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Rubner

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[54] **COMPACT CYLINDER LOCK**

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[52] **U.S. Cl.** **70/368**

[51] **Int. Cl.** **F05b 9/04**

[58] **Field of Search** ..... 70/368, 369, 367, 70/370, 364 R, 364 A, 371

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[57] **ABSTRACT**

A lock cylinder is confined against forward displacement out of a body in which it rotates by a circumferential land near its rear end, overlying the rear face of the body. Overlying the rear face of the land, a hook-shaped lug on the body prevents rearward cylinder displacement. In an assembling position of rotation the cylinder is insertable forwardly into the body because a discontinuity in the land allows it to pass the lug. The cylinder is normally confined against rotation to said assembling position by stop means comprising a stop member similar to a plate tumbler, but not key actuated, engageable with an abutment inside the body defined by a tumbler groove.

10 Claims, 7 Drawing Figures

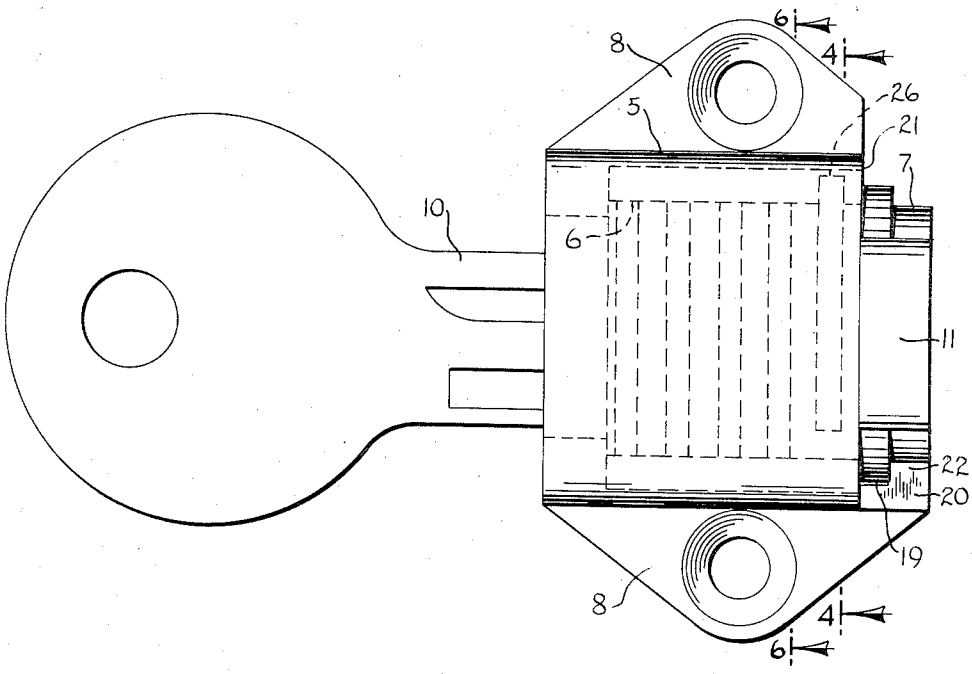


FIG. 1.

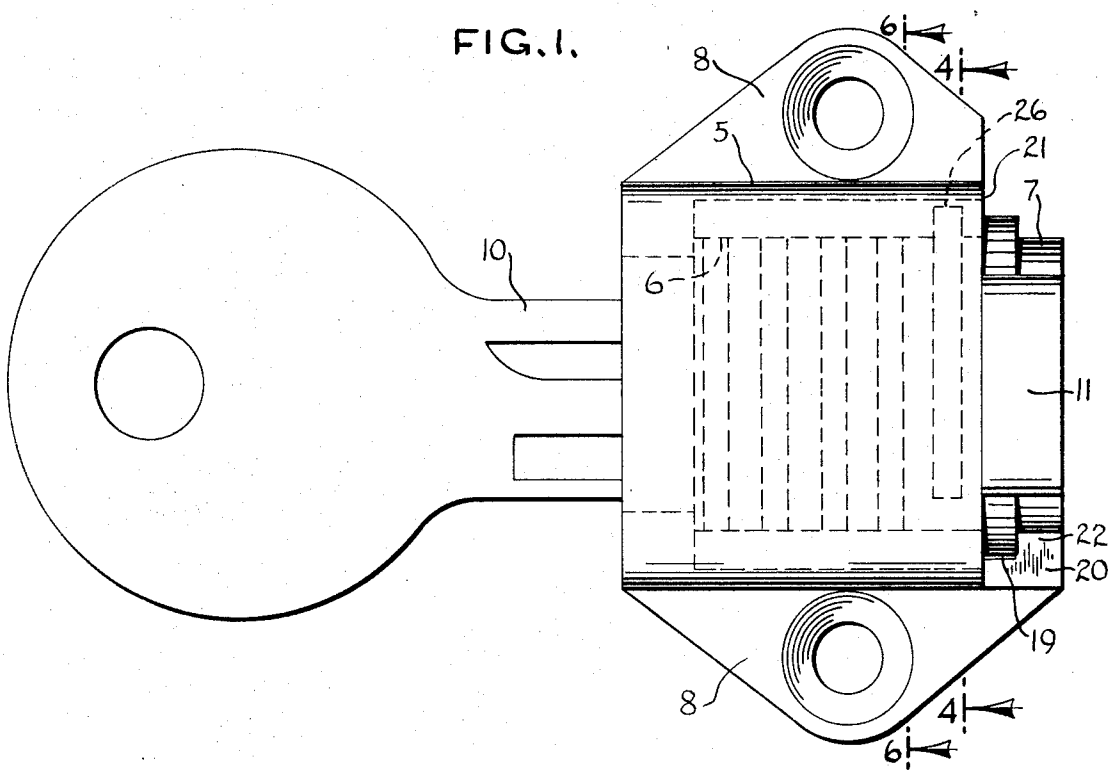


FIG. 2.

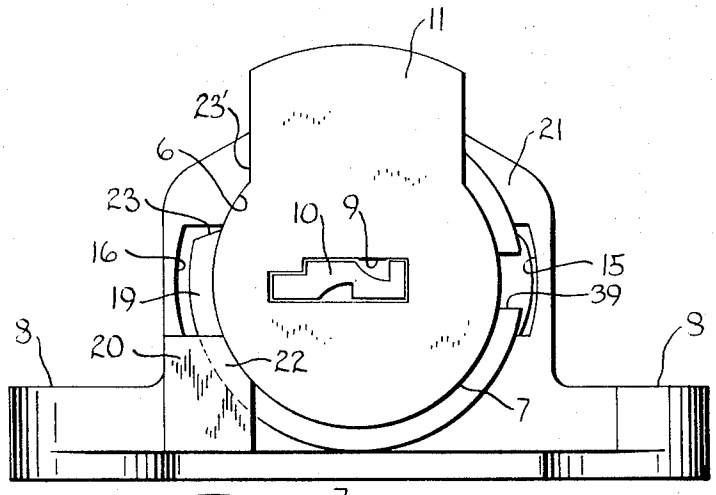


FIG. 6.

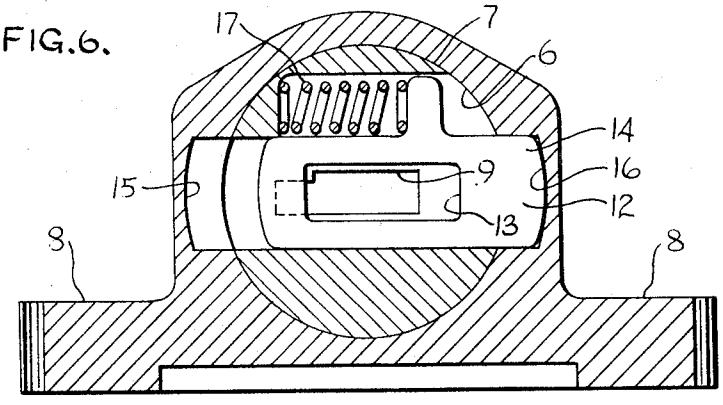


FIG. 3.

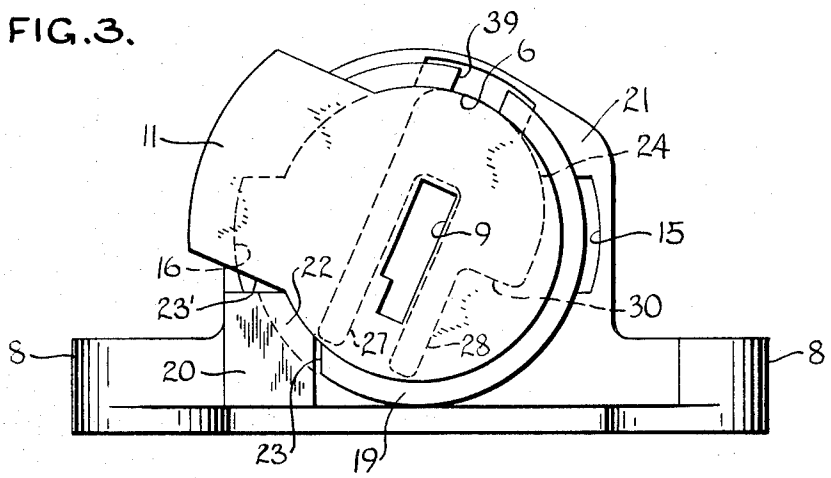


FIG. 4.

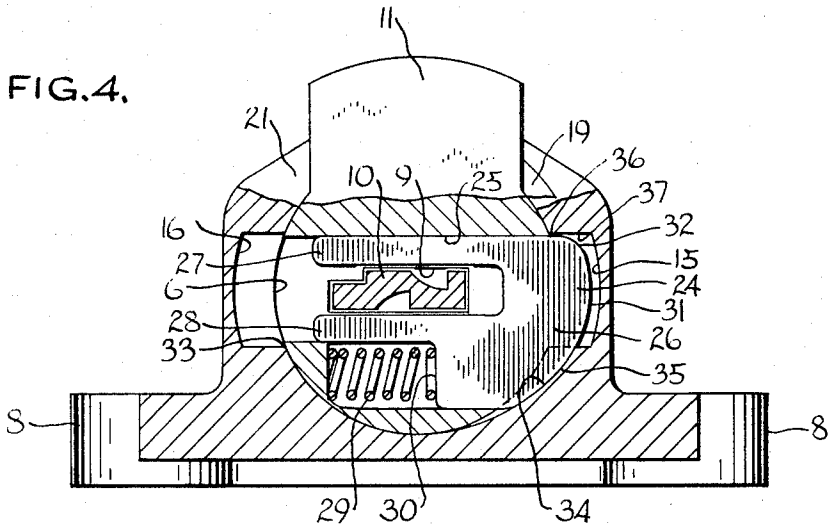


FIG. 5.

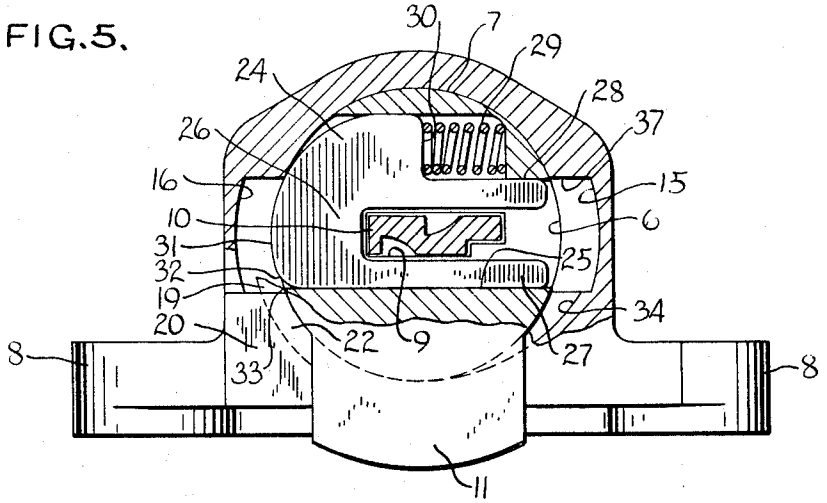
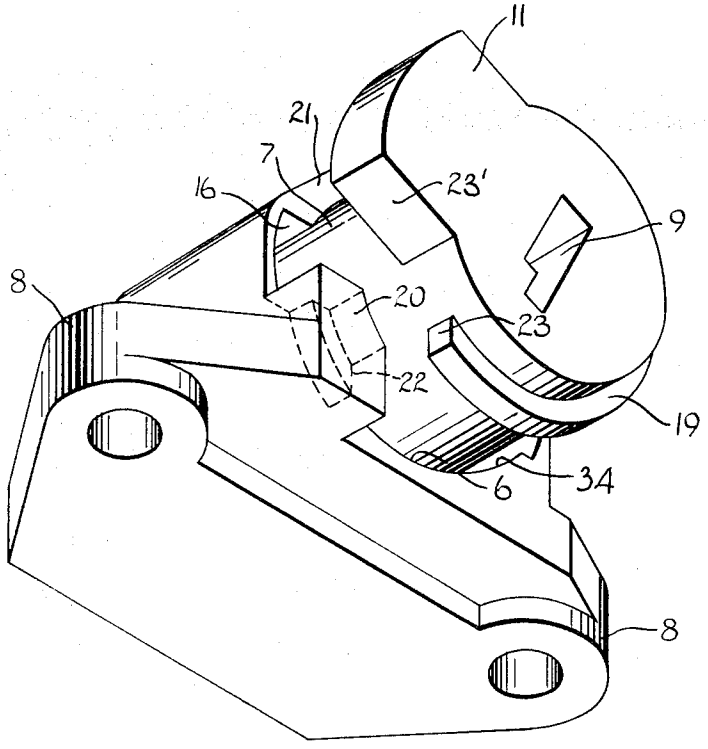


FIG. 7.



COMPACT CYLINDER LOCK

This invention relates to small cylinder locks such as are used for small cabinets, ledger books and the like, and the invention is more particularly concerned with improvements in such a lock that facilitate assembly of its cylinder into its body and normally prevent axial displacement of the cylinder out of the body.

The small locks with which the present invention is concerned are used in applications where compactness and low cost are primary requirements and high security is a secondary consideration but one that should nevertheless be achieved insofar as possible. To attain its principal objectives, such a lock should comprise a small number of easily made parts, and should be capable of being assembled quickly with minimal skills and equipment.

The general object of the present invention is to provide a small cylinder lock structure that very satisfactorily meets cost and compactness requirements and is also reasonably resistant to picking and sturdy enough to withstand all but the most violent forcing.

Another and more specific object of this invention is to provide a compact lock of the type comprising a body or casing having a bore therethrough and a cylinder or plug in which a plurality of tumbler means are confined to radial relative motion, the cylinder of said lock being insertable into the bore from one end thereof when the cylinder is in a predetermined assembling position of rotation relative to the body, and wherein a stop member carried by the cylinder normally cooperates with the body to define one of the key receiving positions of the cylinder and to prevent disassembly of the cylinder from the body by normally preventing rotation of the cylinder to said assembling position, said stop member also serving to provide a detent action as the cylinder is rotated toward and from said one key receiving position.

With these observations and objectives in mind, the manner in which the invention achieves its purpose will be appreciated from the following description and the accompanying drawings, which are intended to exemplify the invention, it being understood that changes may be made in the specific apparatus disclosed herein without departing from the essentials of the invention as set forth in the appended claims.

The accompanying drawings illustrate one complete example of an embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a plan view of a lock embodying the principles of this invention;

FIG. 2 is a view of the lock in rear elevation with its cylinder in the locked position;

FIG. 3 is a view similar to FIG. 2, but with the cylinder in its assembling position of rotation, in which it can be inserted into and removed from the body;

FIG. 4 is a view partly in rear elevation and partly in section on the plane of the line 4—4 in FIG. 1, the cylinder being shown in its locked position of rotation;

FIG. 5 is a view similar to FIG. 4, but with the cylinder shown in its unlocked key withdrawing position of rotation;

FIG. 6 is a sectional view taken on the plane of the line 6—6 in FIG. 1, but showing a tumbler in the locking position it assumes when the key is withdrawn from the cylinder; and FIG. 7 is a rear perspective view of the lock with its cylinder in its assembling position of rotation and partially removed from the body.

Referring now to the accompanying drawings, the lock of this invention comprises, in general, a body or casing **5** having a bore **6** extending therethrough, from front to rear thereof, and a cylinder or plug **7** that is rotatable in the bore in the body. As shown, the lock body has laterally extending mounting lugs **8** that provide for its securement to one of a pair of members to be locked together.

The cylinder has a key slot **9** extending axially through it. By means of a proper key **10**, inserted into the key slot from its front, the cylinder can be turned through a normal range between locked and unlocked positions of rotation, at each of which the key can be withdrawn from the cylinder. Integral with the cylinder at the rear end thereof, behind the body, is a latch or bolt **11** that projects radially beyond the body in the locked position of the cylinder (shown in FIG. 2) to perform a desired locking function.

The cylinder carries a plurality of tumblers **12** that are movable transversely to the cylinder between retracted positions at which the tumblers leave the cylinder free for rotation and locking positions in which an end portion of each tumbler projects radially beyond the circumferential surface of the cylinder and cooperates with the body to prevent cylinder rotation. Preferably they are plate tumblers which are slidable edgewise in axially spaced apart slots in the cylinder that are transverse to the key slot **9**. Each such plate tumbler has a hole **13** therethrough that registers with the key slot and through which the key extends when it is inserted into the cylinder. Each tumbler is biased radially outwardly, towards its locking position, by a small compression spring **17** that reacts between it and the cylinder.

When the cylinder is in either of its key withdrawing positions of rotation, and the key is removed, an outer end portion **14** of each tumbler projects partway out of the cylinder and into an axially extending groove **15** or **16** in the lock body. The grooves **15** and **16**, which open radially inwardly to the bore **6** in the body, are diametrically opposite one another across the bore, hence the cylinder has a normal range of rotation of 180° between its key removing positions.

Upon insertion of the key into the cylinder, its bitting cams the several tumblers to their retracted positions at which they permit the cylinder to be rotated. In intermediate positions of cylinder rotation the tumblers cooperate with the body to hold the key captive in the cylinder, as is conventional in tumbler locks.

When the cylinder is in any position within its normal range of rotation, it is confined against axial displacement out of the body by means of a circumferentially extending land **19** on its rear end portion, in cooperation with a hook-like lug **20** on the rear of the lock body. The land **19**, which is spaced a small distance forwardly of the rear end of the cylinder, flatwise overlies the flat rear surface **21** of the body and thereby prevents forward axial displacement of the cylinder relative to the body. In this respect the body also cooperates with the latch or bolt **11**, which projects radially beyond the land and which has its front surface coplanar with the front surface of the land to likewise make rotational sliding engagement against the flat rear surface of the body.

The lug **20** that normally prevents rearward displacement of the cylinder can be formed integrally with the body. It comprises a small ledge or shoulder **22** that faces the flat rear surface of the body and is spaced therefrom by a distance slightly more than the axial thickness of the land, so that said ledge can overlie the rear surface of the land as the cylinder is turned through its normal range of rotation.

One of the above mentioned key withdrawing positions of the cylinder (in this case the unlocking position illustrated in FIG. **5**) is defined by the engagement of the bolt **11** against the lug **20.** Note that the bolt is substantially thicker than the land **19,** as measured parallel to the cylinder axis, to provide for such stop engagement as well as to afford adequate strength to the bolt to enable it to withstand attempted forcing.

When the cylinder is in its assembling position of rotation illustrated in FIG. **3,** a discontinuity or gap in the land **19** is aligned with the lug **20,** and that discontinuity is large enough to clear the lug and permit the cylinder to be axially inserted into or removed from the body without interference from the lug. As shown, the gap or discontinuity exists by reason of the fact that one end **23** of the land is spaced a distance circumferentially from its adjacent side face **23'** of the bolt **11.**

The assembling position of rotation of the cylinder is outside the normal range of its rotation between key withdrawing positions. Therefore, by preventing rotation of the cylinder beyond that range, its axial rearward displacement relative to the body is prevented. As already mentioned, one of the key withdrawing positions of the cylinder is defined by the engagement of the bolt **11** against the lug **20,** and it will now be observed that in this position the lug is engaged by the side of the bolt that is opposite the above described gap or discontinuity in the land.

The other key withdrawing position is defined by a stop member **24** which is carried by the cylinder and which somewhat resembles a plate tumbler but performs no locking function. To accommodate the stop member for its sliding relative motion, the cylinder has a slot **25** which is transverse to the key slot and which can be identical with the slots in which the plate tumblers are slideable. Preferably the stop member slot **25** is the rearmost one in the cylinder.

The stop member is generally U-shaped, with a wide, deep bight portion **26** and with bifurcations or legs **27** and **28** that are disposed at opposite sides of the key slot so that the stop member straddles a key inserted into the cylinder. Note that the recess between the legs is open at the bitted edge of the key so that the stop member is not actuated by the bitting on the key during key insertion. Instead, the position of the stop member relative to the cylinder is determined by the configuration of the interior of the lock body, with which the bight portion of the stop member is normally engaged under the biasing force of a compression spring **29** that reacts between the stop member and the cylinder. The spring **29** is seated in the slot **25** in the cylinder and bears against a shoulder **30** on the stop member that projects laterally from its leg **28.**

The bight portion **26** of the stop member has its outer edge **31** curved on a compound radius. Opposite the recess between the legs **27** and **28** the radius of this edge **31** is slightly smaller than that of the bore **6,** so that the bight portion of the stop member has a tendency to project a small distance radially into the tumbler groove **16** as the cylinder is rotated in its unlocking direction (clockwise, as viewed in FIG. **5,** toward the position shown in that figure), to thereby provide a detent action that tends to assure full rotation of the cylinder to that position. The detent is particularly defined by a small radius portion **32** of that edge, which cooperates with an inwardly projecting corner **33** in the lock body (see FIG. **4**) that is defined by the junction of the tumbler groove **16** with the bore **6.**

As the cylinder is rotated away from its unlocked key withdrawing position, counterclockwise from the position shown in FIG. **5** to the position shown in FIG. **4,** the stop member enters a spirally tapering groove **34** which extends partway around the bore and which permits the stop member to move, under the bias of its spring **29,** in the direction to have its bight portion **26** project farther and farther from the cylinder with continuing rotation thereof. At its deeper end the tapering groove **34** joins the tumbler groove **15,** and accommodates a large radius edge portion **35** on the stop member to permit the stop member bight portion to project a substantial distance radially from the cylinder as the latter arrives at its locked position of rotation. In that position of the stop member, an edge portion **36** thereon that merges into the small radius edge portion **32** and is continuous with the straight outer edge of the leg **27** can abut the side surface **37** (see FIG. **5**) of the tumbler groove **15,** thus defining the locked key withdrawing position which is one of the normal limits of cylinder rotation. Note that there is a camming reaction between the bottom of the spirally tapering groove **34** and the large radius edge portion **35** on the stop member that provides a soft detent action as the cylinder is rotated towards and from the locked position.

To assemble the cylinder into the lock body, the tumblers **12** and the stop member **24** are held depressed so that they are flush with the side surface of the cylinder, and with the cylinder in its assembling position of rotation relative to the body (as shown in FIGS. **3** and **7**) the cylinder is merely inserted into the body from the rear thereof. Since the tapered groove **34** is circumferentially spaced from the portion of the bore which the tumblers and stop members tend to engage during such insertion, the cylinder assembly can be slid axially along the bore while its smooth surface retains the tumblers and stop members in their flush relationship to the cylinder.

Once fully inserted into the bore, the cylinder can be rotated to its unlocked key withdrawing position (clockwise as shown in FIGS. **3** and **4**) after which the cylinder is confined to its normal range of key propelled motion.

To provide for disassembly of the cylinder out of the lock body, as for replacement of tumblers, the land **19** on the cylinder has a second and smaller gap or discontinuity **39** that is axially in line with the bight portion of the stop member. When the cylinder is in its unlocked key withdrawing position, this gap or discontinuity is aligned with the tumbler groove **15,** and a small probe can be inserted through it to depress the stop member and tumblers so that the cylinder can be rotated to its assembling position.

From the foregoing description taken with the accompanying drawings it will be apparent that this invention provides a very compact and inexpensive cylinder lock that is well suited for small cabinets, ledger books and the like, which lock comprises a relatively

few and simple parts and can be easily assembled with a minimum of skill and equipment.

Those skilled in the art will appreciate that the invention can be embodied in forms other than as herein disclosed for purposes of illustration.

The invention is defined by the following claims:

1. In a lock comprising a lock body having a bore therethrough wherein a cylinder that carries key retractable tumbler means is key rotatable in opposite directions through a normal range between defined rotational positions, means for normally confining the cylinder to rotation in the body and providing for insertion of the cylinder into the body from the rear thereof and for its rearward withdrawal from the body, said means comprising:

A. lug-like means on the body defining a forwardly facing ledge surface which is spaced to the rear of a flat rear surface on the body that is normal to the axis of the bore;

B. a circumferentially extending land on the rear portion of the cylinder, normally slidably received between said lug-like means and said rear surface of the body to cooperate with them in confining the cylinder against axial displacement relative to the body, said land having a discontinuity which clears the lug-like means when the cylinder is in an assembling position of rotation that is outside said normal range, to provide for axial inserting and withdrawing movement of the cylinder relative to the body;

C. a stop member carried by the portion of the cylinder that is normally in said bore, said stop member being confined to movement transversely to the cylinder axis between an extended position projecting radially beyond the cylindrical surface of the cylinder and a retracted position that allows the cylinder to be axially inserted into the body;

D. biasing means reacting between the cylinder and the stop member to yieldingly urge the stop member to its extended position; and

E. the body having a groove extending circumferentially partway around its bore and opening radially inwardly thereto, said groove being radially opposite the stop member when the cylinder is normally in the bore, to receive the projecting portion of the stop member and permit rotation of the cylinder through its normal range, and the body having an abutment defined by one end of said groove which is engageable by the stop member to define one of said rotational positions at the limits of said normal range and thus prevent the cylinder from being rotated to its assembling position of rotation relative to the body.

2. The lock of claim 1 further characterized by:

the cylinder having a radially projecting bolt at its rear which normally overlies said rear surface on the body and which is engageable with said lug-like means to define the other of said rotational positions at the limits of said normal range of cylinder rotation.

3. The lock of claim 1, further characterized by:

said groove being of taperingly decreasing depth in the circumferential direction away from said abutment, to cam the stop member radially inwardly against the yielding force of said biasing means as the cylinder is rotated away from its said position defined by the abutment, thereby providing a detent action as the cylinder is rotated toward that position.

4. The lock of claim 3 wherein said abutment is circumferentially displaced around the bore from said lug, further characterized by:

said land having a second and smaller discontinuity axially in line with the projecting end portion of the stop member through which a probe can be inserted for depressing the stop member to its retracted position so that the cylinder can be rotated to its assembling position for withdrawal from the body.

5. In a lock comprising a lock body having a bore therethrough and axially extending circumferentially spaced apart tumbler grooves in said bore, a cylinder which carries key actuatable tumblers and which is rotatable in said bore through a normal range between key releasing positions at each of which the tumblers can project partway into one of said grooves, and cooperating means on the cylinder and on the body for defining one of said key releasing positions and which are normally slidingly interengaged to prevent axial displacement of the cylinder relative to the body, said cooperating means being disengageable upon rotation of the cylinder to an assembling position that is outside said normal range to permit the cylinder to be axially inserted into and withdrawn from the body:

A. a stop member received in a portion of the cylinder that is normally within the bore, and which is confined to motion relative to the cylinder in opposite directions transverse to its axis between a projected position in which an end portion of the stop member projects radially beyond the side surface of the cylinder and a retracted position;

B. biasing means reacting between the cylinder and the stop member to urge the latter toward its projected position;

C. the body having a circumferentially extending groove that receives said end portion of the stop member when the cylinder is within its normal range of rotation, and having a circumferentially facing surface that is engageable by the stop member to define the other of said key releasing positions;

D. said stop member being flat and being slidable edgewise in a slot in the cylinder that is transverse to the cylinder axis; and

E. said stop member being substantially U-shaped, with legs disposed at opposite sides of the key slot and with its bight portion comprising its said end portion.

6. A lock comprising a lock body having a bore and a cylinder therein rotatable in opposite directions through a normal range between defined rotational positions, characterized by:

A. first cooperating stop members on the body and the cylinder to define one of said rotational positions;

B. second cooperating stop members on the body and the cylinder to preclude axial displacement of the cylinder from the bore in one direction except upon rotation of the cylinder toward and beyond the other of its said rotational positions to a disassembly position outside of said normal range; and

C. means other than said first and second stop members providing third cooperating stop members on the body and the cylinder to define the other of

said rotational positions of the cylinder, one of said third stop members being movable relative to all of the other stop members to an inoperative position to enable the cylinder to be rotated beyond its said other rotational position to said disassembly position thereof.

7. The lock of claim **6**, further characterized by:

A. said cylinder having a number of identical tumbler slots and key operable tumblers mounted in all but one of said slots;

B. and said one stop member being movably mounted in the remaining tumbler slot.

8. The lock of claim **6** wherein said bore opens to the front and to the rear of the lock body; and said first and second stop members are located at the rear of the body.

9. The lock of claim **5**, wherein said circumferentially extending groove has a junction with one of said tumbler grooves, and taperingly increases in depth toward said junction, and wherein the side surface of said tumbler groove that is opposite said junction defines said circumferentially facing surface that is engageable by the stop member.

10. The lock of claim **9**, further characterized by:

A. the bight portion of the stop member having an abutment edge portion that engages the side surface of said one tumbler groove that is opposite the junction of said circumferentially extending groove with said tumbler groove, to define said other key releasing position of the cylinder; and

B. the bight portion of the stop member having a curved edge portion that extends from said abutment edge portion and is receivable partly in said one tumbler groove and partly in said circumferentially extending groove when the cylinder is in said other key releasing position.

* * * * *