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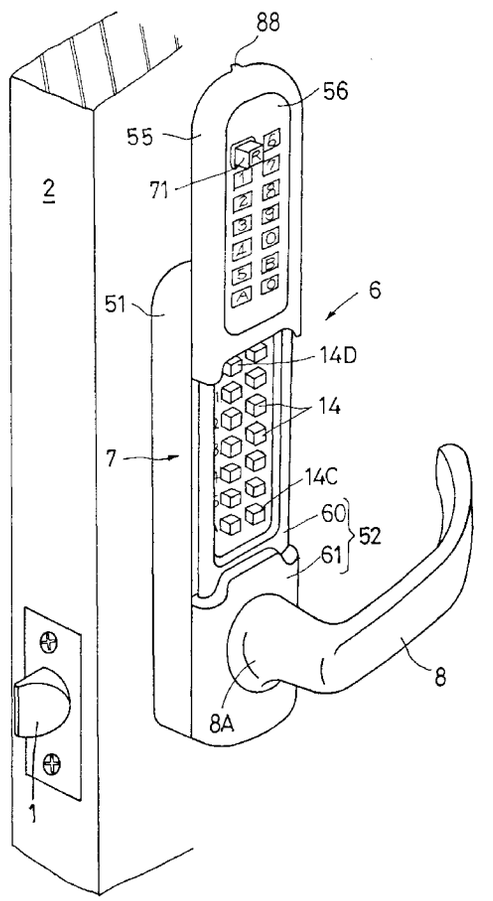
(54) Pushbutton-type locking apparatus

(57) A pushbutton-type locking apparatus comprising: a plurality of unlocking pushbuttons (14A) and a plurality of non-unlocking pushbuttons (14B) retractably disposed on a front face of a holder case (7); a plurality of unlocking tumblers (15A) preset for unlocking the apparatus and a plurality of non-unlocking tumblers (15B) disposed in the holder case (7) at positions corresponding to the pushbuttons (14A) ,(14B) , respectively, and each movable toward the rear side of the case (7) in response to a press of the corresponding pushbutton (14A),(14B); and a slider (21) disposed in the case (7) so as to be movable orthogonally to the moving direction of the tumblers (15A),(15B), wherein when only and all the tumblers (15A) are pressed through corresponding pushbuttons (14A), the slider (21) biased into a locking position is allowed to move to an unlocking position, wherein the holder case (7) is provided with a latching tumbler (15D) for holding the slider (21) which has reached the unlocking position in that position and a latching pushbutton (14D) for pressing the latching tumbler (15D).

F I G. 1



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Description

The present invention relates to a pushbutton-type locking apparatus adapted to release (or unlock) its locking mechanism by pressing a set of predetermined pushbuttons disposed on the holder case thereof.

[Prior Art]

A conventional locking apparatus of this type comprises: a plurality of unlocking and non-unlocking pushbuttons and a clearing pushbutton which are retractably provided on the front face of a holder case; a plurality of unlocking and non-unlocking tumblers and a clearing tumbler disposed in the holder case at positions corresponding to the respective pushbuttons and each adapted to move toward the rear side of the holder case by a press of the corresponding pushbutton; and a slider disposed in the holder case so as to be movable orthogonally to the moving direction of the tumblers, wherein when only and all the unlocking tumblers preset for unlocking the apparatus are pressed through corresponding pushbuttons, the locking mechanism disposed in the holder case is released (refer to Japanese Examined Utility Model Publication No. HEI 2-40206, Japanese Examined Utility Model Publication No. HEI 3-54281 and Japanese Examined Patent Publication No. HEI 3-78467).

In the locking mechanism of this conventional apparatus, the slider in the form of a frame plate having projections along an inner peripheral edge thereof for engaging one lateral side of respective tumbler is disposed in the holder case so as to be movable in a direction which orthogonally intersects the moving direction of the tumblers. The movement of the slider is cooperatively actuated by the rotation of a doorknob (or a doorlever). Each of the unlocking and non-unlocking tumblers is formed with a locking portion and a releasing groove at different positions on one lateral side thereof in the pressing direction for engaging and disengaging the corresponding projection of the slider.

As a result, when only the predetermined unlocking tumblers are pressed, all the engagements between the tumblers and the projections are released to allow the slider to move, thereby releasing the locking state to permit the doorknob to rotate, but otherwise the slider is restrained from moving by the engagements between the one lateral side of any tumblers and the corresponding projections of the slider thereby preventing the doorknob from rotating, hence, maintaining the doorknob as locked.

All of the unlocking and non-unlocking tumblers and the clearing tumbler are each biased toward the front side of the holder case by a return spring. In the holder case a clearing element is disposed as being vertically movable in the same manner as the slider, the clearing element having positioning springs for holding the unlocking and non-unlocking tumblers at respective pressed positions by engaging the other lateral side of the tumblers.

Since the clearing element is disposed between two columns into which the pushbuttons and tumblers are aligned, each pair of tumblers opposingly disposed in row are formed with respective engagement portions on opposing edges thereof for engaging the corresponding positioning springs.

The clearing tumbler is formed with a cam portion at an edge thereof for moving the clearing element, while the clearing element is formed with an inclined cam surface on the lower end thereof against which the cam portion abuts. Accordingly, a press of the clearing pushbutton causes the clearing element to slide upwardly so that the unlocking and non-unlocking tumblers are disengaged from the positioning springs, thereby returning all the tumblers held in the pressed positions to the unpressed positions.

[Problems to be solved by the Invention]

In such a conventional locking apparatus, the clearing element is disposed within the frame of the slider which is formed to enclose all the tumblers so as to reduce the size of the apparatus as a whole. Although the clearing element is downwardly biased by a spring provided separately from the slider so that the clearing element moves independently of the slider when the clearing operation is effected by pressing the clearing pushbutton, the lower end of the clearing element is made to abut against the lower frame segment of the slider so that each tumbler is cleared also by the upward movement of the slider.

As a result, when the unlocking tumblers are pressed and then the doorknob is rotated, the clearing element moves upward cooperatively with the upward movement of the slider, whereby each unlocking tumbler is released from the corresponding positioning spring and returned to its unpressed position.

Such a conventional arrangement is advantageous in safety owing to its autolock function for automatically locking the door when the unlocked doorknob is returned to its original position. On the other hand, such an arrangement is inconvenient when the door is required to be frequently opened, for example, when many parcels are taken in and out through the doorway, since the arrangement requires the unlocking operation, i.e., pressing of a set of pushbuttons, every time the door is to be opened. Accordingly, there has been a demand for a pushbutton-type locking apparatus capable of maintaining the unlocked condition to assume a mere latching condition.

It is conceivable to provide means for keeping the slider in its lifted or unlocking position as the means for providing the mere latching condition. In this arrangement, however, since the slider is held in the unlocking position with its projections inserted in the releasing grooves of the non-unlocking tumblers, thus restraining

the movement of the tumbler, the unlocking number of the apparatus may be easily spied out by any unwanted person if the front side of the holder case is left exposed.

Further, in the conventional locking apparatus the holder case has each pushbutton as exposed on the front face and, hence, the inside mechanism thereof may be damaged by rain water or dust penetrating into the apparatus from the front face thereof.

The present invention has been attained in view of the foregoing circumstances. It is, therefore, a first object of the present invention to provide a pushbutton-type locking apparatus which is unlocked by pressing a set of predetermined pushbuttons disposed on a holder case thereof and is capable of maintaining the unlocked condition to provide a latching condition.

A second object of the invention is to provide a pushbutton-type locking apparatus which is provided with such a latching function and can be manufactured easily with a reduced cost.

A third object of the present invention is to provide a pushbutton-type locking apparatus having an openable cover mounted on the front side of the holder case thereof so as to prevent spying of the unlocking number which would otherwise be possible due to the provision of the latching function and to protect the mechanism inside the holder case.

Where the cover mounted on the front side of the holder case has an open/close means provided independently of, for example, the clearing pushbutton, the clearing pushbutton needs to be pressed after the open/close means is operated to open the cover, resulting in an inconvenience due to complicated manipulations of the locking apparatus as a whole.

Accordingly, it is a fourth object of the present invention to provide a pushbutton-type locking apparatus having an openable cover mounted on the front side of the holder case, which cover is openable cooperatively with the operation of a pushbutton so as to facilitate the handling of the locking apparatus.

[Means for Solving the Problem]

To accomplish the aforementioned objects, the following technical means has been was adopted in the present invention.

Specifically, a pushbutton-type locking apparatus according to the present invention is characterized by comprising a latching tumbler for holding a slider which has reached its unlocking position in that position, and a latching pushbutton for pressing the latching tumbler (Claim 1).

In the above arrangement according to the present invention, since the latching tumbler holds the slider which has reached the unlocking position in that position, the slider is left in the unlocking position to maintain the unlocked condition of the apparatus even when the doorlever (or doorknob) that has been rotated is returned to its original position, thereby keeping the locking apparatus in the latching condition.

Where the slider is formed at the edges thereof with recesses and projections continuously in the moving direction thereof for engaging or disengaging lateral edges of the unlocking and non-unlocking tumblers to restrain or permit the movement of the slider, means for holding the slider in the unlocking position may be such that the latching tumbler is formed at a lateral edge thereof with two releasing grooves spaced from each other in the pressing direction for allowing the corresponding projection to pass therethrough and a stopper pawl at a position between the releasing grooves, while the slider is formed, at its projection corresponding to the latching tumbler, with an engagement recess for receiving the stopper pawl (Claim 2).

In this case it is only required to provide the latching tumbler having two releasing grooves and form a recess at the corresponding projection of the slider. Accordingly, a pushbutton-type locking apparatus with a latching function can be obtained without any fundamental change in the design of the conventional locking apparatus.

Since the above feature according to the present invention is realized by adding only the latching tumbler and the engagement recess for engaging that tumbler, this feature is also applicable to a pushbutton-type locking apparatus in which: all the tumblers are each biased toward the front side of the holder case to assume its unpressed position; a clearing element having positioning springs for holding the unlocking and non-unlocking tumblers at their respective pressed positions is movably provided in the holder case; and the holder case contains a clearing tumbler for moving the clearing element so as to release the positioning springs from the unlocking and non-unlocking tumblers, and a clearing pushbutton for pressing the clearing tumbler (Claim 3).

In the present invention, such an arrangement is possible that: the slider is formed as a frame enclosing all the tumblers; the clearing element and the slider are movable in a same direction while being biased toward a same direction; and the clearing element is disposed within the frame of the slider as abutting against the slider, so that when the slider moves in the unlocking direction, the clearing element is moved cooperatively with and in the same direction as the movement of the slider, thereby releasing the positioning springs from the corresponding tumblers (Claim 4).

With this arrangement, unless the latching pushbutton is pressed, the unlocking tumblers each return to its original position even if the slider moves, so that the apparatus resumes its locking condition. Therefore, the latching function can be imparted to the conventional apparatus without interfering with its autolock function.

The scope of the present invention also includes an arrangement incapable of holding the latching tumbler in its pressed position. In an alternative arrangement capable of holding the latching tumbler in its pressed position, a positioning spring for holding the latching tum-

bler in its pressed position is employed as the clearing element, and the releasing groove of the latching tumbler which is closer to the front side of the case than the other is shaped so as to allow the corresponding projection of the slider to pass therethrough when the latching tumbler is held in the pressed position by the positioning spring (Claim 5).

In this arrangement, a press of the latching tumbler allows the projection of the slider to pass through the releasing groove of the tumbler that is closer to the front side of the case thereby permitting the slider to move toward the unlocking position and thereafter causes the clearing element moving cooperatively with the slider to release the latching tumbler biased toward the front side of the case from the positioning spring, so that the stopper pawl of the tumbler automatically fits into the engagement recess of the slider.

Since the stopper pawl of the latching tumbler automatically engages the engagement recess of the slider just moved if only the latching pushbutton is pressed after the pressing of the unlocking pushbuttons and before the rotating of the doorknob, the arrangement adapted to hold the latching tumbler in its pressed position provides easier latching operation of the locking apparatus than the arrangement without such function.

In the aforementioned arrangement adapted to hold the slider in the unlocking position by means of the latching tumbler, however, the slider is held in such a position with each projection thereof inserted in the releasing groove of each of the unlocking and non-unlocking tumblers, thereby leaving the apparatus in a condition in which only the unlocking pushbuttons can be pressed. As a result, if the front face of the holder case is left exposed, there is a danger that the unlocking number is easily spied out by any unwanted person.

To solve such a problem, the locking apparatus may be provided with a cover openably mounted on the front side of the holder case so as to cover all the pushbuttons when the cover is in the closed position, and with an opening pushbutton for opening the cover which is disposed at a position on the front side of the cover as closed corresponding to the position of the latching pushbutton (Claim 6).

In this case, pressing again the latching pushbutton holding the slider will cause the stopper pawl of the latching tumbler to be disengaged from the engagement recess of the slider, thus cancelling the latching condition and resuming the locking condition. Since the opening pushbutton is provided at a position corresponding to the latching pushbutton, the latching pushbutton is pressed whenever the opening pushbutton is pressed to open the cover, thereby causing the apparatus to resume the locking condition and making all the pushbuttons ready to be pressed. This prevents the unlocking number from being spied out.

Accordingly, it is no longer possible to spy out the unlocking number provided that the cover is necessarily closed after the latching condition is assumed.

In addition, the cover mounted on the front side of the holder case also protects the apparatus from the penetration of rain water or dusts. Therefore, regardless of the provision of the latching pushbutton on the holder case, the cover is an effective means.

In the locking apparatus of the type having a clearing pushbutton, particularly, the opening pushbutton of the cover may be provided at a position on the cover as closed corresponding to the clearing pushbutton (Claim 7).

In this arrangement, the clearing pushbutton is already pressed when the cover is opened and hence, the operations of opening the cover and pressing the clearing pushbutton do not need to be done separately, so that cumbersome operations which would otherwise be necessary due to the provision of the cover can be obviated.

The system for opening and closing the cover may include, more specifically, the cover vertically slidably mounted on the front side of the holder case, a first holding means for holding the cover in its lowest or closed position and a second holding means for holding the cover in its highest or opened position where all the pushbuttons are exposed (Claim 8).

This system may be so designed that the first holding means is provided with a releasing function for releasing the holding of the cover cooperatively with a press of the opening pushbutton while a jumping mechanism is provided which causes the cover thus released by the press of the opening pushbutton to jump so as to assume an ajar condition (Claim 9). With the system thus designed, the cover automatically becomes ajar upon the releasing of the first holding means, thereby facilitating the opening operation of the cover.

The pushbutton-type locking apparatus of the present invention may be characterized in that the clearing element is spaced apart from the slider so as not to abut against the slider (Claim 10).

According to this feature, since the clearing element is spaced apart from the slider, a rotation of the door lever allows the slider to move toward the unlocking position without moving the clearing element. As a result, the slider is allowed to move while the predetermined unlocking tumblers are held in the respective pressed positions by the positioning spring, thereby allowing the locking apparatus to assume the latching condition.

In this case, however, there is merely provided means for spacing the clearing element from the slider and, hence, the conventional autolock function cannot be retained unlike the arrangement having the means for holding the slider in an unlocking position (Claim 1).

[Brief Description of the Drawings]

Fig. 1 is a perspective view showing a locking apparatus mounted on a door with its cover opened;
Fig. 2 is a front elevational view of the locking apparatus with its cover closed as viewed from the

room exterior side;

Fig. 3 is a vertical sectional view showing the inner structure of the apparatus;

Fig. 4 is a rear view showing the inner structure of the apparatus;

Fig. 5 is a sectional view taken along the line A-A of Fig. 4;

Fig. 6 is a sectional view taken along the line B-B of Fig. 4, with a latching tumbler in an unpressed position;

Fig. 7 is a sectional view taken along the line B-B of Fig. 4, with the latching tumbler in a pressed position;

Fig. 8 (a) is a rear view of a slider, (b) is a plan view of the slider, (c) is a vertical sectional view of the slider, and (d) is a sectional view taken along the line C-C of (a);

Fig. 9 (a) is a front elevational view of an unlocking tumbler, (b) is a front elevational view of a non-unlocking tumbler, (c) is a front elevational view of a clearing tumbler, and (d) is a front elevational view of the latching tumbler;

Fig. 10 is a perspective view for showing the relation between the clearing element and the tumblers;

Fig. 11 (a) is a front elevational view of an outer case, (b) is a vertical sectional view of the case, and (c) is a rear view of the case;

Fig. 12 (a) is a front elevational view of a decorative frame, (b) is a sectional view taken along the line D-D of (a), (c) is a side elevational view of the decorative frame, (d) is a vertical sectional view of the decorative frame, and (e) is a rear view of the decorative frame;

Fig. 13 is a rear view of the cover;

Fig. 14 is a perspective rear view of the locking apparatus with its cover opened; and

Fig. 15 is a rear view showing the structure of a locking apparatus according to another embodiment of the present invention.

[Embodiment]

Hereinafter, embodiments of the present invention will be described with reference to the drawings.

In Figs. 1 to 4, a door latch 1 is retractable on a side face of a door 2 and engageable with a latch receiver disposed on a door frame (not shown).

An operating mechanism 3 on the room interior side comprises an ornamental cover 4 mounted on the door 2 on the room interior side and having a shape of a vertically elongated rectangular tray, and an interior lever 5 rotatably disposed in a lower portion of the ornamental cover 4.

A pushbutton-type locking apparatus 6 disposed on the room exterior side comprises a holder case 7 mounted on the exterior side of the door 2 and having a shape of a vertically elongated rectangular box with the rear side thereof opened, and an exterior lever 8 rotatably mounted on the case 7. The ornamental cover 4 and the holder case 7 are fixed on the interior and the exterior sides, respectively, of the door 2 at corresponding positions by means of a spanner screw extending through the door 2 from the interior side to the exterior side thereof.

As shown in Figs. 1, 2 and 4, the holder case 7 comprises an outer case 51 in the form of a rectangular tray having substantially the same peripheral shape as the ornamental cover 4 on the room interior side, a decorative frame 52 fixed on the front side of the outer case 51, and an inner case 53 housed in the outer case 51. The inner case 53 is screwed on mounts 54 formed in upper and lower portions of the outer case 51. All the elements necessary for the locking apparatus 6 are incorporated in the inner case 53. On the front side of the outer case 51 is vertically slidably mounted a cover 55 for covering all the pushbuttons 14 when it is closed.

The interior and the exterior levers 5 and 8 are coaxially positioned on the room interior side and the room exterior side, respectively, and cooperatively connected to a latch driving shaft 10. The latch driving shaft 10 is of a flat elongated plate and has one end on the room interior side which is fitted into a boss portion 11 of the interior lever 5, and the other end inserted through a driving pinion 12 which is fixed in the holder case 7 coaxially with the exterior lever 8 at a position inward of the exterior lever 8. Consequently, a rotation of the latch driving shaft 10 in either direction by means of the levers 5 and 8 makes the door latch 1 retract into the door 2.

The latch driving shaft 10 is inserted through a sector hole 13 of the driving pinion 12 with a play in the direction of the rotation. When a locking mechanism 16, which will be described later, is in a locking condition, the pinion 12 is restrained from rotating to prevent a rotation of the exterior lever 8 in the unlocking direction, while when the locking mechanism 16 is released, the pinion 12 is permitted to rotate thereby allowing the exterior lever 8 to rotate in the unlocking direction.

The pushbutton-type locking apparatus 6 includes a plurality of unlocking and non-unlocking pushbuttons 14A and 14B retractably disposed on the front side of the holder case 7, and a plurality of unlocking and non-unlocking tumblers 15A and 15B disposed in the holder case 7 at positions corresponding to the pushbuttons 14A and 14B, respectively, and adapted to move toward the rear side of the case 7 when the corresponding pushbuttons 14A and 14B are pressed. By moving only and all the tumblers (15A) preset for unlocking the apparatus through corresponding pushbuttons (14A), the locking mechanism 16 in the holder case 7 is released.

As shown in Figs. 3 to 5, the locking mechanism 16 comprises a base 20 having a vertically (longitudinally of the holder case 7) extending groove 18 for guiding a clearing element 17 in the middle of the width of the base and a plurality of throughholes 19 for receiving tumblers aligned on opposite sides of the groove 18, a slider 21 slidably overlying on the base 20 on the room exterior

side thereof, a tumbler support 22 overlying on the slider 21 on the exterior side thereof, and a rear cover 23 detachably covering an opening 7A defined in the rear side of the holder case 7 (inner case 53).

Into each throughhole 19 of the base 20 is inserted each tumbler 15 movably within the inner case 53 in the front/rear direction thereof (toward and away from the room). Each tumbler 15 is further inserted into each throughhole 22A defined on the tumbler support 22 side.

As shown in Figs. 4 to 8, the slider 21 is in the form of a frame plate sized to enclose all the tumbler receiving throughholes 19 (hence all the tumblers 15) and is longitudinally movably (vertically in Fig. 4) disposed in the inner case 53. On the upper end of the slider 21 at right and left sides thereof are formed projections 21A each of which is fitted into a compression spring 24 having an upper end abutting against an upper plate 53A of the inner case 53, whereby the slider 21 is always biased downward.

The slider 21 may be a frame of a discontinuous shape partially cut away.

Along the inner right and left edges of the slider 21 are formed recesses 25 and projections 26 continuously in the sliding direction of the slider 21 for engaging or disengaging the outer lateral edges of tumblers 15 so as to restrain or allow the movement of the slider 21.

According to this embodiment, the pushbuttons 14 comprise four types of pushbuttons: unlocking pushbuttons 14A, non-unlocking pushbuttons 14B, a clearing pushbutton 14C to be described later, and a latching pushbutton 14D. Correspondingly, the tumblers 15 comprise four types of tumblers: unlocking tumblers 15A, non-unlocking tumblers 15B, a clearing tumbler 15C to be described later, and a latching tumbler 15D. The pushbuttons 14 and the tumblers 15 are arranged in two columns and seven rows (14 elements in total).

In the guide groove 18 of the base 20 is disposed the clearing element 17 which is vertically slidable like the slider 21. As shown in Fig. 10, the clearing element 17 has bifurcated positioning springs 29 at given intervals in longitudinal direction thereof for holding the locking and non-locking tumblers 15A,15B and the latching tumbler 15D respectively pressed by the pushbuttons 14A, 14B and 14D in their respective pressed positions.

The clearing element 17 is disposed between the two columns of tumblers 15 in the inner case 53 and always downwardly biased independently of the slider 21 by a lowering spring 30 disposed between the clearing element 17 and the upper plate of the holder case 7.

As shown in Fig. 4, the clearing element 17 is disposed in the frame of the slider 21 with its lower end abutting against the lower frame segment 21B of the slider 21. Accordingly, when the slider 21 moves upward (in the unlocking direction), the clearing element 17 cooperatively moves upward, thereby releasing the positioning springs 29 from the corresponding tumblers 15A, 15B and 15D.

As shown in Figs. 3 and 4, above the driving pinion 12 is provided a sector gear 32 which meshes with the pinion 12 for rotation about a shaft 31 extending in the direction toward and away from the room. To the sector gear 32 are fixed release pins 33 abutting against the lower end of the slider 21 (the lower frame segment 21B).

Consequently, in the locking condition where the slider 21 is restrained from moving upward the release pins 33 abutting against the lower end of the slider 21 prevent the rotation of the sector gear 32, thus preventing the rotation of the exterior lever 8. On the contrary, in the unlocking condition where the slider 21 is allowed to move upward the release pins 33 are allowed to rotate about the shaft 31 of the sector gear 32, thus allowing the rotation of the exterior lever 8.

On the room exterior side of the sector gear 32 is disposed a splined bearing 27 which is fitted into and screwed to a boss portion 8A of the exterior lever 8. The outer periphery of the bearing 27 is coiled with a coiled spring 44 having one end hooked to a fixing element 28 of the inner case 53, the coiled spring 44 serving to return the exterior lever 8 as rotated to its original position by means of resilience.

In this embodiment, on the front surface of the outer case 51 are marked Arabic numerals of 0 to 9 and letters of A, B, C and R (See Fig. 11), corresponding to the 14 pushbuttons, while on the front surface of the cover 55 is fixed a display board 56 on which the numerals and letters are printed at locations corresponding to the push buttons (See Figs. 1 and 2). The numerals and letters "0 to 9 and A, B" are allotted to the unlocking and non-unlocking pushbuttons 14A, 14B (tumblers 15A, 15B).

As shown in Fig. 2 showing the holder case 7 in front elevation, the letter "C" in the right column and the lowest row corresponds to the clearing pushbutton 14C (clearing tumbler 15C), while the letter "R" in the right column and the highest row corresponds to the latching pushbutton 14D (latching tumbler 15D).

As shown in Figs. 5 and 9, each of the unlocking and non-unlocking tumblers 15A, 15B has one lateral edge formed with a locking portion 34 for restraining the corresponding projection 26 of the slider 21 from passing therethrough and a releasing groove 35 for allowing the projection 26 to pass therethrough, and the other lateral edge formed with an engagement portion 36 for engaging a hooked portion 29A on top of each positioning spring 29.

The latching tumbler 15D has one lateral edge formed with two releasing grooves 35U and 35L spaced from each other in the pressing direction for allowing the corresponding projection 26 of the slider 21 to pass therethrough and a stopper pawl 37 between the releasing grooves 35U and 35L, and the other lateral edge formed with an engagement portion 36 for engaging a hooked portion 29A on top of the corresponding positioning spring 29.

As shown in Figs. 6 to 8, the projection 26 of the slider 21 corresponding to the latching tumbler 15D is

formed with an engagement recess 38 for receiving the stopper pawl 37 which is formed by slightly cutting the projection 26 on the side closer to the rear side of the case. As a result, the stopper pawl 37 of the latching tumbler 15D engages the engagement recess 38 of the slider 21, whereby the slider 21 that has reached the unlocking position is held in that position.

The releasing groove 35U of the latching tumbler 15D which is closer to the front side of the case than the other groove 35L is shaped to permit the corresponding projection 26 of the slider 21 to pass therethrough when the latching tumbler 15D is held by the corresponding positioning spring 29, as shown in Fig. 7. Thus, when the latching tumbler 15D is pressed together with all the unlocking tumblers 15A, the slider 21 is allowed to move upward.

The stopper pawl 37 may be formed with a tapered surface 37A on one side thereof which is tapered toward the upper end of the pawl, as shown in Fig. 9 (d), so that the corresponding projection 26 of the slider 21 is properly guided to the releasing groove 35U of the latching tumbler 15D which is closer to the front side of the case. The tapered surface 37A helps the projection 26 press the latching tumbler 15D toward the rear side of the case so that the projection 26 is guided into the releasing groove 35U when the projection 26 of the slider 21 upwardly moving toward the unlocking position contacts the stopper pawl 37 of the tumbler 15D held by the positioning spring 29.

Therefore, such a tapered surface 37A can prevent the projection 26 from being caught by the stopper pawl 37 and interfering with the upward movement of the slider 21 even when the latching tumbler 15D is positioned by the positioning spring 29 with a slight error.

The tapered surface 37A which helps the projection 26 press the latching tumbler 15D and leads the projection 26 into the releasing groove 35U located closer to the front side of the case may be formed on the projection 26 of the slider 21 at a position opposite to the engagement recess 38, as shown in Fig. 8 (c).

The above-mentioned unlocking and non-unlocking tumblers 15A and 15B and the latching tumbler 15D are each inserted into each throughhole 19 in such a manner that the side of each tumbler where the engagement portion 36 is formed is oriented toward the vertically extending center axis of the inner case 53.

On the rear cover 23 is formed a spring containing portion 39 at a position corresponding to each tumbler 15, in which portion 39 returning springs 40 are accommodated for biasing the tumbler 15 toward the front side of the holder case 7 (upper side in Fig. 5).

When the unlocking and non-unlocking tumblers 15A, 15B and the latching tumbler 15D are pressed by the pushbuttons 14, they are each held in the pressed position by means of the engagement between the engagement portion 36 and the hooked portion 29A forming the top of the positioning spring 29 (See left tumblers 15B and 15D in Figs. 5 and 7). In turn, when the clearing element 17 moves upward by means of the clearing tumbler 15C, such engagement between the engagement portion 36 and positioning spring 29 is released, so that the tumblers 15A, 15B and 15D are pressed toward the front side of the inner case 53 and returned to their original positions by the return spring 40 (See right and left tumblers 15A and 15D in Fig. 6).

Of the unlocking and non-unlocking tumblers 15A and 15B, the unlocking tumblers 15A (right tumbler in Fig. 5) each have the releasing groove 35 situated closer to the front side of the case (upper side in Fig. 5) than the locking portion 34, while in each non-unlocking tumbler 15B (left tumbler in Fig. 5) the positional relation between the releasing groove 35 and the locking portion 34 is inverted, i.e., the locking portion 34 is situated closer to the front side of the case than the releasing groove 35.

Accordingly, when each unlocking tumbler 15A is in the pressed position, its releasing groove 35 is located within the frame of the slider 21 so that projection 26 of the slider 21 does not contact the tumbler 15A, while with each tumbler 15A in the original position (as shown in Fig. 5), its locking portion 34 is positioned in the recess 25 of the slider 21 and engages the projection 26 of the slider 21, thus restraining the upward movement of the slider 21.

On the other hand, when each non-unlocking tumbler 15B is in the pressed position (as shown in Fig. 5), its locking portion 34 is positioned in the recess 25 of the slider 21 and engages the projection 26 of the slider 21 to restrain the upward movement of the slider 21, while with each tumbler 15B in the original position its releasing groove 35 is located within the frame of the slider 21 so that the projection 26 of the slider 21 does not contact the tumbler 15B.

As a result, when only the unlocking tumblers 15A are pressed, the slider 21 is allowed to move upward to unlock the apparatus. In other cases, i.e., when the unlocking tumblers 15A are not pressed or when the non-unlocking tumblers 15B are pressed, the locking portion 34 of any one of the tumblers 15A, 15B restrains the upward movement of the slider 21, whereby the locking mechanism 16 is maintained as locked.

It should be noted that Fig. 5 shows a condition in which the unlocking tumbler 15A on the right is not pressed and the non-unlocking tumbler 15B on the left is pressed. In this condition the slider 21 is not allowed to move upward. In Fig 5 the locking portions 34 of the tumblers 15A and 15B are shown with hatching so as to clearly make a distinction between the locking portions 34 and the releasing grooves 35.

Of the two releasing grooves 35U and 35L formed in the latching tumbler 15D, the groove 35L situated closer to the rear side of the case (lower side in Fig. 6) than the releasing groove 35U allows the corresponding projection 26 of the slider 21 to pass therethrough when the tumbler 15D is not pressed (See Fig. 6). On the other hand, the releasing groove 35U situated closer to the

front side of the case (upper side in Fig. 7) allows the corresponding projection 26 of the slider 21 to pass therethrough when the tumbler 15D is pressed (See Fig. 7).

Accordingly, as long as only the unlocking tumblers 15A are pressed, the slider 21 is allowed to move upward to unlock the apparatus, regardless of whether the latching tumbler 15D is pressed or not.

With this arrangement, as aforementioned, since the lower end of the clearing element 17 abuts against the lower frame segment 21B so as to upwardly move the clearing element 17 cooperatively with the upward movement of the slider 21, each of the tumblers 15A, 15B and 15D is released from the corresponding positioning spring 29 with each projection 26 inserted in the corresponding releasing groove 35 or 35U. Further, since the latching tumbler 15D is biased toward the front side of the case by means of the return spring 40, the stopper pawl 37 of the tumbler 15D becomes fitted into the engagement recess 38 formed on the rear side of the slider 21, thereby holding the slider 21 which has upwardly moved and reached the unlocking position in that position.

Where the stopper pawl 37 or the corresponding projection 26 is formed with a tapered surface 37A which helps the projection 26 press down the latching tumbler 15D and guides the projection 26 to the releasing groove 35U situated closer to the front side of the case, even when the projection 26 is brought into contact with the stopper pawl 37 during the upward movement of the slider 21, the tumbler 15D is slightly pressed toward the rear side of the case by means of the tapered surface 37A so as to guide the projection 26 to the releasing groove 35U. Therefore, even when the latching tumbler 15D is positioned by the positioning spring 29 with a slight error, such a tapered surface 37A can prevent the projection 26 from being caught by the stopper pawl 37 and interfering with the upward movement of the slider 21.

The pushbuttons 14 are each formed into a bottomed cylindrical shape and retractably fitted into the outer case 51 in such a manner as to outwardly project from the front face of the outer case 51. In the pushbutton 14 is provided a return spring 41 which has an inner end contacting a projection 42 (See Fig. 5) projecting from the tumbler support 22 toward the room exterior side. Therefore, once the pushbutton 14 is pressed to move the tumbler 15 to the pressed position, the pushbutton solely is then returned to its original position by the return spring 41.

The clearing tumbler 15C causes the clearing element 17 to move upwardly so as to return the unlocking or non-unlocking tumblers 15A or 15B and the latching tumbler 15D to their original positions.

As shown in Figs. 9 and 10, the clearing tumbler 15C has a cam portion 43 formed by cutting one lateral edge of the tumbler 15C, while the clearing element 17 has an inclined cam surface 45 at the lower end thereof for engaging the cam portion 43.

Accordingly, when the clearing tumbler 15C is pressed down by means of the clearing pushbutton 14C corresponding to the mark "C", the engagement between the cam portion 43 and the inclined cam surface 45 causes the clearing element 17 to move upwardly against the lowering spring 30. The positioning springs 29 are also upwardly moved together with the clearing element 17, whereby the engagement between the positioning springs 29 and the corresponding tumblers 15 are released. Thus, the tumblers 15 in their respective pressed positions are returned to their original positions by the corresponding returning springs 40.

The rear cover 23 is formed with inspection windows 23 at positions corresponding to the tumblers 15 for allowing observation of the end edge of each tumbler 15 from outside.

As shown in Fig. 11, the outer case 51 defines button holes 57 in a middle region of the front face thereof in which the pushbuttons 14 are inserted. The case 51 is formed with a vertically extending semi-cylindrical spring-receiving groove 58 on an upper portion of the front face thereof and a throughhole 59 for receiving the bearing 27 of the exterior lever 8 in a lower portion of the front face thereof.

As shown in Fig. 12, the decorative frame 52 comprises a window frame portion 60 formed to enclose all the pushbutton holes 57, and a wider portion 61 integrally molded with the window frame portion 60 at the lower end thereof. The window frame portion 60 is formed with rail grooves 62 on opposite side edges thereof. The wider portion 61 centrally defines a throughhole 63 for receiving a boss portion 8A of the exterior lever 8.

The window frame portion 60 is formed with a vertically extending semi-cylindrical spring-receiving groove 64 on an upper portion of the rear face thereof and a laterally extending guide groove 65 below the groove 64. The window frame portion 60 is further formed with a stopper groove 66 for engaging a stopper arm 75 to be described later.

As shown in Figs. 2, 13 and 14, the cover 55 comprises a cover body 67 in the form of a rounded tray with its rear side and lower side opened, the display board 56 fixed on the front face of the cover body 67, and a rail frame 68 fixed on the rear side of the cover body 67.

The rail frame 68 comprises a board having a pair of rails 69 formed by inwardly bending the opposite side edges of the board so that the edges face each other. Each of the rails 69 is fitted into each of the rail grooves 62 formed on the opposite sides of the decorative frame 52, so that the cover 55 is vertically slidably mounted on the holder case 7. The rails 69 are each formed with a slipoff-preventive recess 70 for engaging a claw 83 of a hooking member 81 to be described later.

In this embodiment, the cover 55 is provided with an opening pushbutton 71 outwardly extending therethrough toward the front side thereof for opening the

cover 55. The opening pushbutton 71 is disposed at a position on the cover 55 as closed corresponding to the position of the latching pushbutton 14D, as shown in Figs. 1 and 2.

The cover 55 is further provided with a first holding means 72 for holding the cover 55 at the lowest position where the cover 55 is closed and a second holding means 73 for holding the cover 55 at the highest position where the cover 55 is opened with all pushbuttons 14 uncovered.

The first holding means 72 comprises a stopper arm 75 pivotally supported by a pin 74 in an upper portion of the rear side of the cover body 67 and a U-shaped flat spring 76 fixed on the middle portion of the rear side of the cover body 67.

As shown in the Figs. 3, 13 and 14, the stopper arm 75 made of a vertically elongated plate which is bent into a substantially boomerang shape is mounted on the cover body 67 with the bent portion thereof pivoted by a laterally extending pin 74 so that an upper end portion 77 thereof can swing toward and away from the cover 55. The position for mounting the stopper arm 75 corresponds to that of the stopper groove 66 formed in the decorative frame 52.

The flat spring 76 comprises upwardly extending two leg portions 78 and 79, one leg portion 78 abutting against a lower end 80 of the stopper arm 75 which abuts against an inner end of the opening pushbutton 71. The other leg portion 79 of the flat spring 76 also abuts against the inner end of the opening pushbutton 71. Accordingly, the upper end 77 of the stopper arm 75 is biased so as to project toward the holder case 7 and the opening pushbutton 71 is biased so as to project toward the room exterior side by the resilient force of the flat spring 76.

When the cover 55 is in the lowest position (as shown in Figs. 2 and 3), the upper end portion 77 of the stopper arm 75 engages the stopper groove 66 of the decorative frame 52, thereby positioning the cover 55 to the closed position. On the other hand, when the opening pushbutton 71 is pressed, the upper end portion 77 of the stopper arm 75 disengages the stopper groove 66 thereby allowing the cover 55 to move upward. Accordingly, the first holding means 72 has a function of releasing the holding of the cover 55 in response to a press of the opening pushbutton 71.

On the other hand, as shown in Fig. 12, the second holding means 73 comprises a pair of hooking elements 81 which laterally movably received in the guide groove 65 of the decorative frame 52, and a spring 82 for biasing the hooking elements 81 away from each other, the hooking elements 81 each having an end portion formed with a claw 83 having a downwardly inclined upper edge and a horizontal lower edge.

Each hooking element 81 defines a laterally elongated slot 84 in the center thereof into which a pin 85 integrally formed with the decorative frame 52 is inserted for preventing the hooking element 81 from slipping off and guiding the lateral movement of the hooking element 81.

The spring 82 is compressedly disposed between the hooking elements 81 so that the resilient force of the spring 82 outwardly biases the hooking elements so as to cause the claws 83 to protrude into the corresponding rail grooves 62.

Therefore, when the cover 55 reaches its highest position (as shown in Figs. 1 and 14), the claws 83 of the hooking elements 81 engage the corresponding slipoff-preventive recesses 70 formed in the rails 69, thereby positioning the cover 55 to the opened position. Since the upper edge of the claw 83 of each hooking element 81 is outwardly downwardly inclined, pressing the cover 55 in the highest position forcibly downward causes the hooking elements 81 to retract toward the center of the guide groove 65, thereby allowing the cover to move downward.

As shown in Fig. 14, the locking apparatus 6 according to this embodiment includes a jumping mechanism 86 adapted to allow the cover 55 to assume an ajar condition by causing the cover 55 thus released from the held condition by a press of the opening pushbutton 71 to jump. The jumping mechanism 86 comprises a jump spring 87 received in the spring-receiving grooves 58 and 64 of the outer case 51 and the decorative frame 52 and a semicircular protrusion 88 formed on the upper edge of the cover body 67.

The jump spring 87 is received in the spring-receiving grooves 58 and 64 with the upper half thereof projecting from the top of the outer case 51. The protrusion 88 is located at a position such as to abut against the upper end of the jump spring 87.

With this arrangement, when the opening pushbutton 71 of the cover 55 in the closed condition is pressed, the upper end portion 77 of the stopper arm 75 is disengaged from the stopper groove 66 and, simultaneously therewith, the jump spring 87 with its upper end abutting against the protrusion 88 presses the cover 55 upwardly so that the cover jumps, thereby rendering the cover ajar, as illustrated in phantom in Fig. 3.

Since the opening pushbutton 71 corresponds to the latching pushbutton 14D, the pushbutton 14D is pressed whenever the opening pushbutton 71 is pressed to open the cover 55.

The operation of the locking apparatus 6 having the aforementioned construction will now be described.

The tumblers 15A and 15B are each inserted into respective throughhole 19 so that the unlocking tumblers 15A respectively correspond to the unlocking pushbuttons 14A bearing, in one-to-one relation, predetermined unlocking numerals and letters (for example, 1, 2, 3, A, B) selected from the numerals 0 to 9 and letters A and B, while the non-unlocking tumblers 15B respectively correspond to the pushbuttons 14B bearing the other numerals (0 and 4 to 9) in one-to-one relation.

When only the pushbuttons 14A with the unlocking numerals and letters (1, 2, 3, A, B) are pressed to move

all the unlocking tumblers 15A to their respective pressed positions, the engagement between the locking portions 34 of all the tumblers 15A and 15B and the corresponding projections 26 of the slider 21 are released, thereby allowing the slider 21 to move upward. Thus, the exterior lever 8 is unlocked.

On the other hand, when any of the unlocking tumblers 15A is not pressed or any of the non-unlocking tumblers 15B is pressed by mistake, the locking portion 34 of that tumbler 15A or 15B engages the corresponding projection 26, thereby restraining the movement of the slider 21. Consequently, the exterior lever 8 is prevented from rotating, thus assuming the locking condition.

If the user presses wrong pushbuttons, then the user can press the clearing pushbutton 14C corresponding to the letter "C" to cause the clearing tumbler 15C to actuate the clearing element 17 whereby all the pressed tumblers 15A, 15B and 15D are returned to their original unpressed positions. After the clearing operation, the user can press the correct pushbuttons.

Further, if the user wishes the mere latching condition of the locking apparatus 6, all the user has to do is press all the unlocking pushbuttons 14A to unlock the apparatus, and then press the latching pushbutton 14D, followed by rotating the exterior lever 8.

In this case, the latching tumbler 15D is held in the pressed position by the positioning spring 29, as shown in Fig. 7, with its releasing groove 35U situated closer to the front side of the case being aligned with the frame of the slider 21. Since this allows the corresponding projection 26 to move in the unlocking direction (or upward), the projection 26 of the slider 21 enters the releasing groove 35U of the tumbler 15D, thereby allowing the slider 21 to move upward.

As soon as the positioning spring 29 is released from the latching tumbler 15D by the clearing element 17 upwardly moved cooperatively with the upward movement of the slider 21, the latching tumbler 15D is moved toward the front side of the case by the return spring 40. Consequently, the stopper pawl 37 of the tumbler 15D engages the engagement recess 38 of the slider 21, thereby holding the slider 21 which has reached the unlocking position in that position.

Therefore, even after the exterior lever 8 returns to its original position, the slider 21 is left in the unlocking position, thus maintaining the locking apparatus in the latching condition.

For cancelling the latching condition, the latching pushbutton 14D is pressed again, so that the stopper pawl 37 of the latching tumbler 15D is disengaged from the engagement recess 38 of the slider 21 to cause the slider 21 to return downward by means of the compression spring 24. As a result, the locking condition is resumed.

In this embodiment, the lower end of the clearing element 17 abuts against the lower frame segment 21B of the slider 21 and, hence, the clearing element 17 moves upward with the upward movement of the slider 21, with the result that the unlocking and non-unlocking tumblers 15A and 15B are all released from the corresponding positioning springs 29 after the slider 21 moves upward. Therefore, when the slider is returned to its original position, the tumblers 15A and 15B are returned to their respective unpressed positions, whereby the locking condition is resumed.

Where the user desires to use the locking apparatus 6 as an autolock apparatus, it is only required that the user rotate the exterior lever 8 without pressing the latching pushbutton 14D after pressing all the unlocking pushbuttons 14A.

In this case, the latching tumbler 15D is in the unpressed position shown in Fig. 6, and hence permits the corresponding projection 26 of the slider 21 to pass through its releasing groove 35L situated closer to the rear side of the case, whereby the slider 21 is allowed to move upward.

Since the clearing element 17 moves upward cooperatively with the upward movement of the slider 21, the unlocking tumblers 15A have already been released from the positioning springs 29 when the slider 21 reaches the highest position. Therefore, as soon as the slider 21 returns to its original position, the unlocking tumblers 15A are returned to their respective unpressed positions, whereby the locking condition is resumed.

Thus, when the exterior lever 8 returns to its original position, the locking condition is automatically resumed, i.e., the locking apparatus 6 is automatically locked.

Under the aforementioned latching condition, the slider 21 is held in the highest position (unlocking position) with the projections 26 thereof inserted in the corresponding releasing grooves 35 of the unlocking and non-unlocking tumblers 15A, 15B.

Under this condition, the unlocking pushbuttons 14A can be pressed since the corresponding tumblers 15A are each in the lower or pressed position, while the non-unlocking pushbuttons 14B cannot be pressed because the corresponding tumblers 15B are each left in the higher or unpressed position. Therefore, if the apparatus 6 is left in this condition, the unlocking number may be spied out easily by any unwanted person.

Such spying of the unlocking number can be avoided by merely closing the cover 55 whenever the locking apparatus 6 is turned into the latching condition.

More specifically, in this embodiment the opening pushbutton 71 for opening the cover 55 is provided at a position corresponding to the latching pushbutton 14D, so that whenever the opening pushbutton 71 is pressed to open the cover 55 again after the latching condition is assumed, the latching pushbutton 14D is necessarily pressed again to release the latching condition. As a result, all the pushbuttons 14 are reset to their unpressed conditions whenever the cover 55 is opened, thereby preventing someone from easily spying out the unlocking number.

It should be appreciated that the foregoing embod-

iment is not limitative of the invention, and various changes and modifications can be made within the scope of the invention. It is possible to provide, for example, a locking apparatus 6 having a latching pushbutton 14D and a tumbler 15D but not having a cover 55 and otherwise a locking apparatus 6 having a cover 55 provided with an opening pushbutton 71 but not having a latching pushbutton 14D and a tumbler 15D.

Where a cover 55 with an opening pushbutton 71 is provided to that locking apparatus 6 having a clearing pushbutton 14C but not having a latching pushbutton 14D, the provision of the opening pushbutton 71 at a position on the cover as closed corresponding to the position of the clearing pushbutton 14C would eliminate the need of separate operations for opening the cover 55 and for clearing, thereby providing the locking apparatus 6 requiring simplified operations.

Although the above embodiment has the positioning spring 29 provided for holding the latching tumbler 15D in the pressed position, such a positioning spring 29 provided to the clearing element 17 in a position corresponding to the latching tumbler 15D may be omitted so that the tumbler 15D is not held in the pressed position.

However, with this arrangement in which the tumbler 15D is not held in the pressed position, the user must follow a somewhat complicated operational procedure for setting the locking apparatus 6 into latching condition, i.e., rotating the exterior lever 8 while pressing the latching pushbutton 14D, releasing the latching pushbutton 14D so as to cause the stopper pawl 37 of the tumbler 15D to engage the engagement recess 38 of the slider 21, and then returning the exterior lever 8 to its original position.

In this connection, the foregoing embodiment having the positioning spring 29 for holding the latching tumbler 15D requires a simplified operation for achieving the latching condition since only a press of the latching pushbutton 14D before rotating the exterior lever 8 serves the purpose.

Although the embodiment has pushbuttons 14 and tumblers 15 which are formed separately, these members may be integrally formed in the present invention. Further, a doorknob may be used instead of the door lever 5 or 8, and the locking apparatus 6 may be constructed as a locking apparatus incorporated with a key-operated locking system in the case holder so as to be operable with both the pushbuttons and a key.

The shape of the slider 21 is not limited to the frame form enclosing all the tumblers 15. The slider 21 is merely required to be engageable with and disengageable from the unlocking and non-unlocking tumblers 15A, 15B and the latching tumbler 15D, and thus may be in the form of, for example, a plate having projections and recesses 25 and 26 on opposite lateral sides thereof to be disposed between the two columns of the tumblers 15.

Fig. 15 shows another embodiment of locking apparatus 6 according to the present invention.

The difference between this embodiment and the embodiment shown in Figs. 1 to 14 is that the lower end of clearing element 17 is spaced a distance E corresponding to the stroke of the slider 21 from the lower frame segment 21B of the slider 21, so that the clearing element 17 will not abut against the slider 21 moving toward the unlocking position.

Accordingly, in this arrangement the upward movement of the slider 21 actuated by the rotation of the exterior lever is not accompanied by the movement of the clearing element 17 and, hence the slider 21 is allowed to move while the unlocking tumblers 15A are held in their pressed positions, thereby achieving the latching condition.

This arrangement, however, cannot maintain the autolock function since the clearing element 17 does not abut against the slider 21.

The other elements of this embodiment which are substantially the same as those of the embodiment of Figs. 1 to 14 are designated by the same reference numerals for omitting the descriptions thereof.

[Effect of the Invention]

As has been described, the present invention provides a pushbutton-type locking apparatus to be unlocked by pressing a set of predetermined unlocking pushbuttons disposed on a holder case, which apparatus is capable of maintaining the unlocked condition by the latching function thereof, thereby eliminating cumbersome operations of pressing pushbuttons from the beginning for each opening of the door (Claims 1 and 10).

Since the latching function can be imparted to a conventional locking apparatus without any substantial change in design, a locking apparatus with the latching function can be provided with ease and reduced cost (Claim 2 and 3).

Further, according to the present invention, the latching function can be added without interfering with the conventional autolock function (Claim 4).

The unlocking apparatus according to the invention requires a simple latching operation since the latching condition can be set only by pressing the latching pushbutton previously (Claim 5).

In the invention, an opening pushbutton for opening the cover is disposed at a position corresponding to the latching pushbutton, thereby preventing the unlocking number from being spied out by someone and eliminating complicated operations which would otherwise be required due to the provision of the cover (Claim 6).

Alternatively, the opening pushbutton for opening the cover is disposed at a position corresponding to the clearing pushbutton, thereby eliminating complicated operations which would otherwise result from the mounting of the cover (Claim 7).

The locking apparatus according to this invention

further comprises a jumping mechanism for causing the vertically slidable cover to jump to assume an ajar condition in response to a press of the opening pushbutton, thereby facilitating the opening operation of the cover (Claims 8 and 9).

[Description of the Reference Numerals]

6	locking apparatus
7	holder case
14	pushbutton
14A	unlocking pushbutton
14B	non-unlocking pushbutton
14C	clearing pushbutton
14D	latching pushbutton
15	tumbler
15A	unlocking tumbler
15B	non-unlocking tumbler
15C	clearing tumbler
15D	latching tumbler
21	slider
25	recess
26	projection
29	positioning spring
34	locking portion
35	releasing groove
35U	releasing groove
35L	releasing groove
37	stopper pawl
37A	tapered surface
38	engagement recess
55	cover
71	opening pushbutton
72	first holding means
73	second holding means
86	jumping mechanism

Claims

1. A pushbutton-type locking apparatus comprising:

a plurality of unlocking pushbuttons (14A) and a plurality of non-unlocking pushbuttons (14B) retractably disposed on a front face of a holder case (7);

a plurality of unlocking tumblers (15A) preset for unlocking the apparatus and a plurality of non-unlocking tumblers (15B) disposed in the holder case (7) at positions corresponding to the pushbuttons (14A),(14B), respectively, and each movable toward the rear side of the case (7) in response to a press of the corresponding pushbutton (14A),(14B); and

a slider (21) disposed in the case (7) so as to be movable orthogonally to the moving direction of the tumblers (15A),(15B),

wherein when only and all the tumblers (15A) are pressed through corresponding pushbuttons (14A), the slider (21) biased into a locking position is allowed to move to an unlocking position,

the apparatus being characterized in that the holder case (7) is provided with a latching tumbler (15D) for holding the slider (21) which has reached the unlocking position in that position and a latching pushbutton (14D) for pressing the latching tumbler (15D).

2. A pushbutton-type locking apparatus as set forth in Claim 1, wherein

the slider (21) is formed at edges thereof with recesses (25) and projections (26) continuously in the moving direction thereof for engaging and disengaging lateral edges of the unlocking and non-unlocking tumblers (15A),(15B) so as to restrain or permit the movement of the slider (21);

the latching tumbler (15D) is formed at a lateral edge thereof with two releasing grooves (35U) and (35L) spaced from each other in the pressing direction thereof for allowing the corresponding projection (26) to pass therethrough and with a stopper pawl (37) between the releasing grooves (35U),(35L); and

the slider (21) is formed, at its projection (26) corresponding to the latching tumbler (15D), with an engagement recess (38) for receiving the stopper pawl (37).

3. A pushbutton-type locking apparatus as set forth in Claim 2, wherein

all the tumblers (15) are each biased toward the front side of the holder case (7);

the holder case (7) contains a clearing element (17) movably provided therein, which clearing element has positioning springs (29) for holding the unlocking and non-unlocking tumblers (15A),(15B) at their respective pressed positions; and

the holder case (7) further contains a clearing tumbler (5C) for moving the clearing element (17) so as to release the positioning springs (29) from the unlocking and non-unlocking tumblers (15A),(15B), and a clearing pushbutton (14C) for pressing the clearing tumbler (15C).

4. A pushbutton-type locking apparatus as set forth in Claim 3, wherein

the slider (21) is formed as a frame enclosing all the tumblers (15), and the slider (21) and the clearing element (17) are movable in a same direction while being biased toward a same di-

rection; and
the clearing element (17) abuts against the slider (21) within the frame of the slider (21) so that when the slider (21) moves in the unlocking direction, the clearing element (17) is moved cooperatively with and in the same direction as the movement of the slider (21), thereby releasing the positioning springs (29) from the corresponding tumblers (15A),(15B).

5. A pushbutton-type locking apparatus as set forth in Claim 3 or 4, wherein

the clearing element (17) has a positioning spring (29) for holding the latching tumbler (15D) in its pressed position; and
the releasing groove (35U) of the latching tumbler (15D) which is closer to the front side of the case than the other releasing groove is shaped so as to allow the corresponding projection (26) of the slider (21) to pass therethrough when the tumbler (15D) is held in the pressed position by the positioning spring (29).

6. A pushbutton-type locking apparatus as set forth in any one of Claims 1 to 5, wherein

the holder case (7) is provided with a cover (55) openably mounted on the front side thereof for covering all the pushbuttons (14) when the cover (55) is in its closed position, the cover (55) being provided with an opening pushbutton (71) on the front side thereof for opening the cover (55) in the closed position; and
the opening pushbutton (71) is disposed at a position on the cover (55) as closed corresponding to the position of the latching pushbutton (14D).

7. A pushbutton-type locking apparatus comprising:

a plurality of unlocking pushbuttons (14A) and a plurality of non-unlocking pushbuttons (14B) retractably disposed on a front face of a holder case (7),
a plurality of unlocking tumblers (15A) preset for unlocking the apparatus and a plurality of non-unlocking tumblers (15B) disposed in the holder case (7) at positions corresponding to the pushbuttons (14A),(14B) and each movable toward the rear side of the case (7) in response to a press of the corresponding pushbutton (14A),(14B); and
a clearing pushbutton (14C) for returning the unlocking and non-unlocking tumblers (15A), (15B) from their pressed positions into their unpressed positions,
wherein when only and all the tumblers are pressed through corresponding pushbuttons (14A),(14B), the apparatus becomes unlocked, the apparatus being characterized in that: a cover (55) is openably mounted on the front side of the holder case (7) for covering all the pushbuttons (14) when the cover (55) is in its closed position, the cover (55) being provided with an opening pushbutton (71) on the front side thereof for opening the cover (55) in the closed position, and
the opening pushbutton (71) is disposed at a position on the cover (55) as closed corresponding to the position of the clearing pushbutton (14C).

8. A pushbutton-type locking apparatus as set forth in Claim 6 or 7, wherein

the cover (55) is vertically slidably mounted on the front side of the holder case;
a first holding means (72) is provided for holding the cover (55) at its lowest position where the cover (55) is closed, while a second holding means (73) is provided for holding the cover (55) at its highest position where the cover (55) is opened.

9. A pushbutton-type locking apparatus as set forth in Claim 8, wherein

the first holding means (72) is provided with a releasing function for releasing the holding of the cover (55) cooperatively with a press of the opening button (71); and
a jumping mechanism (86) is provided which causes the cover (55) released from the held condition by a press of the opening pushbutton (71) to jump so as to assume an ajar condition.

10. A pushbutton-type locking apparatus comprising:

a plurality of unlocking pushbuttons (14A), a plurality of non-unlocking pushbuttons (14B) and a clearing pushbutton (14C) which are retractably provided on a front face of a holder case (7);
a plurality of unlocking tumblers (15A) preset for unlocking the apparatus, a plurality of non-unlocking tumblers (15B) and a clearing tumbler (15C) which are disposed in the holder case (7) at positions corresponding to the pushbuttons (14A), (14B) and (14C), respectively, and biased toward the front side of the case (7), the tumblers (15A), (15B) and (15C) being each movable toward the rear side of the case (7) in response to a press of the corresponding pushbutton (14A),(14B),(14C); and
a slider (21) disposed in the holder case (7) so

as to be movable orthogonally to the moving direction of the tumblers (15A),(15B) and (15C), wherein: when only and all the tumblers (15A) are pressed through corresponding pushbuttons (14A), the slider (21) biased into a locking position is allowed to move to an unlocking position,

the holder case (7) contains a clearing element (17) provided therein, which clearing element (17) has positioning springs (29) for holding the unlocking and non-unlocking tumblers (15A), (15B) at their respective pressed positions and is movable in the same direction as the movement of the slider (21); and

the clearing tumbler (15C) is engaged with the clearing element (17) in such a manner that a press of the clearing pushbutton (15C) causes the clearing element (17) to move in a direction such that the unlocking and non-unlocking tumblers (15A),(15B) are released from the corresponding positioning springs (29),

the apparatus being characterized in that the clearing element (17) is spaced from the slider (21) so as not to abut against the slider (21) moving toward the unlocking position.

FIG. 1

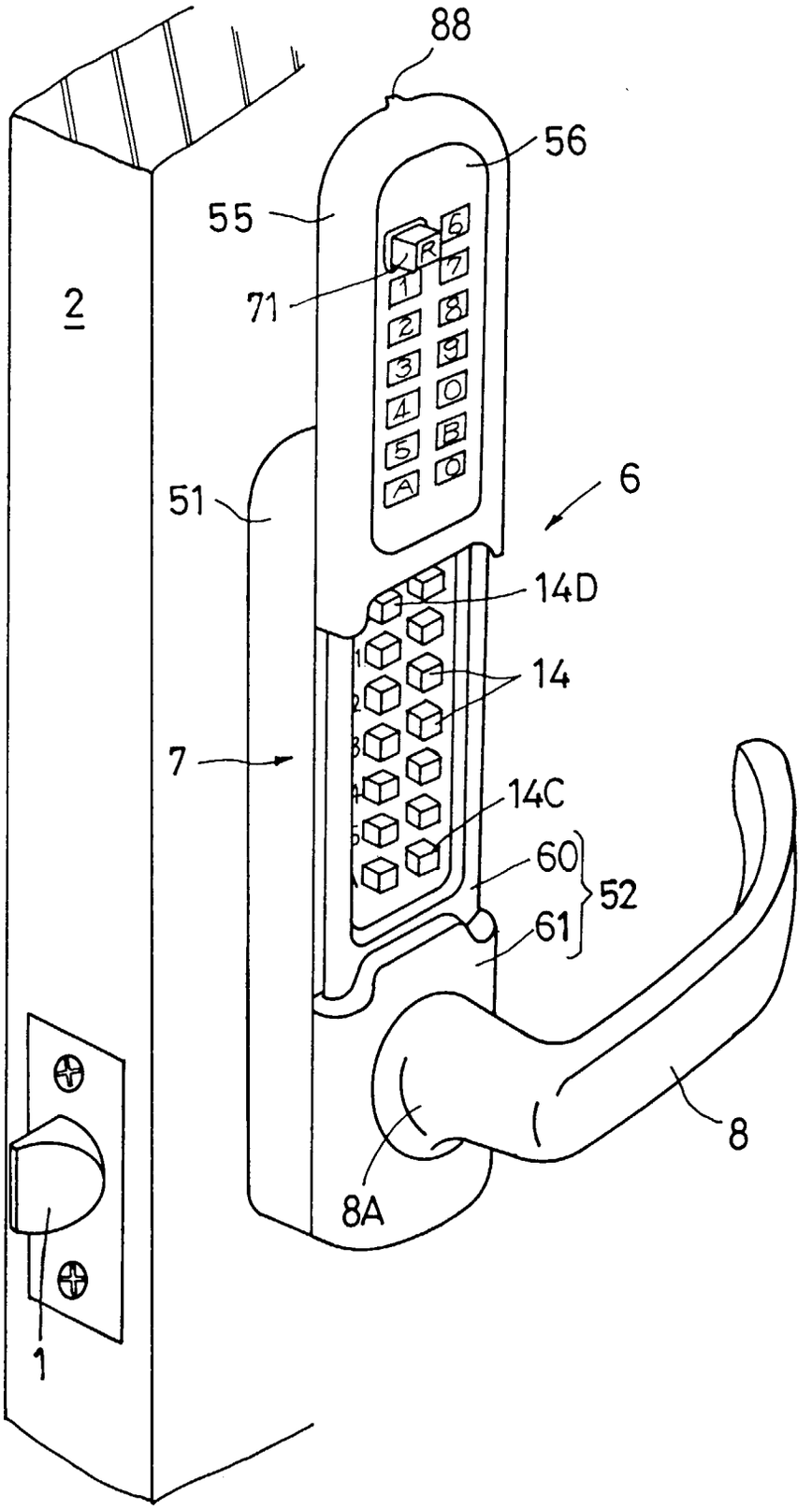


FIG. 2

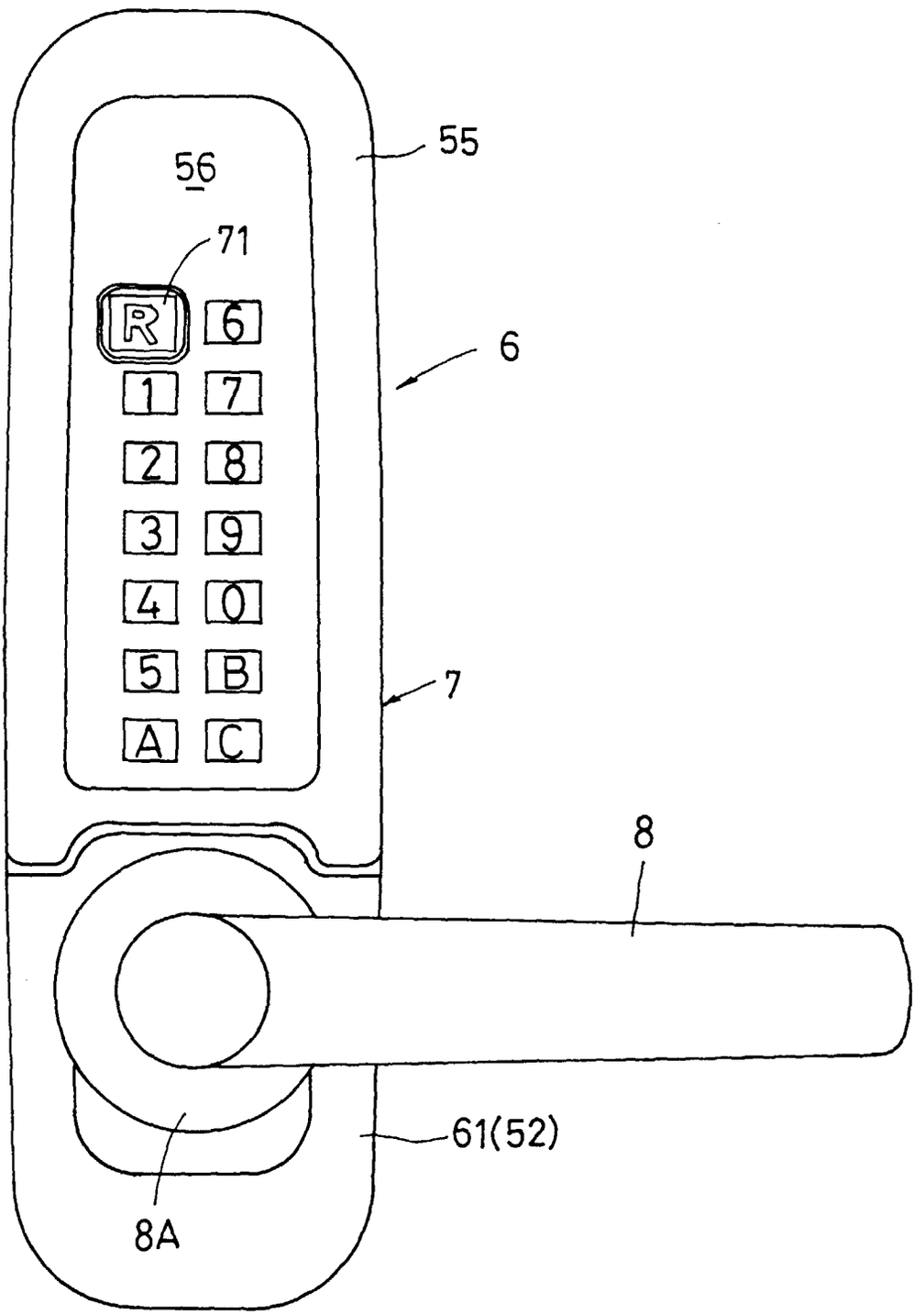


FIG. 3

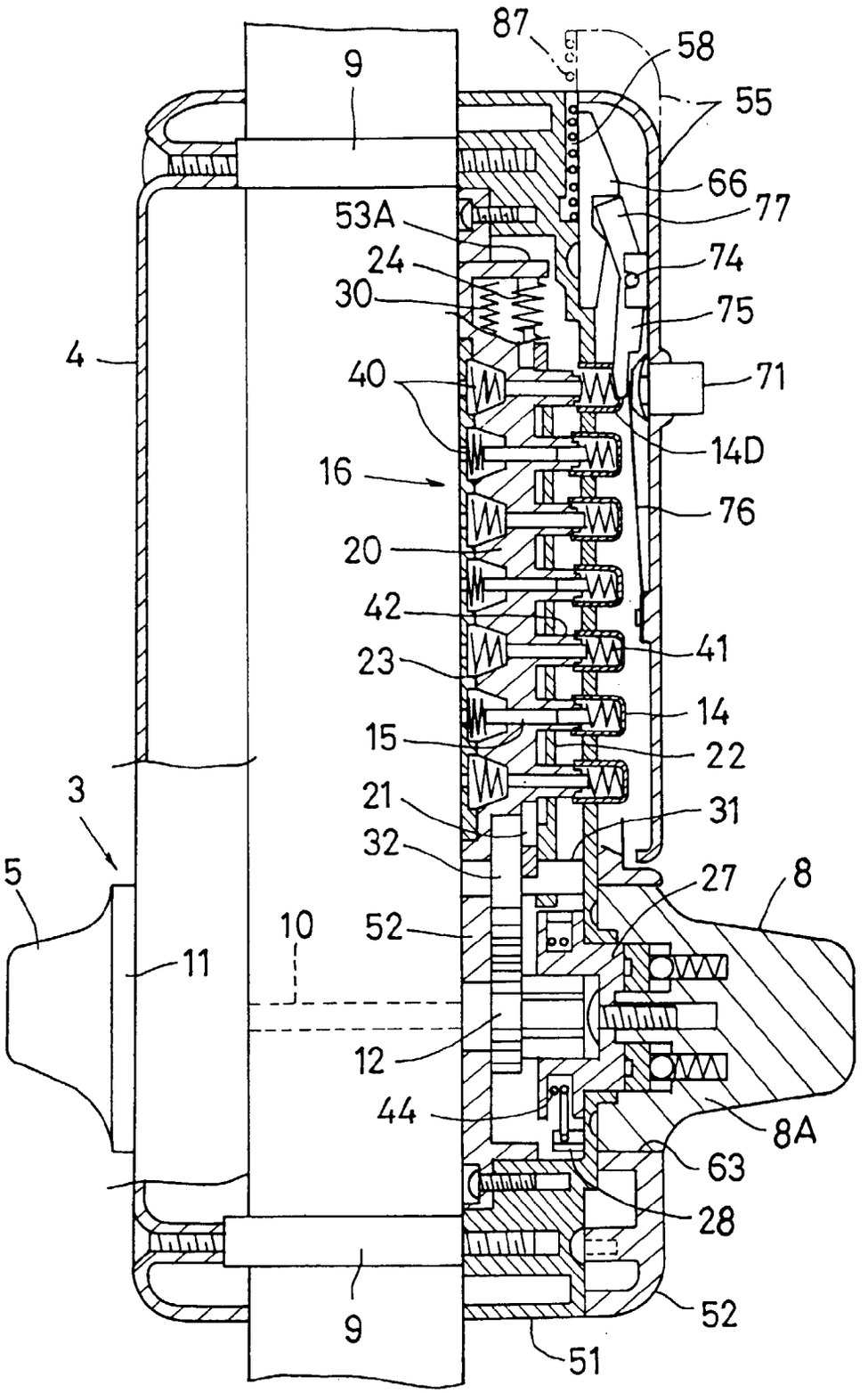

87
58
55
9
66
77
53A
74
24
30
75
4
40
71
14D
16
76
20
42
41
23
14
15
22
3
21
31
32
27
8
5
10
52
11
12
44
8A
63
28
9
52
51

FIG. 4

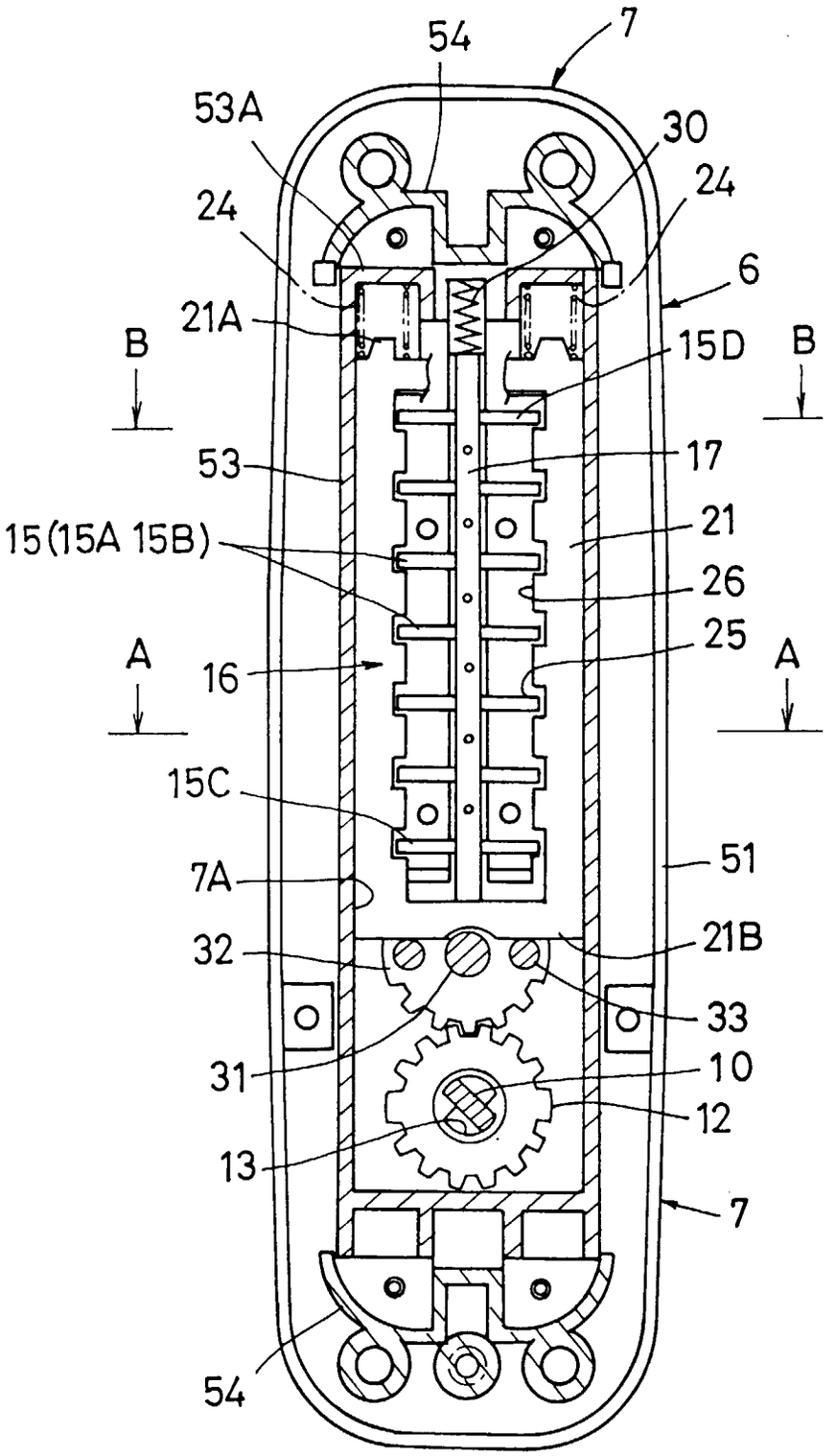

54
7
53A
30
24
24
6
21A
B
B
15D
53
17
15(15A 15B)
21
26
25
A
16
A
15C
51
7A
21B
32
33
31
10
12
13
7
54

FIG. 5

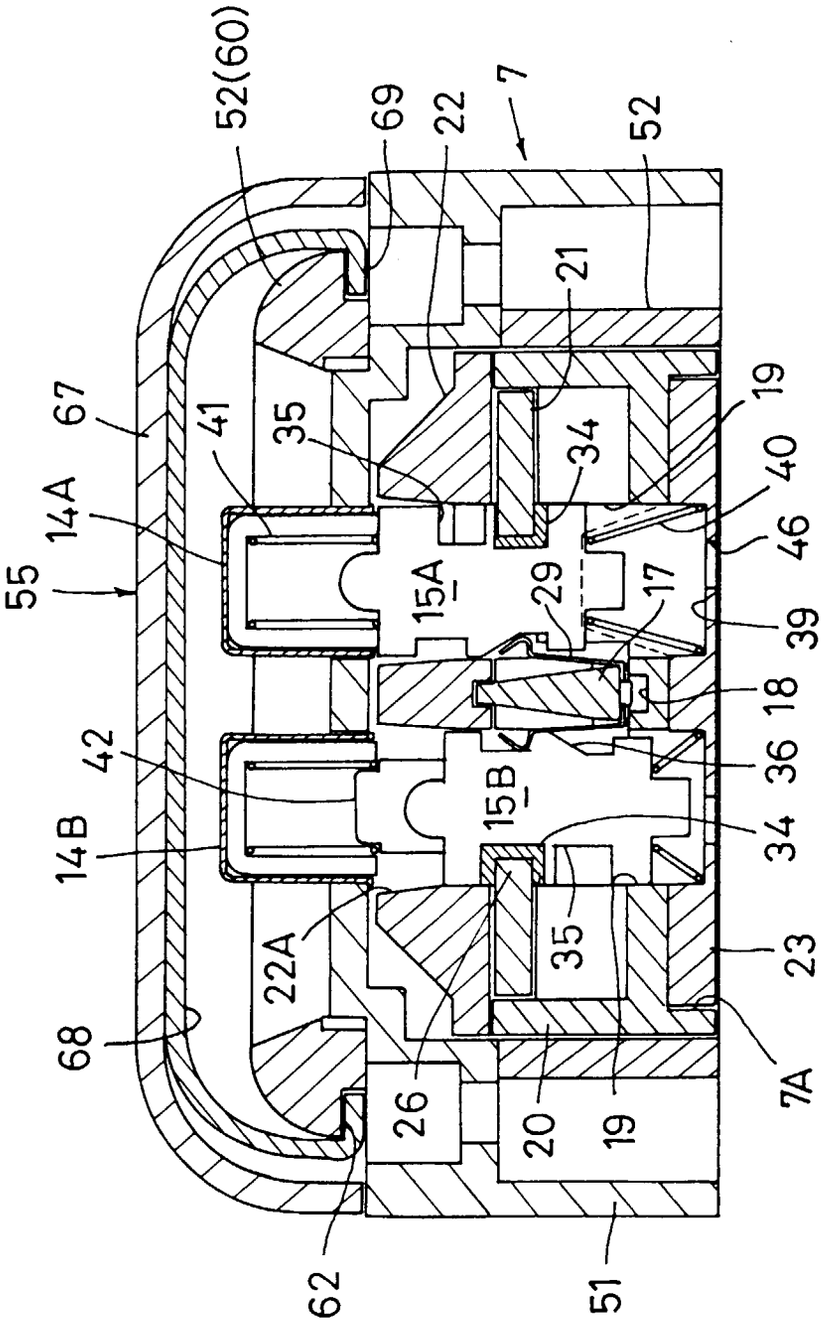
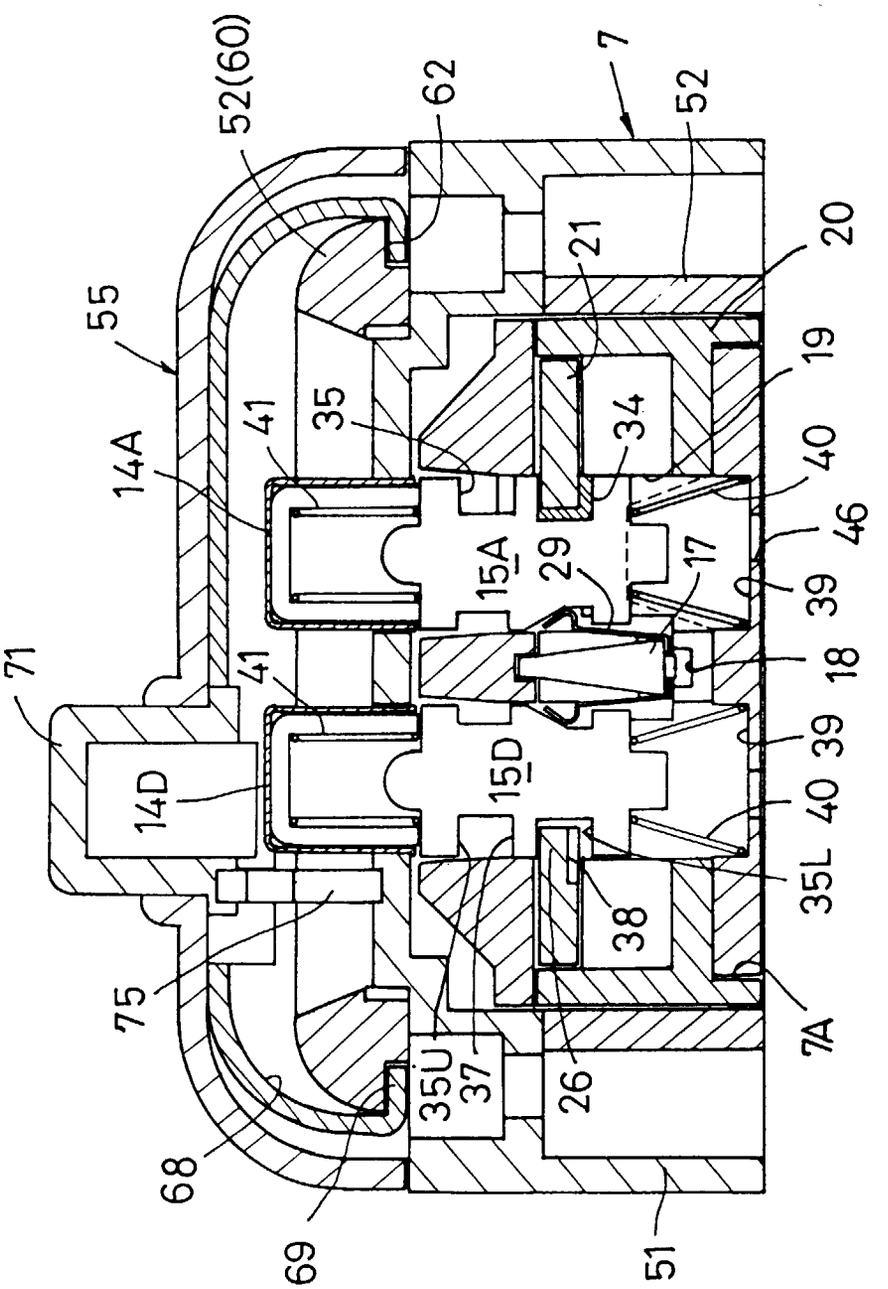

52(60)
69
22
7
52
21
67
41
35
34
19
40
14A
55
15A
29
17
46
39
18
42
36
15B
14B
34
22A
35
23
68
26
20
19
7A
62
51

FIG. 6


52(60)
62
7
52
55
21
20
19
14A
41
35
34
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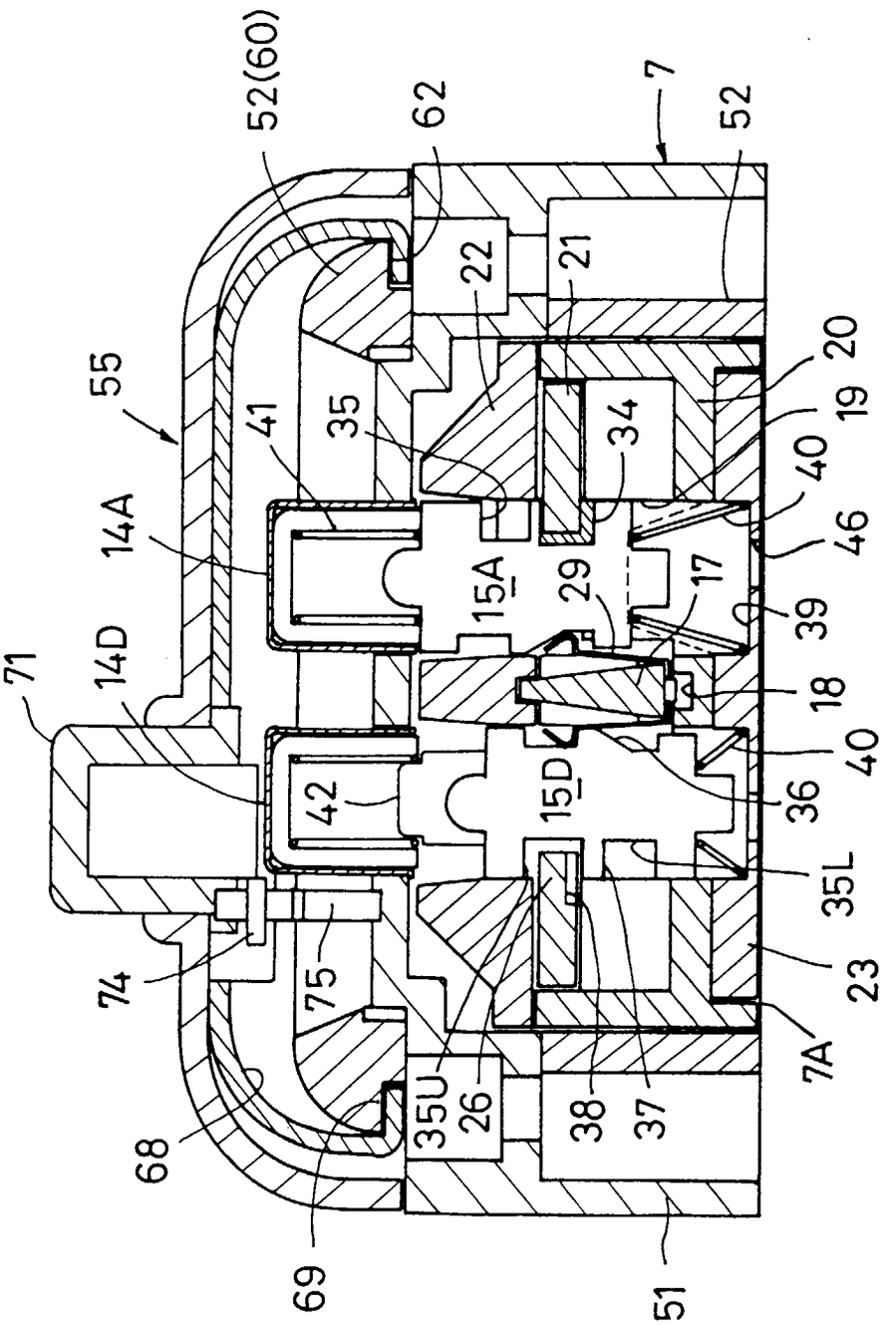
46
15A
29
17
39
18
71
41
14D
15D
39
40
35L
38
75
7A
35U
37
26
68
69
51

FIG. 7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15A
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14D
18
40
42
15D
36
35L
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75
23
7A
35U
26
38
37
68
69
51

FIG. 8

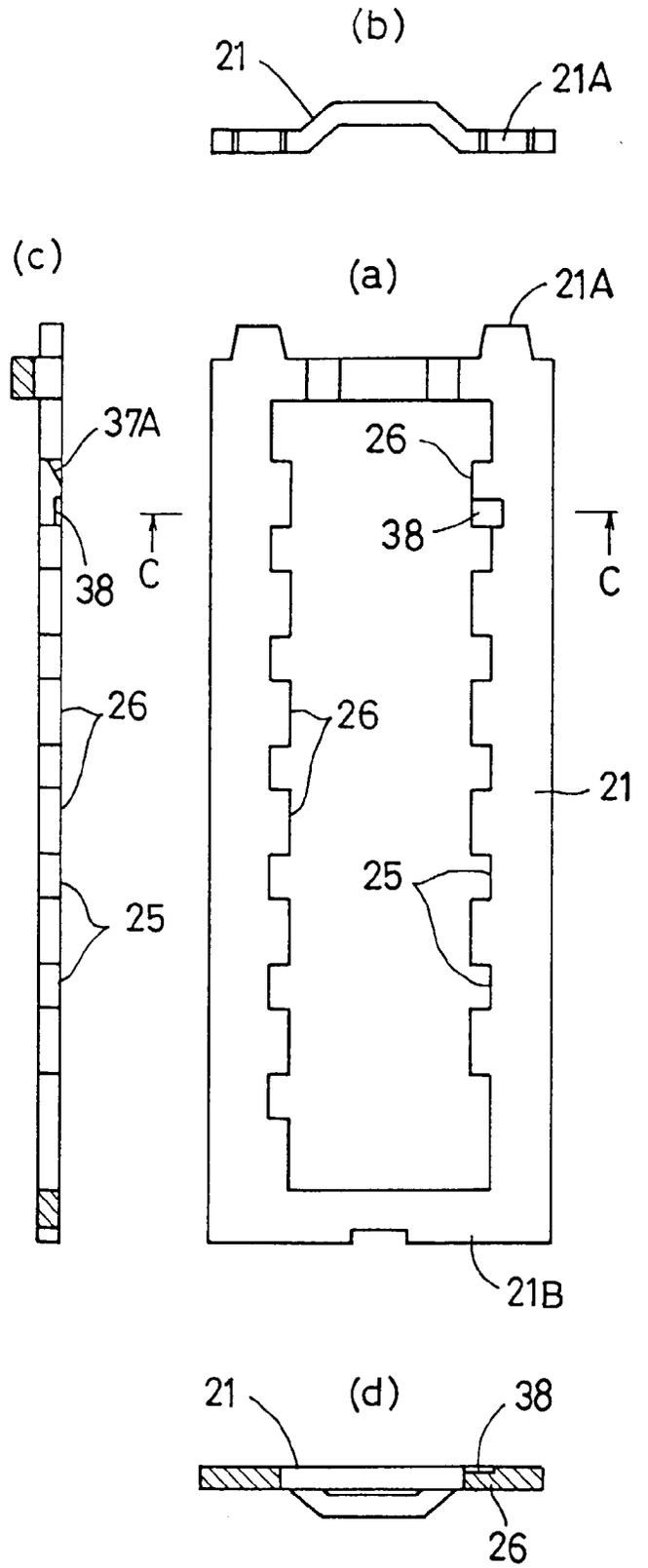


FIG. 9

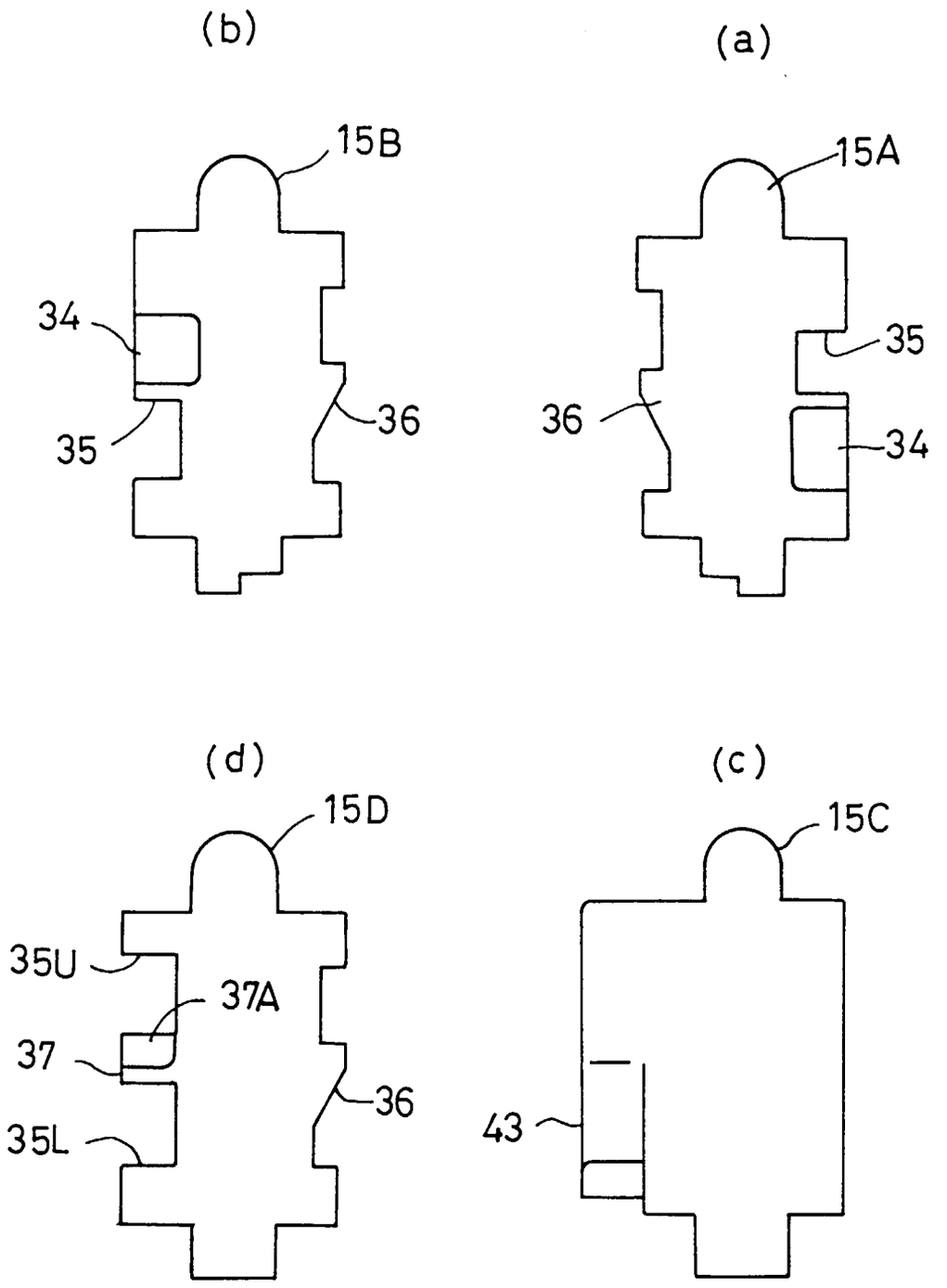


FIG. 10

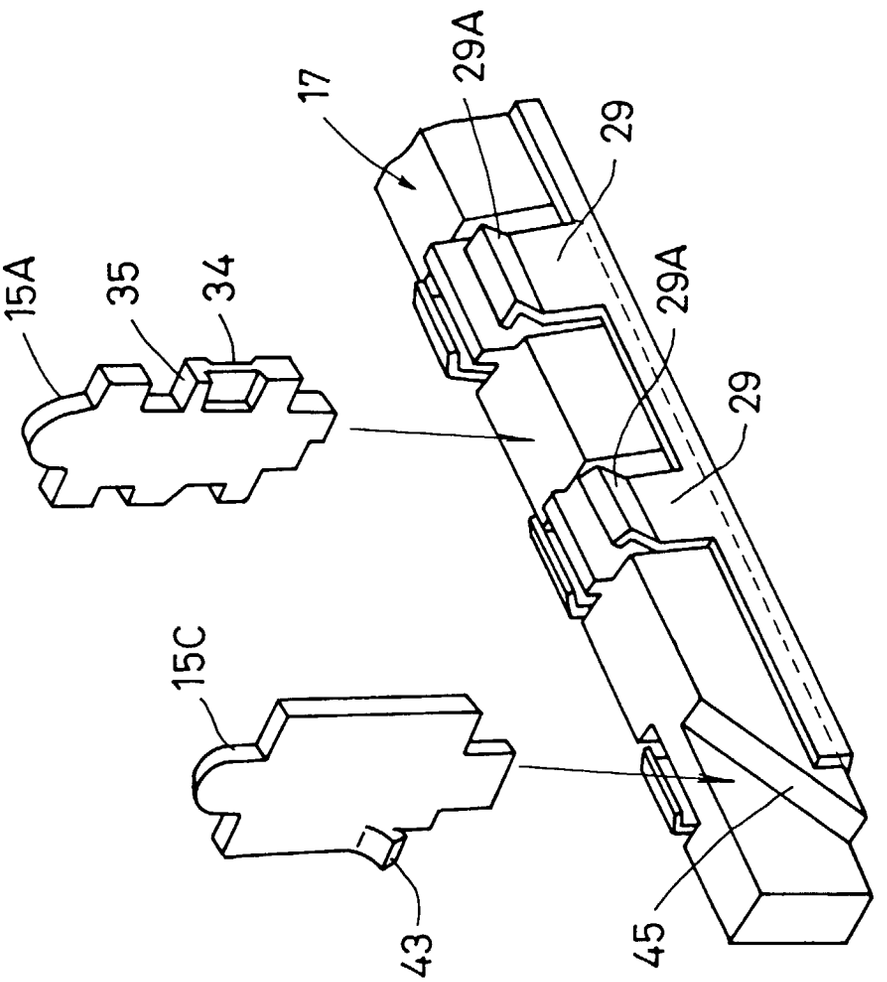


FIG. 11

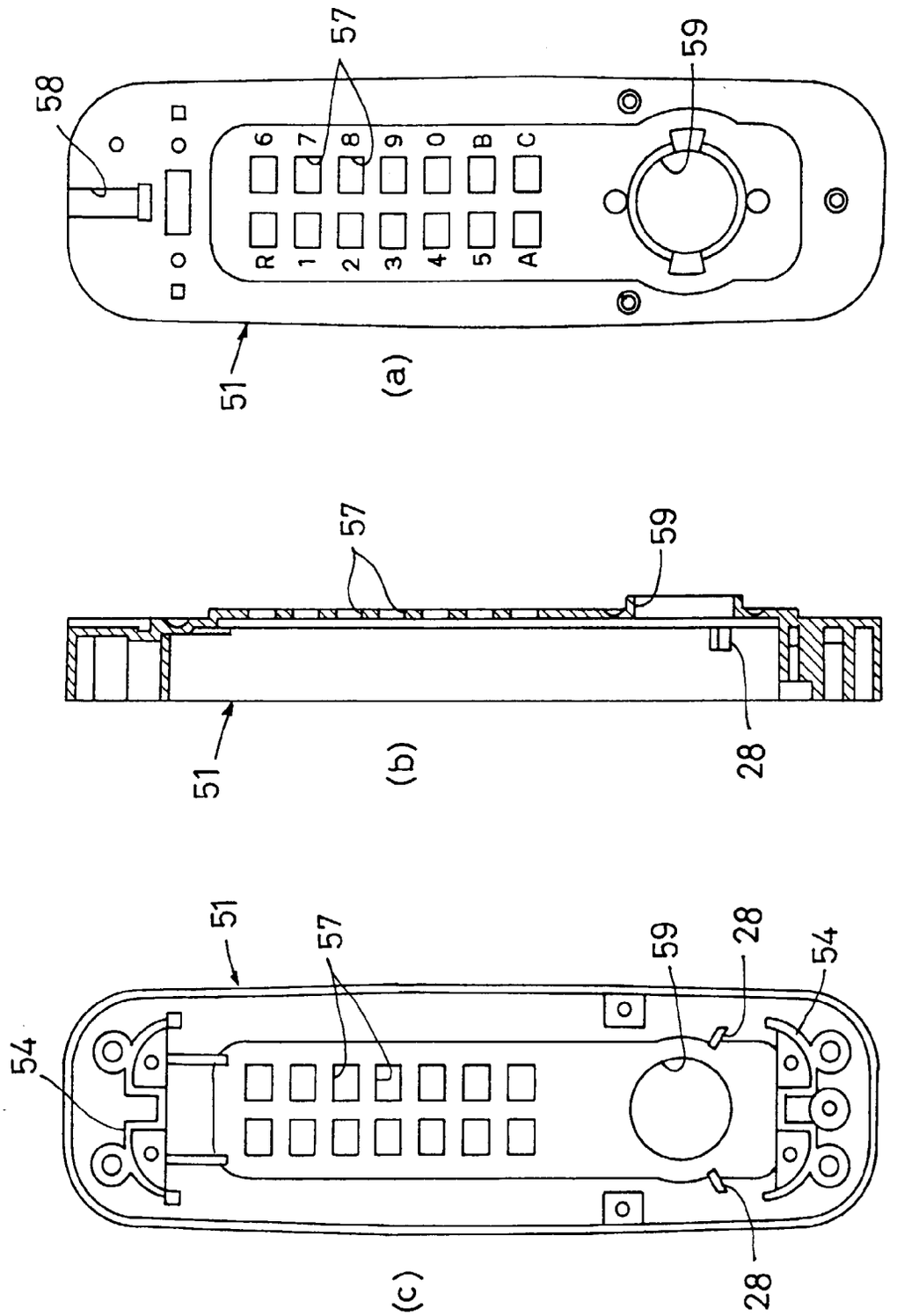
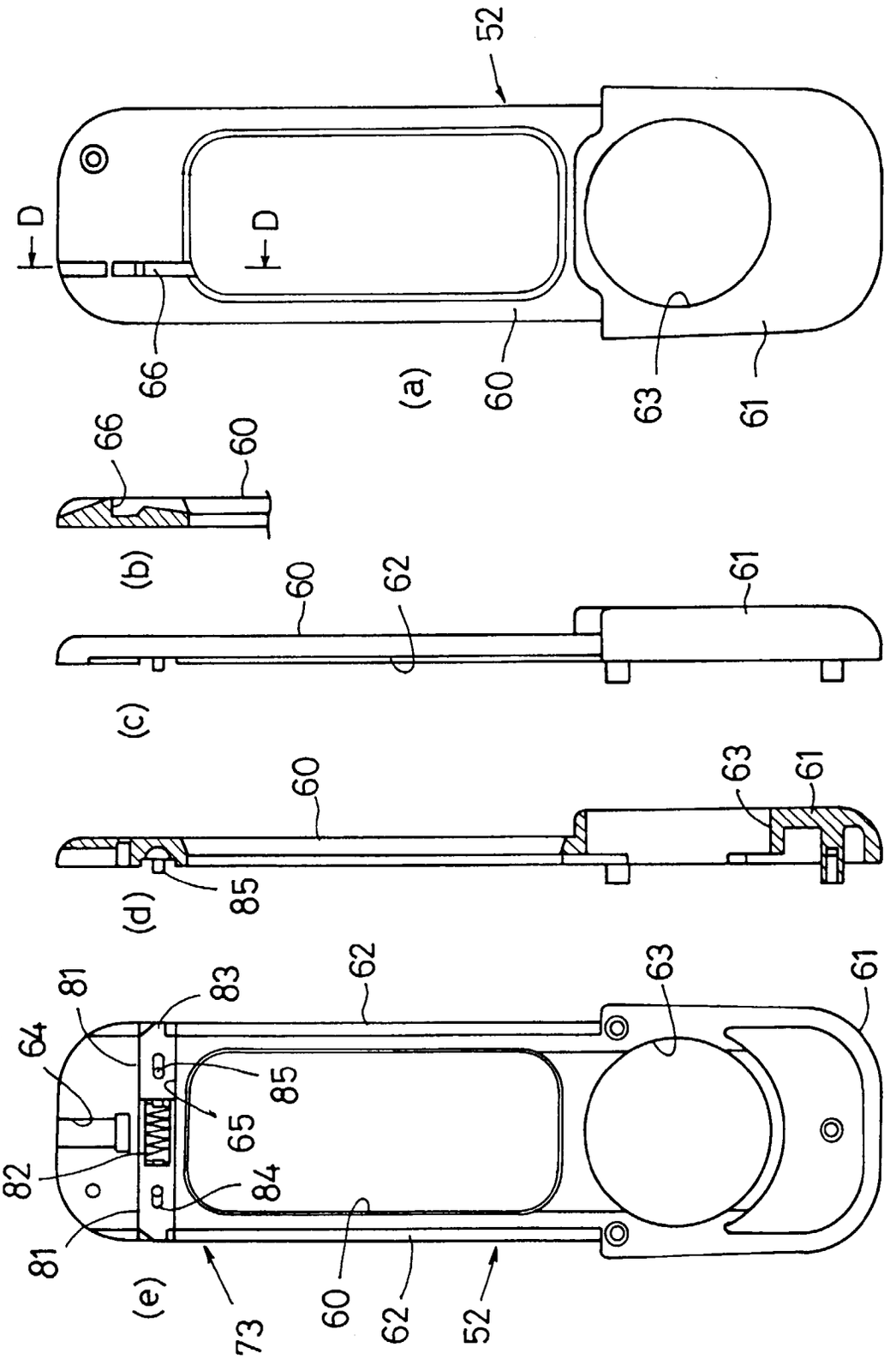


FIG. 12


52
D
D
66
(a)
60
63
61
66
60
(b)
60
62
61
(c)
60
63
61
85
(d)
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63
61
81
83
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85
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82
84
81
(e)
73
60
62
52

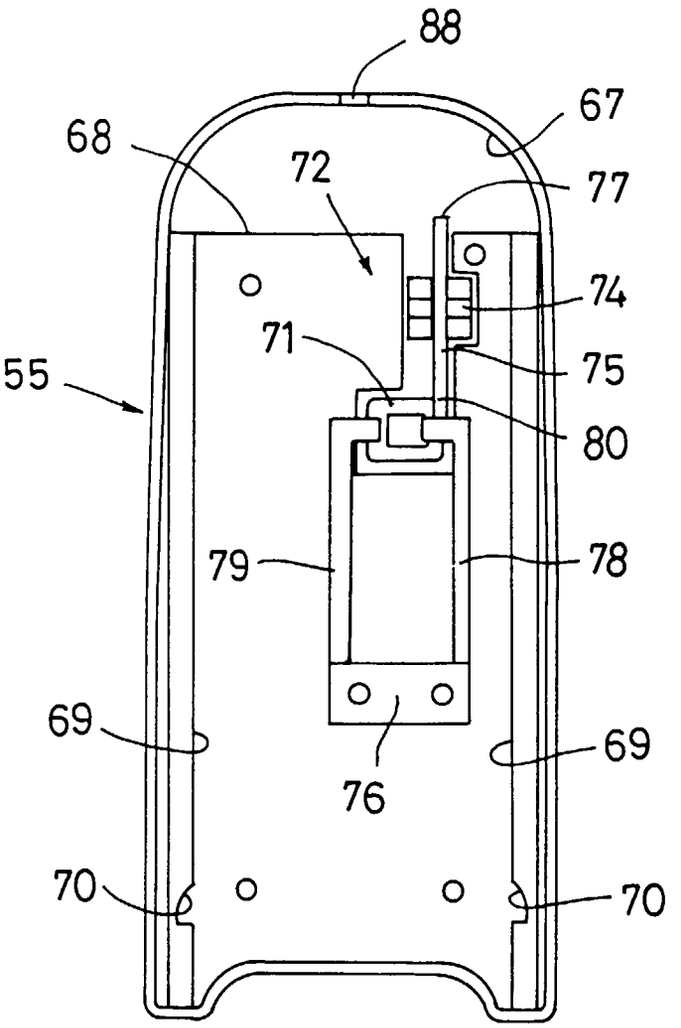


FIG. 13

FIG. 14

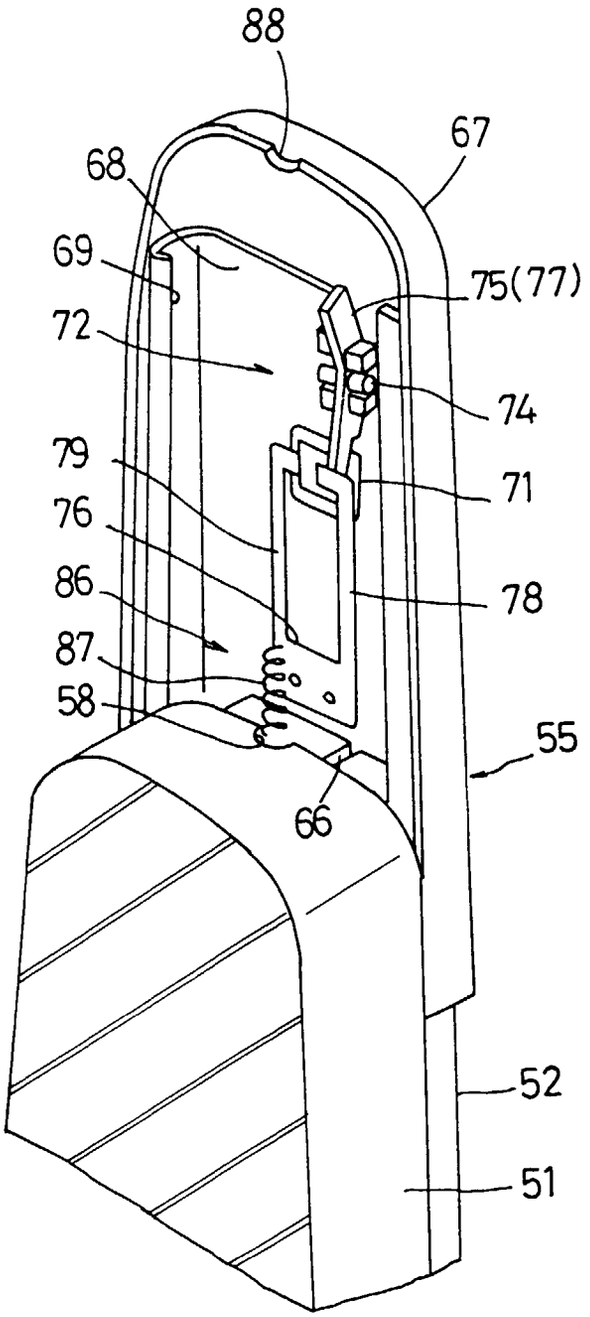
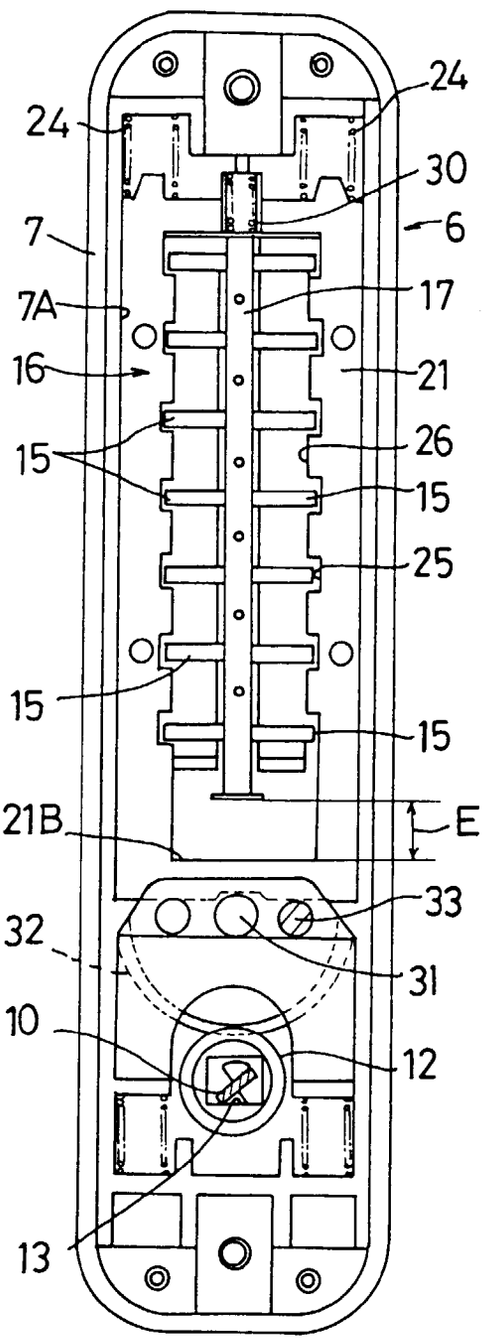


FIG. 15



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EUROPEAN SEARCH REPORT

Application Number
EP 97 40 0081

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB 2 180 587 A (YUNG SHENG LIN) 1 April 1987	10	E05B37/16
A	* the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 96, no. 4, 30 April 1996 & JP 07 317383 A (SHIYUA SEISAKUSHO:KK), 5 December 1995, * abstract; figures 1-10 *	1,3-5,10	
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 177, 9 April 1990 & JP 02 030864 A (SHIYUA SEISAKUSHO:KK), 1 February 1990, * abstract; figures 1-21 *	1,3-5,10	
A	US 4 827 743 A (KIM SUNG B) 9 May 1989 * column 5, line 7 - line 20; figures 1-20 *	1	
A	US 1 986 125 A (TEICHMANN HENRY F) 1 January 1935 * page 1, line 27 - line 37; figures 1,2,4 *	6,7	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 April 1997	PEREZ MENDEZ, J

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