



12

**EUROPEAN PATENT APPLICATION**

21 Application number: 86110919.7

51 Int. Cl.4: E 05 B 27/00

22 Date of filing: 07.08.86

30 Priority: 08.08.85 JP 174671/85

71 Applicant: Oota, Tomio, 9-1-116, Kasugacho, Asiya-shi Hyogo-ken (JP)  
Applicant: YUUKI SANGYO CO., LTD., 433, Tsuchiyama Hiraokacho, Kakogawa-shi Hyogo-ken (JP)

43 Date of publication of application: 04.03.87  
Bulletin 87/10

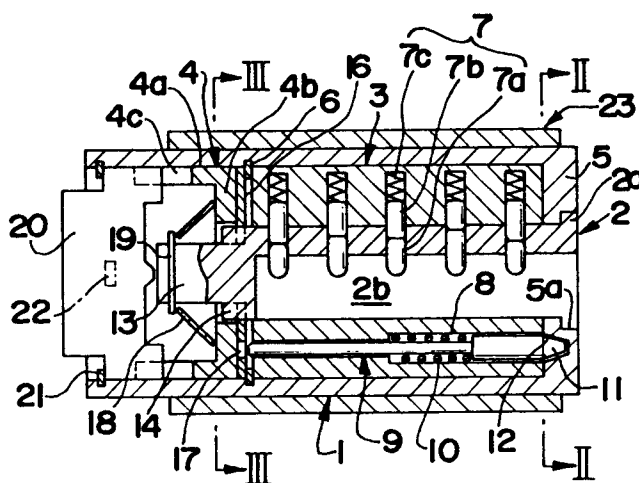
72 Inventor: Oota, Tomio, 9-1-116, Kasugacho, Ashiya-shi Hyogo-ken (JP)

84 Designated Contracting States: CH DE FR GB IT LI

74 Representative: Lehn, Werner, Dipl.-Ing. et al, Hoffmann, Eitle & Partner Patentanwälte  
Arabellastrasse 4 (Sternhaus), D-8000 München 81 (DE)

54 **Cylinder lock.**

57 A cylinder lock comprising the casing (1), the main cylinder (2) which is rotatably supported in said casing (1) and in which the key is held, the intermediate cylinder (3) which is disposed coaxially to said main cylinder (2) and can be rotated integrally to said main cylinder (2), when the regular key is not held in said main cylinder (2), the operational member (4) which, usually actuated to be connected to said main cylinder (2), is caused to take charge of the operations such as locking and unlocking by a rotation of said main cylinder (2), and the means of releasing the connection which is actuated to release the connection between the main cylinder (2) and the operational member (4) by a rotation of the afore-mentioned intermediate cylinder (3).



EP 0 212 468 A1

## Cylinder lock

The present invention relates to a cylinder lock, more specifically to the cylinder lock which is constructed to avoid being broken even under an abnormal situation where the cylinder is forced to be rotated by what is excluded from a regular lock.

Although the cylinder lock is better in safety among various kinds of locks and is widely used as a door lock for a car and a house, recently a strong tool and the like such as a screwdriver are inserted into a keyhole to force the cylinder to be rotated so that the cylinder is broken, whereby such cases as pilferage and vicious harassment are frequently found.

In order to avoid damage caused by such cases, the conventional attempt is only that each of constituent elements is reinforced so that the lock may not be easily broken, even if the cylinder is forced to be rotated by what is excluded from the regular lock so that such a method reaches soon a functional limit in terms of costs and an equilibrium between the entire magnitude of the lock and the costs.

The present invention provides a cylinder lock which can solve the afore-mentioned conventional problems and its main purpose is to provide the cylinder

lock which, when its cylinder is forced to be rotated by using the key other than the regular key and a tool such as screwdriver and the like, it is not released by an idle rotation of the cylinder, and is not broken.

Other purposes and features of the present invention will be apparent from the following description made in conjunction with the accompanying drawings:

#### Brief Description of The Drawing

Fig. 1 is a longitudinal sectional view of the cylinder lock of the first embodiment according to the present invention;

Fig. 2 is a sectional view taken on the line II-II of Fig. 1;

Fig. 3 is a sectional view taken on the line III-III of Fig. 1;

Fig. 4 is a longitudinal sectional view of the cylinder lock which is under the state where a connection between a main cylinder and an operational member is released;

Fig. 5 is a partial longitudinal sectional view of the cylinder lock and the key of the second embodiment according to the present invention;

Fig. 6 is a right side view of the cylinder lock shown in Fig. 5;

Fig. 7 is a sectional view taken on the line VII-VII of Fig. 5;

Fig. 8 is a sectional view taken on the line VIII-VIII of Fig. 5;

Fig. 9 is a longitudinal sectional view of the cylinder

lock, shown in Fig. 5, which is in the state where the connection between the main cylinder and the operational member is released;

Fig. 10 is a longitudinal sectional view of the cylinder lock of the third embodiment according to the present invention;

Fig. 11 is a sectional view taken on the line XI-XI of Fig. 10;

Fig. 12 is a longitudinal sectional view of the cylinder lock, shown in Fig. 10, which is in the state where the connection between the main cylinder and the operational member is released;

Figs. 13 and 14 are sectional views of one example of means for returning a means of releasing the connection between the main cylinder and the operational member to a state of being not actuated;

Fig. 15 is a longitudinal sectional view of the cylinder lock of the fourth embodiment according to the present embodiment;

Fig. 16 is a sectional view taken on the line XVI-XVI of Fig. 15;

Fig. 17 is a sectional view taken on the line XVII-XVII of Fig. 15;

Fig. 18 is a longitudinal sectional view of the state where the connection between the main cylinder and the operational member is released;

Fig. 19 is a longitudinal sectional view of a wafer type cylinder lock of the fifth embodiment of the present

invention;

Fig. 20 is a longitudinal sectional view of the state where the same wafer type cylinder lock is rotated by  $90^{\circ}$ ; and

Fig. 21 is a longitudinal sectional view of the same wafer type cylinder lock which is in the state where the connection between the main cylinder and the operational member is released.

Figs. 1 - 4, illustrate the first embodiment of the present invention, showing a radial pin type cylinder lock. In these figures, 1 is a cylindrical casing, and 2 is the main cylinder, into which the predetermined key (not shown) is held in an insertional manner. 3 is an intermediate cylinder, and 4 is an operating member

to turn the key on which takes charge of the operation such as turning key on and releasing. The main cylinder 2 is supported in the casing 1 such that said main cylinder may be only rotated, while its enlarged portion on the front end 2a is under state where such a portion 2a is held in an enlarged hole part 5a of a front wall part 5 of the casing 1. The intermediate cylinder 3 is fitted outwardly around the main cylinder 2 such that said intermediate cylinder 3 may be rotated, the axial motion of its front and rear ends being impeded by the front wall part 5 of the casing 1 and a snap ring 6 fixed to the internal periphery of said casing 1. A plurality of groups of radial type pin tumblers, different from

one another in length, which comprise pins 7a and drivers 7b, are held by way of coil springs 7c respectively in the intermediate cylinder 3, usually each of the drivers 7b of the pin tumblers 7 is interposed between the intermediate cylinder 3 and the main cylinder 2, by which said main cylinder 2 and the intermediate cylinder 3 are integrally rotated, and if the regular key is held in the keyhole 2b of the main cylinder 2 in an insertional manner, the boundary part between the pin 7a and the driver 7b in each of pin tumblers 7 comes to be located on the external peripheral surface of the main cylinder 2, whereby a relative rotation of the main cylinder 2 and the intermediate cylinder 3 is enabled. The afore-mentioned plurality of groups of pin tumblers 7, are disposed axially in line with one another at one place of the circumferential direction. Rod inserting holes 8 which penetrate axially the intermediate cylinder 3 are provided in three places spaced in a circumferential direction of said cylinder 3, a pushing rod 9 is slidably inserted into each of the holes 8, and each of the pushing rods 9 is always forced to be directed to the front side by coil spring 10. The front end part of each of pushing rod 9 forms a cam head 11 which is approximately conically-trapezoid-shaped, whereas as seen apparently from Figs. 1 and 2, cam faces possessing a recessed part 12 of the trapezoid in section are annularly formed on (three) positions corresponding to the rod inserting holes 8, under the arrangement of which the cam head 11 being forced to be extruded from each of the holes

8 is usually in mesh with the recessed part 12.

The afore-mentioned operational member 4 comprises a circularly-cylindrical-wall-part 4a and an alligator part 4b, directed inwardly, which is extruded from the front end of the circularly-cylindrical-wall-part 4a, while the circularly-cylindrical-wall-part 4a is fitted around the internal side of the casing 1 such that said wall part 4a may be not only rotatable but axially slidable, the shaft hole on the center of the alligator part 4b is idly fitted in a cylinder shaft 13 being concentrically extruded from the rear end of the main cylinder 2, and as shown in Fig. 3, parts to be held for being moved 15 into which transmission projections 14 being extruded from both sides in a diametral direction of a root of the cylinder shaft 13 are held are formed around the afore-mentioned shaft hole. 16 are disc plates which are in fitted mesh with the deeper sides of the afore-mentioned transmission projections 14 and 14, thereby being fixed to the main cylinder 2, and the disc plate 16 is provided with holes into which rods 17 are fitted, at the positions corresponding to the three rod inserting holes 8, which are provided in the afore-mentioned intermediate cylinder 3. 18 is a dished spring which is idly fitted to the cylinder shaft 13, being located between a snap ring 19 mounted to the cylinder shaft 13 and the afore-mentioned operational member 4, and forces the operational member 4 to be axially pressurized forward, holding said operational member 4 at the position where

while the parts to be held for being moved 15 are held in the transmission projections 14, the front face of the alligator part 4b touches the afore-mentioned disc plate 16. 20 is a platelike piece for turning on substantially the key under control of the operational member 4, disposed circumferentially on the rear part in the casing 1, and has slits 4c and 4c which are provided on both the sides of a circumferential direction of circularly-cylindrical-wall-part 4a of the afore-mentioned operational member 4 gotten into its both ends such that these slits 4c and 4c may be slidable together with the operational member 4. For this reason, a rotational operation by the afore-mentioned operational member 4 in the case of using the regular key will cause the piece for turning on the key 20 to be rotated with the shaft line of the main cylinder 2 as a center, thereby turning on the key and unlocking. Furthermore, as apparently seen from Fig. 1, the piece for turning on the key 20 is obstructed in its axial motion by the rear end of the cylinder shaft 13 and snap rings 21 mounted to the casing 1.

As referred to above, usually, the operational member 4 causes it to be connected to the main cylinder 2 with a possibility of being rotated integrally to the main cylinder 2 so that the operational member 4 is located to the position where the parts to be held for being moved 15 can be held in the transmission projections 14, whereby, in response to a rotation of the main cylinder 2 caused

by using the regular key, the operational member 4 is rotated to take charge of performing the operations such as locking and unlocking, but, when the main cylinder 2 is adapted to be rotated without using the regular key and the intermediate cylinder 3 is rotated together with the main cylinder 2, the resulted situation is that a means of releasing the connection which is actuated by a rotation of said intermediate cylinder 3 permits the connection between the main cylinder 2 and the operational member 4 to be released. The means of releasing the connection comprises the pushing rod 9 which is inserted into the rod inserting hole 8 of the intermediate cylinder 3 and forced to be pressurized forward by the coil spring 10 so that the cam head 11 on its front end, being extruded from the front end face of the intermediate cylinder 3, may be held in the recessed part 12 on the front end wall 5 of the casing 1, a rotation of the intermediate cylinder 3 allows the cam head 11 to escape from the recessed part 12 so that at the same time when the pushing rod 9 is pressurized backward against the coil spring 10, the rear end of the pushing rod 9 is extruded from the rear end face of the intermediate cylinder 3, penetrating a holding hole 17 of the disc plate 16, and its top end pushes and moves the operational member 4. Such a pushing and moving action of the pushing rod 9 adapts the operational member 4 to be moved to the position, as shown in Fig. 4, where the parts to be held for being moved 15 cannot be held in the transmission projections 14 on the cylinder shaft

13, thereby releasing the connection between the main cylinder 2 and the operational member 4. In that case, a detecting sensor 22 which detects an actuation of the means of releasing the connection by a rotation of the intermediate cylinder 3 is provided. Namely, as the detecting sensor 22, for example, a proximity sensor, a photoelectric sensor, or mechanical limit sensor and the like are used to detect a using of the key except for the regular key, thereby issuing an alarm. For example, electric cable or wireless unit may allow the detecting signal to be informed to a distant place, the resulted possibility being that an alarm lamp and buzzer are actuated. It is also accepted to provide the detecting sensor 22 to detect an actuation of the intermediate cylinder 3 or the pushing rod 9 and the like.

In Figs. 1 -4 23 stands for a frame for mounting the cylinder lock which is fixed to the casing 1.

When inserting and holding the regular key in the keyhole 2b of the main cylinder 2, the cylinder lock adopting the afore-mentioned construction releases the combination between the main cylinder 2 and the intermediate cylinder 3 made by the pin tumblers 7, thereby enabling the main cylinder 2 to be rotated independently. For this reason, a rotation of the main cylinder 2 permits the operational member 4 to be rotated in an interlocking manner so that the locking and the unlocking are performed by way of the piece for turning on the key. In the case where an insertion of the key except for the regular key

or a wrong instrument such as a screwdriver and the like into the keyhole 2b imparts a rotational force to the main cylinder 2, since the combination between the main cylinder 2 and the intermediate cylinder 3 is not released, the afore-mentioned wrong rotational force is transmitted from the main cylinder 2 through the pin tumblers 7,

to the intermediate cylinder 3. Such a rotation of the intermediate cylinder 3 permits the means of releasing the connection to be actuated, thereby releasing the connection between the main cylinder and the operational member 4. Namely, each of the pushing rods 9 is moved backward by an action of the cam means, and pushes and moves the operational member 4 backward, resulted in the state where the transmission projections 14 on the side of the main cylinder 2 and the parts to be held for being moved 15 of the operational member 4 cannot be held in each other. On the other hand, in the case where a rotation of the intermediate cylinder 3 causes the means of releasing the connection to be actuated, the rear end of the pushing rod 9 constituting the afore-mentioned means of releasing the connection is adapted to rush in to be held in the hole into which the rod is held 17 of the disc plate 16 being fixed to the main cylinder 2. For this reason, resulting from anyone, vicious, making the main cylinder 2 rotate together with the intermediate cylinder 3, if the cylinder lock is left in the state where the means of releasing the connection is located to the actuating position as shown in Fig. 4, i.e. the connection between

the main cylinder 2 and the operational cylinder 4 is released, even commencement of rotating independently the main cylinder 2 by means of inserting the regular key into the keyhole 2b leads to an inability of the operations such as locking or unlocking, and, as found in the present embodiment, a restoration is made from rushing in to be held of the rear end of the pushing rod 9 in the hole into which the rod is inserted 17 of the disc plate 16 integral to the main cylinder 2 at an rotation of the intermediate cylinder 3 to the original position where the pushing rod 9, located correspondingly to the predetermined rotational position, causes a rotation of the main cylinder 2 made by using the regular key to be interlocked with a rotation of the intermediate cylinder 3, thereby returning the means of releasing the connection to the position where such a means is not actuated so that it is possible to restore the main cylinder 2 and the operational member 4 all together to the original state where they are connected to each other.

Figs. 5 - 9, illustrating the second embodiment according to the present invention, shows an axial pin type cylinder lock. In the following description as to the cylinder lock of the second embodiment, its members which are identical or similar functionally to the constituent members of the cylinder lock of the first embodiment are indicated by the number of adding 100 to the number which stands for the constituent member of the first embodiment.

In these drawings, 101 is the circularly-cylindrical

casing, 102 is the main cylinder, 103 is the intermediate cylinder, 104 is the operational member. The main cylinder 102 comprises the enlarged portion 102A, the reduced portion 102B, the front cylinder shaft 102C and the rear cylinder shaft 113 which are provided integrally to one another in a coaxial manner, the enlarged portion 102A is inserted into the casing 101 under the state of being rotatably supported in the front end side of the shaft hole 101a of the casing 101, the intermediate cylinder 103 having the same external diameter as that of the afore-mentioned enlarged portion 102A is rotatably fitted around the reduced portion 102B of the main cylinder 102, and the intermediate cylinder 103 is obstructed its axial motion by the side face of the enlarged portion 102A and the snap rings 106 mounted to the casing 101. The front cylinder shaft 102C rushes in the opening hole on the front end side 101b of the casing 101, its front end face shares approximately the same surface with the front end face of the casing 101, and the internal peripheral surface of the opening hole 101b has its front side provided with an internally-directed flange 24. The afore-mentioned intermediate cylinder 103 holds by way of the coil springs 107c a plurality of groups (e.g. 7 groups) of axial type pin tumblers 107, comprising the pins 107a and the drivers 107b, and each of the pins 107a of the pin tumbler 107 penetrates axially the enlarged portion of the main cylinder 102, being extruded to the side of the opening hole on the front end side. For this reason, usually, the driver

107b of each of the pin tumblers 107 is interposed between the enlarged portion 102A of the main cylinder 102 and the intermediate cylinder 103, thereby making an integral rotation of both the cylinder 102 and 103 possible, and an insertion of such a regular key 25 as shown in the right side of Fig. 5 into the keyhole 102b which is formed between the opening hole on the front end side 101b of the casing 101 and the front cylinder shaft 102C of the main cylinder 102 which is adapted to rush in said opening hole 101b and concurrent holding of a plurality of the recessed parts to be held 27, different from one another in length, which are formed on the external peripheral surface of the top end of the circularly-cylindrical wall 26 of the key 25 around the pins 107a, of the pin tumblers 107, which are extruded from the external side face of the enlarged portion 102A cause the boundary part between the pin 107a and the driver 107b in each of the pin tumblers 107 to be located between the end face of the intermediate cylinder 103 and the internal side face of the enlarged portion 102A opposite to said end face thereof, whereby the main cylinder 102 and the intermediate cylinder 103 can be rotated relatively to each other. The circularly-cylindrical wall 26 of the key 25 has its external surface side and internal surface side provided with a convex piece to be held 28a and a convex part to be held 28b which are used for indexing, and while the recessed part to be held 29a capable of having the afore-mentioned convex piece to be held 28a

held therein is provided on the internally-directed flange 24 of the casing 101, the recessed part to be held 29b capable of having the convex part to be held 28b held therein is provided on the front cylinder shaft 102C of the main cylinder 102. For this reason, when using the key 25, unless the convex piece to be held 28a and the convex part to be held 28b of the key 25 are located at the position where these piece and part 28a and 28b fall in line with the recessed parts to be held 29a and 29b on the side of the keyhole, an insertion and a pulling-out of the key 25 cannot be performed.

On the other hand, a circularly-cylindrical movable member 30 is axially slidably fitted onto the rear part of the reduced portion 102B of the main cylinder 102 such that its both front and rear end faces touch the intermediate cylinder 103 and the operational member 104. The movable member 30 has both sides of its diametral direction provided with guide pieces 30a and 30a respectively, and these guide pieces 30a and 30a are fitted into guide slits 31 and 31 which are provided on the rear part of the casing 101, being axially extended. Furthermore, two places in a diametral direction of the front end face of the movable member 30 are provided with such trapezoidal cam following projections 111 as shown in Fig. 9, and the rear end face of the intermediate cylinder 103 forms an annular cam face equipped with a trapezoidal recessed part 112 into which the afore-mentioned cam following projection 111 is fitted.

The afore-mentioned operational member 104 is idly fitted around the rear cylinder shaft 113 of the main cylinder 102, and the parts to be held for being moved 115 into which the transmission projections 114 being provided on both the sides of the diametral direction of the root of said shaft 113 are held are formed on the shaft hole thereof. 32 is a stopper which is provided on the rear end of the casing 101, and is fitted into the peripheral notched recessed part 33 of the operational member 104, thereby limiting the angle of rotational operation of said operational member 104 to the predetermined angle. 118 is the dished springs which force the operational member 104 to be pressurized forward and holds the operational member 104 at the position where the parts to be held for being moved 115 can be held in the transmission projections 114. Thus, usually, it causes the operational member 104 to be connected to the main cylinder 102 such that they may be rotated integrally to each other that the parts to be held for being moved 115 are located at the position where such parts to be held 115 can be held around the transmission projections 114, so, in response to a rotation of the main cylinder 102 made by using the regular key, the operational member is rotated to take charge of operations such as locking and unlocking, and when the main cylinder 102 is rotated without using the regular key 25 and concurrently the intermediate cylinder 103 is rotated, the resulting situation is that the means of releasing the connection which is actuated by a rotation

of said intermediate cylinder 103 allows the main cylinder 102 and the operational member 104 to release their connection. For this reason, the means of releasing the connection comprises the movable member 30 which is axially movably disposed on the main cylinder 102 between the intermediate cylinder 103 and the operational member 104 as referred to above and a cam means (cam following projection 111 and the trapezoidal recessed part 112) which is provided on the face which is oppositely interposed between the movable member 30 and the intermediate cylinder 103, and executes the arrangement in which a rotation of the intermediate cylinder 103 may cause the projection 111 of the cam means to escape from the recessed part 112 and the movable member 30 to be pushed and moved backward against the dished springs 118, whereby the parts to be held for being moved 115 and the transmission projections 114 cannot be held in one another.

When inserting and holding the regular key 25 in the keyhole 102b, the cylinder lock possessing the aforementioned construction has the combination between the main cylinder 102 and the intermediate cylinder 103 by the pin tumblers 107, released, so a commencement of rotating the main cylinder 102 adapts the operational member 104 to be rotated by way of the transmission projections 114 and the parts to be held for being moved 115, thereby performing the operations such as locking and unlocking. In the case where a rotational force is imparted to the main cylinder 102, using the key except for the

regular key or the tool, such a wrong rotational force is transmitted to the intermediate cylinder 103, and a rotation of the intermediate cylinder 103 permits the means of releasing the connection to be actuated and the connection between the main cylinder 102 and the operational member 104 to be released, thereby making it impossible to perform the operations such as locking and unlocking (see Fig. 9.) Furthermore, if the cylinder lock is left in the state (state shown in Fig. 9) where a wrong using causes the means of releasing the connection to be actuated, since the main cylinder 102 is deviated from the regular position, it is impossible to insert the key 25. For this reason, the requirement lies in an insertion of the regular key 25 into the keyhole 102b, when the main cylinder 102 is returned to such a regular position as shown in Fig. 6 under the state where while the top end of the key 25 is held in the inlet part of the keyhole 102b, the top end of the convex part to be held 28b is adapted to be held in the recessed part to be held 29b of the front cylinder shaft 102c. Once the regular key 25 is inserted, it cannot be pulled out from any position but the regular position, i.e. the position of inserting primarily the same.

Although the second embodiment omits the pertinent illustration, similarly to the case of the first embodiment, the detecting sensor which detects the actuation of the means of releasing the connection may be adequately provided.

Figs. 10 - 12 illustrate the third embodiment according

to the present invention, and shows the same axial pin type cylinder lock as the cylinder lock of the second embodiment. The constituent members of the cylinder lock of the second embodiment which are functionally identical or similar to those of the cylinder lock of the first embodiment are indicated by the number of adding 200 to the number which stands for the constituent members of the first embodiment.

According to the third embodiment, the main cylinder 202 comprises the enlarged shaft 202A, the reduced shaft 202B, and the front cylinder shaft 202C which are integrally provided in a coaxial manner, the enlarged shaft 202A is inserted into the casing 201 under the state where said enlarged shaft 202A is rotatably supported in the front end side of the shaft hole 201a of the circularly-cylindrical casing 201, the intermediate cylinder 203 having the same external diameter as that of the aforementioned enlarged shaft 202A is rotatably fitted around the front end side of the reduced shaft 202B of the main cylinder 202, and the intermediate cylinder 203 is obstructed in its axial motion by the side face part of the enlarged shaft 202A and the disc plates 216 mounted to the rear end of the casing 201. The front cylinder shaft 202C rushes in the opening hole on the front end side of the casing 201, its front end face shares approximately the same face with the front end face of the casing 201, and the internal peripheral surface of the opening hole 201b has its front side provided with the internally-directed

flange 34. Between the afore-mentioned intermediate cylinder 203 and the main cylinder 202, similarly to the case of the second embodiment, a plurality of groups of axial type pin tumblers 207, are fitted, so, usually, these pin tumblers 207, cause the main cylinder 202 and the intermediate cylinder 203 to be combined with each other so that they are in the state of being integrally rotatable, but if the regular key is inserted and held in the keyhole 202b, it adapts their combination to be released. On the other hand, apparently from Fig. 11, while the afore-mentioned disc plate 216 provides its central part with the shaft hole 216a, its both sides in diametral direction possess pieces to be held 216b and 216b, the shaft hole 216a is idly fitted around the reduced shaft 202B of the main cylinder 202, and each of pieces to be held 216b is held is fixed in the holding groove 35 on the rear end of the casing 201. The pin holes 208 penetrate axially three circumferential places in the disc place 216, the pushing pin 209 is inserted into each of the holes 208, and the rear end face of the intermediate cylinder 203 forms an annular cam face equipped with the trapezoidal recessed part 212 into which the top end of the pushing pin 209 is fitted. Operational member 204 is idly fitted onto the reduced shaft 202B of the main cylinder 202, and the part to be held for being moved 215 into which the transmission projections 214 being provided on both the sides of a diametral direction of the reduced shaft 202B are held is formed in the shaft

hole of the operational member 204. For this reason, the operational member 204 is forced to be pressurized forward by the dished springs and is pressurized to face the rear face of the disc plate 216 at the position where the part to be held for being moved 215 and the transmission projections 214 can be held in one another. As referred to above, usually, since the operational member 204 is located to the position where the part to be held for being moved 215 can be held in the transmission projections 214, it is connected to the main cylinder 202 such that they can be integrally rotated. For this reason, in response to a rotation of the main cylinder 202 by using the regular key, the operational member 204 is rotated to take charge of performing the operations such as locking and unlocking. On the other hand, when the main cylinder 202 is adapted to be rotated without using the regular key and concurrently the intermediate cylinder 203 is rotated, the means of releasing the connection which is actuated by a rotation of said intermediate cylinder 203 adapts the connection between the main cylinder 202 and the operational member 204 to be released. The means of releasing the connection includes the pushing pins 209 which are inserted into the pin holes 208 of the disc plate 216 interposed between the intermediate cylinder 203 and the operational member 204 and the cam face located on the rear end face of the intermediate cylinder 203 opposite to the disc plate 216 and executes the arrangement in which a rotation of the intermediate cylinder 203 causes the front end of the

pushing pins 209 to escape from the recessed parts 212 on the cam face, by which the rear end of the pins 209 is extruded backward from the holes 208 to push backward the operational member 204, whereby the part to be held for being moved 215 and the transmission projections 214 cannot be held in one another.

When using the cylinder lock possessing the aforementioned construction, if the regular key is inserted and held in the keyhole 202b, the combination between the main cylinder 202 and the intermediate cylinder 202 by the pin tumblers 207, is released so that a resulted rotation of the main cylinder 202 adapts the operational member 204 to be rotated by way of the transmission projections 214 and the part to be held for being moved 215, thereby performing the operations such as locking and unlocking. In the case where using the key except for the regular key or the tool imparts the rotational force to the main cylinder 202, the wrong rotational force is transmitted to the intermediate cylinder 203, the resulted rotation of the intermediate cylinder 203 allows the means of releasing the connection to be actuated so that the connection between the main cylinder 202 and the operational member 204 is released, thereby making it impossible to perform the operations such as locking and unlocking. (See Fig. 12.) Also in this embodiment, the detecting sensor which detects the actuation of the afore-mentioned means of releasing the connection may be provided.

Figs. 13 & 14 illustrate one example of a means of

restoring the means of releasing the connection to the original state, in the case where a wrong use and the like selected at the time of using the cylinder lock of the afore-mentioned third embodiment adapt the mean of releasing the connection to be left in the actuating state. Under the arrangement in which the pins 37 and 38 are inserted by way of the springs 36 into the reduced shaft 202B of the main cylinder 202 and the intermediate cylinder 203, usually, as shown by the upper half part of these figures, while the cut line between the pins 37 and 38 is adapted to fall in line with the boundary part between both the cylinders, the top ends of the pins 38 are adapted to be held in the recessed parts 39 which are provided on the adequate parts on the internal peripheral surface of the casing 201. When the abnormality takes place, if the main cylinder 202 and the intermediate cylinder 203 are rotated integrally to each other, as shown by the lower half of the same figures, the pin 38 escapes from the recessed part 39 so that said pin 38 moves inwardly in a radial direction, whereby both the cylinders 202 and 203 are integrally combined with each other. For this reason, in the case, as shown in Fig. 12, where a wrong use and the like cause the means of releasing the connection to be left in the actuating state, the resulted situation is that if the regular key causes the main cylinder 202 to be rotated, it rotates the intermediate cylinder 203 at the same time, and the rotation of the intermediate cylinder 203 enables the mean of releasing the connection

to be returned to the original state.

Figs. 15 - 18 illustrate the fourth embodiment according to the present embodiment and show similarly to the first embodiment the radial type cylinder lock. The members of the fourth embodiment which are functionally identical or similar to the constituent members of the cylinder lock of the first embodiment are indicated by the number of adding 300 to the number which stands for the constituent member of the first embodiment.

According to this embodiment, the main cylinder 302 is only rotatably supported in the casing 301 under the state where its front enlarged portion 302a is held in the hole 305a in the front end wall 305 of the circularly-cylindrical casing 301. The intermediate cylinder 303 is rotatably fitted around the main cylinder 302, and its both front and rear ends are slidably supported by the front end wall 305 of the casing 301 and the projections to be held 40 which are provided on the adequate parts of the external peripheral surface of the main cylinder 302, whereby the intermediate cylinder 303 is obstructed its axial motion. While the thick and circularly-cylindrical movable member 41, approximately of C-shape in section, which possesses a notch groove 41a, produced by notching partially the circumference of movable member 41, which is extended axially along the full length, is concentrically arranged between the casing 301 and the intermediate cylinder 303, a projection to be held 303a which are axially and integrally provided on one side of the external peripheral

surface of the intermediate cylinder 303 is fitted into the notch groove 41a of the C-shaped movable member 41 such that said projection to be held 303a is relatively slidable in an axial direction. The cam following projections 311 and 311 are provided on both the sides of the diametral direction of the front end face of the C-shaped movable member 41, and, on the other hand, the rear end face of the front end wall 305 of the casing opposite to the front end face of said movable member 41 forms the cam face equipped with the trapezoidal recessed parts 312 and 312 into which the afore-mentioned cam following projections 311 and 311 are fitted. Similarly to the case of the first embodiment, between the main cylinder 302 and the intermediate cylinder 303 a plurality of groups of radial type pin tumblers 307, lie, and, usually, these pin tumblers 307, combine the main cylinder 302 with the intermediate cylinder 303 to lead them to be able to be integrally rotated, a use of the regular key permitting the combination between both the cylinders 302 and 303 to be released. On the other hand, the operational member 304, formed to get circularly-cylindrical-shaped, is inwardly fitted in the rear side of the casing 301 with a possibility not only of being rotated but of being axially slidable, and the front end in the internal peripheral surface of the circularly-cylindrical operational member 304 forms the part to be held for being moved 315 into which the projections to be held 40 being provided on the external peripheral surface of the main cylinder

302 are fitted. The dished springs 308 are mounted between the snap ring 319 mounted to the cylinder shaft 313 and the operational member 304, force the operational member 304 to be pressurized forward, and to hold the same at the position where the afore-mentioned part to be held for being moved 315 and the projections to be held 40 can be held in one another. The piece for turning on the key 320 is mounted to the rear end of the casing 301 under the state where said piece for turning on the key 320 is fitted into the slits 304c and 304c which are provided on both the sides of the diametral direction of the rear end of the operational member 304, and an operation of rotating the operational member 304 may allow said piece for turning on the key 320 to be rotated with the shaft line of the main cylinder 302 as a center. As shown in Fig. 17, the projection to be held 40 is formed to get fan-shaped in section so that it may correspond to the sectional shape of the notch groove 41a of the movable member 41, and is adapted to be held in the notch groove 41a at the time of the backward motion of the movable member 41 accompanying the rotation of the intermediate cylinder 303. The means of releasing the connection according to the fourth embodiment comprises the projection to be held 303a, the circularly-cylindrical movable member 41, approximately of C-shape in section, which is axially slidably fitted by way of the notch groove 41a around the intermediate cylinder 303, the cam following projection 311 which is provided on the front end face of the movable

member 41, the cam face of the casing 301 opposite to the cam following projection 311, and the dished springs 308 which force the movable member 41 by way of the operational member 304 to be pressurized in a direction opposite to the afore-mentioned cam face and execute the arrangement in which a rotation of the intermediate cylinder 303 causes the cam following projection 311 to escape from the recessed part 312 on the cam face so that the movable member 41 is pressurized backward, thereby releasing the part to be held for being moved 315 of the operational member 304 from the position of being held in the projection to be held 40 of the main cylinder 302. In addition, when using the cylinder lock of the fourth embodiment, if the afore-mentioned means of releasing the connection is adapted to be left in such a state of being actuated as shown in Fig. 18, as referred to above, since, in response to the backward motion of the movable member 41, the projection to be held 40 is held in the notch groove 41a of said movable member 41, an insertion of the regular key into the keyhole 302b of the main cylinder 302 and adequately rotating the main cylinder 302 allow the movable member 41 to be rotated by way of the projection to be held 40, whereby the cam following projection 311 is fitted into the recessed part 312 on the cam face, resulted in a possibility of returning the means of releasing the connection to the original state.

Fig. 18 illustrate the state where the main cylinder 302 is rotated by about  $90^{\circ}$  from such a state as shown

in Fig. 15 together with the intermediate cylinder 303. The afore-mentioned projection to be held 40 is provided on the mounting member 42 which is inserted in the hole penetrating the main cylinder 302 in a diametral direction.

Also in the fourth embodiment, the detecting sensor which detects the actuation of the afore-mentioned means of releasing the connection may be provided.

Figs. 19 - 21 illustrate the fifth embodiment according to the present invention, and this is the embodiment of the wafer type cylinder lock. In Figs. 19 and 20, longitudinal sectional views taken sectionally from the position where each of these figures illustrates the cylinder lock under the usual state to be shifted  $90^\circ$  by  $90^\circ$ , 401 is the casing, 402 is the main cylinder, 403 is the intermediate cylinder, and 404 is the operational member. A plurality of pieces to be held 407 which the regular key causes to be moved inwardly from the holding grooves 400, are axially disposed on the main cylinder 402, while they are adequately spaced, and, usually, fitted into the holding grooves 400, axially spaced, which are provided on the opposite sides of the diametral direction of the internal peripheral surface of the intermediate cylinder 403. 440 is a torsion spring which holds the main cylinder 402 at the neutral position (the state where the pieces to be held 407 are fitted in the holding grooves 400) with respect to the intermediate cylinder 403, is idly fitted in an annular groove 441 in the external peripheral surface of the intermediate cylinder 403, and its both ends 440a and 440b

are inwardly folded to face notched end faces 403a which are formed on both the sides of the diametral direction of the intermediate cylinder 403 and the notched end faces 402a which are formed on both the sides of the diametral direction of the main cylinder 402 such that these notched end faces 403a and 402a are adjacent to one another.

The means of releasing the connection between the main cylinder 402 and the operational member 404 comprises a plurality of trapezoidal cam following projections 411 which are provided on the front end of the intermediate cylinder 403, the cam face 412 which is provided in the casing 401, and the trapezoidal recessed part 412a. 418 is dished springs which are mounted to the shaft 413 of the main cylinder 402.

When using the cylinder lock possessing the aforementioned construction, if the regular key is inserted into the keyhole of the main cylinder 402, all the pieces to be held 407 are moved inwardly, depart from the holding grooves 400 of the intermediate cylinder 403, and the combination between the main cylinder 402 and the intermediate cylinder 403 is released. For this reason, a rotation of the main cylinder 402 adapts by way of the transmission projections 414 and the part to be held for being moved 415 the operational member 404 to be rotated, thereby performing the operations such as locking and unlocking. In that case, if a rotational operating force imparted to the key which is inserted into the keyhole of the main cylinder 402 is released, the main cylinder 402 can be

restored to the neutral position by the torsion spring 440. On the other hand, if the key except for the regular key or the wrong tool 442 is inserted into the keyhole of the main cylinder 402 to rotate the same, naturally, since all the pieces to be held 407 are not moved inwardly, the wrong rotational force is transmitted by way of said pieces to be held 407 and the holding grooves 400 to the intermediate cylinder 403. As a result, as shown in Fig. 21, an action of the means of releasing the connection made in response to an rotation of the intermediate cylinder 403 causes the intermediate cylinder 403 to be moved in an arrow direction of the same figure, thereby releasing the connection between the main cylinder 402 and the operational member 404, so that the operations such as locking and unlocking become impossible.

According to the cylinder lock of the present invention, when the main cylinder is forced to be rotated by using the key except for the regular key and the tools such as screwdriver, a rotational force imparted to the main cylinder allows the intermediate cylinder to be rotated together with the main cylinder, such a rotation of the intermediate cylinder actuates the means of releasing the connection, and the connection between the main cylinder and the operational member is released, whereby the main cylinder is only idly rotated together with the intermediate cylinder so that the operation of unlocking becomes impossible.

Thus, in the cylinder lock according to the present

invention, since, even if the wrong tool except for the regular key forces the main cylinder to be rotated, the operation of unlocking is not be performed, it can be effectively utilized as a highly safe cylinder lock. In the case where a wrong method forces the main cylinder to be rotated, since, while the state of extruding the pin tumblers (pin type) or the pieces to be held (wafer type) is still kept, the main cylinder is idly rotated, the result is to avoid a breakage of the pin tumbler and the like, and since, only if the main cylinder is returned to the original rotational position, a re-use of the present cylinder lock as a normal one is possible without any special treatment given thereto, it can produce a marked economic effect.

CLAIMS

1. A cylinder lock comprising the casing (1; 101, 201, 301, 401), the main cylinder (2; 102, 202, 302, 402) which is rotatably supported in said casing (1; 101, 201, 301, 401) and into which the key is held, the intermediate cylinder (3; 103, 203, 303, 403) which is disposed coaxially to said main cylinder (2; 102, 202, 302, 402) and can be rotated integrally to said main cylinder (2; 102, 202, 302, 402) when the regular key is not held in said main cylinder (2; 102, 202, 302, 402), the operational member (4; 104, 204, 304, 404) which, usually actuated to be connected to said main cylinder (2; 102, 202, 302, 402), is caused to take charge of the operations such as locking and unlocking by a rotation of said main cylinder (2; 102, 202, 302, 402), and the means of releasing the connection which is actuated to release the connection between the main cylinder (2; 102, 202, 302, 402) and the operational member (4; 104, 204, 304, 404) by a rotation of the afore-mentioned intermediate cylinder (3; 103, 203, 303, 403).

2. A cylinder lock as defined in claim 1, wherein the afore-mentioned means of releasing the connection includes the pushing rod (9, 209) which is inserted into the rod inserting hole (8; 208, 308, 408) being extended axially of the afore-mentioned intermediate cylinder (3; 103, 203, 303, 403) and is forced to be pressurized in one direction together with the afore-mentioned operational member (4; 104, 204, 304, 404) so that the cam head (11; 111, 311, 411) on its end may be extruded from the end face of the intermediate cylinder (3; 103, 203, 303, 403) and be always held in the cam face of the afore-mentioned casing (1; 101, 201, 301, 401) and releases the connection between said operational member (4; 104, 204, 304, 404) and the afore-mentioned main cylinder (2; 102, 202, 302, 402) by means of a rotation of the intermediate cylinder (3; 103, 203, 303, 403) causing the cam head (11; 111, 311, 411) to escape from the recessed part (12; 112, 212, 312, 412) on the cam face, thereby pushing the pushing rod (9; 209) in a reversive direction so that said operational member (4; 104, 204, 304, 404) is adapted to be axially moved.

3. A cylinder lock as defined in claim 1, wherein the afore-mentioned means of releasing the connection comprises the movable member (30, 41) which is axially movably disposed on the afore-mentioned main cylinder (2; 102, 202, 302, 402) between the afore-mentioned intermediate cylinder (3; 103, 203, 303, 403) and the afore-mentioned operational member (4; 104, 204, 304, 404), the cam following projection (111) provided on the end face of said movable member (30, 41), the cam face, possessing the recessed part (12; 112, 212, 312, 412), which is formed on the end face of the intermediate cylinder (3; 103, 203, 303, 403) opposite to said cam following projection (111), and the spring (10) which forces the afore-mentioned operational member (4; 104, 204, 304, 404) and the movable member (30, 41) to be pressurized to the side of the intermediate cylinder (3; 103, 203, 303, 403), and releases the connection between said operational member (4; 104, 204, 304, 404) and afore-mentioned main cylinder (2; 102, 202, 302, 402) by means of a rotation of the intermediate cylinder (3; 103, 203, 303, 403) causing the cam following projection (111) of the movable member (30, 41) to escape from the recessed part (12;

112, 212, 312, 412) of the cam face, thereby pushing the movable member (30, 41) in a reversible direction so that the operational member (4; 104, 204, 304, 404) is adapted to be axially moved.

4. A cylinder lock as defined in claim 1, wherein the afore-mentioned means of releasing the connection includes the pushing pin (9, 209) which is inserted into the pin hole (17) in the disc plate (16; 216) interposed between the afore-mentioned intermediate cylinder (3; 103, 203, 303, 403) and the afore-mentioned operational member (4; 104, 204, 304, 404), the cam face, possessing the recessed part (12; 112, 212, 312, 412), which is formed on the end face of the intermediate cylinder (3; 103, 203, 303, 403) opposite to said disc plate (16; 216), and the spring (10) which forces the pushing pin (9; 209) by way of the afore-mentioned operational member (4; 104, 204, 304, 404) to be pressurized to the side of the cam face, and releases the connection between the operational member (4; 104, 204, 304, 404) and the afore-mentioned main cylinder (2; 102, 202, 302, 402) by means of a

rotation of the intermediate cylinder (3; 103, 203, 303, 403) causing one end of the pushing pin (9; 209) to escape from the recessed part (12; 112, 212, 312, 412) of the cam face, whereby another end of the pushing pin (9; 209) pushes axially the operational member (4; 104, 204, 304, 404) against the spring (10).

5. A cylinder lock as defined in claim 1, wherein the afore-mentioned means of releasing the connection includes the circularly-cylindrical movable member (30, 41), approximately of C-shape in section, which is axially movably supported with respect to the intermediate cylinder (3; 103, 203, 303, 403) by means of having the projection to be held of said intermediate cylinder (3; 103, 203, 303, 403) held slidably in the notch groove produced by notching axially some part of the circumference at the full length, the cam following projection (111) provided on one end face of said movable member (30, 41), the cam face of the casing equipped with the recessed part (12; 112, 212, 312, 412) into which said cam following projection (111) is fitted, and the spring (10) which forces the afore-mentioned movable member (30, 41) by way of the operational

member (4; 104, 204, 304, 404) to be pressurized in a direction opposite to the afore-mentioned cam face, and releases the connection between said operational member (4; 104, 204, 304, 404) and the main cylinder (2; 102, 202, 302, 402) by means of a rotation of the afore-mentioned intermediate cylinder (3; 103, 203, 303, 403) causing the afore-mentioned cam following projection (111) to escape from the recessed part (12; 112, 212, 312, 412) of the cam face, thereby pushing the movable member (30, 41) in a reversive direction so that the afore-mentioned operational member (4; 104, 204, 304, 404) is adapted to be moved against the afore-mentioned spring (10).

6. A cylinder lock as defined in claims 1 to 5, wherein the detecting sensor (22) is provided which detects the actuation of the afore-mentioned means of releasing the connection.

FIG. 1

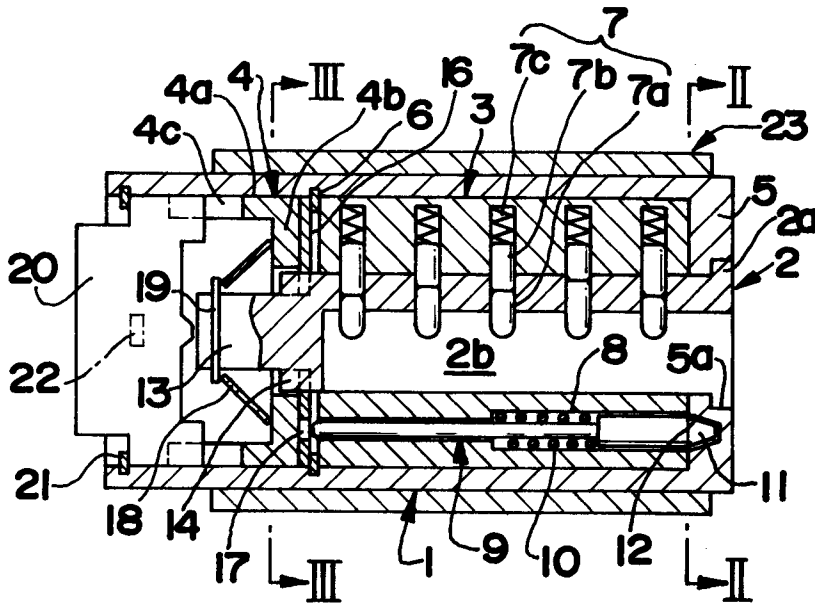


FIG. 2

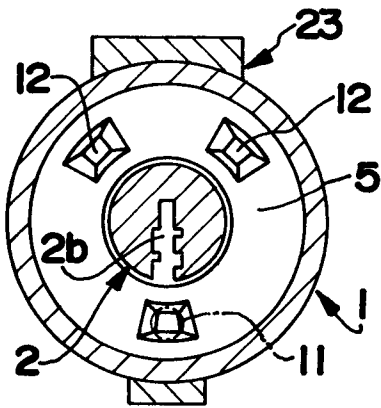


FIG. 3

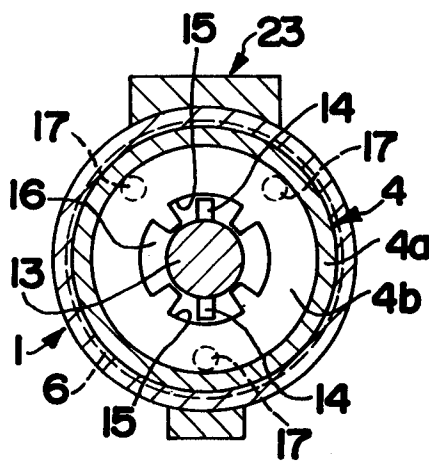




FIG. 6

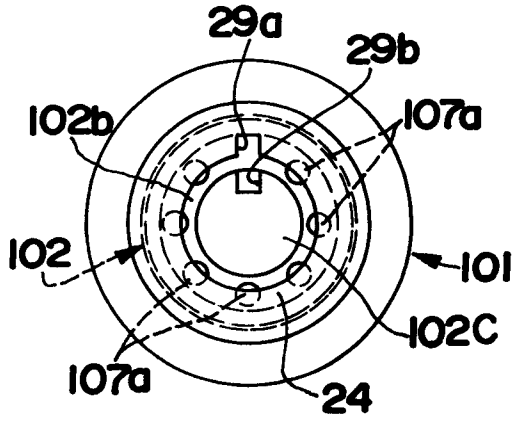


FIG. 7

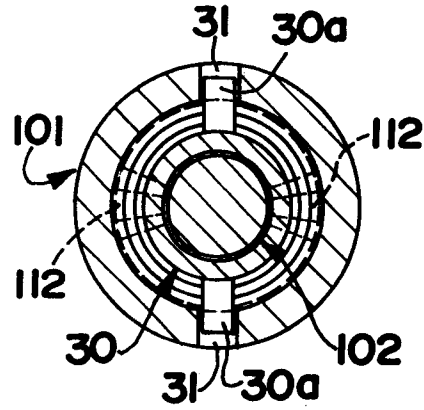


FIG. 8

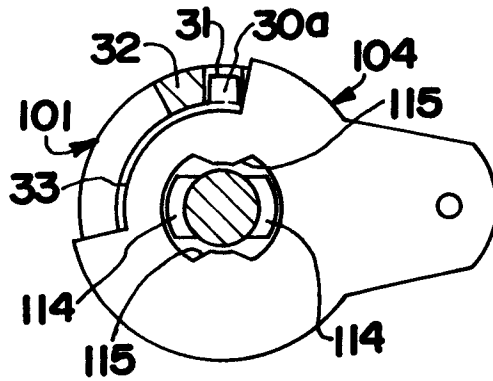
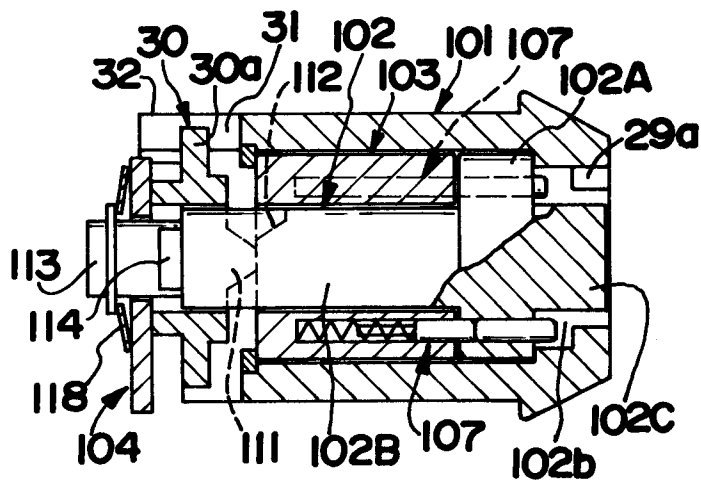
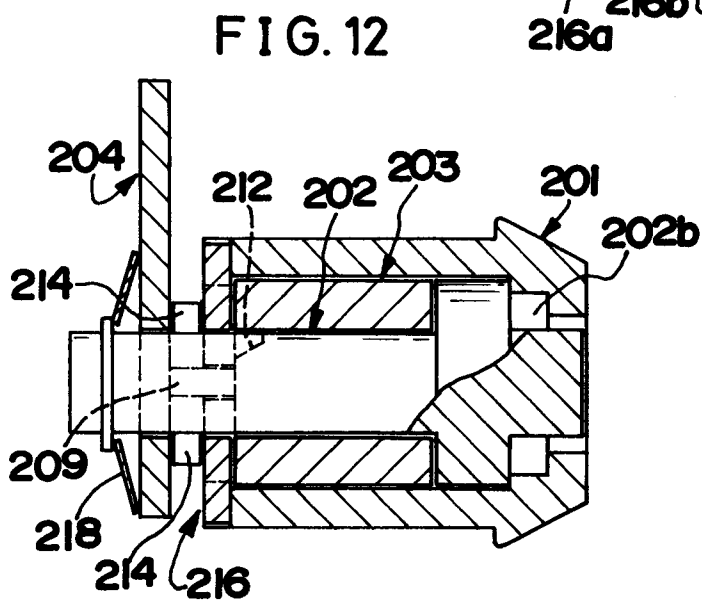
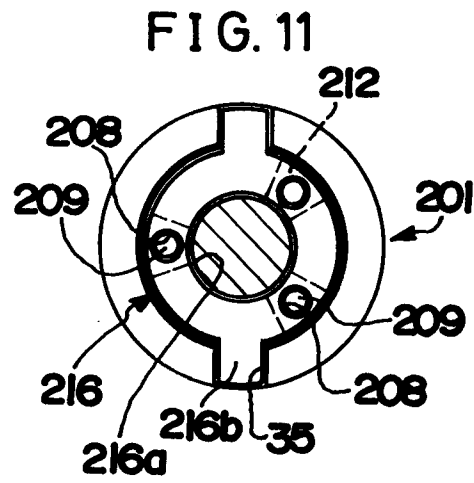
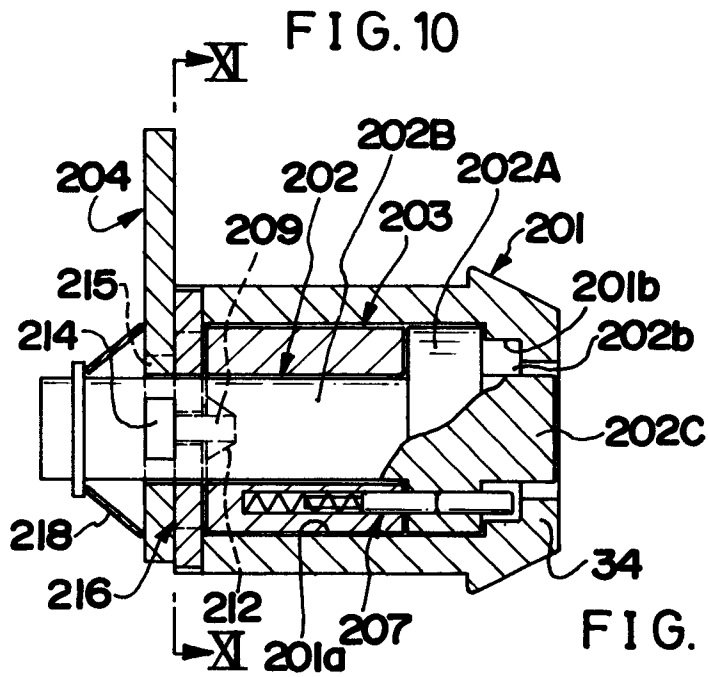


FIG. 9





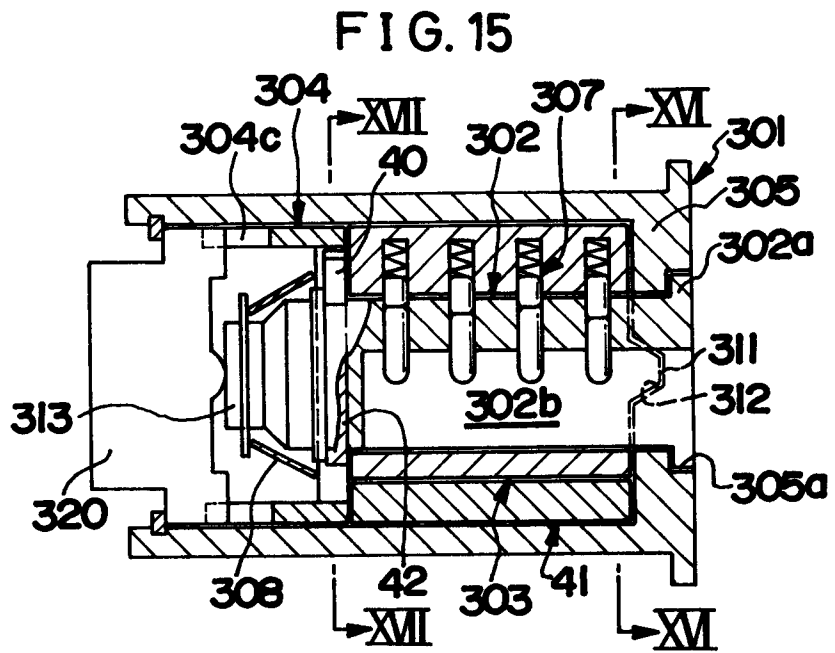
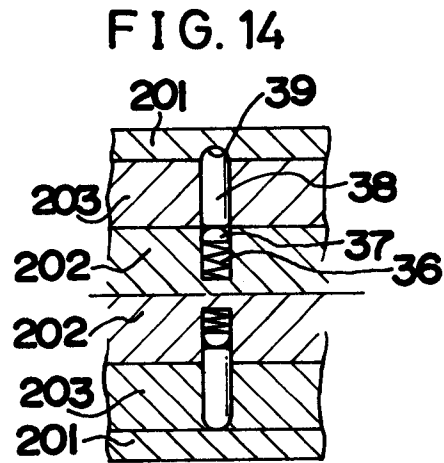
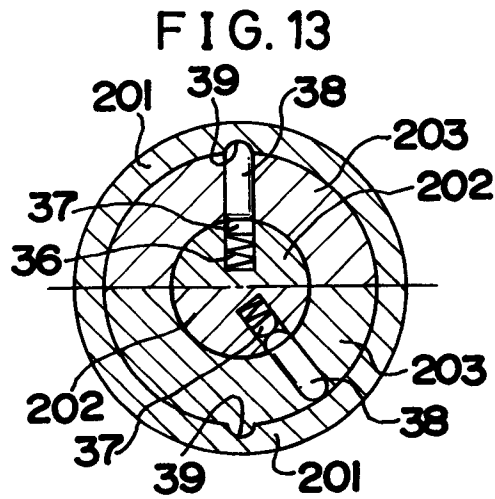


FIG. 16

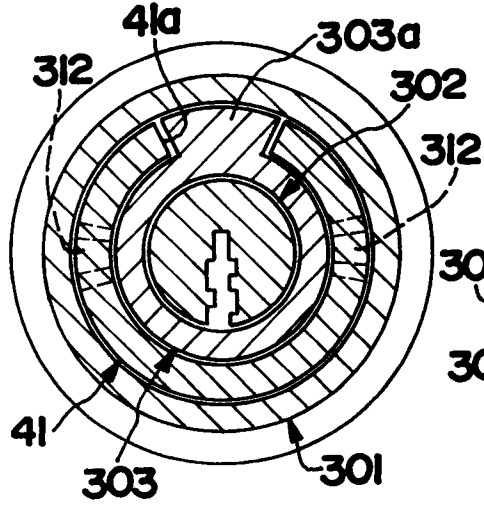


FIG. 17

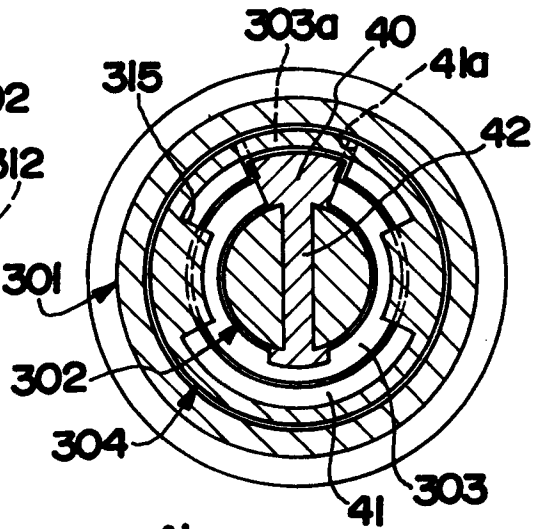


FIG. 18

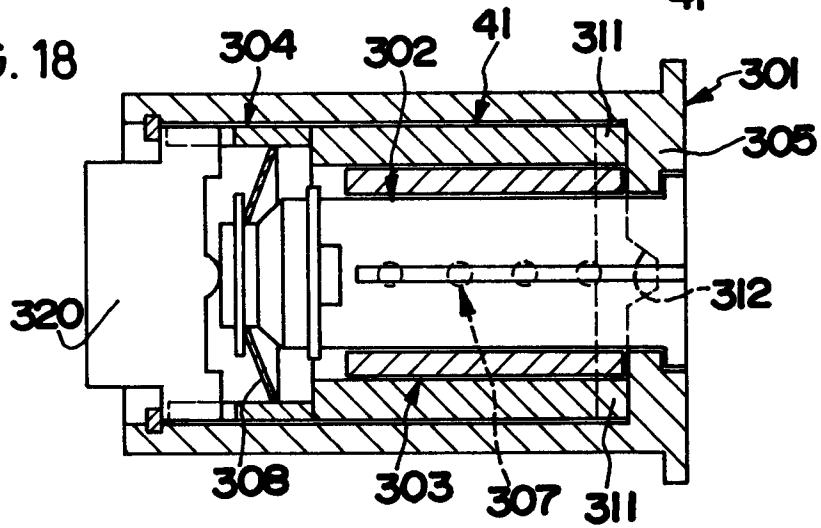


FIG. 19

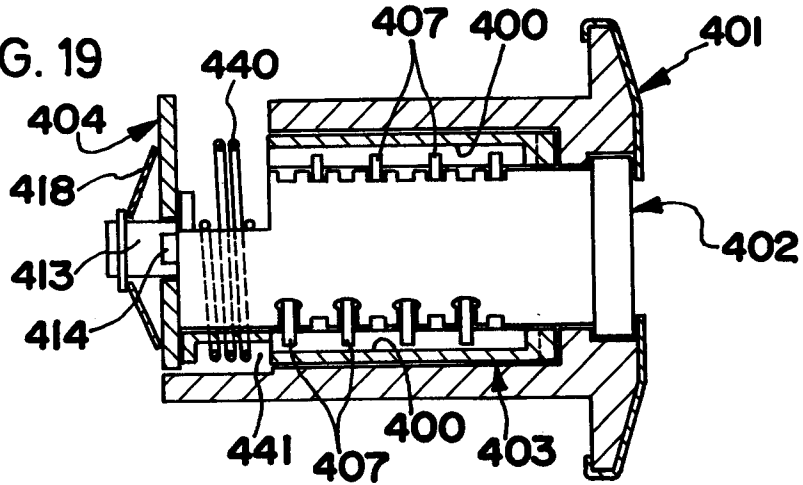


FIG. 20

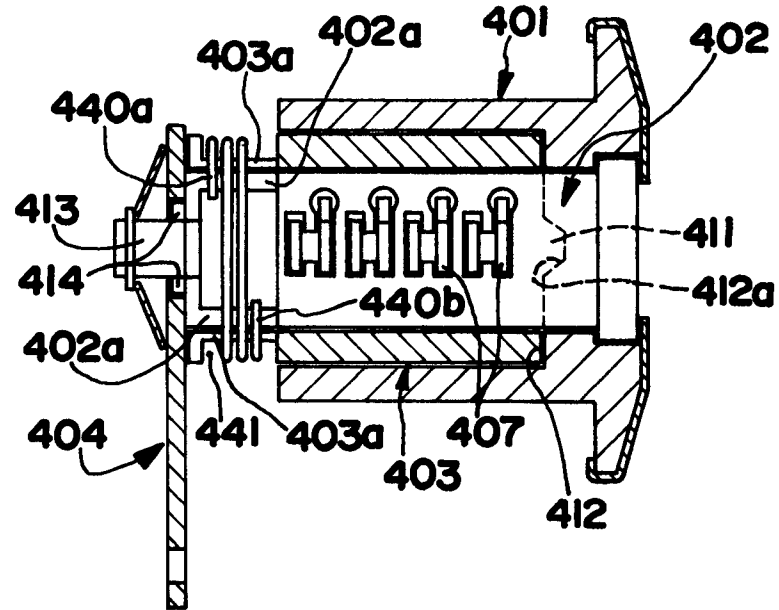
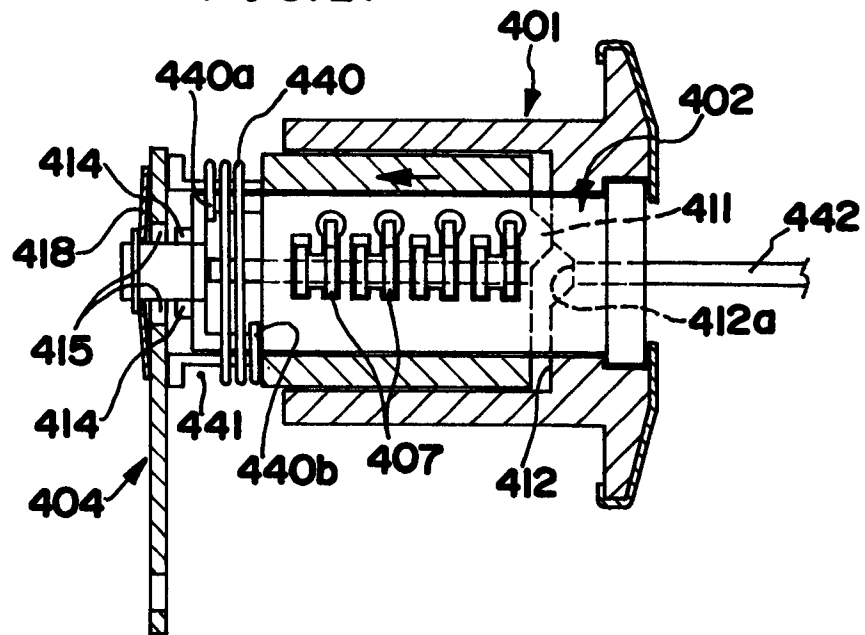


FIG. 21





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 86110919.7
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	<u>US - A - 4 309 882 (MAIOCCO)</u> * Fig. 1-15 * ---	1-5	E 05 B 27/00
A	<u>US - A - 3 606 776 (DRACH)</u> * Fig. 1-6 * -----	1-5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 05 B
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 06-10-1986	Examiner CZASTKA
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			