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(71) Applicant: **TAKIGEN MANUFACTURING CO., LTD.**
No. 24-4, Nishigotanda 1-chome
Shinagawa-ku Tokyo-to(JP)

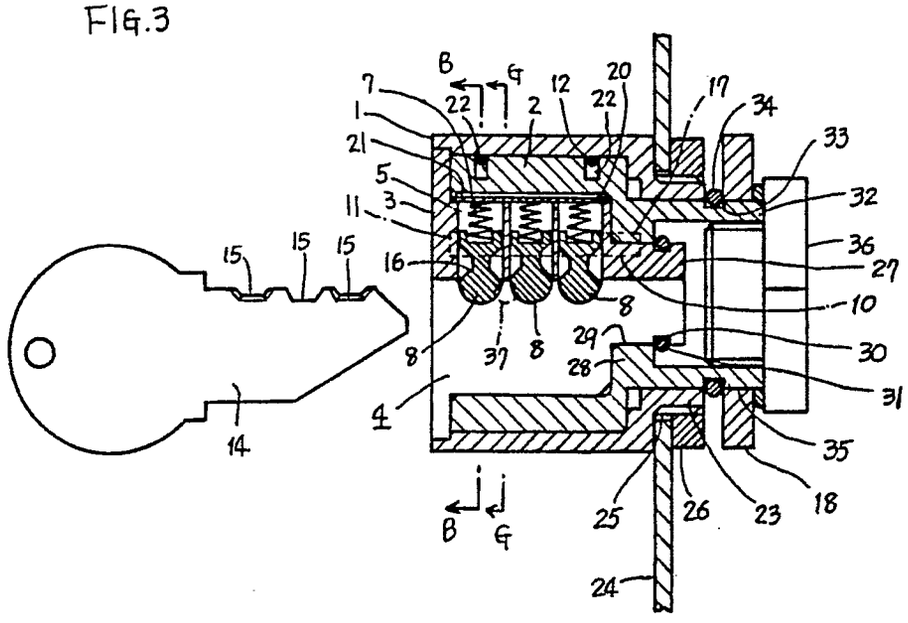
(72) Inventor: **Tomoyuki, Yahata Takigen**
Manufacturing Co., Ltd.
No. 24-4, Nishigotanda 1-chome
Shinagawa-ku
Tokyo-to(JP)
Inventor: **Yoshiyasu, Tamura Takigen**
Manufacturing Co., Ltd.
No. 24-4, Nishigotanda 1-chome
Shinagawa-ku
Tokyo-to(JP)

(74) Representative: **Liedl, Gerhard**
Steinsdorfstrasse 21 - 22
D-8000 München 22(DE)

(54) Lock with lock plug capable of idling.

(57) A lock with lock plug capable of idling is diclosed, which comprises a housing, a lock sleeve rotatably fitted therein and a lock plug rotatably fitted therein and having an axial key insertion hole. As in an ordinary lock, the lock can be unlocked by merely turning a key after insertion thereof in it so long as the key is the regular one and is not any other picking tool. The lock thus never gives the user any burden or puzzlement in operation, and eliminates any claim due to misunderstanding of any erroneous operation as a trouble of it.

FIG.3



EP 0 388 516 A2

LOCK WITH LOCK PLUG CAPABLE OF IDLING

This invention relates to a lock with a lock plug capable of idling, in which the lock plug merely idles and can never move a lock portion to a locked position when a picking tool other than a regular key in inserted in it.

Japanese Patent Disclosure 63-312,477 discloses a lock with a lock plug capable of idling. In this lock, an interlock portion of a lock sleeve and an interlock portion of the lock plug are coupled together by inserting a key in the plug and then pushing the key to cause retreat of the plug by a predetermined stroke with respect to a housing. Further, it is necessary to turn the key while holding the plug urged to the retreated position, so that the lock plug and the lock sleeve are never disengaged.

With the ordinary lock, however, it is only necessary to turn the key after insertion thereof in the plug, but it is not necessary to push the key at all. Therefore, the peculiar operation of the lock as noted above, i.e., turning the key while holding it urged in a retreated position, gives the user extra burden and puzzlement in operation. Further, when a user can not unlock the lock with the regular key because of turning the key without holding the key sufficiently urged in the retreated position in the plug , the user may misunderstand an erroneous operation to be a trouble in the lock, and then he may claim inspection, repair or replacement of the lock.

An object of the invention is to provide a lock with a lock plug capable of idling, which can be unlocked by merely turning the key in the inserted position such as in the ordinary lock so long as the regular key is used, so that it never gives the user any burden or puzzlement in operation and eliminates any claim due to misunderstanding of an erroneous operation as a trouble.

According to invention, there is provided a lock with a lock plug capable of idling, which comprises a housing; a lock sleeve rotatably fitted in the housing; a lock plug rotatably fitted in the lock sleeve and having an axial key insertion hole, and one or more juxtaposed main pin holes extending radially and communicating with an inner edge of the key insertion hole; one or more auxiliary pin holes each crossing an intermediate portion of each main pin hole; one or more follower pins each slidably received in each main pin hole and biased by a spring toward the center of the lock plug; one or more pairs of driver pins each pair slidably received in each auxiliary pin hole such that each has its outer end found on a shear line between an outer periphery of the lock plug and an inner periphery of the lock sleeve when its inner end is in contact with a corresponding side of the associated follower pin; one or more axial grooves formed in the inner periphery of the lock sleeve and communicating with the auxiliary pin hole or holes; one or more pairs of stoppers each pair received in the axial grooves and biased by a spring toward the lock plug, each stopper having a lock projection with an inner end thereof in contact with the outer end of the associated driver pin; a lock key having a recessed portion formed on an edge thereof, the recessed portion engaging with the inner end of the follower pin and moving each follower pin along the associated main pin hole when the key is inserted in the key insertion hole; locking grooves formed in the inner periphery of the housing for detachably receiving the rear end of the stopper; each follower pin having a pair of opposite side recesses, the stoppers being engaged in both the axial grooves of the lock sleeve and the auxiliary pin hole or holes of the look plug while their rear ends are detached from the locking grooves when the ends of the driver pins are engaged in the opposite side recesses of the follower pin or pins.

The above and other objects, features and advantages of the invention will become more apparent from the following description when the same is read with reference to the accompanying drawing.

Fig. 1 is a front view showing an embodiment of the lock lock with lock plug capable of idling according to the invention in a locked state;

Fig. 2 is a back view showing the same lock;

Fig. 3 is a sectional view taken along line A-A in Fig. 1;

Fig. 4 is a sectional view, to an enlarged scale, taken along line B-B in Fig. 3;

Fig. 5 is a front view showing a housing of the same lock;

Fig. 6 is sectional view taken along line C-C in Fig. 5;

Fig. 7 is a back view showing the housing;

Fig. 8 is a front view showing a lock sleeve of the same lock;

Fig. 9 is a sectional view taken along line D-D in Fig. 8;

Fig. 10 is a back view showing the lock sleeve;

Fig. 11 is a right side view showing the lock sleeve;

Fig. 12 is a front view showing a lock plug of the same lock;

Fig. 13 is a sectional view taken along line E-E in Fig. 12;

Fig. 14 is a plan view showing the lock plug;

Fig. 15 is a bottom view showing the lock plug;

Fig. 16 is a sectional view, to an enlarged scale, taken along line F-F in Fig. 13;

Fig. 17 is a view similar to Fig. 4 but showing the lock when a lock key is inserted;

Fig. 18 is a view similar to Fig. 4 but showing the lock when a picking tool is inserted therein; and

Fig. 19 is a sectional view taken along line G-G in Fig. 3.

A preferred embodiment of the lock with lock plug capable of idling will now be described with reference to the drawings. The illustrated lock comprises a housing 1, a lock sleeve 2 rotatably fitted therein and a lock plug 3 rotatably fitted therein. The plug 3 has an axial key insertion hole 4, juxtaposed main pin holes 5 extending radially and communicating with an inner edge the key insertion hole 4, and auxiliary pin holes 6 each crossing an intermediate portion of each main pin hole 5.

Follower pins 8 are each slidably received in each main main pin hole 5 and biased by a spring 7 toward the center of the lock plug 3. Pairs of driver pins 9 are each slidably received in the auxiliary pin hole 6 such that each driver pin 9 has its outer end found on a shear line or a contact surface between the outer periphery 3a of the lock plug 3 and inner periphery 2b of the lock sleeve 2 when its inner end is in contact with a corresponding side of the associated follower pin 8. The sleeve 3 has axial grooves 10 formed in the inner periphery and communicating with the auxiliary pin holes 6.

Pairs of stoppers 11 are each received in the axial grooves 10 and biased by a spring 12 toward the lock plug 3. The stoppers 11 each have a lock projection 13 with an inner end thereof in contact with the outer end of the associated driver pin 9. The follower pins 8 are movable along the main pin holes 5 by a recessed portion 15 formed on an edge of the key 14, when the key 14 is inserted in the key insertion hole 4 and engages with the inner end of the follower pins 8.

The housing 1 has locking grooves 17 formed in the inner periphery for detachably receiving the rear end of the stoppers 11. The follower pins 8 each have a pair of opposite side recesses 6. The stoppers 11 are engaged in both the axial grooves 10 of the sleeve 2 and the auxiliary pin holes 6 of the plug 3 while their rear ends are detached from the locking grooves 17 when the inner ends of the driver pins 9 are engaged in the opposite side recesses 16 of the follower pins 8.

Fig. 4 shows the lock in a locked state with the key 14 removed from the key insertion hole 4 of the lock plug 3. In this state, the opposite sides of the outer end of each follower pin 8 are blocking the associated auxiliary pin hole 6 of the lock plug 3, and the inner ends of the driver pins 9 are in contact with the opposite sides of the follower pin 8 noted above. Further, the inner ends of the locking projections 13 of the stoppers 11 received in the axial grooves 10 of the lock sleeve 2 and the outer ends of the driver pins 9 are in engagement with one another along the shear line between the outer periphery 3a of the plug 3 and the inner periphery 2b of the sleeve 2. This means that the sleeve 2 and plug 3 are not coupled to each other.

Hence, even when the plug 3 is turned by a picking tool such as a wire or a screw driver inserted in its key insertion hole 4, the torgue is never transmitted to the lock sleeve 2, but the lock plug 3 only idles.

Further, in this state the stoppers 11 engaged in the axial grooves 10 of the sleeve 2 are also received in the locking grooves 17 of the housing 1 on its rear end, so that the sleeve 2 is locked to the housing 1 via the stoppers 11 and can not be turned with respect to the housing 1. Thus, the sleeve 2 is never operated when any force is given to the plug 3, and a lock portion 18 at the rear end of the sleeve 2 is held at the lock position.

Fig. 17 shows the lock in a state attained by inserting the regular lock key 14 in the key insertion hole 4 of the plug 3. When the key 14 is inserted, its recessed portion 15 causes movement of each follower pin 8 against the biasing force of the associated spring 7. When the follower pin 8 is moved to a position, at which the opposite side recesses 16 faces the associated auxiliary pin hole 6 of the plug 3, the locking projections 13 of the stoppers 11 are brought into the auxiliary pin hole 6 by the spring force of the spring 12, thus causing engagement of the inner ends of the driver pins 9 in the opposite side recesses 16 of the follower pin 8.

In this state, the stoppers 11 each have the body portion 11a engaged in the associated axial groove 10 of the sleeve 2 and the locking projection 13 engaged in the corresponding auxiliary pin hole 6 of the plug 3, that is to say, the stoppers 11 are engaged in both the plug 2 and the sleeve 3, and the plug 3 and sleeve 2 are coupled together. Further, the sleeve 2 is unlocked from the housing 1 with detachment of the rear ends of the stoppers 11 from the locking grooves 17 of the housing 1.

Thus, by turning the key 14 in a predetermined direction, the plug 2 is rotated in unison with the plug 3. The lock portion 18 is moved to an unlocked or locked position with forward or reverse rotation of the lock sleeve 2.

Fig. 18 shows the lock in a state with a picking tool 19, other than the regular key 14, inserted in the key insertion hole 4 of the plug 3. In this case, the follower pin 8 is never moved to the position, at which the opposite side recesses 16 correctly face the auxiliary pin hole 6. Therefore, the driver pins 9

are still in contact with the opposite side surfaces of the follower pin 8, that is, the outer ends of the driver pins 9 and inner ends of the locking projections 13 are in contact with one another along the shear line or contact surface between the outer periphery 3a of the plug 3 and inner periphery 2b of the sleeve 2. Hence, the sleeve 2 and plug 3 are not coupled together. Further, the sleeve 2 is locked to the housing 1 due to engagement of the rear ends of the stoppers 11 in the locking grooves 17 of the housing 1.

Turning the plug 3 in any way with the picking tool 19 produces mere idling of the plug 3, and the lock sleeve 2 is never operated, so that the lock portion 18 is held at the locked position.

In the illustrated embodiment, a shoulder 41 is formed between the inner end of each main pin hole 5 of the plug 3 and key insertion hole 4, and the inner end of the follower pin 8 urged by the spring 7, which is a compression coil spring, is in contact with the shoulder 41. A spring retainer 21 is received in an axial groove 20 crossing and communicating with the outer ends of three main pin holes 5 and is secured by rivetting or pressing to the plug 3. Each follower pin 8 has an annular recess, which is formed in the periphery of its intermediate portion and serves as the opposite side recesses 16.

As the auxiliary pin holes 6, three pairs of holes are provided symmetrically on the opposite sides of the main pin holes 5. In correspondence to these holes, two axial grooves 10 are formed in the sleeve 2. The outer periphery of the sleeve 2 is provided with two semi-annular narrow grooves 22, in each of which a bias spring 12 consisting of a U-shaped wire is received. The stoppers 11 each have a body portion 11a having a semi-circular sectional profile and a locking projection 13 projecting from a semi-arcular inner side of the body portion 11a.

Each spring 12 providing inward restoring force has its opposite ends each urged against the outer side of the body portion 11a of each stopper 11. The follower pins 8 each have a semi-spherical inner end, and the driver pins 9 each have semi-spherical inner and outer ends. The locking projection 13 has an inner side surface of an arcuate sectio nal profile.

The housing 1 is secured to a door panel 24 by inserting its reduced-diameter rear end portion 23 having flat opposite sides in an opening 25 having like shape and formed in the panel 24, and by screwing a nut 26 on the reduced-diameter portion 23. The plug 3 is mounted against detachment in the sleeve 2 by inserting its reduced-diameter rear end portion 27 in a central hole 29 in an intermediate radial wall 28 of the sleeve 2, and by fitting a set ring 31 in an annular groove 30 of the reduced-diameter end portion 27.

The sleeve 2 is mounted against detachment in the housing 1 by inserting its reduced-diameter rear end portion 32 in the reduced-diameter end portion 23 of the housing 1, and by fitting a set ring 34 in an annular groove 33 formed in the reduced-diameter end portion 32. On the reduced-diameter end portion 32 of the sleeve 2 with the flat opposite sides noted above is fitted a flat lock portion 18 having a hole 35 having a shape like that of the reduced-diameter end portion 32. The lock portion 18 is secured to the sleeve 2 by a bolt 36 screwed in the reduced-diameter end portion 32. The shape of the lock portion 18 as well as the status of mounting of the portion 18 with respect to the sleeve 2 is not limited to the illustrated one.

The plug 3 has a radial blind bore 37, in which a detent ball 39 is accommodated such that it is biased outwardly by a compression coil spring 38. The ball 39 is received in and detached from a recess 40 formed in the inner periphery of the sleeve 2 with rotation of the plug 3.

As has been described in the foregoing, in the case of the lock with lock plug capable of idling according to the invention, insertion of the regular key 14 in the key hole 4 of the plug 3 causes each follower pin 8 to be moved outwardly by the recessed portion 15 of the key 14 to cause engagement of the inner ends of the driver pins 9 in the opposite side recesses 16 of the follower pin 8, and thus cause the stoppers 11 to be engaged in both the axial grooves 10 of the sleeve 2 and auxiliary pin holes 6 of the plug 3, while causing detachment of the rear ends of the stoppers 11 from the locking grooves 17 of the housing 1. Thus, by merely turning the ley 14 in a predetermined direction in this state, the lock sleeve 2 is rotated in unison with the plug 3 to the locked position.

Thus, there is no need of pushing the key 14 to a retreated position. The lock thus is operable in the same way as the ordinary locks, and never gives the user any burdun or puzzlement in operation. It permits any user to reliably unlock it without possibility of occurrence of any operation failure state which might be erroneously regarded to be a trouble. Hence it is free from any claim for inspection or repair due to misunderstanding.

Claims

A lock with lock plug capable of idling, comprising a housing; a lock sleeve rotatably fitted in the housing; a lock plug rotatably fitted in the lock sleeve and having an axial key insertion hole; one or more juxtaposed main pin holes extending radially and communicating with an inner edge of said

key insertion hole, and one or more auxiliary pin holes each crossing an intermediate portion of each said main pin hole; one or more follower pins each slidably received in each said main pin hole and biased by a spring toward the center of said lock plug; one or more pairs of driver pins each pair slidably received in each said auxiliary pin hole such that each has its outer end found on a shear line or a contact surface between an outer periphery of said lock plug and an inner periphery of said lock sleeve when its inner end is in contact with a corresponding side of the associated follower pin; one or more axial grooves formed in the inner periphery of said lock sleeve and communicating with said auxiliary pin hole or holes; one or more pairs of stoppers each pair received in said axial grooves and biased by a spring toward the lock plug, each said stepper having a lock projection with an inner end thereof in contact with the outer end of the associated driver pin; each said follower pin being moved along the associated main pin hole by a recessed portion, which is formed on an edge of a lock key and engages with the inner end of said follower pin, said housing having locking grooves formed in the inner periphery for detachably receiving the rear end of the stoppers, each said follower pin having a pair of opposite side recesses, said stoppers being engaged in both said axial grooves of said lock sleeve and said auxiliary pin hole or holes of said look plug while their rear ends are detached from said locking grooves when the ends of the said driver pins are engaged in said opposite side recesses of said follower pin or pins.

FIG.1

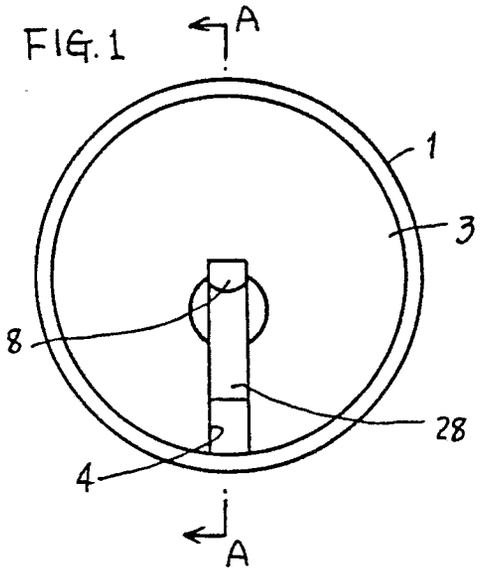


FIG.2

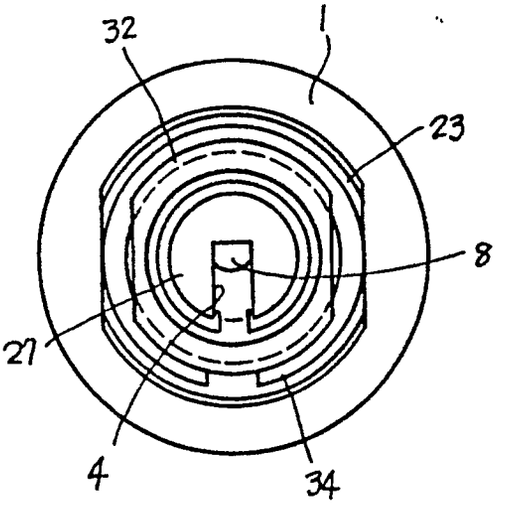


FIG.3

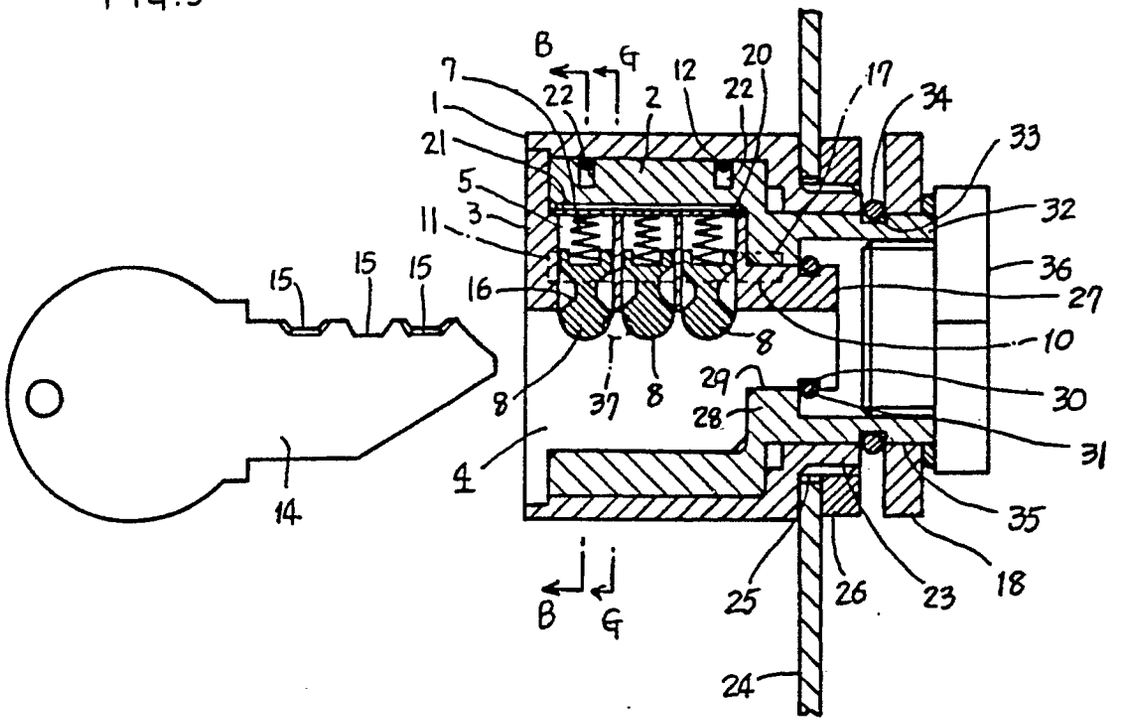


FIG.4

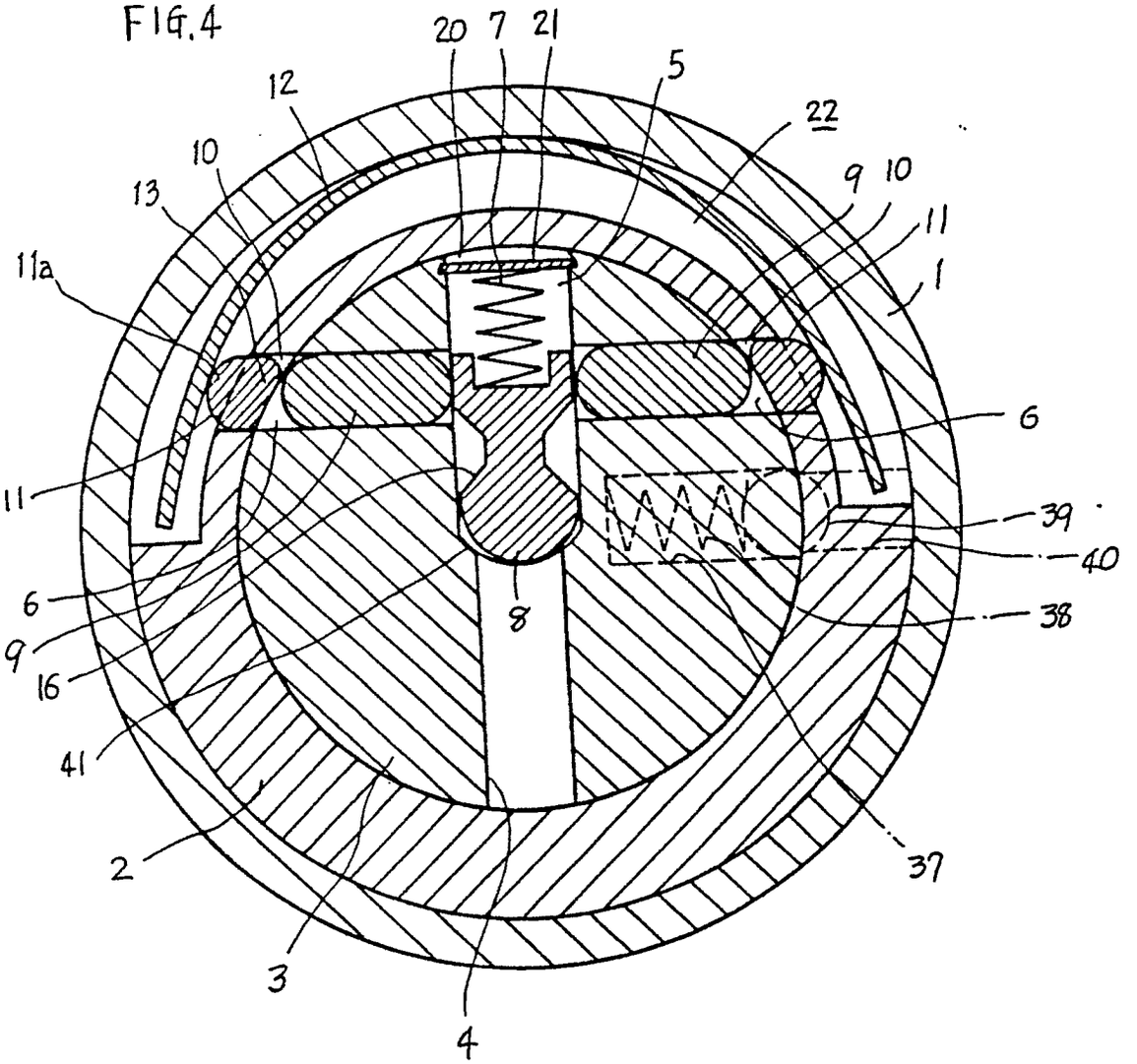


FIG.5

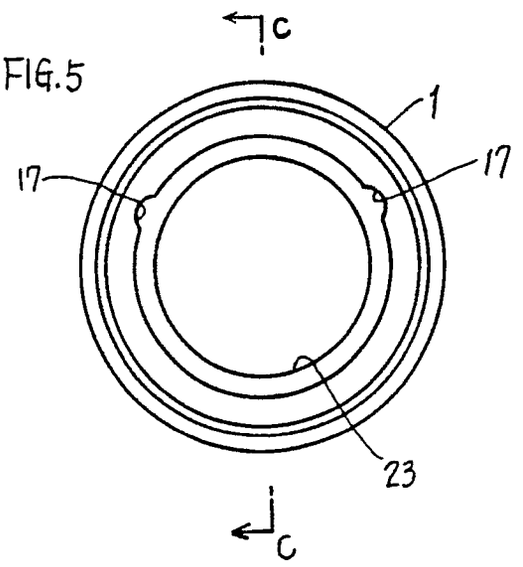


FIG.6

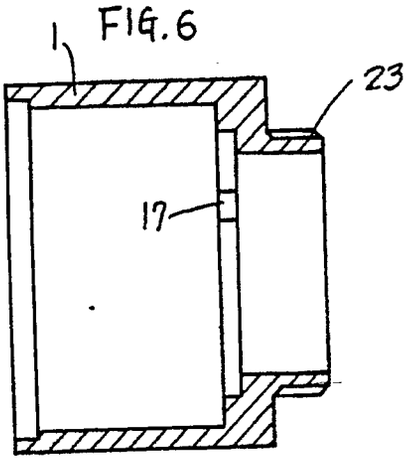


FIG.7

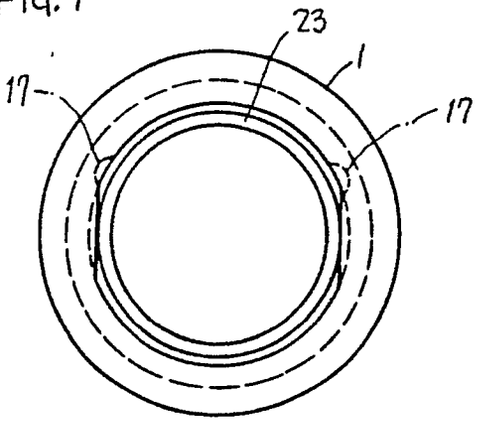


FIG.8

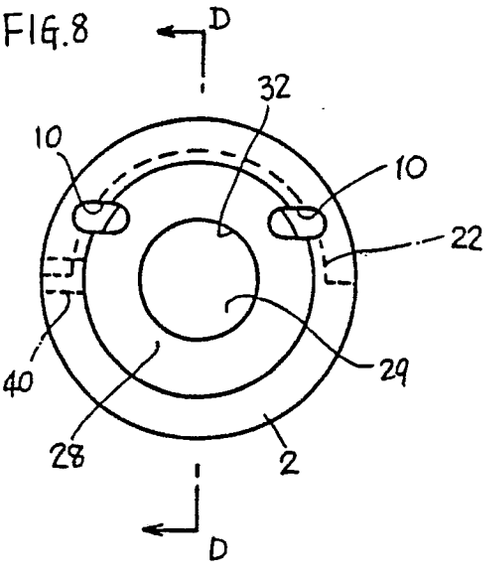


FIG.9

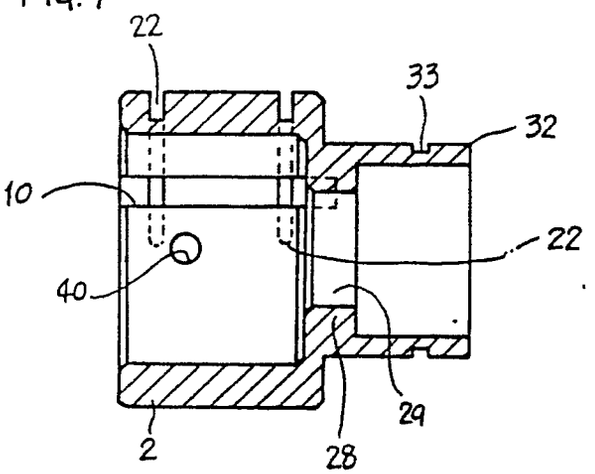


FIG. 10

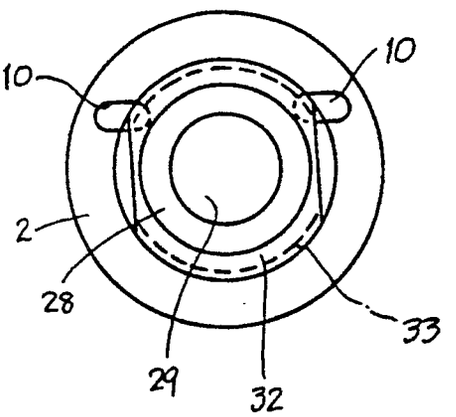


FIG.11

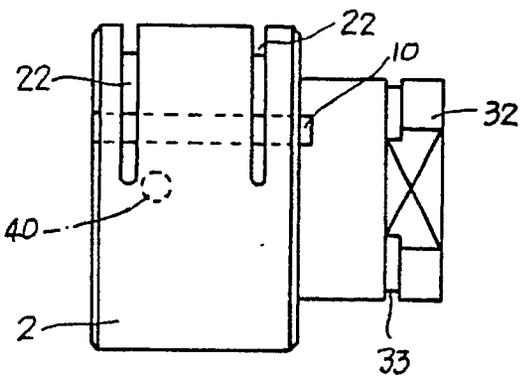


FIG.12

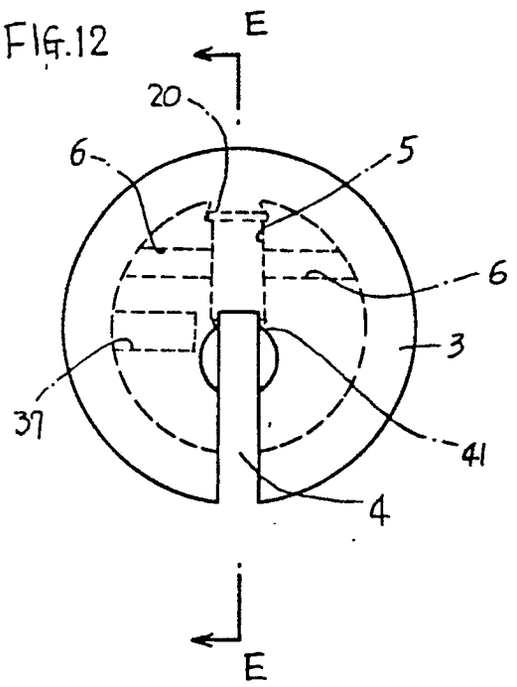


FIG.13

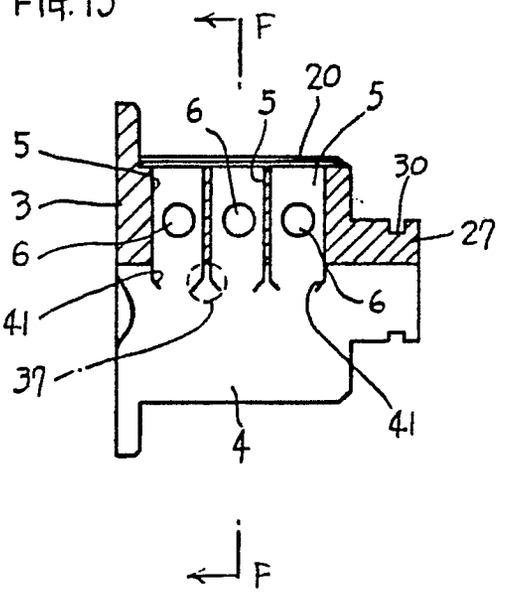


FIG.14

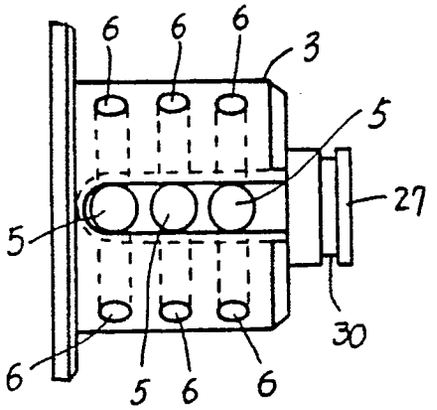


FIG.15

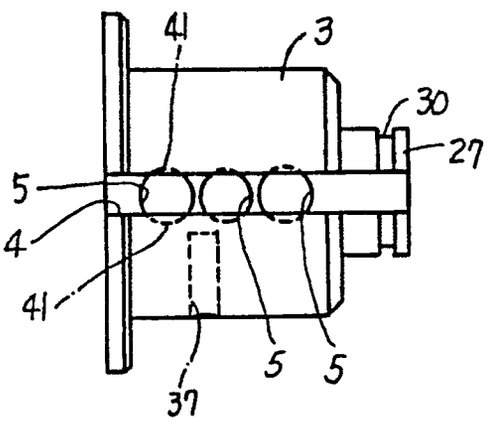


FIG. 16

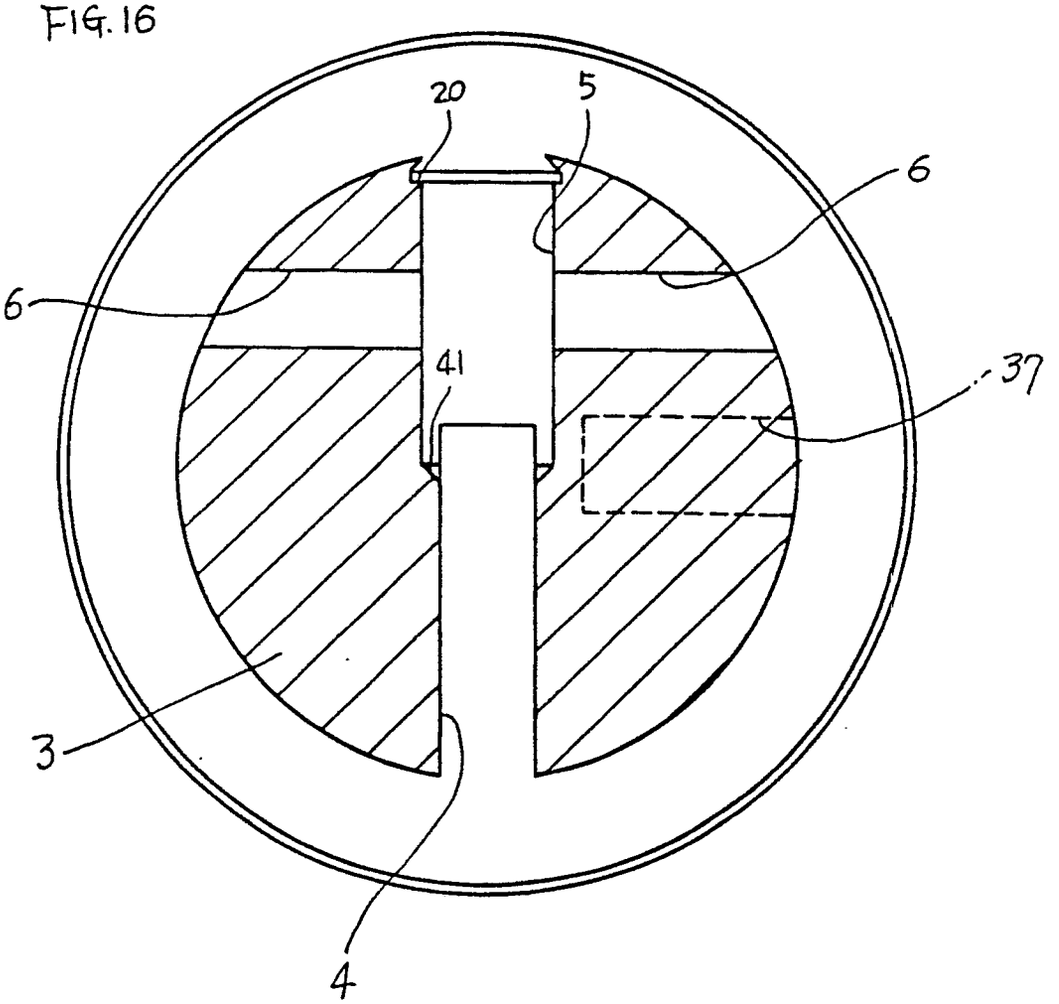


FIG.17

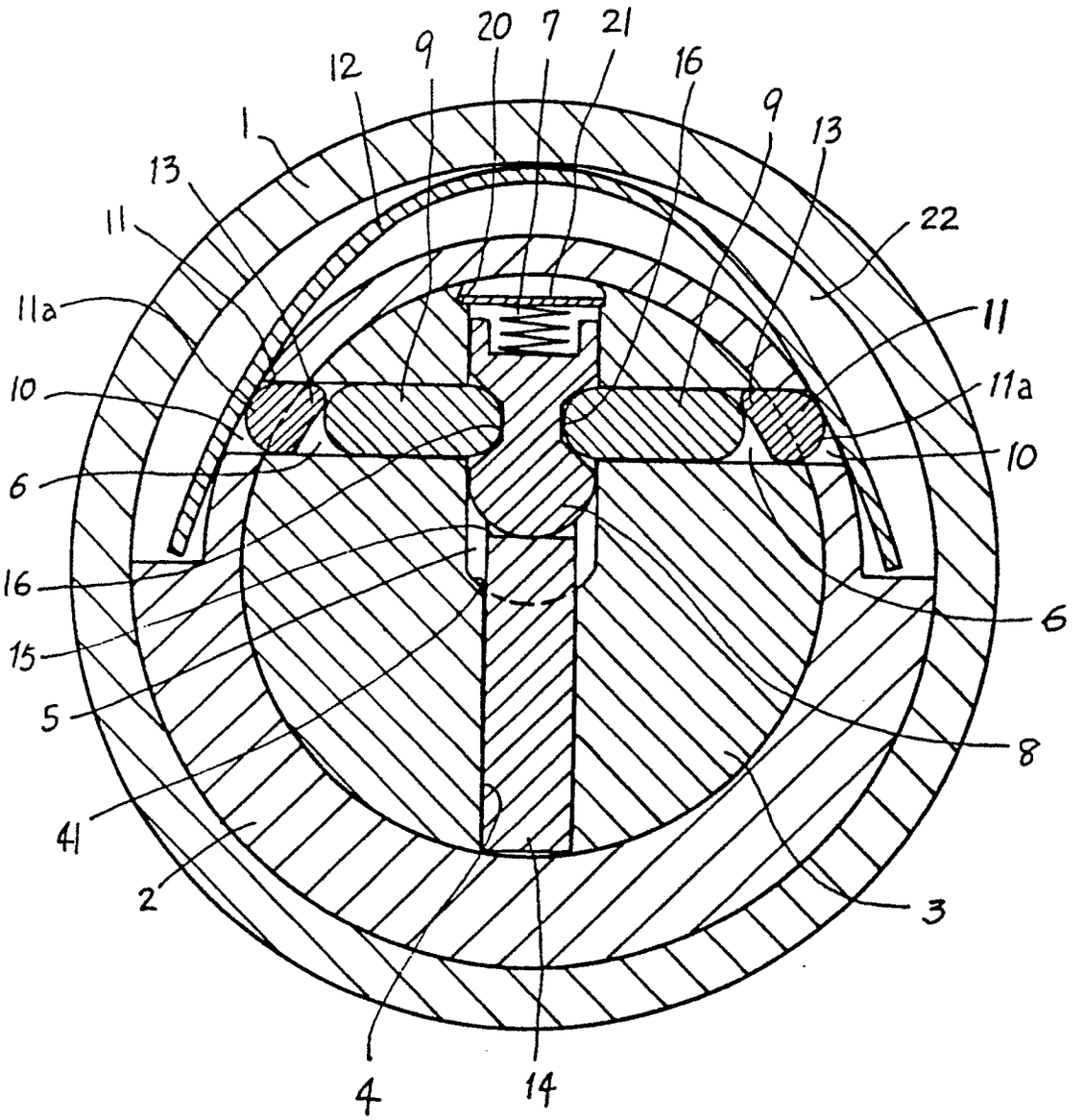


FIG. 18

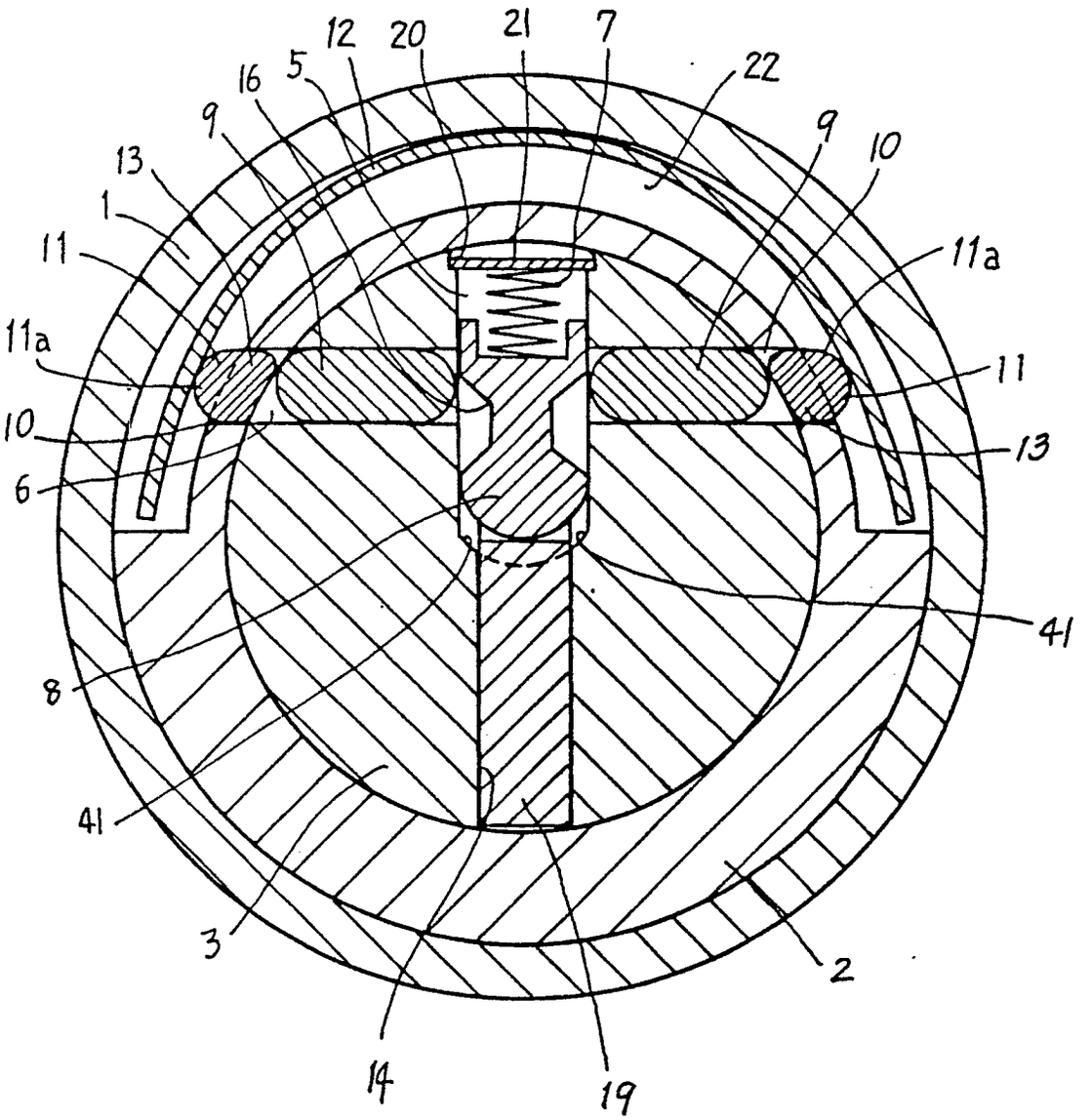


FIG. 19