(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 336 464 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
22.06.2011 Bulletin 2011/25

(21) Application number: **09179405.7**

(22) Date of filing: **16.12.2009**

(51) Int Cl.:
E05B 65/00 *(2006.01)* ***E05B 63/00*** *(2006.01)*
E05C 9/18 *(2006.01)*

(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
Designated Extension States:
AL BA RS

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Remarks:
A request for correction of Fig. 8 has been filed pursuant to Rule 139 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) Locking mechanism

(57) A locking mechanism 100 comprises a plurality of locking members 22. The locking mechanism 100 is arranged to selectively retract one or more of the locking members 22 to the left of axis X. An actuation member 102 is arranged to move up and down along axis Y in response to rotation of a handle. If one or more of locking members 22 is interconnected with actuation member 102 by an interconnection means, movement of actuation member 102 upwardly along axis Y causes the retraction of the selected locking members 22 to the left of axis X. A first, or rear, surface of the actuation member 102 faces a second, or forwardly facing, surface of the locking members 22 such that the actuation member 102 and locking members 22 are arranged in a substantially overlapping configuration.

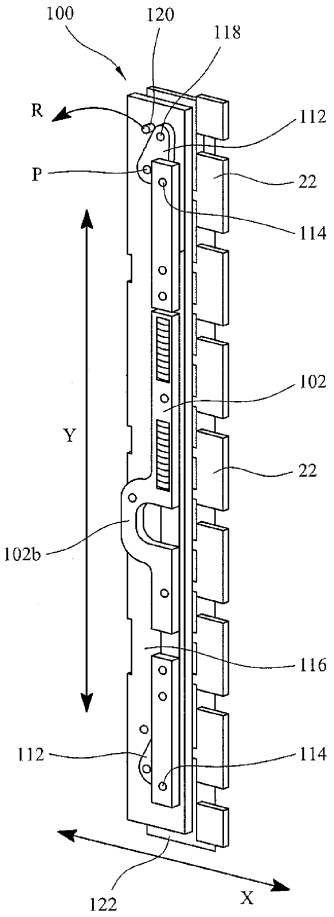

FIG. 8

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Description

[0001] The present invention relates to a locking mechanism for a security assembly comprising a frame and at least one door, and relates particularly, but not exclusively, to a locking mechanism for a security assembly that is used to protect cash cassettes in automated teller machines (ATMs).

[0002] Automated teller machines (ATMs) generally comprise a terminal having a keypad, card slot, screen and cash dispenser. The rear of an ATM comprises a rack having a plurality of mounts in which cash cassettes are inserted in order to supply the ATM with bank notes. The cash cassettes are generally protected by one or more reinforced doors. A security assembly for protecting the cash cassettes of an ATM is proposed in W02008/145961, which is hereby incorporated by reference.

[0003] Referring to Figures 1 to 7, which show the security assembly of WO2008/145961, an ATM 2 comprises a housing 4 and a reinforced outer door 6 having a locking mechanism 8. The ATM 2 comprises four cash compartments 10 in which cash cassettes (not shown) containing bank notes can be mounted in order to supply the ATM 2 with cash to be dispensed. A security assembly comprising a frame member 12 and a plurality of doors 14 is mountable inside the housing 4 of the ATM 2. The security assembly can be welded to the inside of the ATM.

[0004] Figure 1 shows all of the doors 14 in the open condition permitting access to all of the compartments for holding cash cassettes. Figure 2 shows all of the doors 14 in the locked condition preventing access to compartments 10 and Figure 3 shows one of the doors 14 in the open condition allowing access to one of the compartments 10. Each of doors 14 is independently lockable to permit access to only one compartment 10 at a time such that if service personnel who refill the ATM 2 are attacked, the attacker will only initially be able to access a single compartment 10 and therefore a single cash cassette which will increase the time taken for the thief to gain access to the further cash cassette.

[0005] Referring to Figures 4 and 5, each door 14 is attached to the frame member 12 by a hinge 16. A barrier member 18 is mounted to the door 14 by two pivoting brackets 20. When in the locked condition, the barrier members 18 extend substantially along the whole length of one or more sides of the periphery of the door to prevent access through the gaps between the periphery of the doors and the frame. The barrier members in the locked condition are received in a recess in the adjacent door or portion of frame. Alternatively, the barrier members may be received in a bracket (not shown) attached to an adjacent door or portion of frame.

[0006] The barrier members 18 are moved by engagement with a locking member 22. The locking members 22 are slideably mounted to the frame 12 and are actuated by a locking mechanism which will be described in further detail below. In Figures 4 and 5, the locking members 22 move from a leftward retracted condition to a rightward engaged condition and prevent access through the boundary between the frame and the doors.

[0007] Referring to Figure 6, in order to lock a door 14, each of the locking members 22 associated with the door 14 is moved rightwardly in the direction of Arrow A into the engaged condition. Each locking member 22 is moveable independently of the other locking member in order to allow each individual door 14 to be independently lockable.

[0008] Referring to Figure 7, as the locking members 22 move in the direction of Arrow A into the engaged condition, the uppermost locking member 22 abuts the left hand edge of barrier member 18 causing mounting bracket 20 pivot in the direction of Arrow B and barrier member 18 to move in the direction of Arrow C into the locked condition. In the locked condition, barrier member 18 projects into a recess (not shown) formed in one of the other doors 18 or in the frame member in order to lock the door 14 in the closed condition preventing access to the cash container in front of which the door 14 is located.

[0009] A preferred embodiment of the present invention seeks to provide a locking mechanism operable to move locking members 22 or other locks, the locking mechanism being resistant to drilling and other attacks which are commonly associated with unauthorised persons attempting to gain access to the cash contained in ATMs.

[0010] According to the present invention, there is provided a locking mechanism for a security assembly comprising a frame assembly and at least one door, wherein at least one said door has an open condition and a closed condition in which the door is lockable to the frame assembly to prevent opening of the door, the locking mechanism comprising:

> an actuation member moveable along a first path by a user; and
>
> at least one locking member movable along a second path, different to the first path, in response to movement of the actuation member, at least one said locking member having an engaged condition in which the at least one said locking member is engageable with a door in use to prevent opening of the door, and a retracted condition enabling opening of the door;

wherein a first surface of the actuation member faces a second surface of at least one said locking member such that the actuation member and at least one said locking member are arranged in a substantially overlapping configuration.

[0011] This provides the advantage that if a hole is drilled in the locking mechanism in an attempt to obtain access to the internal components of the locking mechanism, moving either the actuation member or at least one locking member causes the drilled hole to become

misaligned because the actuation member and locking members move along different paths and are arranged in a substantially overlapping configuration. Consequently, this makes it more difficult to release the locking mechanism by using a drilling attack.

[0012] In a preferred embodiment, the locking mechanism further comprises interconnection means arrange to selectively interconnect at least one said locking member to the actuation member, such that in a first condition of the interconnection means, movement of the actuation member causes movement of at least one said locking member, and in a second condition of the interconnection means, movement of the actuation member does not cause movement of at least one said locking member.

[0013] This provides the advantage of enabling the door to be locked in the closed condition even if the actuation member is moved. This is advantageous because a single actuation member can be used to selectively open one or more of the doors of an assembly having a plurality doors.

[0014] In a preferred embodiment, the interconnection means comprises:

a retraction member movable along the second path in response to movement of the actuation member; and

an interconnection member arranged to selectively interconnect at least one said locking member with the retraction member such that in an interconnected condition, retraction of the retraction member in response to movement of the actuation member causes at least one said locking member to move from the engaged condition to the retracted condition.

[0015] A third surface of said retraction member may face the first surface of the actuation member such that the actuation member and retraction member are arranged in a substantially overlapping configuration.

[0016] This provides the advantage of causing a hole drilled in the locking mechanism to become misaligned if any of the components are moved.

[0017] In a preferred embodiment, the locking mechanism further comprises a pivot mechanism arranged to cause the retraction member to move along the second path in response to movement of the actuation member along the first path, the pivot mechanism comprising:

a link member pivotally mounted to a guide means;

wherein the link member is pivotally interconnected to the actuation member at a first point on the link member and wherein the link member is pivotally interconnected to the retraction member at a second point on the link member such that movement of the actuation member along the first path causes the link member to pivot about the guide means to cause the retraction member to move along the second path.

[0018] In a preferred embodiment the guide means comprises a mounting plate arranged between the actuation member and retraction member.

[0019] This provides the advantage of further increasing the difficulty of gaining access to the locking mechanism by providing a further layer of material which must be drilled through, the further layer of material also acting as guide means for the pivot mechanism.

[0020] In a preferred embodiment, the interconnection member comprises a dowel member arranged to be moveable in a longitudinal slot formed in at least one said locking member and wherein the retraction member comprises a substantially L-shaped slot, the dowel member projecting into and being moveable in said substantially L-shaped slot such that in a first position of the dowel member, movement of the retraction member causes movement of the corresponding locking member through engagement of the dowel member with a first leg of the L-shaped slot, and in a second position of the dowel member, movement of the retraction member results in sliding movement of the dowel member in a second leg of the L-shaped slot such that the locking member remains stationary.

[0021] This provides a relatively straightforward method of enabling the locking members to be selectively coupled to the retraction member in order to enable selective opening of the doors of the security assembly.

[0022] In a preferred embodiment, when the dowel member is in the second position, the dowel member engages with a locking member retention member to prevent the locking member from being moved.

[0023] This provides the advantage of making it more difficult for unauthorised persons to release the doors by attempting to prise open the locking members.

[0024] In a preferred embodiment, the locking mechanism further comprises a plurality of dowel members arranged to project through a corresponding plurality of longitudinal and L-shaped slots, wherein said plurality of dowel members are mounted to a selector member.

[0025] This provides the advantage that any attempt to disassemble the mechanism by selective drilling on the dowels will cause the mechanism to fail in the locked position. The security assembly then would have to be physically removed in a time consuming way which helps to resist attacks for as long as possible.

[0026] In a preferred embodiment, the locking mechanism further comprises a housing having a front panel accessible to a user, wherein the actuation member is located inside of the housing and adjacent a rear surface of the front panel, and wherein at least one said locking member is located behind the actuation member at a greater distance from the front panel than the actuation member.

[0027] The retraction member may be located between the actuation member and at least one said locking member.

[0028] This provides the advantage of a relatively compact and sturdy assembly.

[0029] The locking mechanism may further comprise a handle assembly arranged to cause movement of the actuation member back and forth along said first path, the handle assembly comprising:

a handle pivotally mounted to the front panel;

a cam member connected to the handle and arranged to be rotated by movement of the handle;

a cam follower connected to the actuation member and arranged to cause the actuation member to move along said first path in response to rotation of the handle.

[0030] The actuation member, retraction member, locking member retention member and at least one said locking member may be formed from a plurality of metal plates.

[0031] This provides the advantage that if a hole is drilled into the locking mechanism, there is less likelihood of disabling the locking mechanism because other portions of the metal plate will still be able to operate the locking mechanism. This also provides the advantage of a sturdy and layered assembly.

[0032] Said plurality of metal plates may be arranged in an overlapping and substantially parallel configuration.

[0033] Said first and second paths may be substantially perpendicular first and second longitudinal axes.

[0034] A preferred embodiment of the present invention will now be described, by way of example only and not in any limitative sense, with reference to the accompanying drawings in which:

Figure 1 is a rear view of an ATM in which a security assembly is fitted, the doors of the security assembly being shown in the open condition;

Figure 2 is a rear view of an ATM corresponding to Figure 1 with the doors of the security assembly shown in the closed condition;

Figure 3 is a rear view of an ATM corresponding to Figures 1 and 2 with one door of the security assembly shown in the open condition;

Figure 4 is a rear view of the security assembly shown in partial cross-section;

Figure 5 is a perspective view from the rear of the security assembly corresponding to Figure 4;

Figure 6 is a front view of one of the doors of the security assembly of Figures 1 to 5 shown with the three locking members in the retracted condition;

Figure 7 is a partial cross-sectional view from the front of the door of Figure 6 with the locking members shown in the engaged condition;

Figure 8 is a front perspective view of a locking mechanism embodying the present invention for opening and closing the locking members of the security assembly of Figures 1 to 7;

Figure 9 is a rear view of the locking mechanism of Figure 8;

Figure 10 is a perspective view of the inside of the housing of the locking mechanism of Figure 8 showing a first stage of the assembly of the locking mechanism;

Figure 11 is a view corresponding to Figure 10 showing a second stage of the assembly of the locking mechanism;

Figure 12 is a view corresponding to Figures 10 and 11 showing a third stage in the assembly of the locking mechanism;

Figure 13 is view corresponding to Figures 10 to 12 showing a fourth stage in the assembly of the locking mechanism;

Figure 14 is a view of the locking mechanism showing the mounting of the locking members to the retraction member;

Figure 15 is a view corresponding to Figure 14 showing the mounting of selection plates to the locking members;

Figure 16 is a close up partially cut away perspective view of a locking member, retraction member and interconnection member demonstrating the selection of a locking member for retraction;

Figure 17 is a rear view of the locking mechanism corresponding to the position of the selector plate in Figure 16, showing a locking member retention plate disposed behind the selector plates; and

Figure 18 is a view corresponding to Figure 17 but showing the selector plate in the uppermost position.

[0035] Referring to Figures 8 and 9, a locking mechanism 100 comprises a plurality of locking members 22 corresponding to those shown in Figures 4 to 7. The locking mechanism 100 is arranged to selectively retract one or more of the locking members 22 to the left of axis X in Figure 8. An actuation member 102 is arranged to move up and down along axis Y in response to rotation of a handle 108 (Figure 10). If one or more of locking members 22 is interconnected with actuation member 102 by an interconnection means, which will be explained

in more detail below, movement of actuation member 102 upwardly along axis Y causes the retraction of the selected locking members 22 to the left of axis X. It can be seen from Figures 8, 10 and 14 that a first, or rear, surface 102R (Figure 10) of the actuation member 102 faces a second, or forwardly facing, surface of the locking members 22 such that the actuation member 102 and locking members 22 are arranged in a substantially overlapping configuration. Referring to Figure 10, actuation member 102 comprises four metal plates 102a to 102d which are rigidly interconnected to one another by means of welding or the like. The locking mechanism is assembled in an outer housing 104 having a front panel 106. Housing 104 is also shown in Figure 5.

[0036] Actuation member 102 is arranged to reciprocate in response to rotation of handle 108. Handle 108 is connected to and arranged to rotate a cam member 110. Cam follower portion 102b of the actuation member 102 surrounds the cam member 110 and is arranged to be reciprocated along axis Y in response to rotation of cam member 110.

[0037] Referring to Figures 8, 10, 11 and 12, a pivot mechanism comprises a link member such as a quadrant plate 112 disposed at each end of the actuation member 102. Link member 112 is rotatably mounted to each end of the actuation member about pin 114. Each link member 112 is pivotally mounted to a guide means such as a mounting plate 116 (Figures 8 and 12) about pivot pin P. A retraction member pin 118 formed on each link member 112 projects through arcuate slots 120 formed in mounting plate 116. Consequently, referring to Figure 8, when the actuation member 102 is moved upwardly along axis Y (to the right in Figures 10 to 12) as a result of rotation of the handle, link members 112 pivot about points P to cause retraction member pins 118 to move through arcuate slots 120 in the direction of rotation R.

[0038] Referring to Figure 13, retraction member 122 is slidably mounted on a rear side of mounting plate 116. Retraction member pins 118 are disposed in corresponding apertures 124 such that movement of retraction member pins 118 through arcuate slots 120 in the direction of rotation R (Figure 12), in response to movement of the actuation member 102 along axis Y, moves the retraction member 122 downwardly along axis X in Figure 13, relative to the mounting plate 116, which remains stationary.

[0039] Referring to Figure 14, locking members 22 are selectively interconnected with the retraction member 122 by an interconnection means. Retraction member 122 is always moved in response to movement of the actuation member 102. However, locking members 22 are only moved by retraction member 122 if the interconnection means, which will be described in further detail below, interconnects a locking member 22 with the retraction member 122. It can be seen from Figures 8 and 12 to 14 that a third, or forward facing, surface of the retraction member 122 faces the first, or rearward facing, surface 102R of the actuation member 102 such that the actuation member and retraction member are arranged in a substantially overlapping configuration.

[0040] Referring to Figures 14 to 16, the interconnection means comprises an interconnection member 130 such as a dowel member which is arranged to project through elongated slots 132 formed in the locking members 22 and also project through substantially L-shaped slots 134 formed in the retraction member 122. Two dowel members 130 are interconnected by a selector member such as selector plate 136. Figures 15 and 16 show an uppermost locking member 22U. In the lower position of selector plate 136 and therefore dowel member 130, as shown in Figure 16, the locking member 22 is not selected and therefore when the retraction member 122 is retracted along axis X in the direction shown by the arrow in Figure 16, the locking member 22 remains stationery, and is locked to the housing in a manner that will be explained below.

[0041] Referring to Figures 17 and 18, a locking member retention member such as plate 140 comprises two retention slots 142 each having an L-shaped configuration. Locking member retention plate is securely fastened to the locking mechanism housing. When the selector plate 136 and therefore dowel members 130 are in the lowermost position as shown in Figures 16 and 17, dowel members 130 engage notches 142a of retention slots 142 and the locking members therefore cannot be retracted. When the selector plate 136 and therefore dowel members 130 are in the uppermost position as shown in Figure 18, dowel members are free to retract in leg portions 142b of retention slots 142 such that the locking members 22 can be retracted.

[0042] Figures 15 to 18 show two dowel members 130 connected by a selector plate 136, although the mechanism would also work with a single dowel member 130 for each locking member 22. The dowel members 130 and selector plate 136 are arranged to be raised by a selector mechanism (not shown). One example of the selector mechanism comprises an electric motor arranged to operate a worm gear and pinion mechanism in order to move the dowel members 130 and selector plate 136 in the direction of Arrow Y (Figure 16) to the uppermost position. In the lower position shown in Figures 16 and 17, it can be seen that when the retraction member 122 moves in the direction of Arrow X, the open edge of L-shaped slot 134 moves past the dowel member.

[0043] However, if dowel members 130 are raised into the upper portions 134U of the L-shaped slots 134, then the dowel member 130 engages a closed edge of L-shaped slot 134 such that retraction of the retraction member 122 causes retraction of the locking member 22.

[0044] From Figures 8 to 16, it can be seen that the actuation member 102 and locking members 22 are arranged in an overlapping configuration. Furthermore, the retraction member 122, mounting plate 116, selector plates 136 and locking member retention plate 140 are also arranged in the overlapping configuration.

[0045] Also, the components are arranged to move

along different paths. For example, actuation member 102 moves along axis Y and the retraction member 122 and locking members 22 move along axis X which is perpendicular to axis Y. However, it will be apparent to person skilled in the art that axes X and Y do not need to be straight, i.e. they could be curved, or do not need to be perpendicular.

[0046] Consequently, as a result of the components moving along different paths and being assembled in a substantially overlapping configuration, a hole drilled through the locking assembly will become misaligned when the locking mechanism is actuated. This makes it more difficult for potential attackers to gain access to the security assembly by using a drilling or cutting attack.

[0047] Furthermore, the components are formed from metallic plates which means that if a hole is drilled through the locking mechanism, it is less likely that any of the parts will break or snap.

[0048] It will be appreciated by persons skilled in the art that the above embodiment has been described by way of example only and not in any limitative sense, and that various alterations and modifications are possible without departure from the scope of the invention as defined by the appended claims.

Claims

1. A locking mechanism for a security assembly comprising a frame assembly and at least one door, wherein at least one said door has an open condition and a closed condition in which the door is lockable to the frame assembly to prevent opening of the door, the locking mechanism comprising:

    an actuation member moveable along a first path by a user; and
    at least one locking member movable along a second path, different to the first path, in response to movement of the actuation member, at least one said locking member having an engaged condition in which the at least one said locking member is engageable with a door in use to prevent opening of the door, and a retracted condition enabling opening of the door;

    wherein a first surface of the actuation member faces a second surface of at least one said locking member such that the actuation member and at least one said locking member are arranged in a substantially overlapping configuration.

2. A locking mechanism according to claim 1, further comprising interconnection means arrange to selectively interconnect at least one said locking member to the actuation member, such that in a first condition of the interconnection means, movement of the actuation member causes movement of at least one said locking member, and in a second condition of the interconnection means, movement of the actuation member does not cause movement of at least one said locking member.

3. An apparatus according to claim 2, wherein the interconnection means comprises:

    a retraction member movable along the second path in response to movement of the actuation member; and
    an interconnection member arranged to selectively interconnect at least one said locking member with the retraction member such that in an interconnected condition, retraction of the retraction member in response to movement of the actuation member causes at least one said locking member to move from the engaged condition to the retracted condition.

4. A locking mechanism according to claim 3, wherein a third surface of said retraction member faces the first surface of the actuation member such that the actuation member and retraction member are arranged in a substantially overlapping configuration.

5. A locking mechanism according to claim 3 or 4, further comprising a pivot mechanism arranged to cause the retraction member to move along the second path in response to movement of the actuation member along the first path, the pivot mechanism comprising:

    a link member pivotally mounted to a guide means;
    wherein the link member is pivotally interconnected to the actuation member at a first point on the link member and wherein the link member is pivotally interconnected to the retraction member at a second point on the link member such that movement of the actuation member along the first path causes the link member to pivot about the guide means to cause the retraction member to move along the second path.

6. A locking mechanism according to claim 5, wherein the guide means comprises a mounting plate arranged between the actuation member and retraction member.

7. An assembly according to any one of claim 3 to 6, wherein the interconnection member comprises a dowel member arranged to be moveable in a longitudinal slot formed in at least one said locking member and wherein the retraction member comprises a substantially L-shaped slot, the dowel member projecting into and being moveable in said substantially L-shaped slot such that in a first position of the dowel

member, movement of the retraction member causes movement of the corresponding locking member through engagement of the dowel member with a first leg of the L-shaped slot, and in a second position of the dowel member, movement of the retraction member results in sliding movement of the dowel member in a second leg of the L-shaped slot such that the locking member remains stationary.

8. A locking mechanism according to claim 7, wherein when the dowel member is in the second position, the dowel member engages with a locking member retention member to prevent the locking member from being moved.

9. A locking mechanism according to claim 7 or 8, further comprising a plurality of dowel members arranged to project through a corresponding plurality of longitudinal and L-shaped slots, wherein said plurality of dowel members are mounted to a selector member.

10. A locking mechanism according to any one of the preceding claims, further comprising a housing having a front panel accessible to a user, wherein the actuation member is located inside of the housing and adjacent a rear surface of the front panel, and wherein at least one said locking member is located behind the actuation member at a greater distance from the front panel than the actuation member.

11. A locking mechanism according to claim 10, wherein the retraction member is located between the actuation member and at least one said locking member.

12. A locking mechanism according to claim 10 or 11, further comprising a handle assembly arranged to cause movement of the actuation member back and forth along said first path, the handle assembly comprising:

a handle pivotally mounted to the front panel;
a cam member connected to the handle and arranged to be rotated by movement of the handle;
a cam follower connected to the actuation member and arranged to cause the actuation member to move along said first path in response to rotation of the handle.

13. A locking mechanism according to any one of the preceding claims, wherein the actuation member, retraction member, locking member retention member and at least one said locking member are formed from a plurality of metal plates.

14. A locking mechanism according to claim 13, wherein said plurality of metal plates are arranged in an overlapping and substantially parallel configuration.

15. A locking mechanism according to any one of the preceding claims, wherein said first and second paths are substantially perpendicular first and second longitudinal axes.

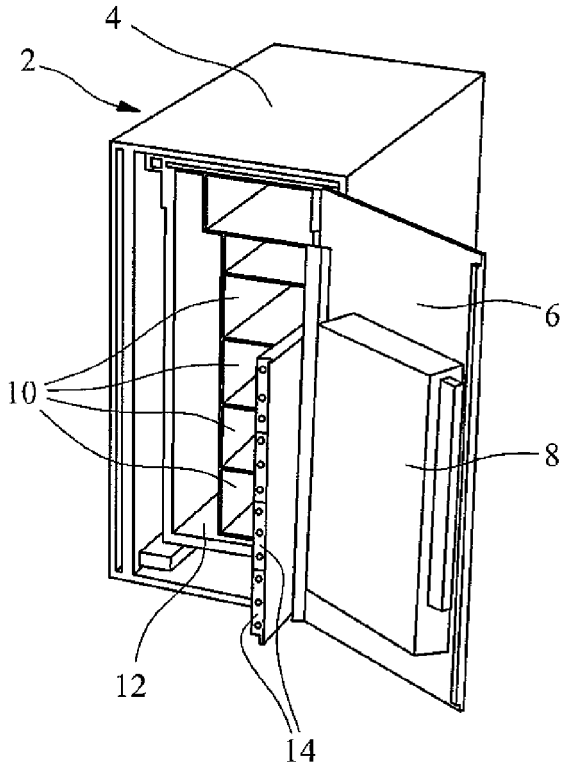


FIG. 1

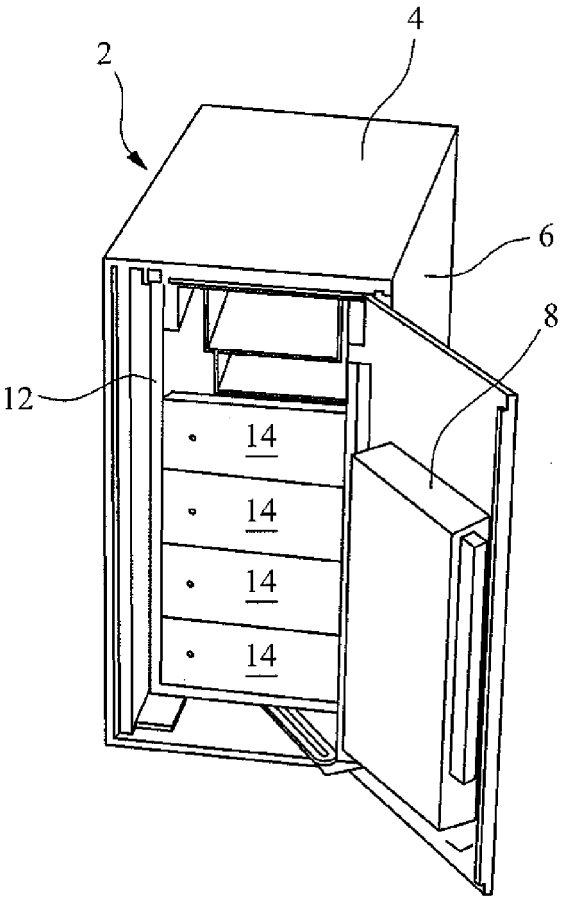


FIG. 2

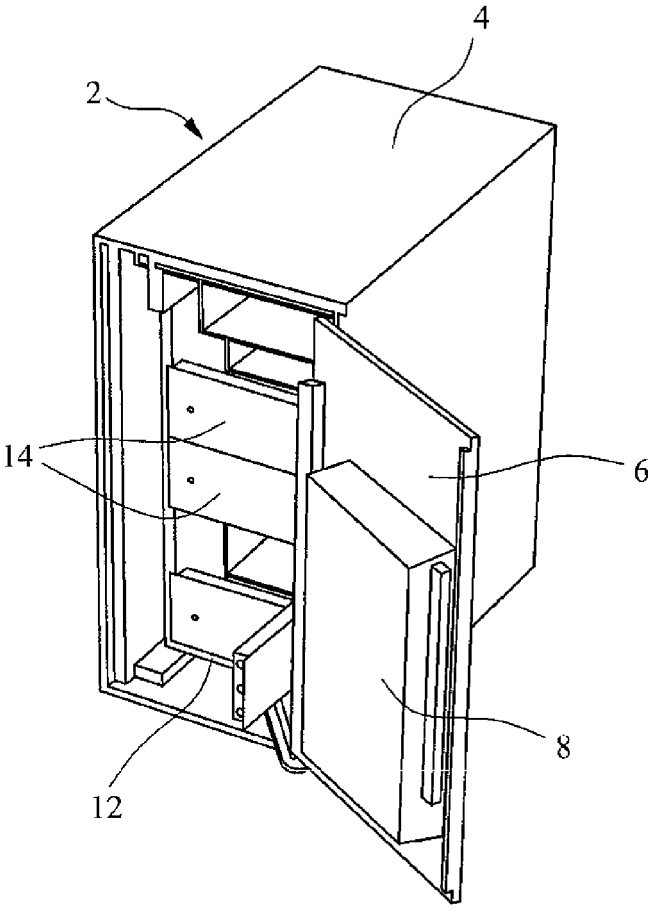


FIG. 3

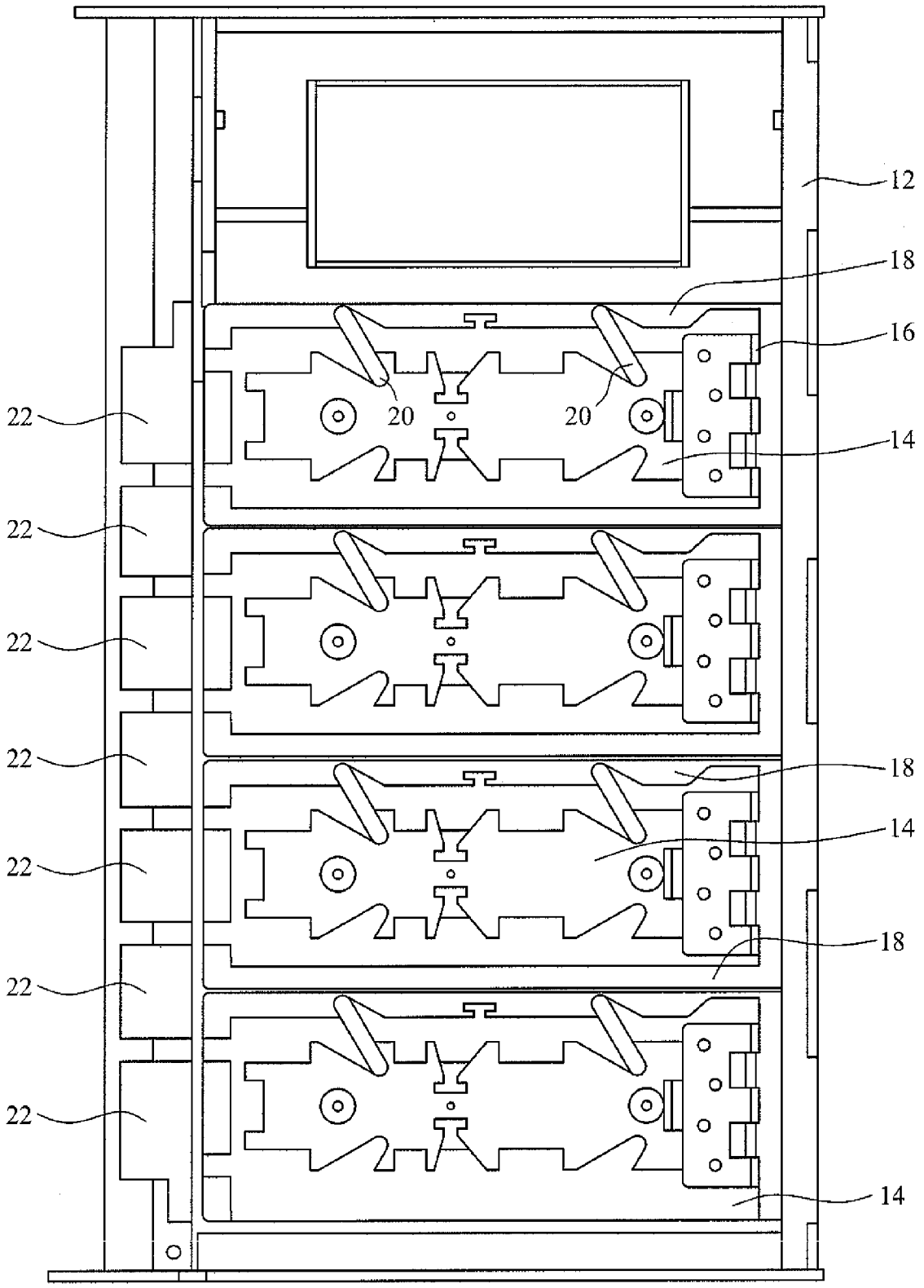


FIG. 4

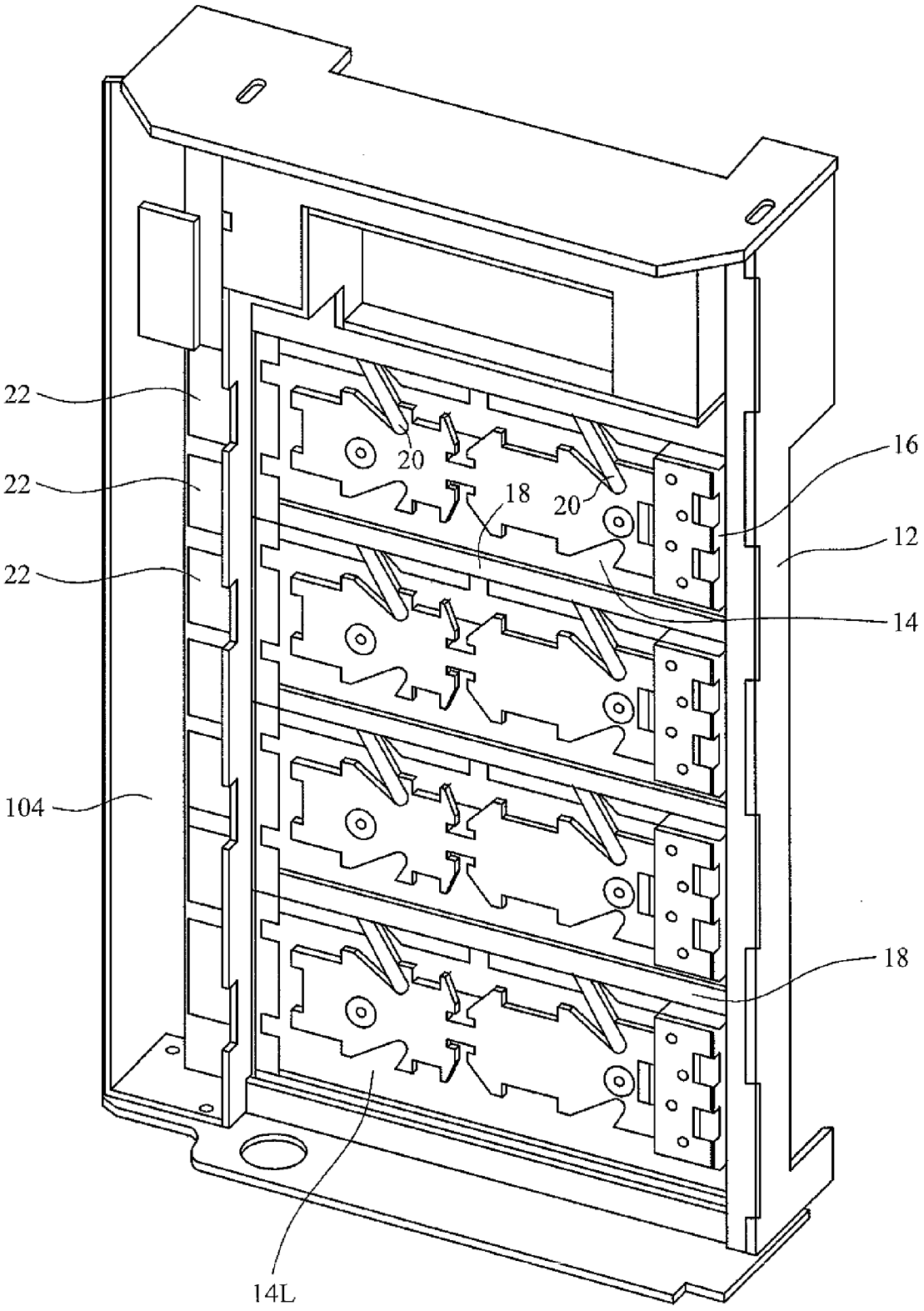


FIG. 5

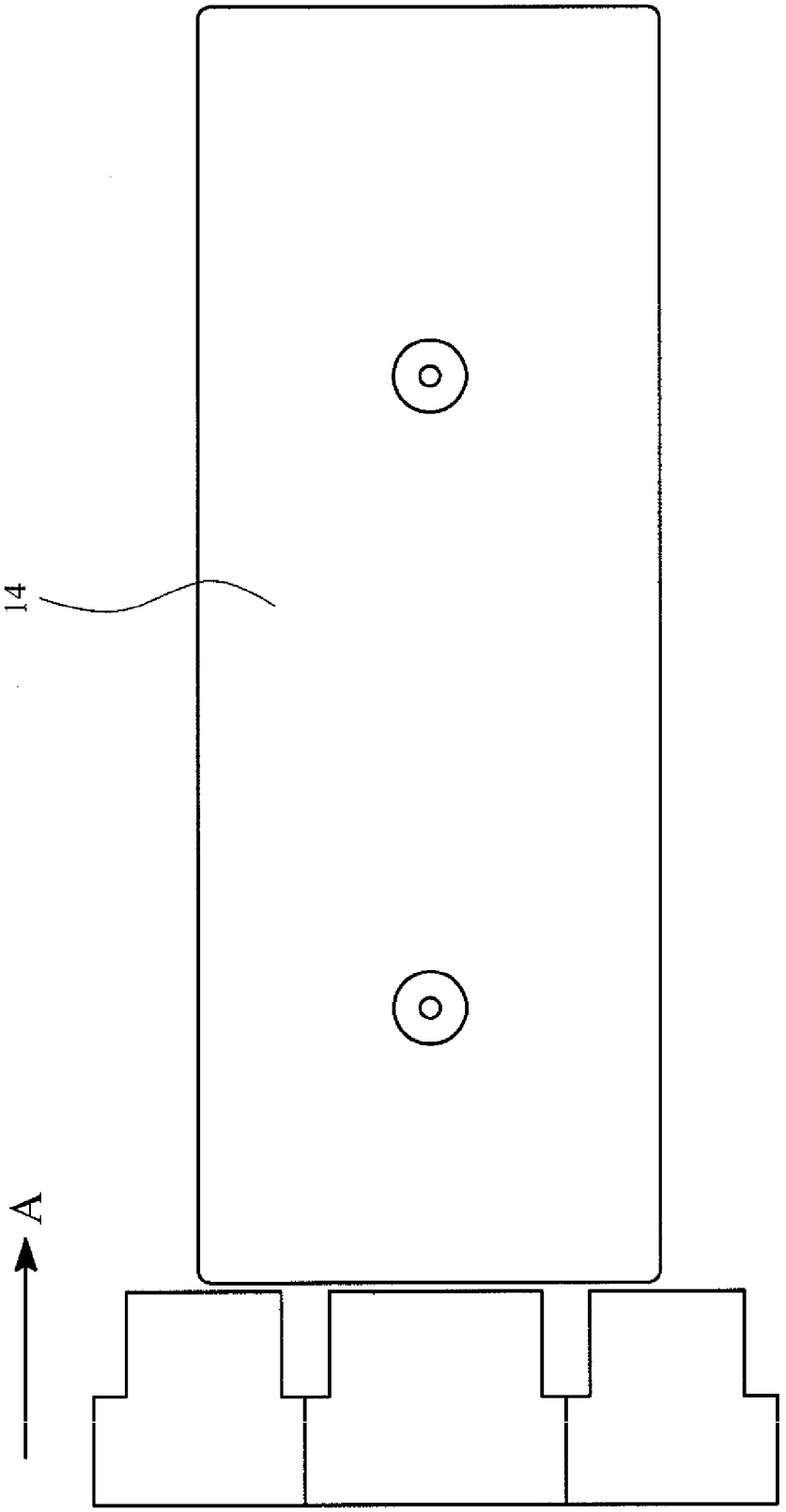


FIG. 6

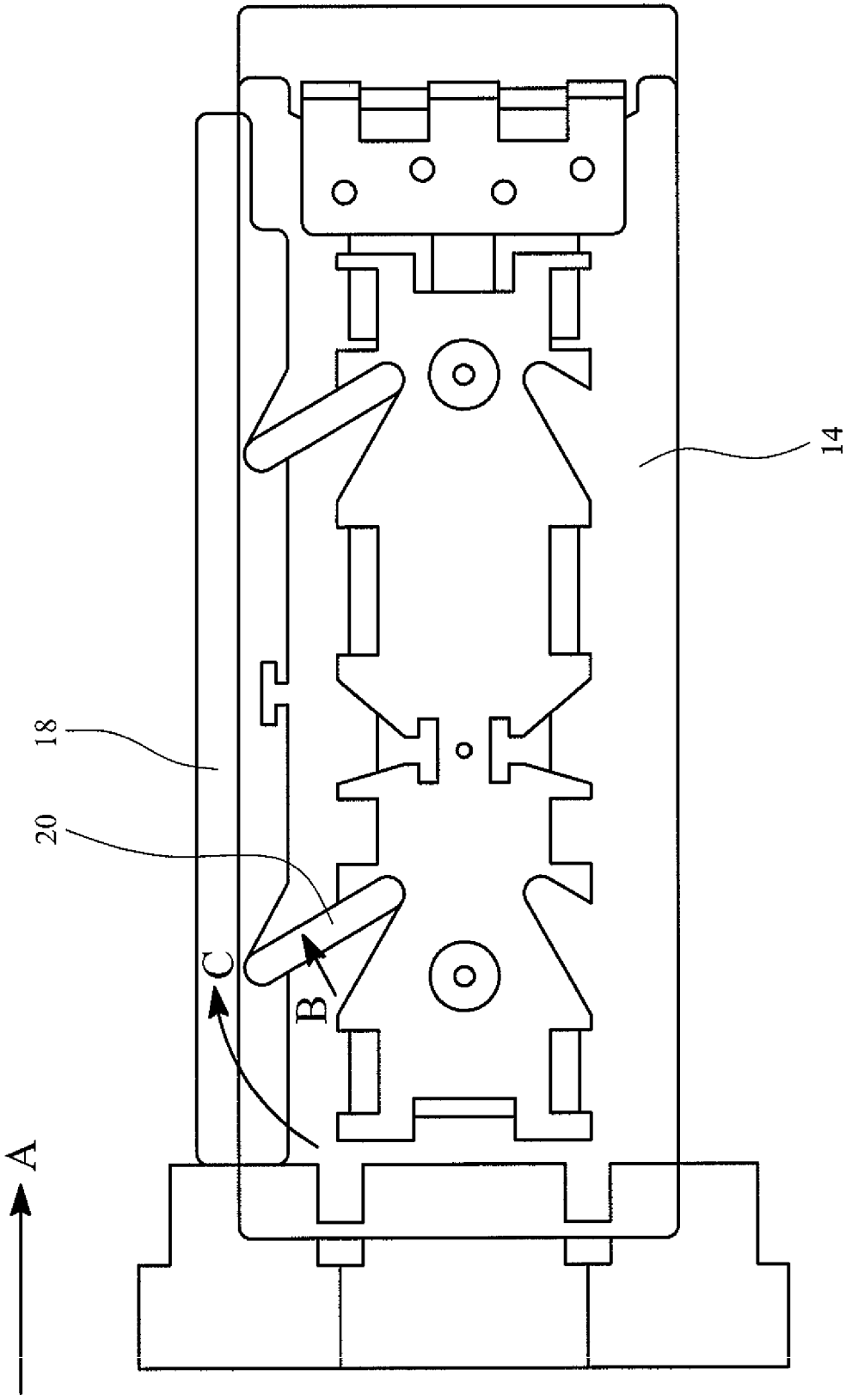


FIG. 7

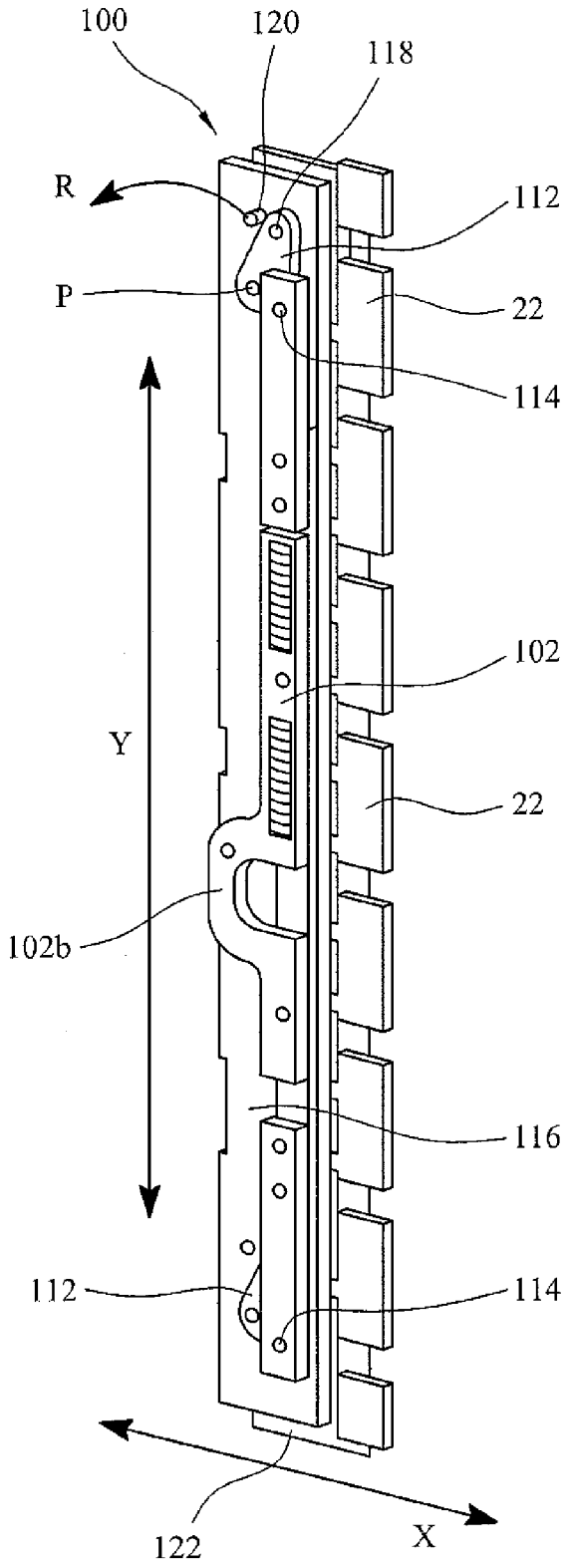


FIG. 8

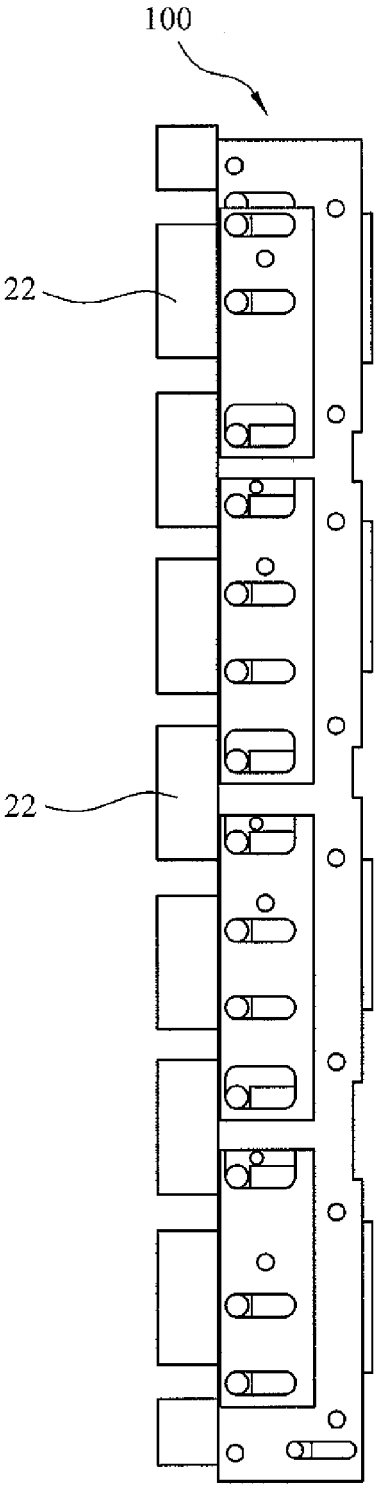


FIG. 9

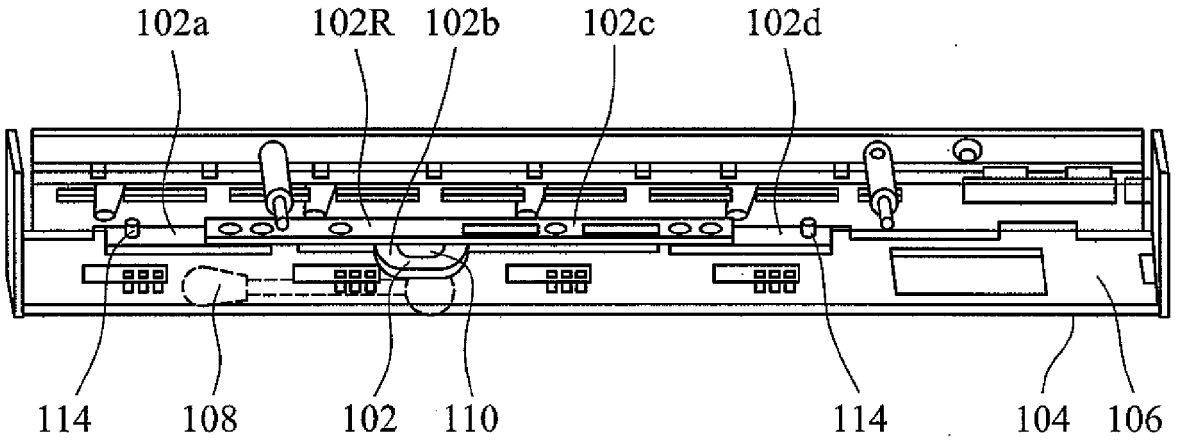


FIG. 10

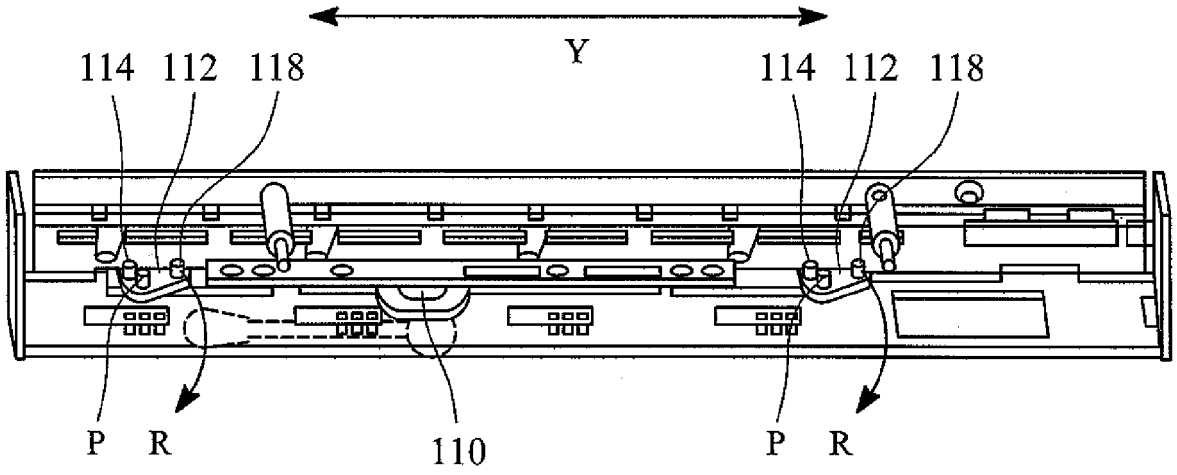


FIG. 11

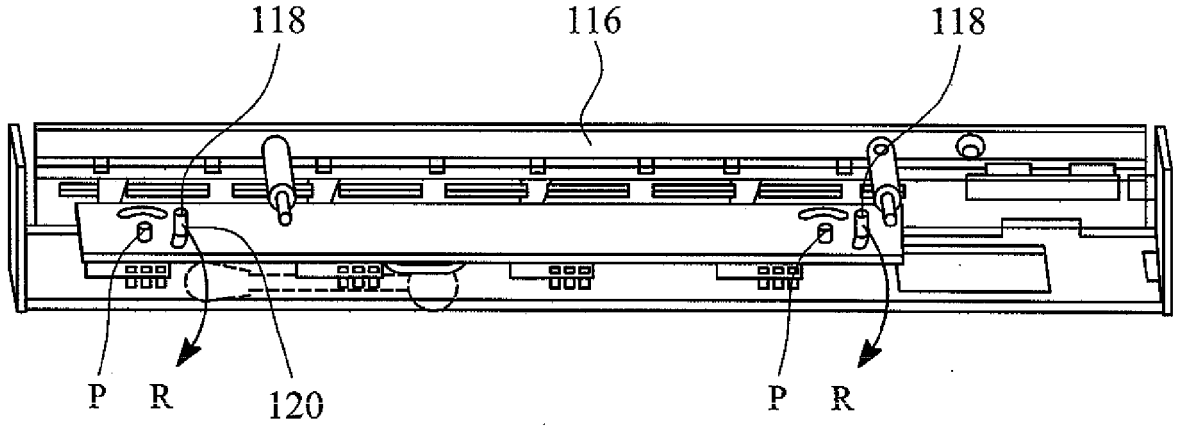


FIG. 12

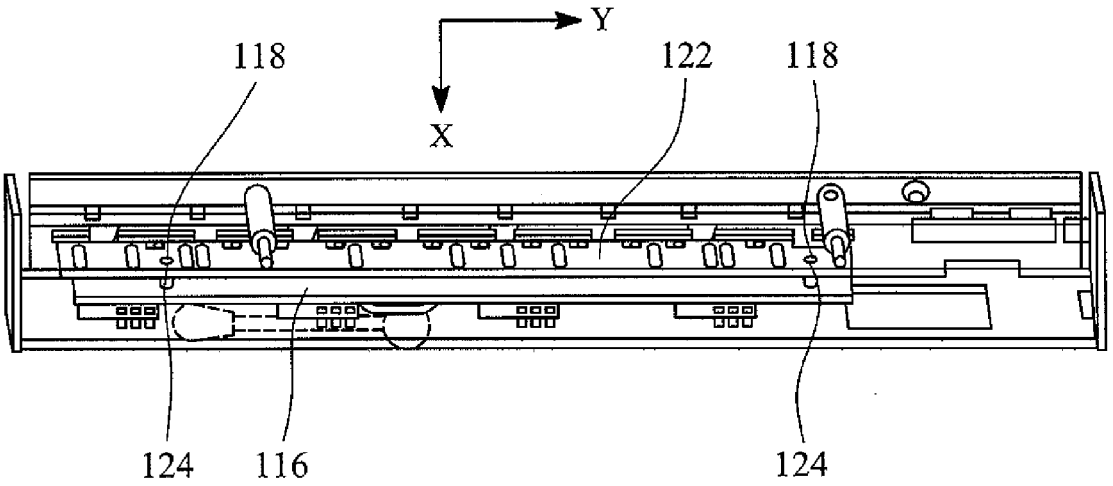


FIG. 13

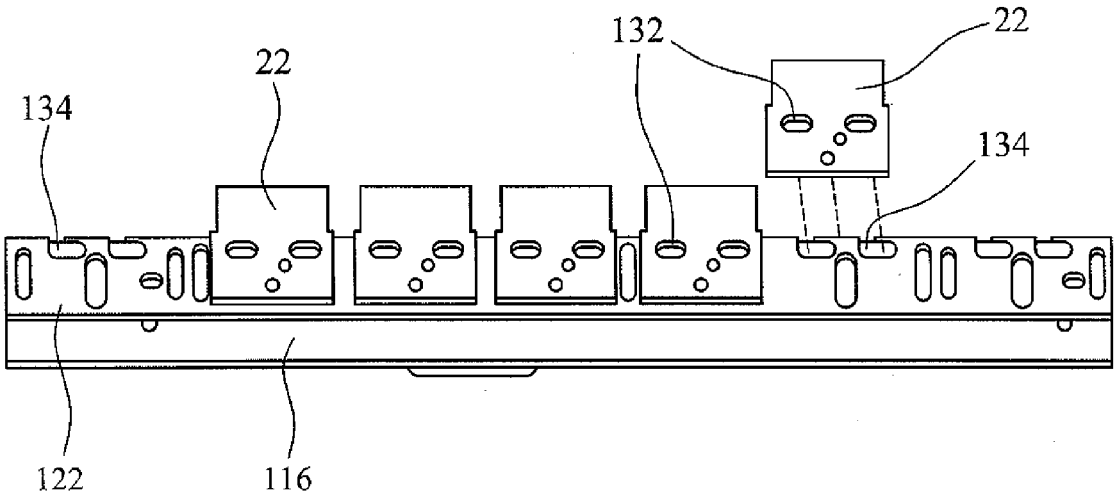


FIG. 14

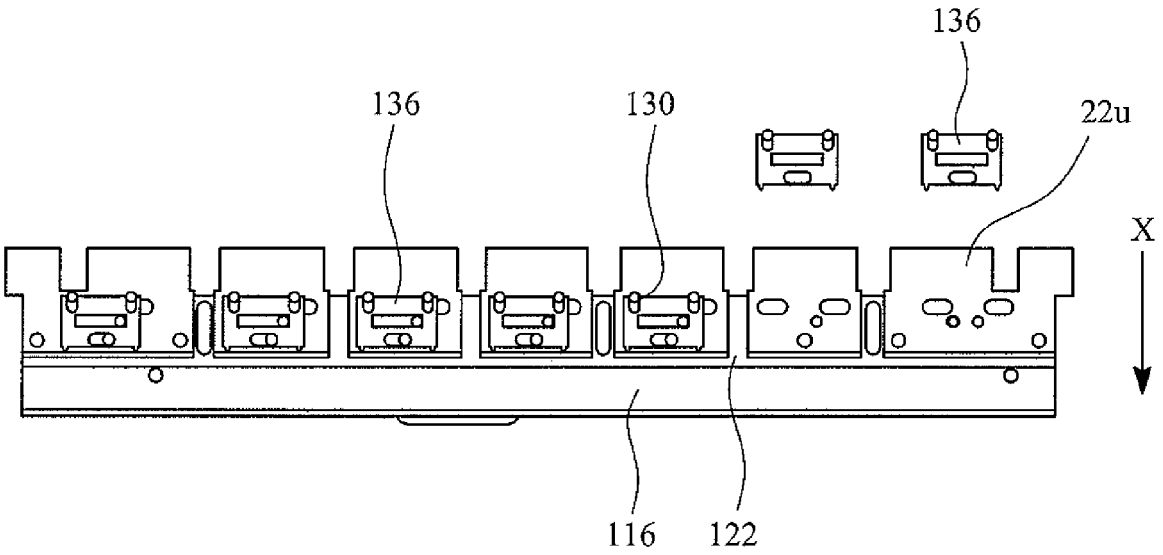


FIG. 15

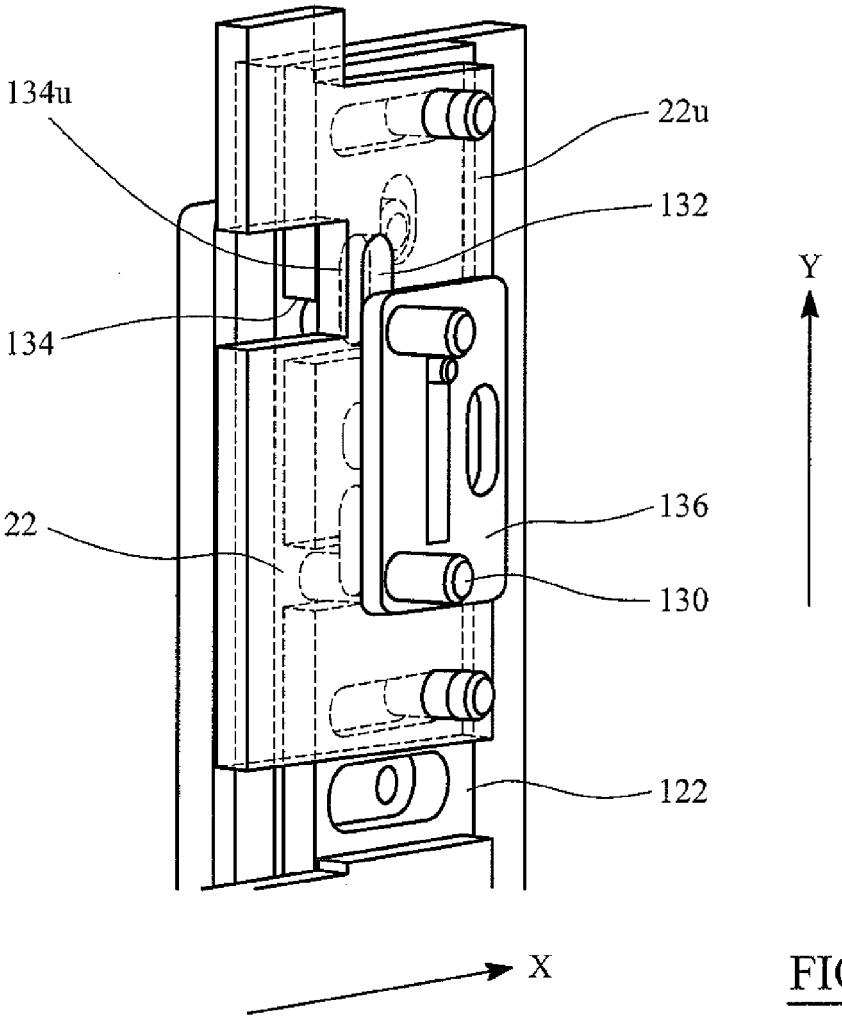
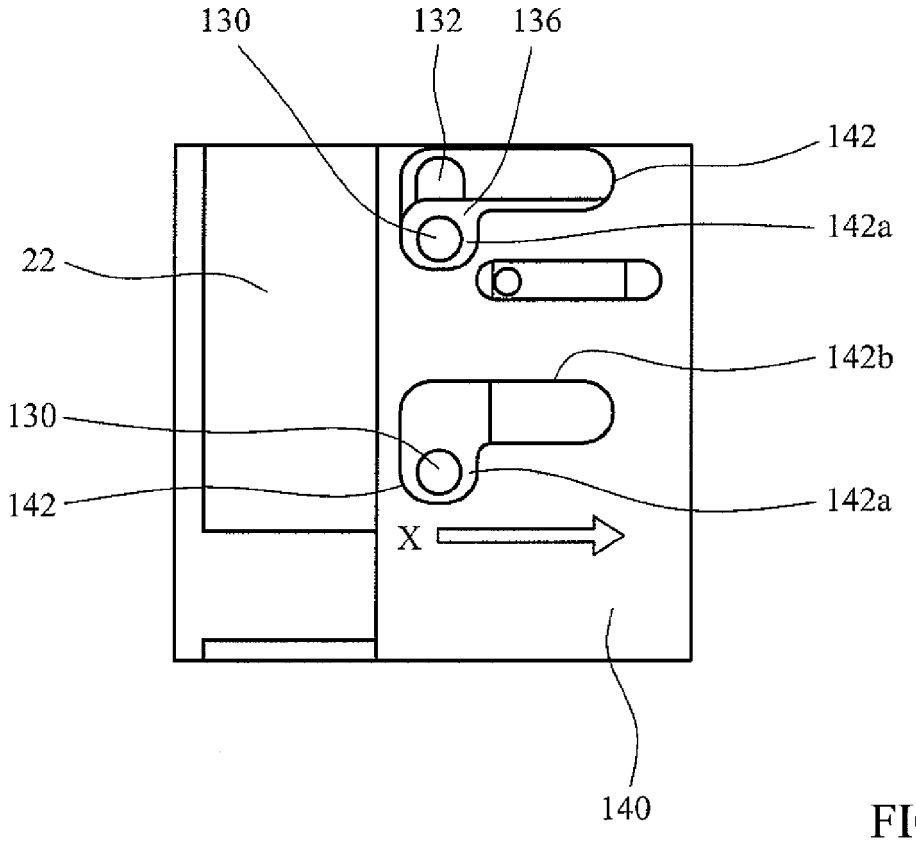


FIG. 16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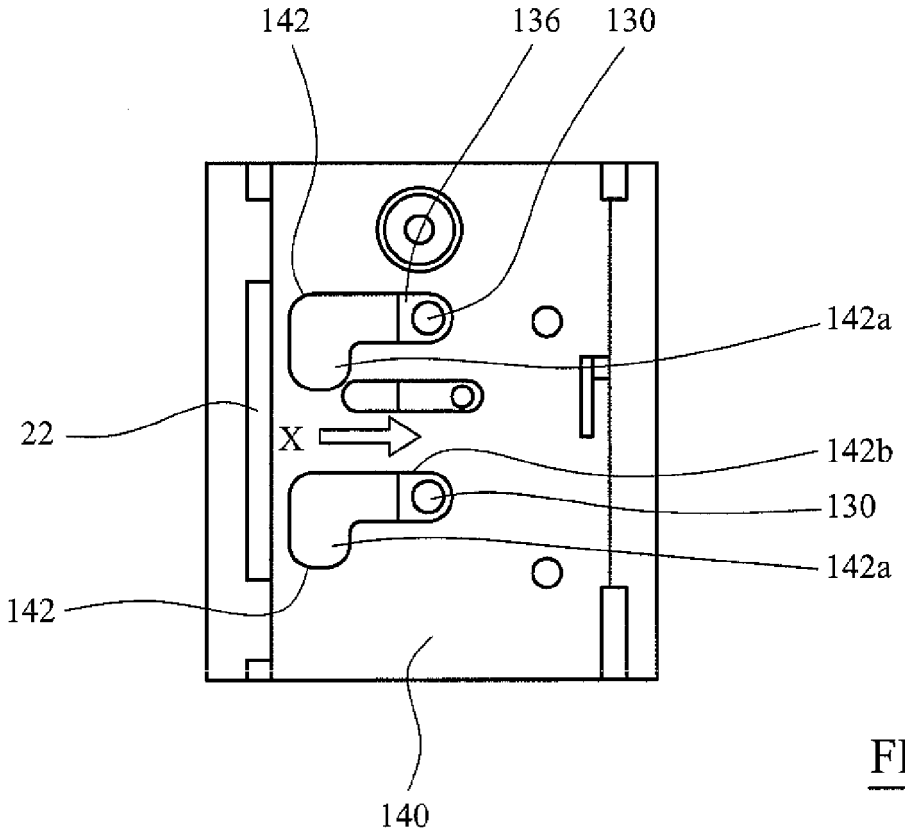
136
142
142a
22
142b
130
142
142a
X
140

FIG. 17


142
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142b
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142a
142
140

FIG. 18

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EUROPEAN SEARCH REPORT

Application Number
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Place of search	Date of completion of the search	Examiner
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1

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