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Babb, Jr. et al.

[11] **3,800,573**

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[54] **FREE INSIDE KNOB LOCK SET**

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[52] **U.S. Cl.** **70/217,** 292/359

[51] **Int. Cl.** **E05b 13/08,** E05b 13/10

[58] **Field of Search** 292/169.14, 169.17, 359; 70/146, 152, 153, 216, 223, 217

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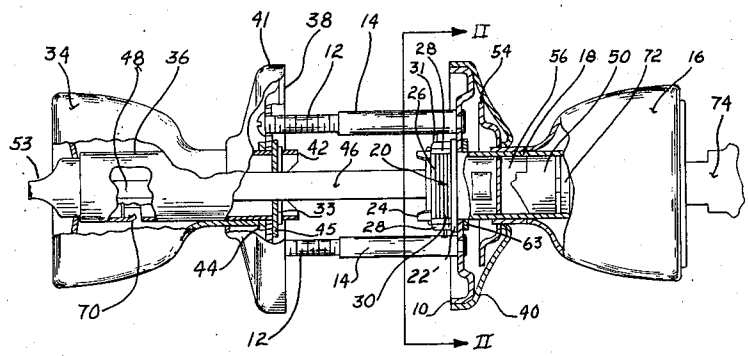
[57] **ABSTRACT**

Locking mechanism including a cam-actuated locking plate shiftable between engaging and nonengaging locking positions to lock an outside knob while the inside knob remains free to open the latching mechanism. When in its unlocked position, the plate is rotatable with the outside knob so that the door latch may be operated in a conventional manner. When shifted to its locked position, the plate fixed to the knob is moved by a cam mechanism into an engaging position with supporting structure such that the knob cannot be turned. The inside knob, however, remains free and operates the conventional latching mechanism without regard to the position of the locking plate.

5 Claims, 8 Drawing Figures



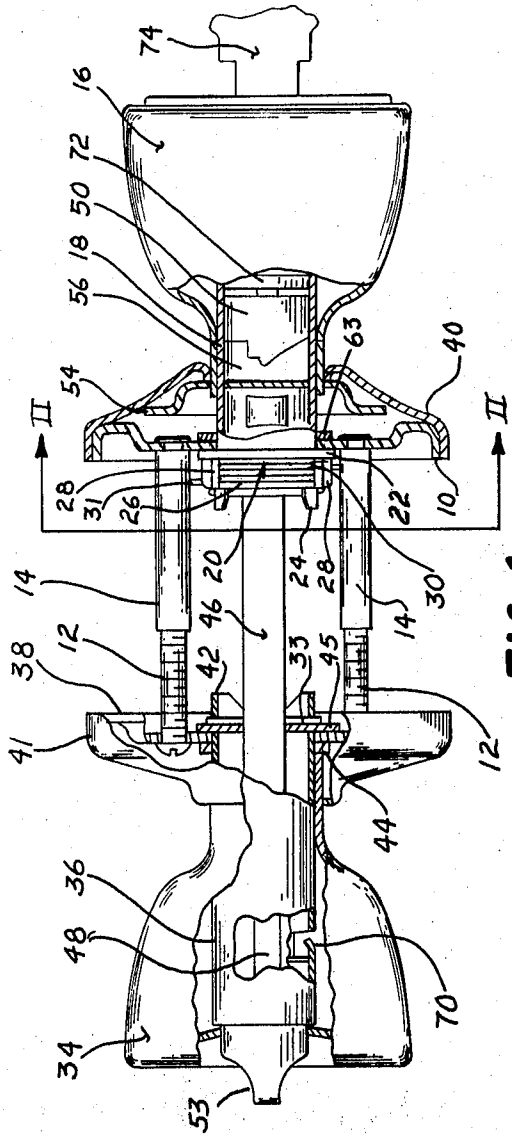


FIG. 1.

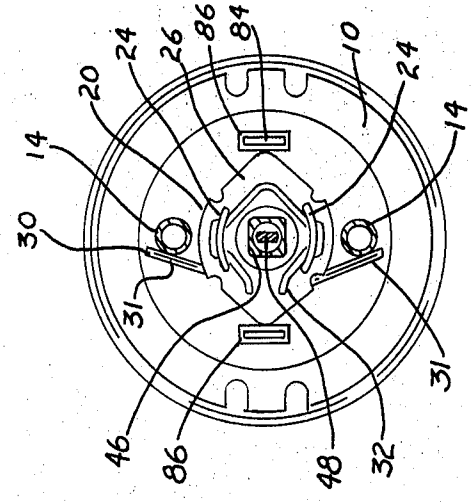


FIG. 2.

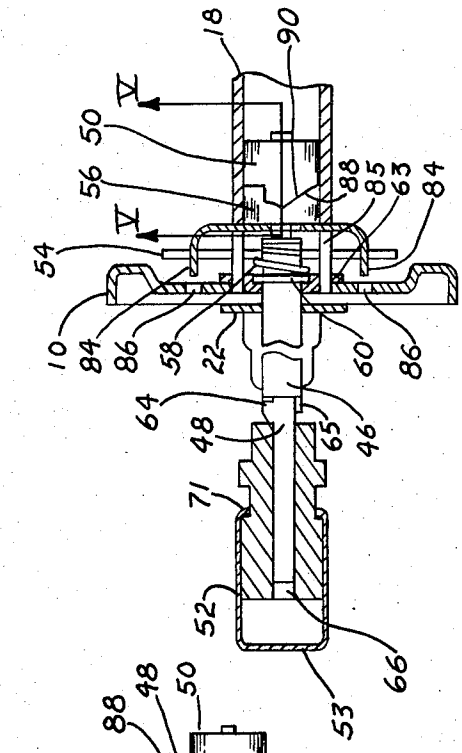


FIG. 3.

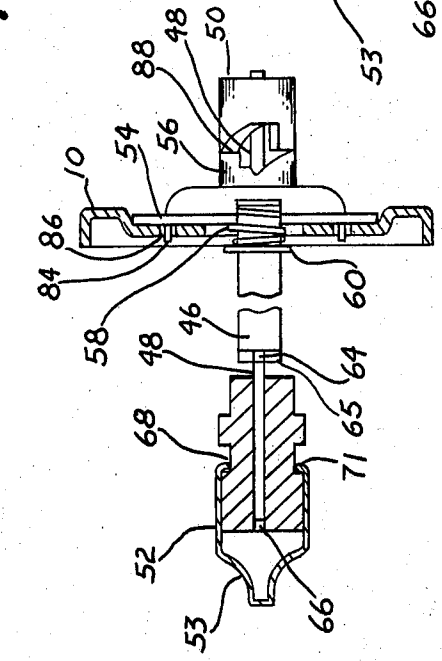


FIG. 4.

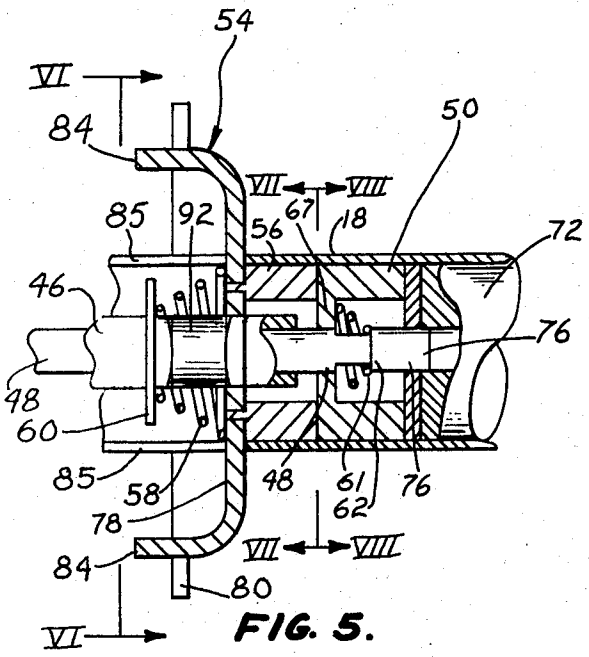


FIG. 5.

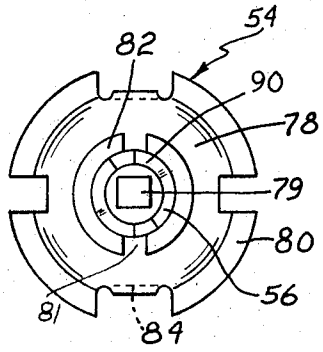


FIG. 7.

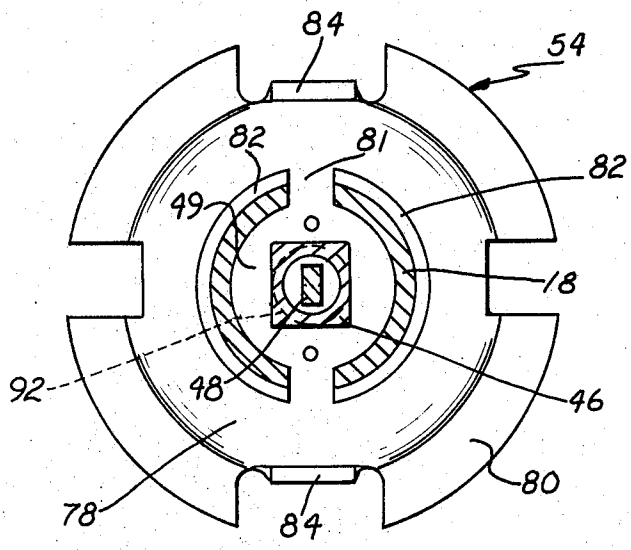


FIG. 6.

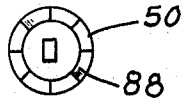


FIG. 8.

FREE INSIDE KNOB LOCK SET

BACKGROUND OF THE INVENTION

This invention relates to a free inside knob lock set which may be locked and unlocked through an actuator on the inside knob and unlocked by a key positioned on the outside knob. When locked, the outer knob remains fixed such that the latching mechanism cannot be operated. The inside knob, however, is free to turn and to operate the latching mechanism without releasing the lock.

In the known prior art constructions, locking of the lock set from the inside requires that the lock be released before the door can be opened. In some constructions, the lock is automatically released as the inside knob is turned while in other constructions, the lock must be manually released. In either event, when the door is again closed, the lock must be reset in order to prevent operation of the outside knob. In many applications, it is desirable to provide a door which remains locked from the outside, can be operated from the inside, and yet, which will remain locked from the outside without resetting the locking mechanism. Prior art structures disclosing conventional lock-setting mechanisms are exemplified in U.S. Pat. Nos. 3,011,331 and 3,025,096 to which reference may be made for a better understanding of the prior art. As disclosed in these prior art patents, it is not possible to open the door from the inside without eliminating or destroying the locking function, thereby requiring that the lock be reset each time the door is opened.

SUMMARY OF THE INVENTION

The present invention overcomes the inherent disadvantages of the prior art as outlined above in its provision of a lock set which is shiftable between locked and unlocked positions by means of a cam operated by a latch actuator and which when locked may be released by a key from the outside or by a latch actuator from the inside. When locked, the inside knob remains free to open the door without destroying the locking function while the outside knob remains in a locked position and can only be operated from the outside by a key. In the unlocked position, both the inside and outside knobs are free to turn and operate the latching mechanism. The locking mechanism includes a cam-operated locking plate shiftably mounted to unexposed structures on the outside knob and shiftable between locking and nonlocking positions with respect to supporting structures for the lock. When unlocked, the locking plate is rotatable with the outside knob. When in a locked position, the locking plate engages the supporting structure and the outside knob such that it is not free to rotate. The inner knob is free to rotate in either the locked or unlocked position to operate the latching mechanism within a door panel.

Accordingly, it is a primary object of the present invention to provide a lock set for a door panel having means therein providing a free inside knob while the outside knob is locked.

It is another object of the present invention to provide a lock set wherein a door may be operated from the inside without disruption of the locking function so that the door will remain locked from the outside.

Another object of this invention is to provide a simplified free inside knob lock set. The lock set has a unique locking plate arrangement. The locking plate is specially axially shiftable under the influence of a cooperative camming device. The camming device is selectively operable from the exterior with a key and selectively operable from the interior with a twist lock actuator in the knob. The locking plate can be so shifted axially by simple rotation of the interior twist lock actuator without requiring axial movement of this actuator.

Another object of this invention is to provide a free inside knob lock set which can be readily mounted to different thickness doors, e.g., over the common range of 1-5/16 inch to 1-13/16 inch thickness without complex tie bolts and the like or careful adjustment as with present complex devices.

These and other important aspects, objects and advantages of this invention will become apparent to those skilled in the art from a study of this disclosure, the drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the accompanying drawings in which:

FIG. **1** is an elevational view partially in cross section, illustrating the locking mechanism and supporting assembly in the unlocked position;

FIG. **2** is a cross-sectional view taken along the plane II—II of FIG. **1**;

FIG. **3** is a partial sectional view of the inside end of the locking mechanism illustrating the assembly in unlocked condition;

FIG. **4** is a view similar to FIG. **3** partially in cross section, illustrating the locking mechanism in a locked condition;

FIG. **5** is an enlarged cross-sectional view of the cam mechanism and locking plate taken along the plane V—V of FIG. **3**;

FIG. **6** is an enlarged side view of the locking plate construction shown in FIG. **5** as viewed along the plane VI—VI;

FIG. **7** is a plan view of the locking plate and cam follower mechanism taken along the plane VII—VII of FIG. **5**; and

FIG. **8** is a plan view of the cam member which operates the locking plate and cam follower shown in FIG. **7**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and in particular to FIGS. **1** and **2**, the outer knob support structure includes a plate **10** which is normally fixed about an opening in a door panel and is held in position by engagement of screws **12** with internally threaded stud members **14** permanently affixed to the plate. The outer knob **16** includes an axially extending central tubular member **18** which is rotatably mounted in the fixed plate **10**. The tubular member **18** is maintained in fixed axial relationship with plate **10** by the combined action of a bias spring retainer assembly **20**. The retainer assembly includes a first washer **22** having slots therein engageable with a pair of projections **24** extending from the outer extremity of the tubular member **18**. The bias spring retainer assembly **20** also includes an outer washer **26** having a pair of inwardly turned arms **28** abutting the washer **22** but holding portions of it slightly spaced therefrom to form a housing **20** in which a torsion bias spring **30** is positioned. Bias

spring 30 includes a pair of outwardly directed ends or arms 31 abutting the oppositely positioned stud members 14. Thus, the spring operates on tubular member 18 to return member 18 and knob 16 to a normal position when it is rotated in either direction and released. The bias spring return housing 20 is fixed to the tubular portion by a snap ring 32 extending into slots provided on projection 24. When knob 16 is rotated either clockwise or counterclockwise from the normal position, one of the arms 31 of spring 30 acts on studs 14 to return the knob to its central normal position.

Covering members on rose plates 40 and 41 are positioned over mounting plates 10 and 38 respectively. Rose plate 40 is preferably staked in place on the outside mounting plate 10 so that it cannot be removed to thereby prevent tampering with the lock mechanism. Rose plate 41 is snapped into position on mounting plate 38 after the assembly is mounted to the door panel and prior to installation of inner knob 34.

The inner knob tubular member 36 includes a pair of axially extending arms 42 extending through a pair of washers 44 and 45 positioned on each side of plate 38 for rotation in plate 38. A locking ring 33 similar to locking ring 32 previously described in connection with FIG. 2 is used to hold the assembly together by locking engagement with slots in the extending arms 42. The inner knob 34, tubular member 36, and washers 44 and 45 are fixed and rotate together. Washer 45 has a central opening therein through which a square tubular operating shaft or spindle 46 is passed such that rotation of the inner knob causes a corresponding rotation of operating shaft or spindle 46.

The spindle 46 is freely mounted for rotation about a latch actuator shaft or locking bar 48. As will be more fully described hereinafter, locking bar 48 extends substantially the entire length of the housing and through the hollow center of the spindle 46. A cam actuator 50 is fixed at one end of locking bar 48 within tubular member 18 and within outer knob 16. The opposite end of locking bar 48 is slidably received in a lock knob 52 which is rotatably mounted in tubular housing 36 within inner knob 34 and extends from the outer face thereof.

Referring additionally to FIGS. 3 and 5, a locking plate 54 having a cam-engaging mechanism, i.e., cam follower 56 fixed thereon is slidably mounted and resiliently fixed with respect to the end of the spindle 46. A locking ring 60 positioned in a recess formed in the outer surface of spindle 46 holds one end of a torsional bias spring 58 while its opposite end abuts the central portion 49 (FIG. 6) of locking plate 54. The locking ring 60 also abuts a washer 63 positioned about the tubular member 18 and prevents removal of the spindle from the assembly. A cam actuator 50 fixed at the end of locking bar 48 is mounted for axial movement on the end of locking bar 48. This cam actuator 50 is biased into engagement with cam mechanism 56 by means of a cam bias spring 61 (FIG. 5). Bias spring 61 is positioned in a recess formed in the inner diameter of cam 50 and abuts an inner wall 67 formed in its central portion. The opposite end of spring 61 is held in position by a pair of radially outwardly directed extensions 62 formed by a notch near the end 76 of locking bar 48.

Referring again to FIGS. 3 and 4, excessive rotational movement of locking bar 48 with respect to spindle 46 is prevented by the abutment of an outwardly extending tab 64 against a notch or step 65 provided at the end of the spindle 46 opposite from the locking plate 54. The lock knob 52 has an axially extending slot 66 formed therein to receive and embrace locking bar 48. The end of bar 48 is slidably received in elongated opening 66, and spindle 46 is slidably engaged by the previously mentioned washer 45, such that the assembly may be readily mounted in door panels of varying thicknesses without any adjustments or complexities. The lock knob 52 further includes an annular depression 68 formed in its outer diameter for abutment with a tab 70 (FIG. 1) formed in inner knob tubular member 36 to prevent its outward movement. The lock knob includes an outer decorative casing or cover 53 formed of metal and fixed in place by tabs 71 folded over in the depression 68.

A key-operated tumbler lock 72 (FIG. 1) is positioned within outer knob 16 in a conventional manner and is adapted, in response to the insertion and turning of a key 74, to engage an outermost end 76 of the actuator bar 48 to shift the locking plate 54 as will be more fully described hereinafter.

As best illustrated in FIGS. 5, 6, and 7, the locking plate 54 is generally disc-shaped, having a recessed central surface area 78 tapering upwardly to form an outer circular peripheral flange 80. A pair of arcuate-shaped slots 82 in the central portion define a spindle engaging portion 49 including a square-shaped opening 79 therein through which spindle 46 projects. The central portion 49 is connected to recessed surface 78 of the locking plate by opposed webs or spokes 81. A pair of locking tabs 84 are formed in the radial flange 80 and extend outwardly with respect to recessed portion 78. The tabs 84 are arranged for engagement in a pair of corresponding recesses or slots 86 in the surface of mounting plate 10 (FIGS. 2, 3, and 4) when in a locked position.

The cam follower 56 may be formed of Nylon or the like and is fixed to central portion 49 of the locking plate 54 and extends axially into tubular member 18 fixed in the outer knob. Axially extending slots 85 on the tubular member slidably receive the web or spokes 81 so that the locking plate may slide axially of tubular member 18 but is in rotatable engagement therewith.

The cam 50 and cam follower 56 illustrated in plan view in FIGS. 7 and 8 include a pair of interengageable cam faces 88 and 90 (see also FIG. 4) having axially and circumferentially extending, cooperative, sloped faces arranged such that rotation of one with respect to the other causes axial movement between the cam and cam follower to move them away from each other with rotation in one direction, and toward each other with rotation in the other direction. Adjacent each of these cooperative, sloped faces are flat abutment faces normal to the axis of the mechanism so that, after these cam elements are shifted apart the maximum amount, these flat faces come into abutment and are retained thereby by the now compressed spring 58. In other words, the camming shaft device is fully axially extended when the locking plate is engaged and fully axially contracted when the locking plate is disengaged. The square spindle 46 includes a portion of reduced diameter 92 (FIG. 5) into which locking plate 54 is biased when moved into a locking position.

OPERATION

The operation of the latching mechanism is best illustrated with reference to FIGS. 3 and 4. Referring first to FIG. 3, the assembly is shown in an unlocked position. The locking plate 54 is biased outwardly on spindle 46 by bias spring 58 as cam faces 88 and 90 are matched and in full complementary engagement with each other. When in this position, rotation of inner knob 34 will cause a corresponding rotation of spindle 46 and outer knob 16. This is accomplished through the interengagement of inner knob 34 with spindle 46 through washer 45 which engages both the tubular member 36 and the spindle. The outer knob 16 is also operably connected to spindle 46 because of its engagement through locking plate 54. As previously described, central portion 49 of locking plate 54 has a square opening 79 in the central portion thereof (FIGS. 6 and 7) which engages the square surface of spindle 46. The outer knob is also operatively connected to locking plate 54 through tubular portion 18 where the sides of the slots 85 engage webs 81 formed on locking plate 54. Consequently, rotation of either the inner knob or the outer knob causes a corresponding rotation of the other through spindle 46.

To shift the assembly into a locked position as illustrated in FIG. 4, locking knob 52 is simply rotated 90°. This in turn causes a corresponding rotation of locking bar 48 and cam 50 fixed at the opposite end of locking bar 48. As cam 50 rotates, cam surfaces 88 and 90 move out of engagement with each other, causing them to spread axially apart with respect to each other to thereby move locking plate 54 axially along spindle 46 until axially extending tabs 84 engage corresponding slots 86 provided in fixed mounting plate 10. The spindle 46 does not, however, move axially with respect to locking bar 48 because the locking ring 60 abuts washer 63 (FIG. 3). When the latch is shifted into the position shown in FIG. 4, square opening 79 provided in the central portion of locking plate 54 has been moved into the reduced diameter portion 92 (FIG. 5) of spindle 46 such that the spindle is free to rotate with the inner knob about locking bar 48 and in opening 79. The outer knob 16, because of its engagement with locking plate 54 through spokes 81 with tubular member 18 is solidly fixed by the engagement of tabs 84 with slots 86 in mounting plate 10. The inner knob is thus free to rotate for operation of the latch mechanism while the outer knob is fixed and not able to operate the mechanism.

To unlock the assembly, all that is required is to rotate the locking bar 48 back to its original position to allow the cam surfaces to axially move together into their original engaging position thereby shortening the overall axial length of the camming device. Rotation of the shaft may be simply accomplished by turning locking button 52 at the inner knob or by rotation of the appropriate key 74, causing lock 72 to engage and turn end 76 of locking bar 48. In either case, lock plate 54 is allowed to move axially outwardly with respect to plate 10 as cam faces 88 and 90 return to their original engaging position. As the locking plate moves outwardly, square portions of spindle 46 engage the cooperative square opening 79 in the lock plate. In this position, rotation of either of the knobs will again cause rotation of the other and a corresponding rotation of spindle 46.

From the foregoing description and drawings, it will become readily apparent to those skilled in the art that the present invention provides a unique lock set wherein the inside knob remains free to operate the latching mechanism without regard to the locked or the unlocked condition of the outer knob. In addition, when locked, operation of the latch from the inside knob will not release the locking condition at the outside knob, so that the assembly will remain locked with respect to the outside knob. The locking function is released, however, by simply turning the locking knob or through the use of a key-operated lock from the outside knob. The unique cam-operated locking plate structure described herein is extremely efficient in its operation, temper-proof, and contains a minimum number of relatively simple operating components. The assembly, therefore, is relatively simple as compared to the prior art devices resulting in lower manufacturing costs with corresponding savings to the consumer and maximum adaptability to different width doors.

While the preferred embodiment of the invention has been illustrated and described, it will be recognized to those skilled in the art that other embodiments and modifications of the invention incorporating the teachings hereof may be readily made in light of this disclosure. All modifications employing the principles of this invention are therefore considered as included in the appended claims unless these claims by their language expressly state otherwise.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a lock set having an inner knob; an outer knob; supporting means for said knobs positionable on opposite sides of a door panel; and a latch actuator extending between said knobs, said actuator being operatively fixed to said inner knob for rotation therewith; the improvement comprising:

engaging means operatively associated with said outer knob and said latch actuator, said engaging means shiftable to effect engagement and disengagement of said outer knob with said actuator; said engaging means including a plate member mounted for sliding movement axially with respect to said outer knob and said actuator, said plate member fixed for rotation with said outer knob;

biasing means normally biasing said plate into engaging position with said actuator;

shifting means operable on said plate member to effect disengagement of said plate member with said actuator; and

locking means cooperable with said engaging means, said locking means being shiftable and when shifted, being engageable with said supporting means to fix said outer knob with respect thereto while simultaneously effecting disengagement of said outer knob with said latch actuator whereby said outer knob remains fixed with respect to said support means while said inner knob remains free to rotate with said latch actuator.

2. The apparatus as defined in claim 1 and further including means for shifting said engaging means, said shifting means including a cam; means for rotating said cam; and a cam follower on said engaging means engageable with said cam, rotation of said cam shifting said engaging means to effect engagement and disengagement of said outer knob with said actuator.

3. The apparatus as defined in claim 2 wherein said outer knob includes a tubular housing rotatably mounted on said support means; said cam and cam follower are positioned in said tubular housing, and said plate means is slidably mounted on said housing.

4. Locking mechanism for a lock set including an inner knob, an outer knob, a latch actuator spindle supported between said knobs, said spindle being operatively connected to said inner knob for rotation therewith, and supporting means adapted for placement on opposing sides of a door panel adjacent said inner and said outer knobs for rotatably supporting same, the improvement comprising:

shiftable connecting means for effecting engagement and disengagement of said outer knob with said spindle;

cooperable locking means on said supporting means and said connecting means, said locking means including a pair of axially directed arm members on said connecting means, said supporting means including a pair of slots therein to receive said arm members to effect locking engagement therebetween when said connecting means is shifted to effect disengagement of said outer knob with said spindle whereby said outer knob is fixed while said inner knob and said spindle remain free to rotate;

means supporting said connecting means for axial movement with respect to said outer knob and said spindle;

means for axially shifting said connecting means between engaging and nonengaging positions, said shifting means including a cam on said connecting means and a cam follower; and

a locking bar connected to said cam and extending through said inner knob, rotation of said locking bar causing axial movement of said connecting means to thereby shift said locking means between said positions.

5. The lockset as defined in claim 4 and further including stop means on said locking bar and stop abutment means on said spindle whereby to prevent excessive rotation of said locking bar when shifting said locking means between said positions.

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