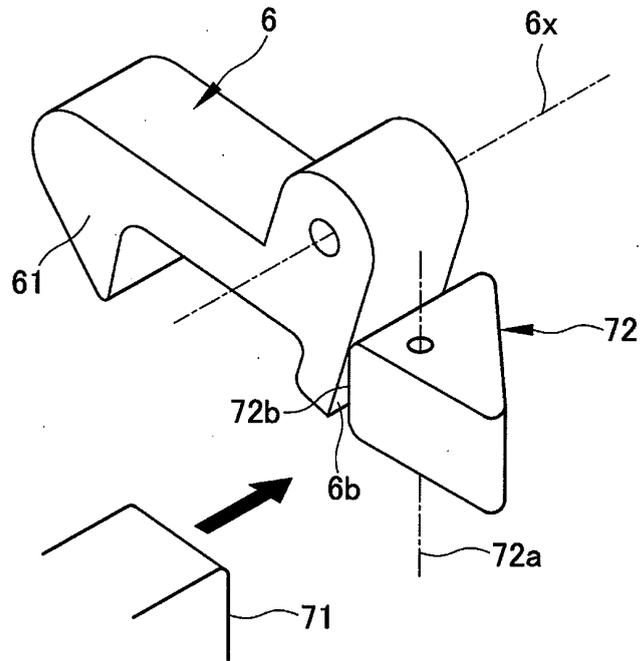


Fig. 14

(a)



(b)

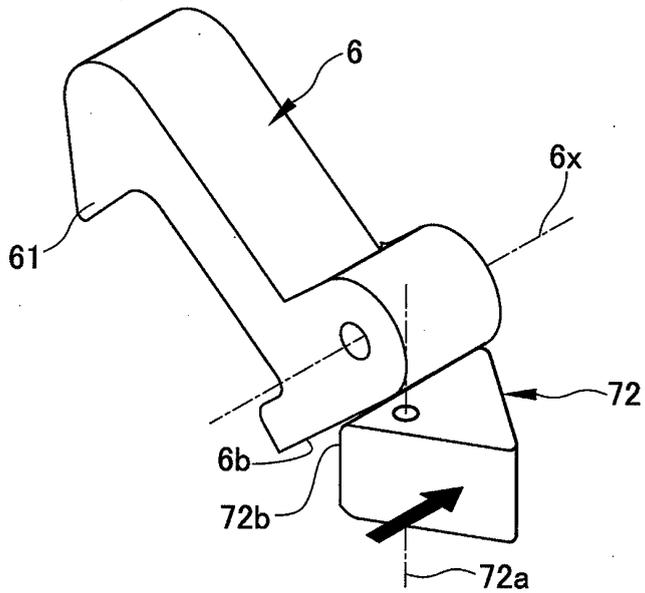


Fig. 15

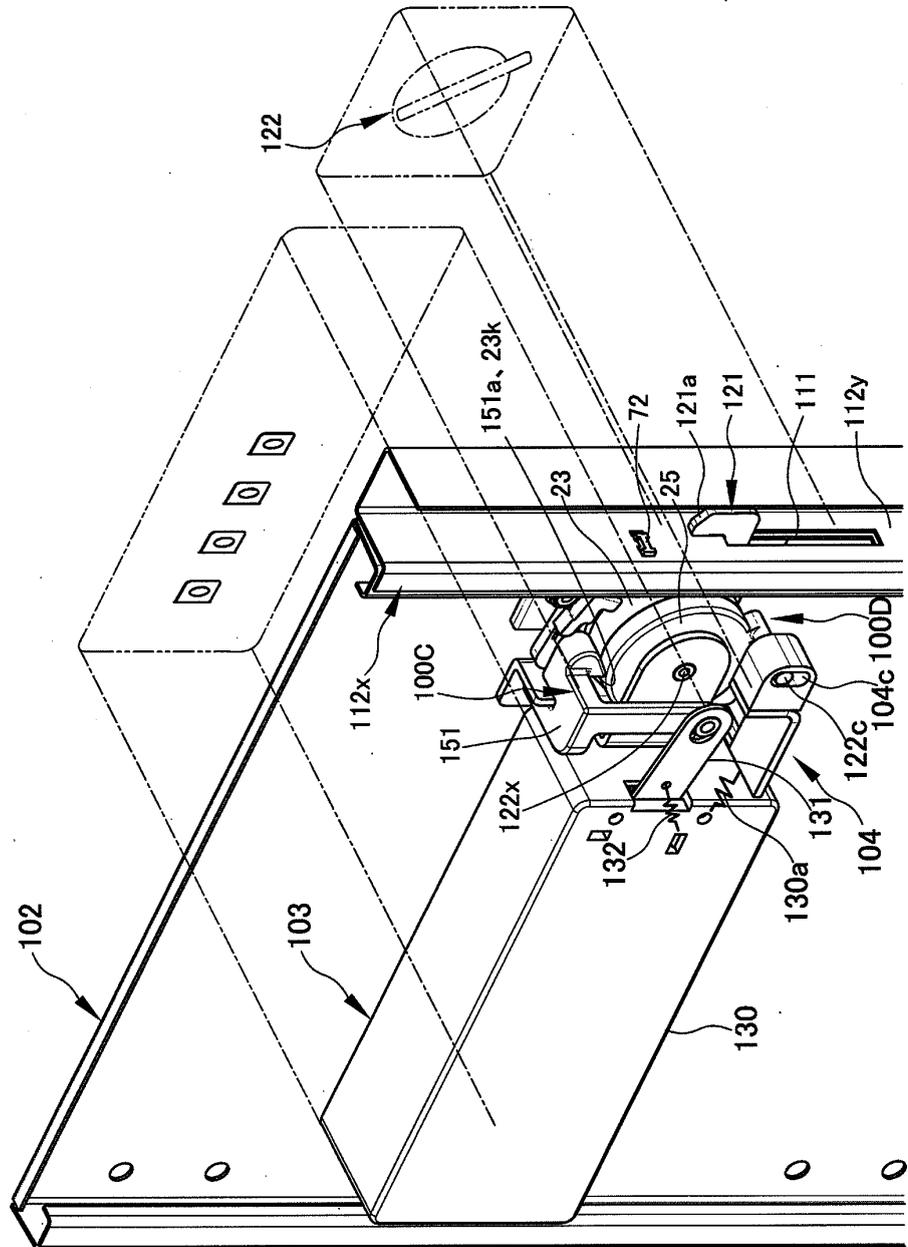


Fig. 16

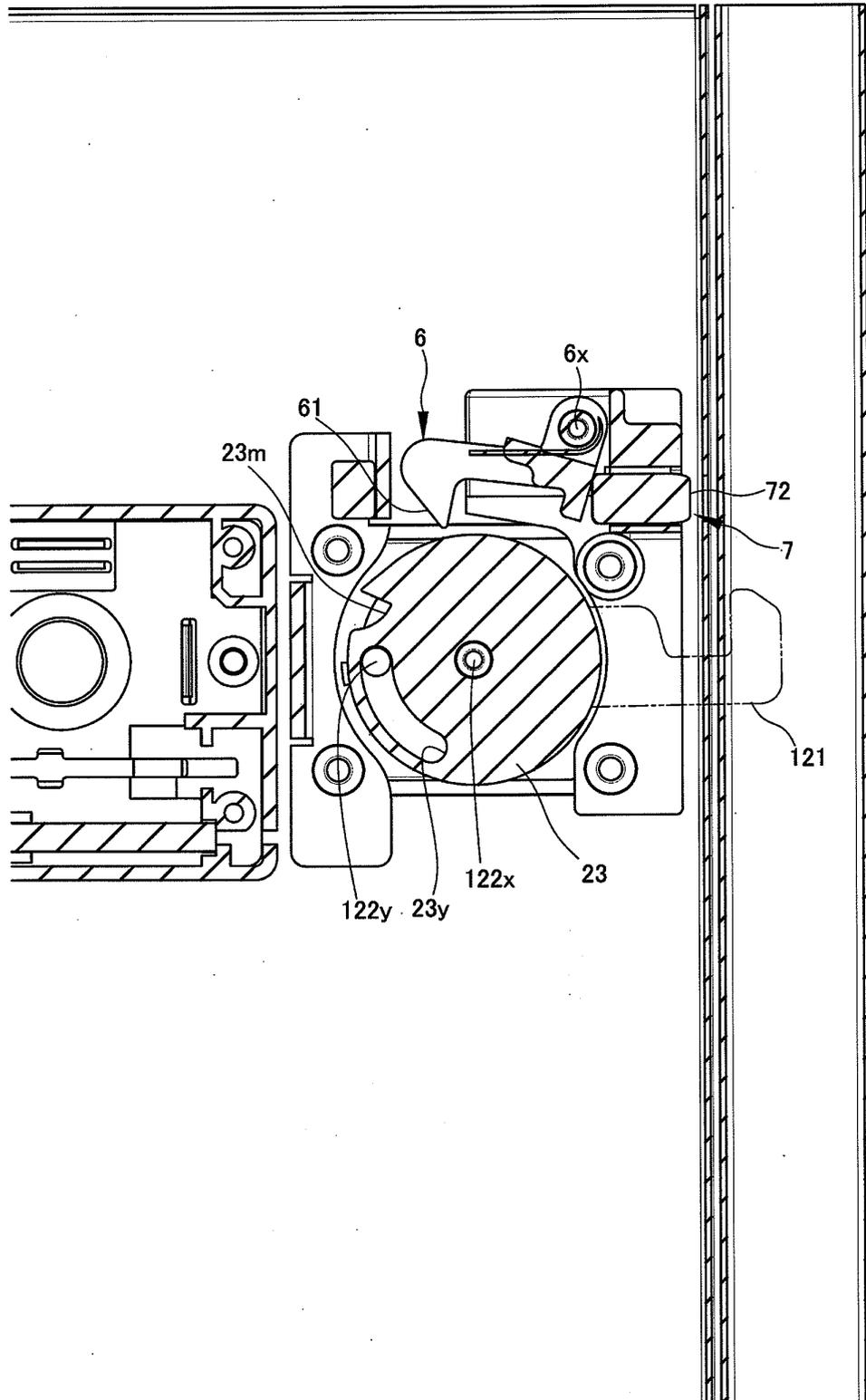


Fig. 17

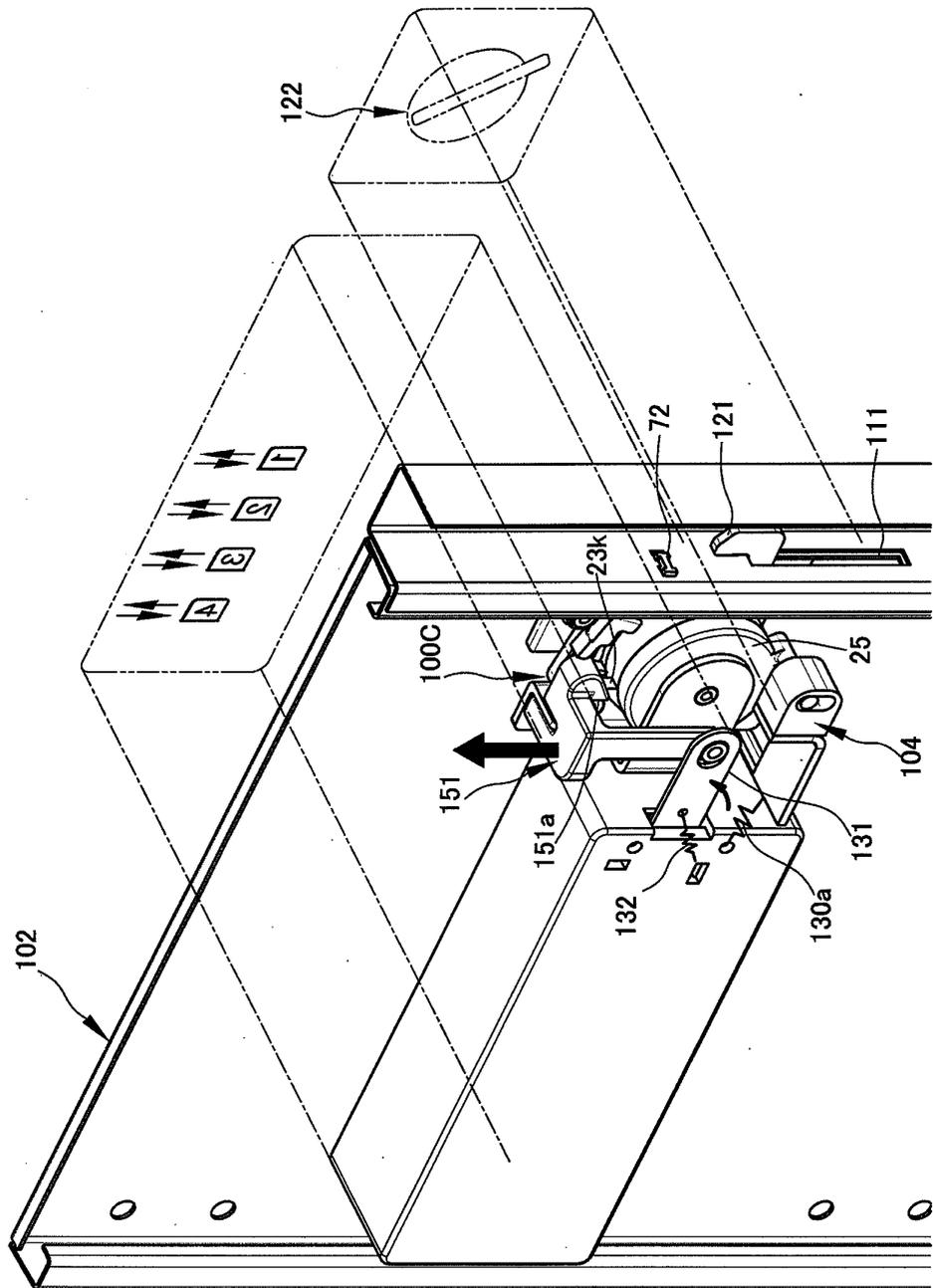


Fig. 18

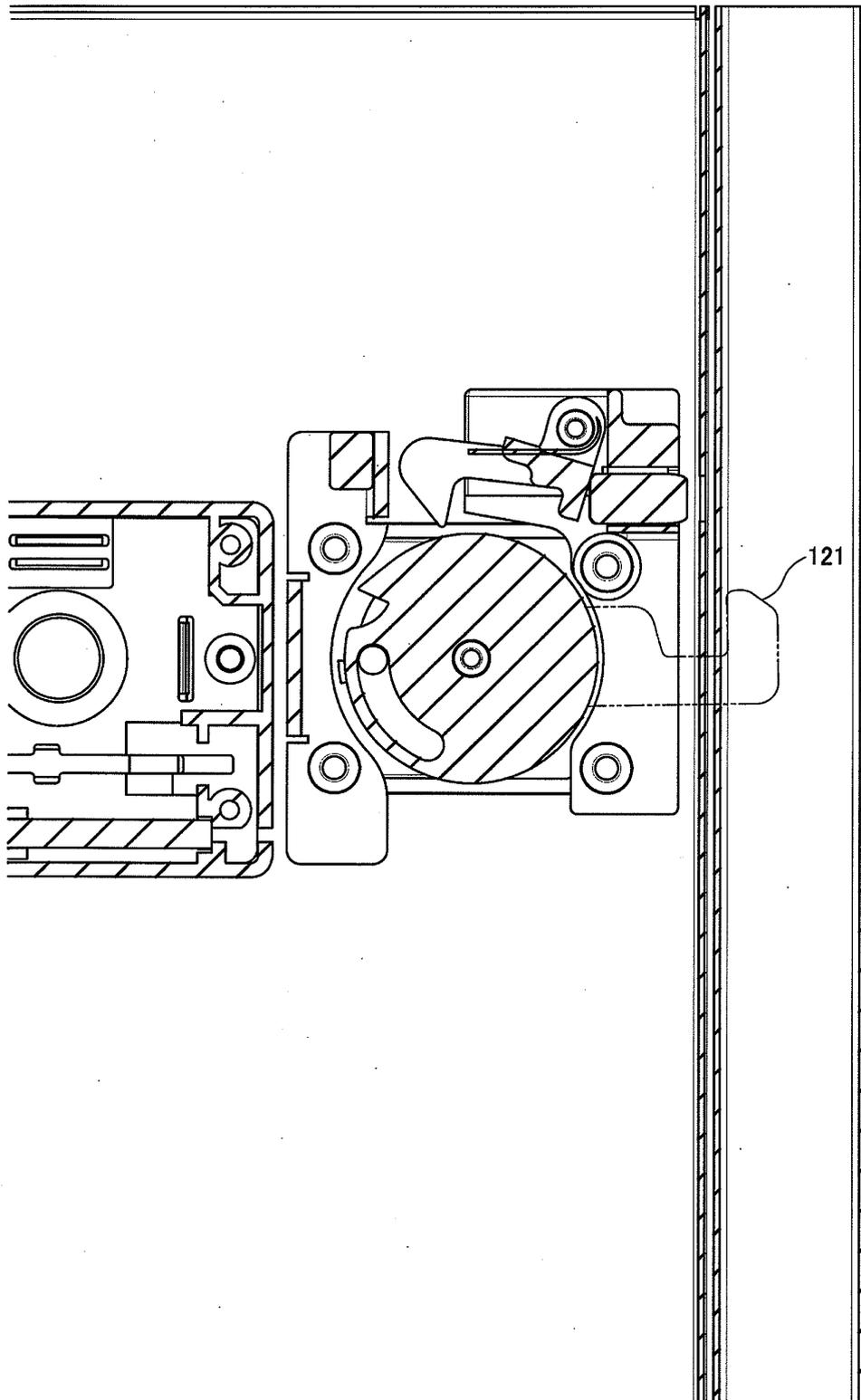


Fig. 20

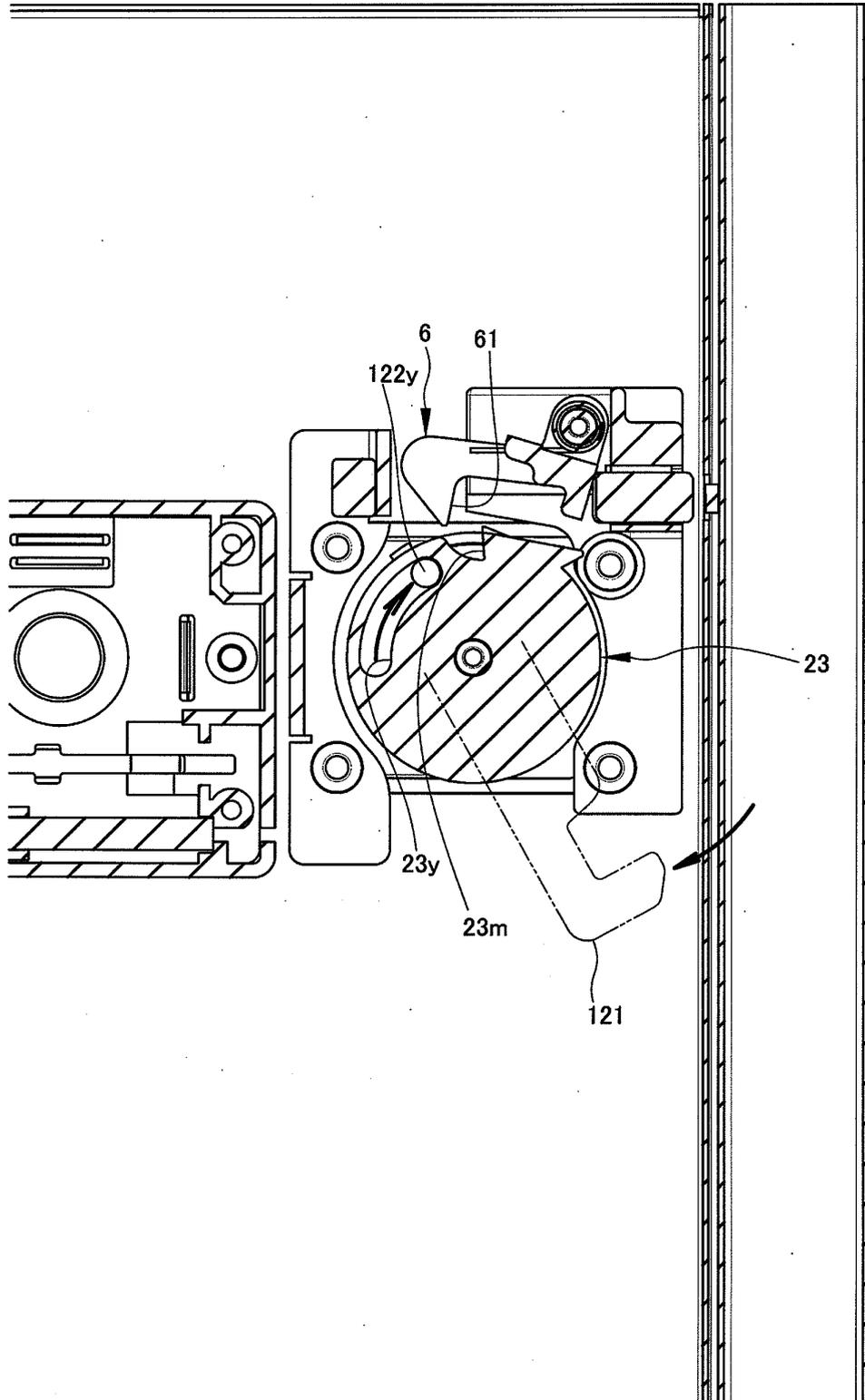


Fig. 21

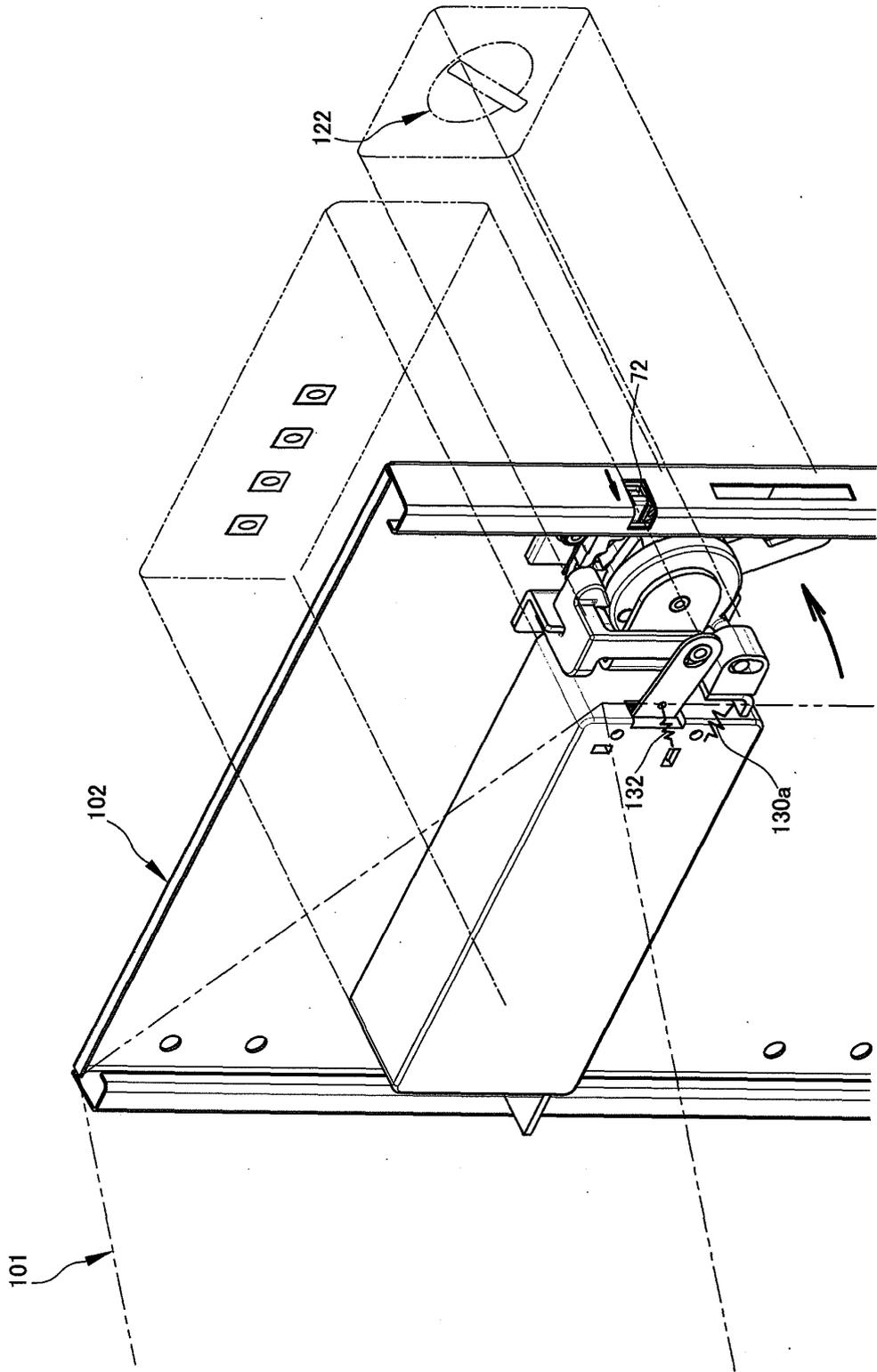


Fig. 22

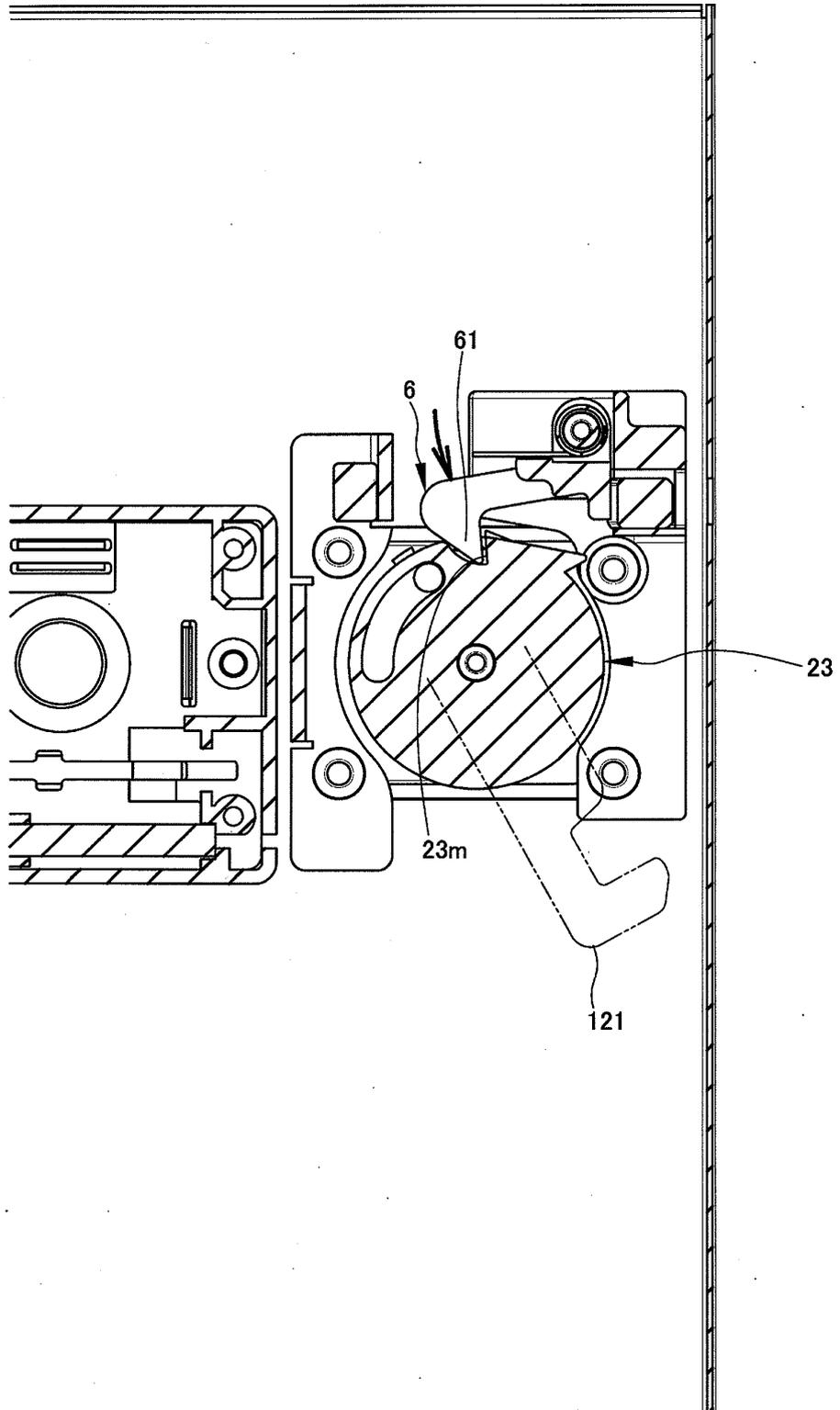


Fig. 23

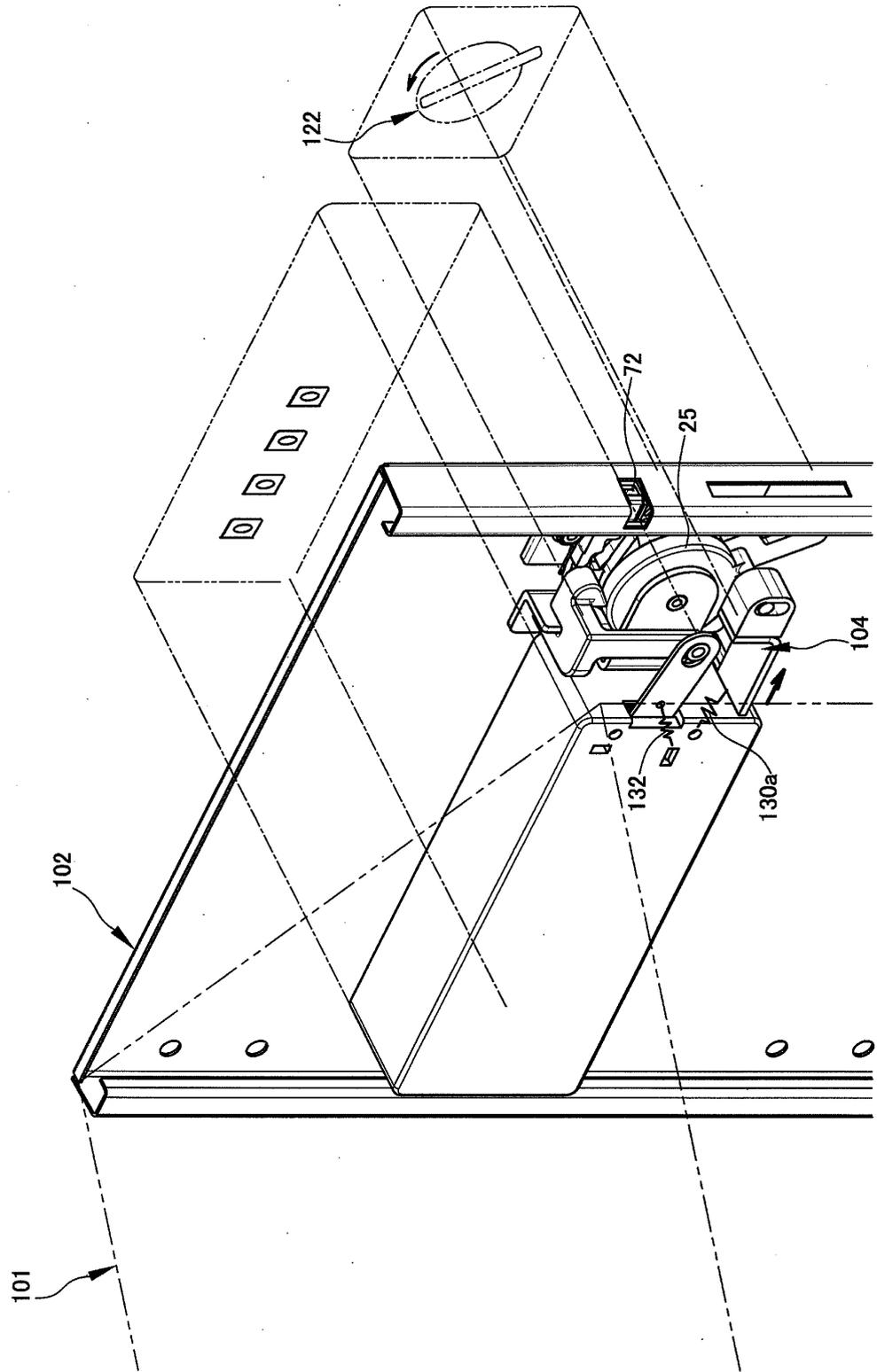
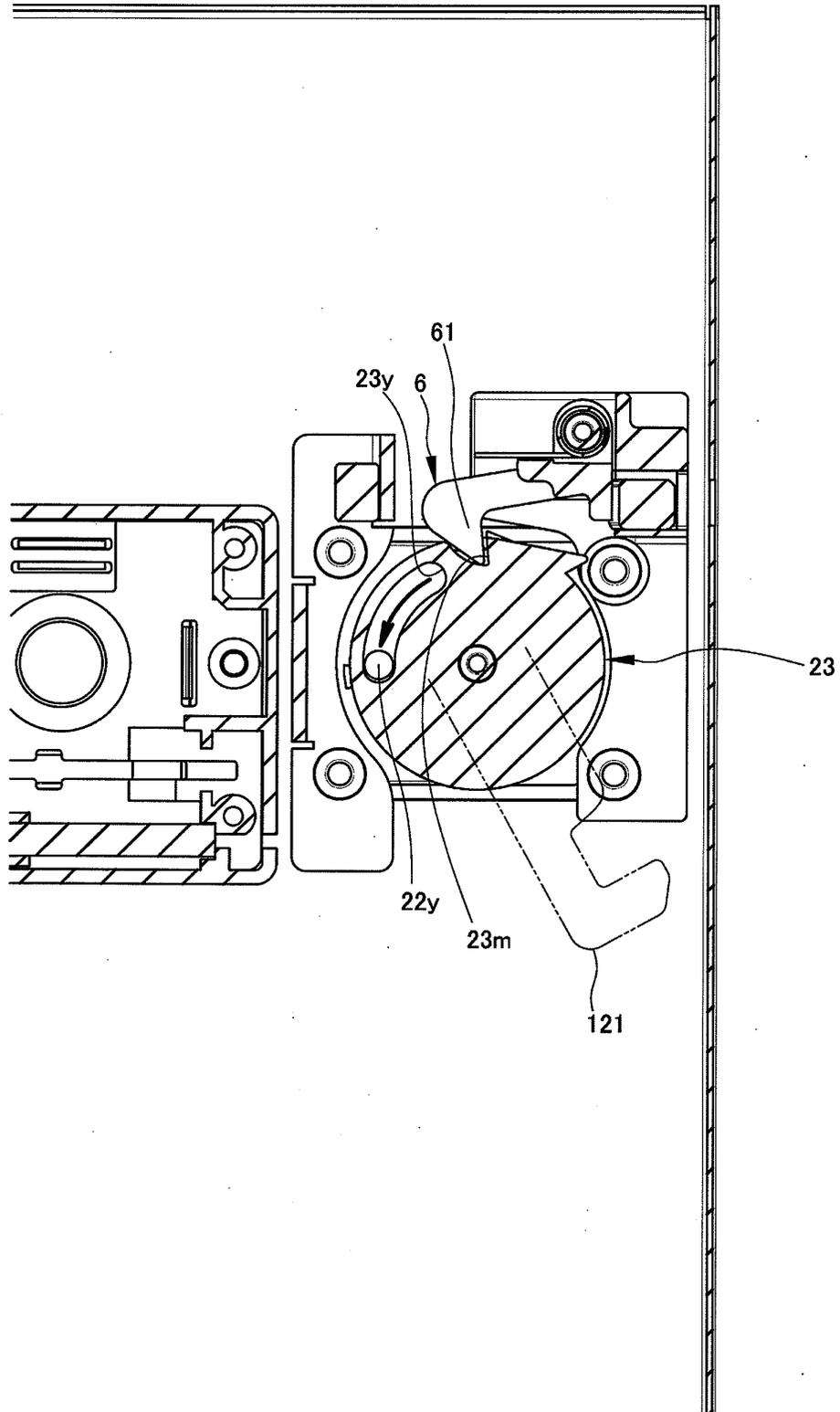


Fig. 24



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/056847

A. CLASSIFICATION OF SUBJECT MATTER E05B37/02(2006.01) i, E05B1/00(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) E05B37/02, E05B1/00		
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.
A	JP 11-131874 A (Kokuyo Co., Ltd.), 18 May 1999 (18.05.1999), entire text; all drawings (Family: none)	1-15
A	JP 2008-208661 A (Kokuyo Co., Ltd.), 11 September 2008 (11.09.2008), entire text; all drawings (Family: none)	1-15
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input type="checkbox"/> See patent family annex.
* Special categories of cited documents:	"I" 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	
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 14 July, 2010 (14.07.10)	Date of mailing of the international search report 27 July, 2010 (27.07.10)	
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	
Facsimile No.	Telephone No.	

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

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- JP 6060544 A [0003]