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

(11) Publication number: **0 447 906 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **91103649.9**

(51) Int. Cl.[5]: **E05B 35/00**, E05B 65/52

(22) Date of filing: **09.03.91**

(30) Priority: **16.03.90 JP 67597/90**
26.02.91 JP 30991/91

(43) Date of publication of application:
25.09.91 Bulletin 91/39

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE

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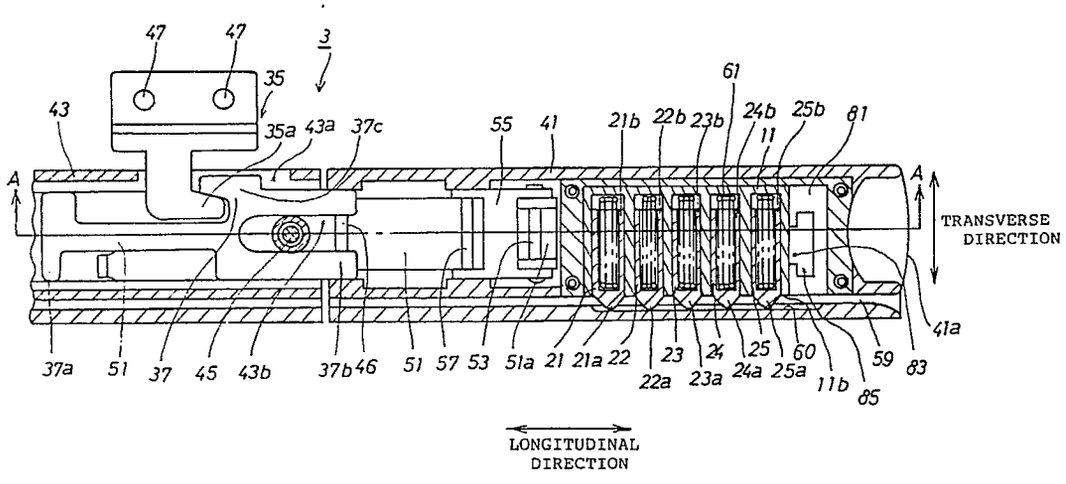
(54) Locking device for unlocking or locking by the insertion of a card key provided with a plurality of holes.

(57) In the improvement to a locking device (3) of this invention, a slider (11) is mounted for sliding by a card key with tumblers (21 - 25) being pushed in the sliding direction by the card key. In addition, since the tumblers (21 - 25) are pushed into the slider (11), the slider (11) does not prevent the card key from sliding. Consequently, unlocking or locking operations can be attained by sliding the card key along the tips of the tumblers (21 - 25) without stopping of the card key by a step portion. Therefore, the improvement to a locking device (3) of the invention effects smoother unlocking or locking operation than a conventional locking device.

FIG. 1



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BACKGROUND OF THE INVENTION

This invention relates to a locking device for unlocking or locking by the insertion therein of a card key provided with a plurality of holes.

Currently, locking devices for unlocking or locking by the insertion of a card key provided with a plurality of holes are disclosed, for example, in Japan Unexamined Patent Application 62-268481 and in Japan Unexamined Patent Application 62-228578. Such a locking device comprises a slider having a plurality of tumblers, a card key provided with several holes through which pre-determined portions of the tumblers project out, a groove to guide the card key to the tips of the tumblers, a mechanism to slide the slider when the pre-determined portions of each tumbler project out, and a mechanism for unlocking or locking by sliding the slider. In addition, the slider comprises a step portion which the card key pushes to move the slider.

In the prior art locking device constructed as above, since the edge of the card key pushes the step portion of the slider for unlocking or locking, the sliding of the card key and the slider are stopped by the step portion. This stop is often bothersome, especially in these days when other computer-controlled card keys used for hotels and the like only slide in a groove without stops. Moreover, the slider of the prior art locking device can move only one way for unlocking or locking.

Wherefore, the object of this invention is to provide a locking device for unlocking or locking which requires only sliding of a card key without stops by a step portion.

Other objects and benefits of the invention will become apparent from the detailed description which follows hereinafter when taken in conjunction with the drawing figures which accompany it.

SUMMARY OF THE INVENTION

To attain the above-mentioned object, a locking device of this invention comprises a slider provided with a plurality of tumblers that can freely advance and retreat and are activated upon advancing, and effects unlocking or locking by insertion of a card key which moves the slider when pre-determined portions of the tumblers project through a plurality of holes of the card key, wherein at least one of the tumblers is enabled to move the slider by engaging with the hole of the card key.

The card key moves the slider by means of the tumblers. The tumblers are mounted on the slider and can freely advance and retreat. When the card key continues moving in the direction in which the slider moves after unlocking or locking is completed and the slider stops moving, each tumbler retreats and disengages from the holes of the card key. Namely, when the card key continuously moves along the points of the tumblers, the tumblers engage with the holes of the card key for unlocking or locking, and then the tumblers once inserted into the holes of the card key disengage from the holes. Therefore, the card key effects unlocking or locking without stopping of the sliding by a step portion.

BRIEF DESCRIPTION OF THE DRAWIGS

Fig. 1 is a partial sectional view of a locking device of the present invention.
Fig. 2 is a sectional view of Fig. 1 taken along the line A-A.
Fig. 3 is a plan view of a card key of the first embodiment.
Fig. 4 is a front view of the card key of Fig. 3.
Fig. 5 is an external view of a suitcase incorporating the present invention.
Figs. 6, 7 and 8 are sectional views around a slider of the first embodiment.
Fig. 9 is an explanatory view of a groove member of the present invention.
Fig. 10 is a front view of a slider of the second embodiment.
Fig. 11 is a plan view of the slider of Fig. 10.
Fig. 12 is a bottom view of the slider of Fig. 10.
Fig. 13 is a left side view of the slider of Fig. 10.
Fig. 14 is a sectional view of the slider of Fig. 10 taken along F-F.
Fig. 15 is a plan view of tumblers of the second embodiment.
Fig. 16 is a sectional view of the tumblers of Fig. 15 taken along G-G.
Fig. 17 is a bottom view of the tumblers of Fig. 15.
Fig. 18 is a front view of the tumblers of Fig. 15.
Fig. 19 is a plan view of the tumblers of the second embodiment.
Fig. 20 is a sectional view of the tumblers of Fig. 19 taken along the line H-H.
Fig. 21 is a bottom view of the tumblers of Fig. 19.

Fig. 22 is a front view of the tumblers of Fig. 19.

Fig. 23 is a plan view of a card key of the second embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Illustrative embodiments of the present invention are described hereinafter with reference to the drawings.

A suitcase 1 comprises a grip 7 and a case member 9 as shown in Fig. 5. The case member 9 consists of a first case 9A and a second case 9B. The grip 7 is positioned on the suitcase 9 at the point the first case 9A and the second case 9B are combined. A locking device 3 is constructed between the first case 9A and the second case 9B adjacent to the grip 7.

As can be seen in Figs. 1 and 2, the locking device 3 comprises a slider II, five tumblers 21 through 25, a first engaging projection 31, a first receiving portion 33, a second engaging projection 35, a second receiving portion 37, a first main body 41 and a second main body 43.

The second main body 43 is fixed to the second case 9B by means of a plurality of fixing machine screws 45. An aperture 43a is formed on the second main body 43 in the direction where the first case 9A is moved to close the two cases 9A and 9B. The second main body 43 further comprises an aperture 43b in the first main body 41 side. The second receiving portion 37 is a cast made of light alloy, and has a pre-determined thickness of da as illustrated in Fig. 2. One end 37a of the second receiving portion 37 is T-shaped, while the other end 37b which projects out of the second main body 43 through the aperture 43b is U-shaped. This projecting portion of the end 37b is rotatably fixed to an axis member 46. Both ends of the axis member 46 are fixed to the first main body 41. A hook 37c is formed in the middle of the second receiving portion 37. The second receiving portion 37 is prevented from moving in the transverse and the height directions by the second main body 43. The second receiving portion 37 is movable in the longitudinal direction.

The second engaging projection 35 is fixed to the first case 9A by means of two fixing machine screws 47. This second engaging projection 35 is constructed such that the hook 35a of the projection 35 is inserted into the second main body 43 through the aperture 43a of the second main body 43 when the first case 9A and the second case 9B are combined. As mentioned later, the hook 35a of the second engaging projection 35 meshes with the hook 37c of the second receiving portion 37 as shown in Fig. 1 in order to keep the two cases 9A and 9B combined.

An iron framework member 51 is fixed to the second main body 43 between the second receiving portion 37 and the second case 9B by means of a plurality of fixing machine screws 45. One end 51a of the framework member 51 is formed between the first main body 41 and the second case 9B, and stretches to the middle of the first main body 41. This end 51a thus supports a first axis member 53 such that the first axis member 53 is fixed to a pre-determined point of the second case 9B in the first main body 41.

One end of a linking member 55 is rotatably fixed to the first axis member 53, and a second axis member 57 is supported on the other end of the linking member 55. The second axis member 57 rotates along a circumference EK shown with an alternate long and two short dashes line in Fig. 2 with the center being the first axis member 53. Both ends of the second axis member 57 are rotatably fixed to the first main body 41 as shown in Figs. 1 and 2.

According to the aforementioned structure of the first main body 41 and the second main body 43 shown above, the components of the instant invention act in cooperation with each other as follows.

When an eaves member 41a at the end of the first main body 41 in the state illustrated in Fig. 2 is pulled up in a direction of an arrow YA, the first main body 41 fluctuates along an alternate long and two short dashes line with the first and second axis members 53 and 57 being its axes. The first main body 41 then moves in the directions of the arrow YA and an arrow YB.

The second receiving portion 37 linked to the first main body 41 slides in the direction of the arrow YB in accordance with the movement of the body 41. Consequently, as illustrated in Fig. 1, the hook 35a of the second engaging projection 35 engages with the hook 37c of the second receiving portion 37 until the second receiving portion 37 moves in the direction of the arrow YB such that the suitcase 1 is locked. When the eaves member 41a is pulled up in the direction of the arrow YA and the second receiving portion 37 moves in the direction of the arrow YB, the hooks 35a and 37c are disengaged. The suitcase 1 is thus unlocked, enabling the first case 9A and the second case 9B to be separated.

Embodiment 1 --

Following next is the first embodiment of the present invetion, describing the structures of the slider 11,

the tumblers 21 through 25 and the like which effect or prevent the movement of the first main body 41 in the direction of the arrow YA.

As can be seen in Figs. 1 and 2, the slider 11 is mounted inside the first main body 41, and can slide in the longitudinal direction of the first main body 41. The movement of the slider 11 in the transverse and the height directions is controlled.

A slit 59 is formed in the first main body 41 along one side 11b of the slider 11 as illustrated in Fig. 1, Fig. 6 describing the details of the slider 11 and Fig. 7 showing a sectional view taken along B-B of Fig. 6. A concave member 60 is formed adjacent to the slit 59 in opposition to the side 11b of the slider 11. The slit 59 guides the card key 5 along the side 11b of the slider 11. The concave member 60 determines the maximum amount of projections of the tumblers 21 through 25.

The first engaging projection 31 is connected with the slider 11a in the second case 9B side of the slider 11. As shown in Fig. 2 and Fig. 8 illustrating the details of Fig. 2, the first engaging projection 31 is L-shaped, and is inserted into the second case 9B through an opening 9Ba formed in the second case 9B. Adjacent to the opening 9Ba is the first receiving portion 33 which is a part of the second case 9B. The first engaging projection 31 is positioned such that a projecting portion 31a of the engaging projection 31 is opposite to the first receiving portion 33 when the slider 11 is located as illustrated in Fig. 2. Since the projecting portion 31a engages with the first receiving portion 33, the first main body 41 cannot be pulled up in the direction of the arrow YA. On the other hand, when the slider 11 positioned as shown in Fig. 2 is moved in the direction of the arrow YB, the projecting portion 31a is not opposite to the first receiving portion 33. Therefore, the projecting portion 31a disengages from the first receiving portion 33, and the first main body 41 can be pulled up in the direction of the arrow YA.

The tumblers 21 through 25 are provided on the slider 11 at the same intervals in the longitudinal direction of the slider 11. The tumblers 21 through 25 are slidingly inserted into the slider 11 in the transverse direction of the slider 11. Openings 11a1 through 11a5 are formed along the tumblers 21 through 25 in the side of case 9B as shown in Figs. 2, 7 and 8. The tumblers 21 through 25 are equipped with acuminate members 21a through 25a and cylindrical members 21b through 25b as shown in Fig. 6. Coil springs 61 are provided inside the cylindrical members 21b through 25b in the slider 11. The coil springs 61 actuate the tumblers 21 through 25 in the direction from the slider 11 to the slit 59.

As shown in Figs. 2, 7 and 8, rectangular engaging projections 71 through 75 are located on pre-determined points of the tumblers 25 in the side of the second case 9B. The engaging projections 71 through 75 protrude outside the slider 11 in the side of the second case 9B via the openings 11a1 through 11a5 of the slider 11.

A groove-forming member 81 is provided adjacent to the openings 11a1 through 11a5 of the slider 11 in the side of the second case 9B of the first main body 41. The groove-forming member 81 is equipped with a groove 83 and engaging concave member 85 as shown in Fig. 9 which shows a sectional view of Fig. 2 taken on the line C-C. As Fig. 9 illustrates, the slider 11 freely slides in the longitudinal direction when all of the engaging projections 71 through 75 are positioned inside the groove 83. On the other hand, if any of the engaging projections 71 through 75 are inserted into the engaging concave member 85, the slider 11 cannot slide in the longitudinal direction.

Relative positions of the engaging projections 71 through 75 and the groove 83 are determined in accordance with the projections of the tumblers 21 through 25 from the slider 11 into the slit 59. The projections into the slit 59 change according to the sliding of the card key 5 shown in Figs. 3 and 4.

The card key has a plurality of holes 87 at the same intervals as the tumblers 21 through 25. When the card key 5 is inserted into the slit 59, the holes 87 receive the acuminate members 21a through 25a. The holes 87 are formed at the pre-determined points A through E. A pre-determined size, e.g. full, large, medium, small or none, is selected for each of the points A through E. The holes 87 are formed at pre-determined points of the card key 5. The points A, B, C, D and E are bilaterally symmetrical with their center being the center line in the longitudinal direction of the card key 5. The card key 5 is thus able to be inserted into the slit 59 from both directions.

The diameters of the holes 87 of the card key 5 and the positions of the engaging projections 71 through 75 of the tumblers 21 through 25 are orderly determined. As shown in Fig. 6, all of the engaging projections 71 through 75 are located inside the groove 83 as illustrated in Fig. 9 only when the tumblers 21 through 25 engage with the card key 5, and thus the slider 11 can slide in the longitudinal direction.

At least one of the points A through E of the holes 87 is a full hole. This hole indicates, for instance, a hole through which the tumbler 23 protrudes till the acuminate member 23a reaches the concave member 60 as shown in Fig. 6. The tumblers 21 through 25 are constructed, in the case of the tumbler 23, such that a boundary member 23c separating the acuminate member 23a and the cylindrical member 23b abuts an inside edge 5E of the full hole at point C. The boundary member 23C is formed between the acuminate

member 23a and the cylindrical member 23b. The boundary member 23c abuts the card key 5 more vertically than the acuminate member 23a.

When the card key 5 slides with the tumblers 21 through 25 engaging with the full hole, the tumblers 21 through 25 engaging with the full hole receive great pushing force in the sliding direction of the card key 5.

While the tumblers 21 through 25 engage with the smaller holes (large, medium and small), the inside edge 5E abuts the acuminate members 21a through 25a. In this case, the tumblers 21 through 25 do not receive great pushing force in the sliding direction of the card key 5 even when the card key 5 slides. The tumblers 21 through 25 receive great pushing force in the direction where the tumblers 21 through 25 are pushed.

The card 5 key slides in the slit 59 till the key 5 engages with the tumblers 21 through 25 as shown in Fig. 6. When the card key 5 does not engage with the tumblers 21 through 25, the tumblers 21 through 25 are successively pushed into the slider 11 in accordance with the sliding of the card key 5 and the card key 5 slides in the slit 59. In this case, at least one of the engaging projections 71 through 75 is positioned inside the engaging concave member 85, and thus the slide 11 cannot slide.

When the card key 5 thus engages with the tumblers 21 through 25 as shown in Fig. 6, all of the engaging projections 71 through 75 are positioned inside the groove 83, so that the slider 11 can slide in the longitudinal direction. The tumbler engaging with the full hole is forcefully pushed in the sliding direction of the card key 5. The slider 11 thus slides in accordance with the sliding of the card key 5. The slider 11 stops when the slider 11 reaches a pre-determined point. The card key 5 then continues sliding in the slit 59 with pushing the tumblers 21 through 25 into the slider 11.

As mentioned above, in the locking device 3 the first engaging projection 31 moves in the direction of the arrow YB when the card key slides in the direction of the arrow YB in Fig. 2. Accordingly, the first main body 41 can be pulled up in the direction of the arrow YA, so that the locking device 3 is unlocked without stopping of the card key 5 by steps or the like.

On the other hand, the first engaging projection 31 moves in the reverse direction of the arrow YB when the card key 5 slides in the slit 59 in the reverse direction of the arrow YB. Therefore, the first main body 41 cannot be pulled up in the direction of the arrow YA, so that the locking device 3 is also locked without stopping of the card key 5 by steps or the like.

The suitcase 1 in the aforementioned embodiment can be unlocked or locked by sliding the card key 5 in the slit 59 mounted adjacent to the grip 7 without stopping of the card key by steps or the like. Therefore, the card key 6 can effect unlocking or locking more smoothly than a conventional card key.

Embodiment 2 --

Following next is the second embodiment of the invention. A slider 111, tumblers 121 through 125, and a card key 105 are employed in this embodiment instead of the slider 11, the tumblers 21 through 25, and the card key 5 of the first embodiment, respectively.

The slider 111 comprises a first engaging projection 131, openings 111a1 through 111a5 and receiving chambers 111b1 through 111b5. The first engaging projection 131 and the openings 111a1 through 111a5 have almost the same structures as the first engaging projection 31 and the openings 11a1 through 11a5 of the first embodiment.

The receiving chambers 111b1 through 111b5 have quadrilateral sections. The tumblers 121 through 125 are slidingly inserted into the receiving chambers 111b1 through 111b5.

As can be seen in Figs 15 through 18, the tumblers 121, 123 and 125 comprise acuminate members 121a, 123a and 125a, quadrilateral tube-like members 121b, 123b and 125b, and engaging projections 171, 173 and 175, respectively. The acuminate members 121a, 123a and 125a are formed below an axis JC of the quadrilateral members 121b, 123b and 125b as shown in Fig. 16. Dimensions L1 and L2 of the engaging projections 171, 173 and 175 in Fig. 16 are selected from Table 1, No. 1 through No. 3.

TABLE 1

No.	DIMENSION L1	DIMENSION L2
1	A	B
2	A - α	B - γ
3	A - β	B - δ

The tumblers 122 and 124 comprise acuminate members 122a and 124a, quadrilateral tube-like members 122b and 124b, and engaging projections 172 and 174, respectively, as shown in Figs. 19 and 20. The acuminate members 122a and 124a are formed above the axis JC of the quadrilateral members 122b and 124b as illustrated in Fig. 20. Dimensions L1 and L2 of the engaging projections 172 and 174 in Fig 20 are selected from Table 1, No. 1 through No. 3 shown above.

The card key 105 shown in Fig. 23 changes the projecting portions of the tumblers 121 through 125 inserted into the slider 111. The card key 105 is provided with a plurality of holes 187. The holes 187 are positioned at points AL, BL, CL, DL and EL in Fig. 23 in accordance with the positions of the tumblers 121 through 125.

The points AL, CL and EL are provided along a line LL1, and the points BL and DL are along a line LL2. The centers of the acuminate members 121a, 123a and 125s are on the line LL1 during engagement with the holes 187. The centers of the acuminate members 122a and 124a are on the line LL2 during engagement with the holes 187.

TABLE 2

No.	DIMENSION D1	DIMENSION D2
1	D	E
2	D	E - ε
3	0	0

Dimensions D1 and D2 of the holes 187 are selected from Table 2, No. 1 through No. 3. When the same numbers of Table 1 and Table 2 are selected for each tumbler, the pre-determined portions of the tumblers project out and the slider 111 can slide in the longitudinal direction.

At least one of the points AL through EL for the holes 187 is a full hole. The acuminate members 121a through 125a reach the concave member 60 through the full hole, wherein boundary members 220 of the tumblers 121 through 125 in Figs. 15 and 19 abut an inner edge 230 of the full hole in Fig. 23, as in the first embodiment. The boundary members 220 are formed between the acuminate members 121a through 125a and the quadrilateral members 121b and 125b. The boundary members 220 abut the card key 105 more vertically in the sliding direction than the acuminate members 121a through 125a.

When the card key 105 slides with the tumblers 121 through 125 engaging with the full hole, the tumblers 121 through 125 engaging with the full hole receive great pushing force in the sliding direction of the card key 105.

While the tumblers 121 through 125 engage with the smaller hole (No. 2 in Table 2), the inner edge 230 of the smaller hole abuts the acuminate members 121a through 125a. If No.3 in Table 2 is selected for the holes which does not form a hole, the acuminate members 121a through 125a are not inserted into the card key 105. If No. 2 or No. 3 in Table 2 is selected, the tumblers 121 through 125 does not receive great pushing force in the sliding direction from the card key 105 during sliding of the card key. When No. 2 in Table 2 is selected, the tumblers 121 through 125 receive great pushing force in the direction where the tumblers are pushed into the slider 111.

When the card key 105 meshes with the tumblers 121 through 125, the slider moves till a pre-

determined point by sliding the card key in the slit 59, as in the first embodiment. Therefore, the locking device 3 can attain locking or unlocking operation by sliding the card key without stops by a step portion. Additionally, in the second embodiment, the acuminate members 121a, 123a and 125a are formed in the upper position, and the acuminate members 122a and 124a are in the lower position. The tumblers 121 through 125 are placed in a line, but the holes 187 and the acuminate members 121a through 125a are positioned in two lines. Accordingly, a wider variety of alternatives for unlocking or locking operation can be made in this embodiment than simply selecting from three types of dimensions for five tumblers placed in a line. A locking device difficult to break with simple structure can be thus provided.

This invention is not limited to the embodiment illustrated and described as above, but can be applied to a wide variety of locking devices. For example, the configuration of the card key and the holes, the number of the holes and the tumblers and the like do not have to be the same as in this embodiment. Additionally, pushing force can be adjusted by changing the quality or configuration of the acuminate members of the tumblers, though the pressure is controlled by changing the angle at which the tumblers abuts the edges of the holes of the card key in the instant invention.

Furthermore, the acuminate members of the tumblers can be positioned in the left or right of the axis of the tumblers instead of the acuminate members the centers of which are positioned along the axis or above or below the axis as in the aforementioned embodiments. The acuminate members can be also located on pre-determined area of the front of the tumblers with the front being divided lengthwise and crosswise into a pre-determined number of the pre-determined area.

Claims

1. A locking device comprising:

a) a lock body having a longitudinal slot therein, said longitudinal slot having a plurality of side slots perpendicular to and communicating with said longitudinal slot;

b) a slider disposed over said longitudinal slot and connected for engaging and disengaging a locking pawl upon sliding motion of said slider along said longitudinal slot between a locked position and an unlocked position;

c) a plurality of tumblers carried by said slider at positions of respective ones of said side slots when said slider is in said locked position, said plurality of tumblers being slidable perpendicular to said longitudinal slot and parallel to said side slots between an advanced position and a retracted position, each of said plurality of tumblers having a projection on a body portion thereof engaged with said longitudinal slot and a respective one of said side slots for sliding movement therein, each of said plurality of tumblers having a tapered tip on an outer end of said body portion and bias means on an inner end of said body portion for biasing said tapered tip towards said advanced position, said projection of each of said plurality of tumblers being positioned along a length thereof so that said slider can slide between said locked position and said unlocked position only when each of said plurality of tumblers is disposed between said advanced position and said retracted position at a point where said projection thereof is positioned to slide in said longitudinal slot;

d) guide means for guiding a lock card along a path adjacent to said slider and said tapered tip of said plurality of tumblers; and,

e) a lock card for insertion into said path and sliding movement therealong, said lock card having indentations therein spaced to receive said tapered tip of respective ones of said plurality of tumblers, said indentations being sized to receive said tapered tip of respective ones of said plurality of tumblers to a depth which places each of said plurality of tumblers at said point where said projection thereof is positioned to slide in said longitudinal slot, one of said indentations being sized to receive said tapered tip of one of said plurality of tumblers to a depth where a side of said indentation contacts a one of said plurality of tumblers disposed therein at a point adjacent said body portion thereof whereby sliding of said lock card along said path pushes said one of said plurality of tumblers and said slider in combination therewith along said path.

2. The locking device of claim 1 wherein:

said indentations in said lock card comprise bores through said lock card.

3. The locking device of claim 1 wherein:

said guide means comprises a guide member disposed in parallel, spaced relationship to said path adjacent to said slider and said tapered tip of said plurality of tumblers.

4. The locking device of claim 3 wherein:

said guide member has a slot therein disposed in parallel, spaced relationship to said path adjacent to said slider and said tapered tip of said plurality of tumblers for receiving tapered tips thereof therein while supporting said lock card adjacent said slider.

5. The locking device of claim 2 wherein:

a) said tapered tips are generally frusto-conical in shape; and,

b) said indentations in said lock card comprise circular bores through said lock card.

6. The locking device of claim 5 wherein:

a) said tapered tips are generally of the same size; and,

b) said indentations in said lock card comprise circular bores of different diameters through said lock card.

7. The locking device of claim 2 wherein:

a) said tapered tips are generally rectangular in cross-section; and,

b) said indentations in said lock card comprise rectangular bores through said lock card.

8. The locking device of claim 7 wherein:

a) said tapered tips are generally of the same size; and,

b) said indentations in said lock card comprise rectangular bores of different sizes through said lock card.

9. The locking device of claim 7 wherein:

a) some of said tapered tips are disposed along a line offset from others of said tapered tips; and,

b) said rectangular bores through said lock card are offset in a pattern to match said tapered tips.

10. In a locking device having,

a lock body having a longitudinal slot therein, the longitudinal slot having a plurality of side slots perpendicular to and communicating with the longitudinal slot,

a slider disposed over the longitudinal slot and connected for engaging and disengaging a locking pawl upon sliding motion of the slider along the longitudinal slot between a locked position and an unlocked position,

a plurality of tumblers carried by the slider at positions of respective ones of the side slots when the slider is in the locked position, the plurality of tumblers being slidable perpendicular to the longitudinal slot and parallel to the side slots between an advanced position and a retracted position, each of the plurality of tumblers having a projection on a body portion thereof engaged with the longitudinal slot and a respective one of the side slots for sliding movement therein, each of the plurality of tumblers having a tapered tip on an outer end of the body portion and bias means on an inner end of the body portion for biasing the tapered tip towards the advanced position, the projection of each of the plurality of tumblers being positioned along a length thereof so that the slider can slide between the locked position and the unlocked position only when each of the plurality of tumblers is disposed between the advanced position and the retracted position at a point where the projection thereof is positioned to slide in the longitudinal slot, the improvement CHARACTERIZED BY:

a) guide means for guiding a lock card along a path adjacent to the slider and the tapered tip of the plurality of tumblers; and,

b) a lock card for insertion into the path and sliding movement therealong, said lock card having indentations therein spaced to receive the tapered tip of respective ones of the plurality of tumblers, the indentations being sized to receive the tapered tip of respective ones of the plurality of tumblers to a depth which places each of the plurality of tumblers at the point where the projection thereof is positioned to slide in the longitudinal slot, one of the indentations being sized to receive the tapered tip of one of the plurality of tumblers to a depth where a side of the indentation contacts a one of the plurality of tumblers disposed therein at a point adjacent the body portion thereof whereby sliding of said lock card along the path pushes the one of the plurality of tumblers and the slider in combination therewith along the path.

11. The improvement to a locking device of claim 10 wherein:

said indentations in said lock card comprise bores through said lock card.

12. The improvement to a locking device of claim 10 wherein:

said guide means comprises a guide member disposed in parallel, spaced relationship to the path adjacent to the slider and the tapered tip of the plurality of tumblers.

13. The improvement to a locking device of claim 12 wherein:

said guide member has a slot therein disposed in parallel, spaced relationship to the path adjacent to the slider and the tapered tip of the plurality of tumblers for receiving tapered tips thereof therein while supporting said lock card adjacent the slider.

14. The improvement to a locking device of claim 11 wherein:

a) the tapered tips are generally frusto-conical in shape; and,

b) said indentations in said lock card comprise circular bores through said lock card.

15. The improvement to a locking device of claim 14 wherein:

a) the tapered tips are generally of the same size; and,

b) said indentations in said lock card comprise circular bores of different diameters through said lock card.

16. The improvement to a locking device of claim 11 wherein:

a) the tapered tips are generally rectangular in cross-section; and,

b) said indentations in said lock card comprise rectangular bores through said lock card.

17. The improvement to a locking device of claim 16 wherein:

a) the tapered tips are generally of the same size; and,

b) said indentations in said lock card comprise rectangular bores of different sizes through said lock card.

18. The improvement to a locking device of claim 16 wherein:

a) some of the tapered tips are disposed along a line offset from others of the tapered tips; and,

b) the rectangular bores through said lock card are offset in a pattern to match the tapered tips.

19. In a locking device having a slider connected for engaging and disengaging a locking pawl upon sliding motion of the slider between a locked position and an unlocked position, a plurality of tumblers carried by the slider and being slidable between an advanced position and a retracted position, each of the plurality of tumblers having a tapered tip on an outer end of the body portion, guide means for guiding a lock card along a path adjacent to the slider and the tapered tip of the plurality of tumblers, and a lock card for insertion into the path and sliding movement therealong, said lock card having indentations therein spaced to receive the tapered tip of respective ones of the plurality of tumblers, the improvement comprising:

one of the indentations being sized to receive the tapered tip of one of the plurality of tumblers to a depth where a side of the indentation contacts a one of the plurality of tumblers disposed therein at a point adjacent the body portion thereof whereby sliding of said lock card along the path pushes the one of the plurality of tumblers and the slider in combination therewith along the path between the locked position and the unlocked position.

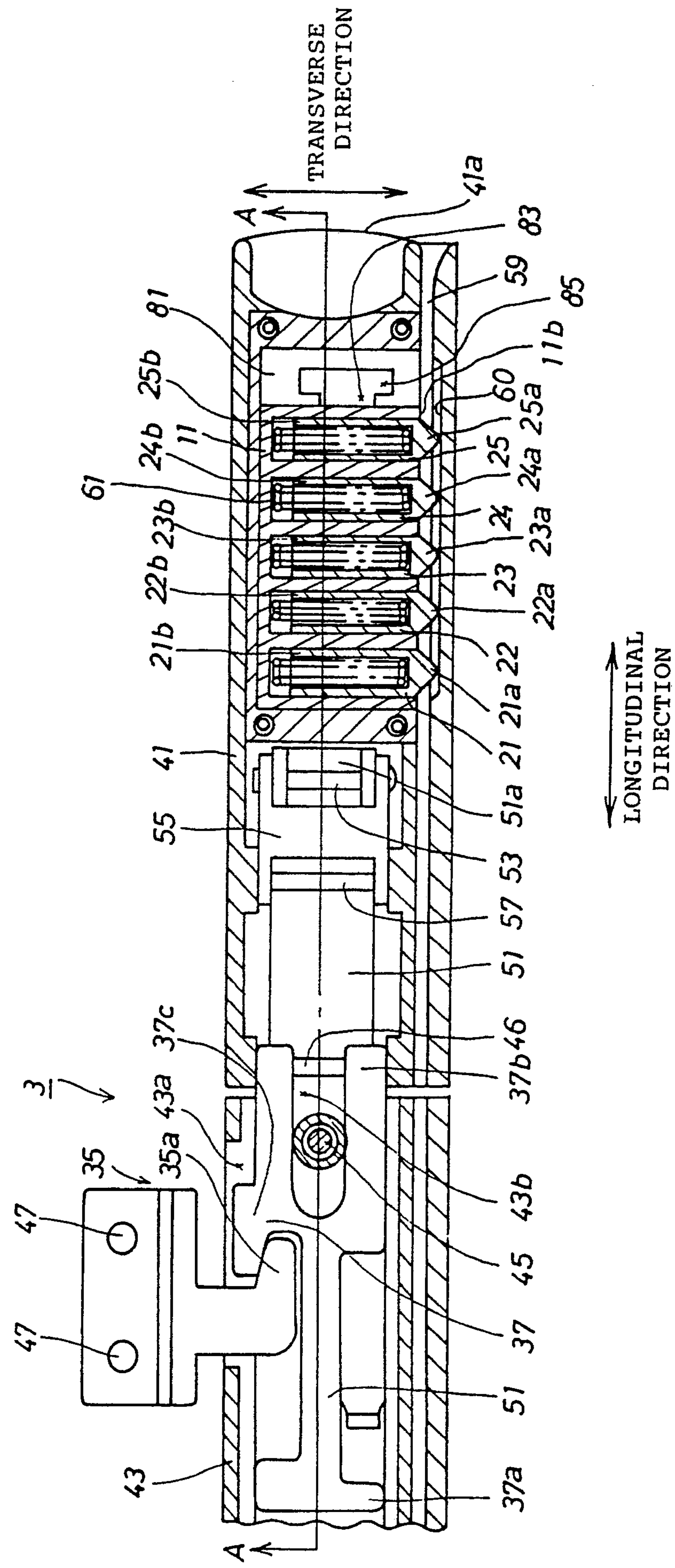
TRANSVERSE DIRECTION
LONGITUDINAL DIRECTION
A
A
41a
83
59
85
11b
60
25a
25
24a
24
23a
23
22a
22
21a
21
51a
53
57
51
46
37b
43b
45
37
51
37a
81
25b
11
24b
61
23b
22b
21b
41
55
37c
3
43a
35
35a
47
47
43

FIG. 1

FIG. 2

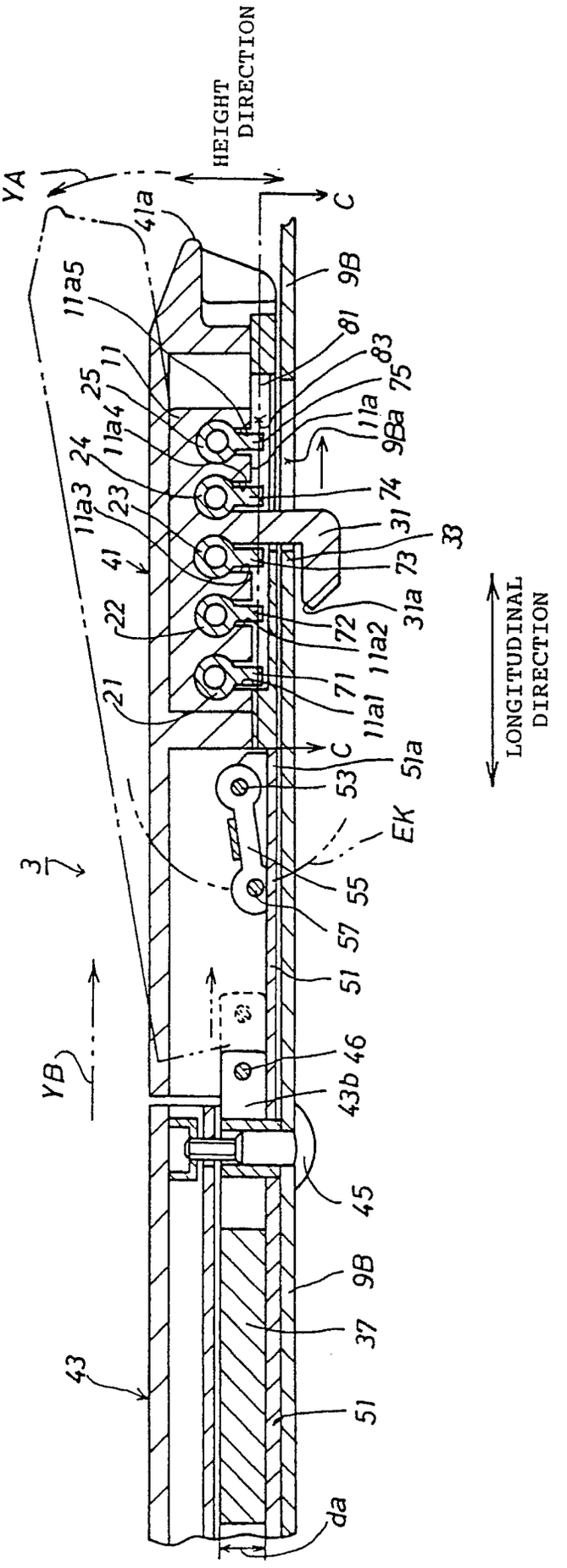
HEIGHT DIRECTION
LONGITUDINAL DIRECTION
YA
YB
C
3
7
41a
11a5
11
25
11a4
24
11a3
23
41
22
21
9B
81
83
75
11a
9Ba
74
31
33
73
31a
72
71
11a2
11a1
51a
53
55
57
51
EK
46
43b
45
37
43
da

FIG. 3

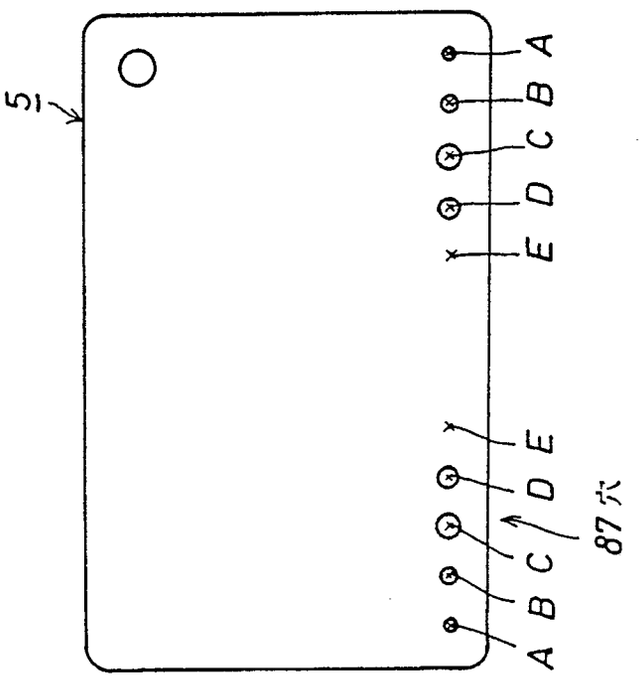

FIG. 4

FIG. 5

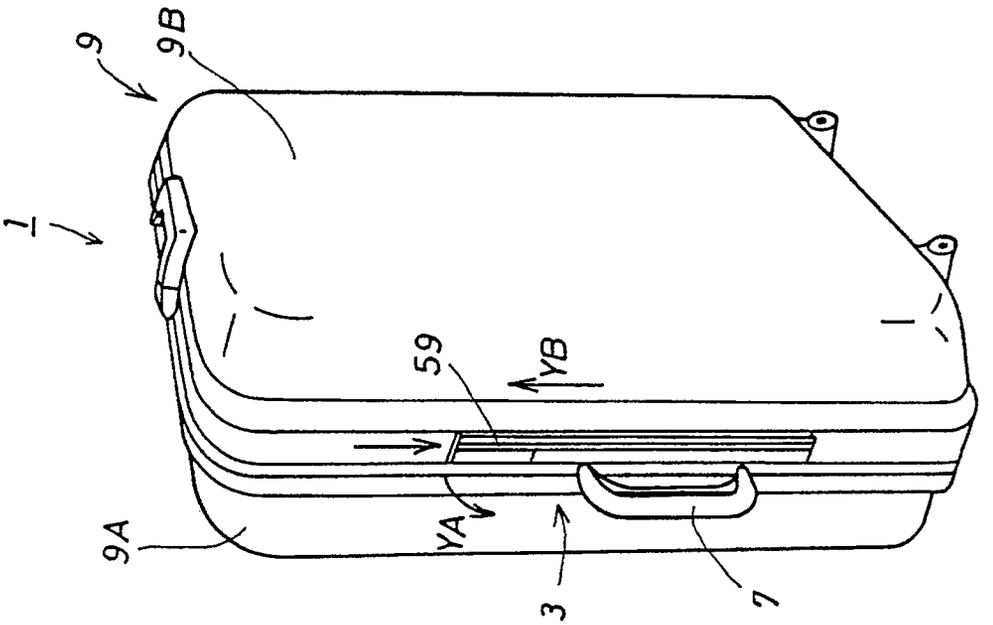

FIG. 6

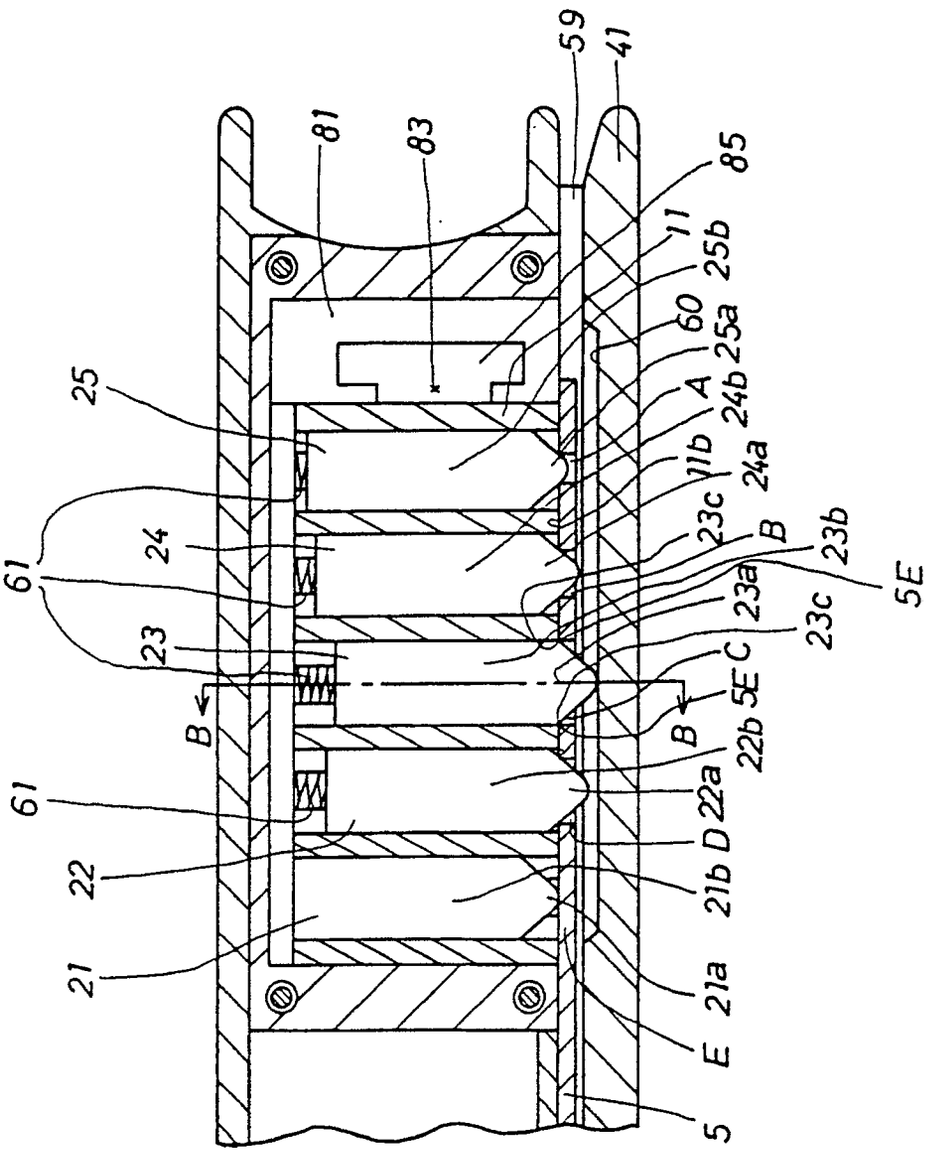
59
41
81
83
85
11
25b
60
25a
25
A
24b
11b
24a
24
23c
B
23b
61
23a
5E
23
23c
C
B
B
5E
22b
61
22a
D
22
21b
21
21a
E
5

FIG. 6

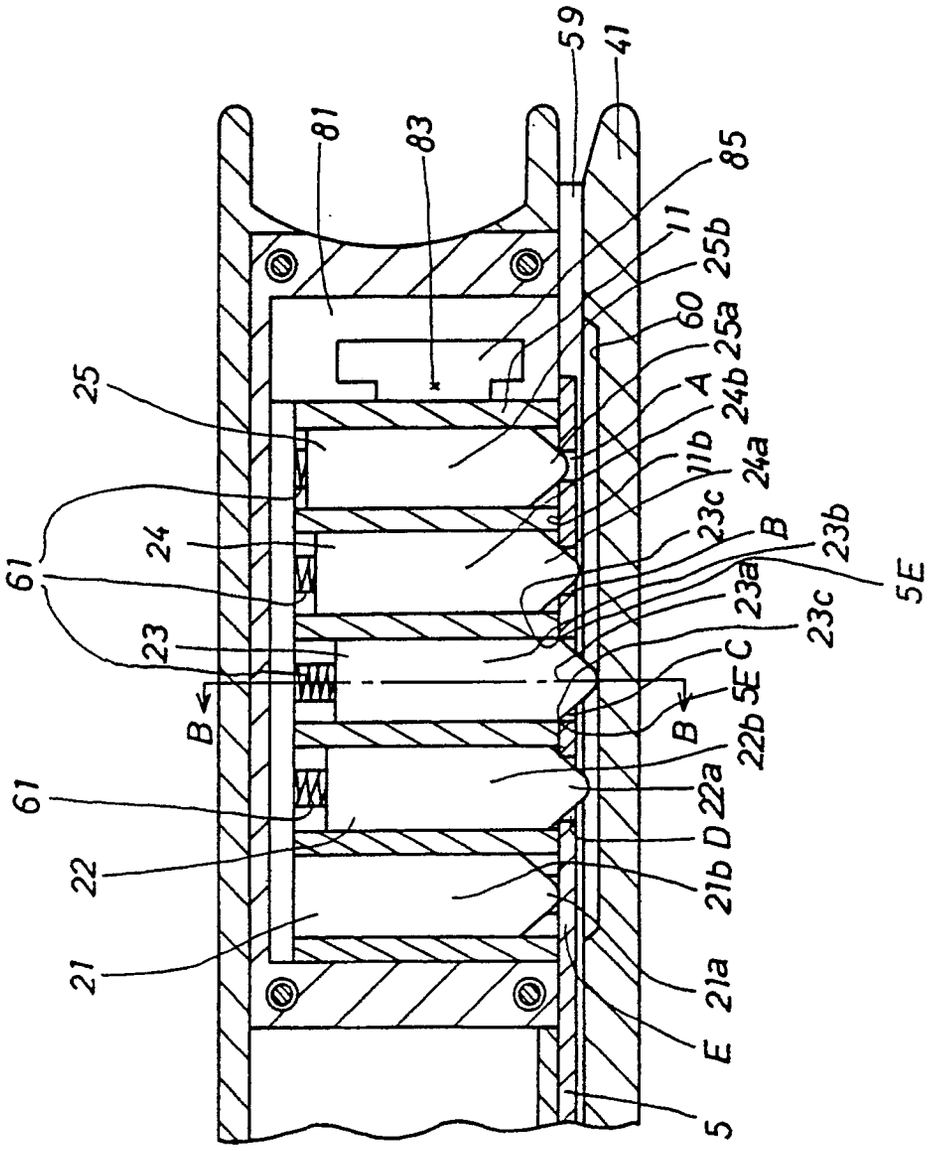
59
41
81
83
85
11
25b
60
25a
A
24b
11b
24a
23c
B
23b
5E
23a
23c
C
5E
B
B
22b
22a
D
21b
21a
E
5
25
61
24
23
61
22
21

FIG. 8

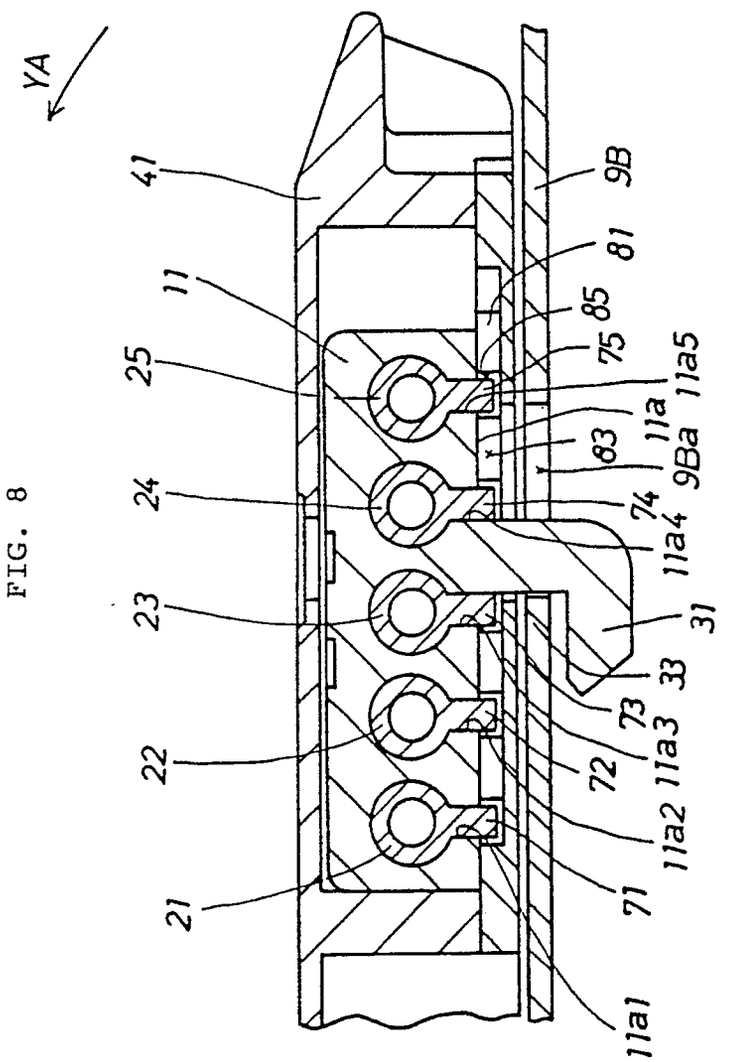
YA
41
11
25
24
23
22
21
11a1
71
11a2
72
11a3
73
33
31
11a4
74
9Ba
63
11a
11a5
75
85
81
9B

FIG. 9

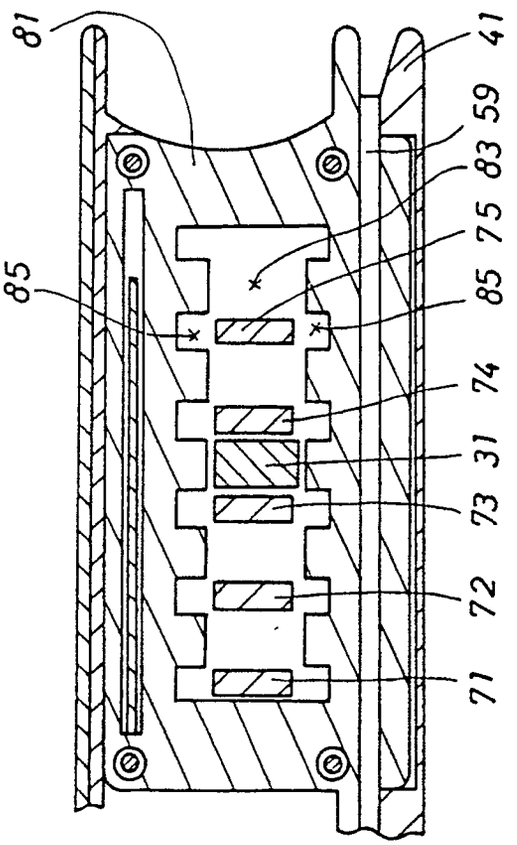

FIG. 10

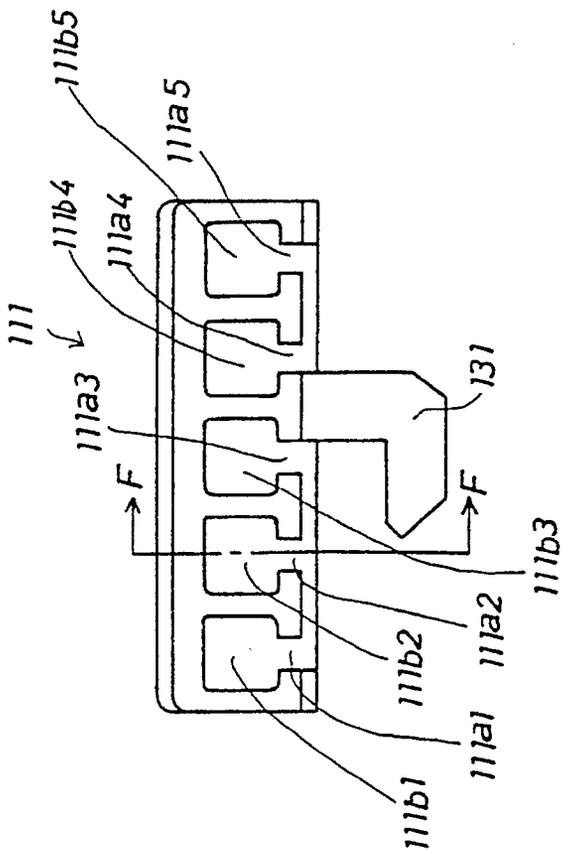
111b5
111a5
111b4
111a4
111
111a3
131
F
F
111b3
111a2
111b2
111a1
111b1

FIG. 11

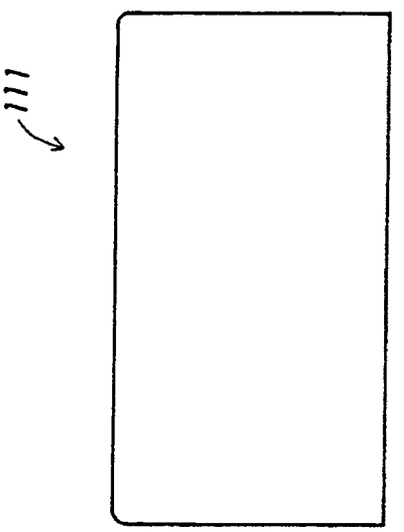

FIG. 12

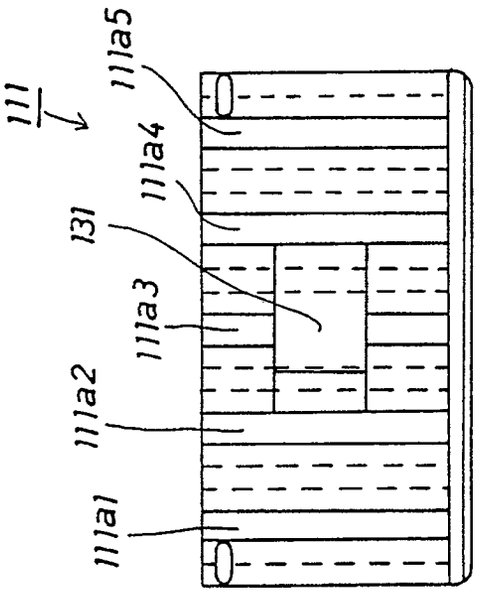

FIG. 13

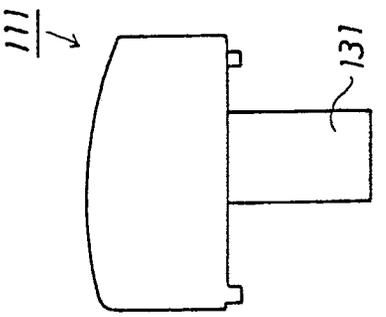

FIG. 14

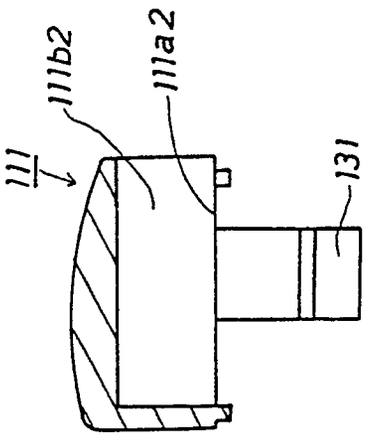

FIG. 15

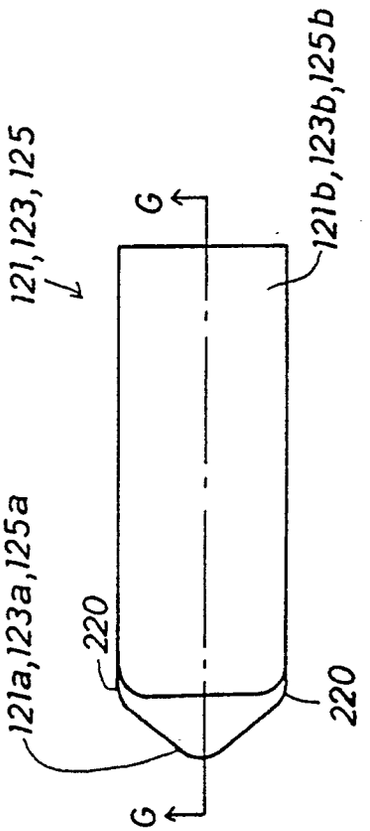

FIG. 16

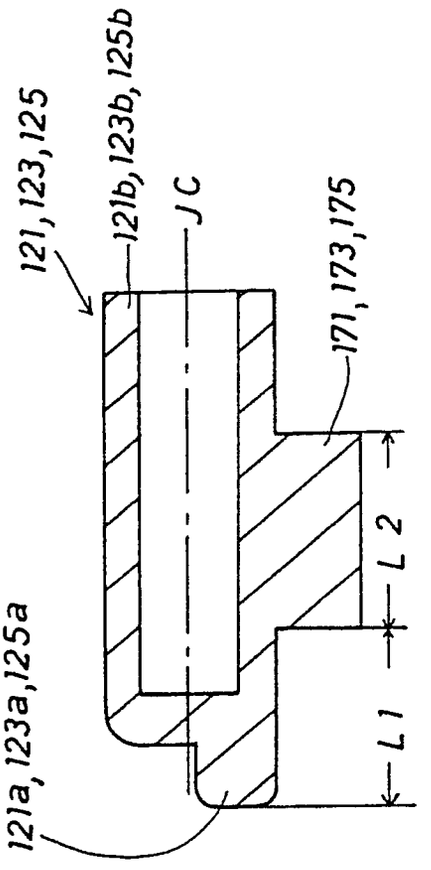

FIG. 17

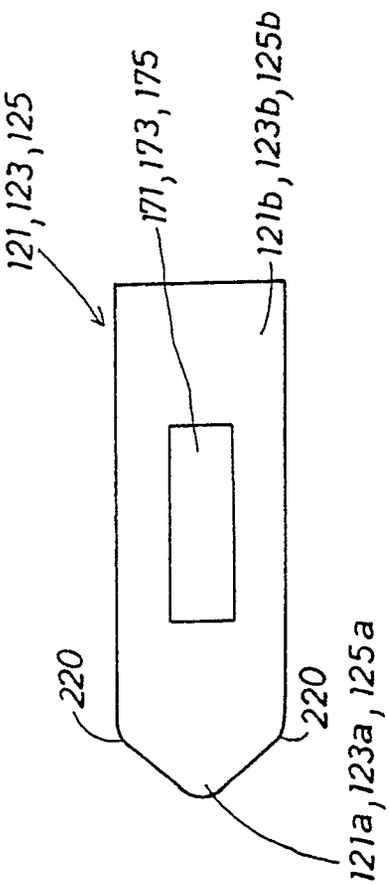

FIG. 18

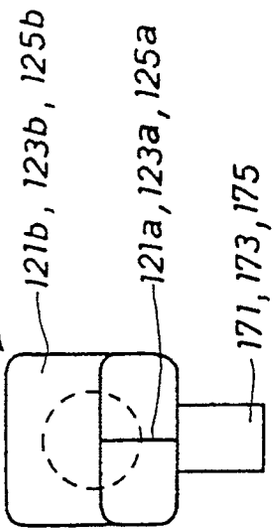

FIG. 19

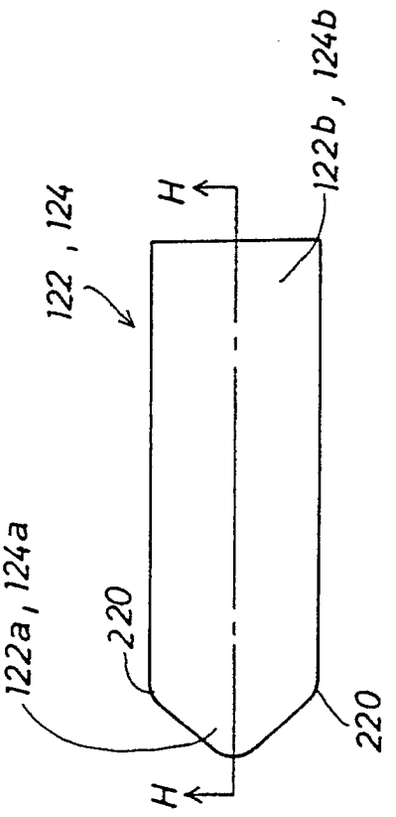

FIG. 21

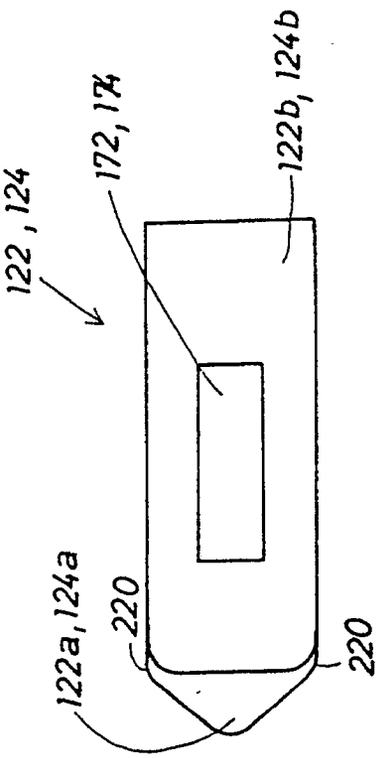

FIG. 22

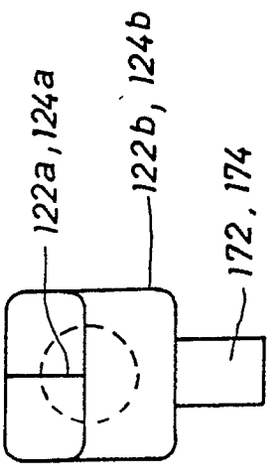

FIG. 23