March 20, 1956 J. A. TORNOE 2,738,666

LOCKING MECHANISM

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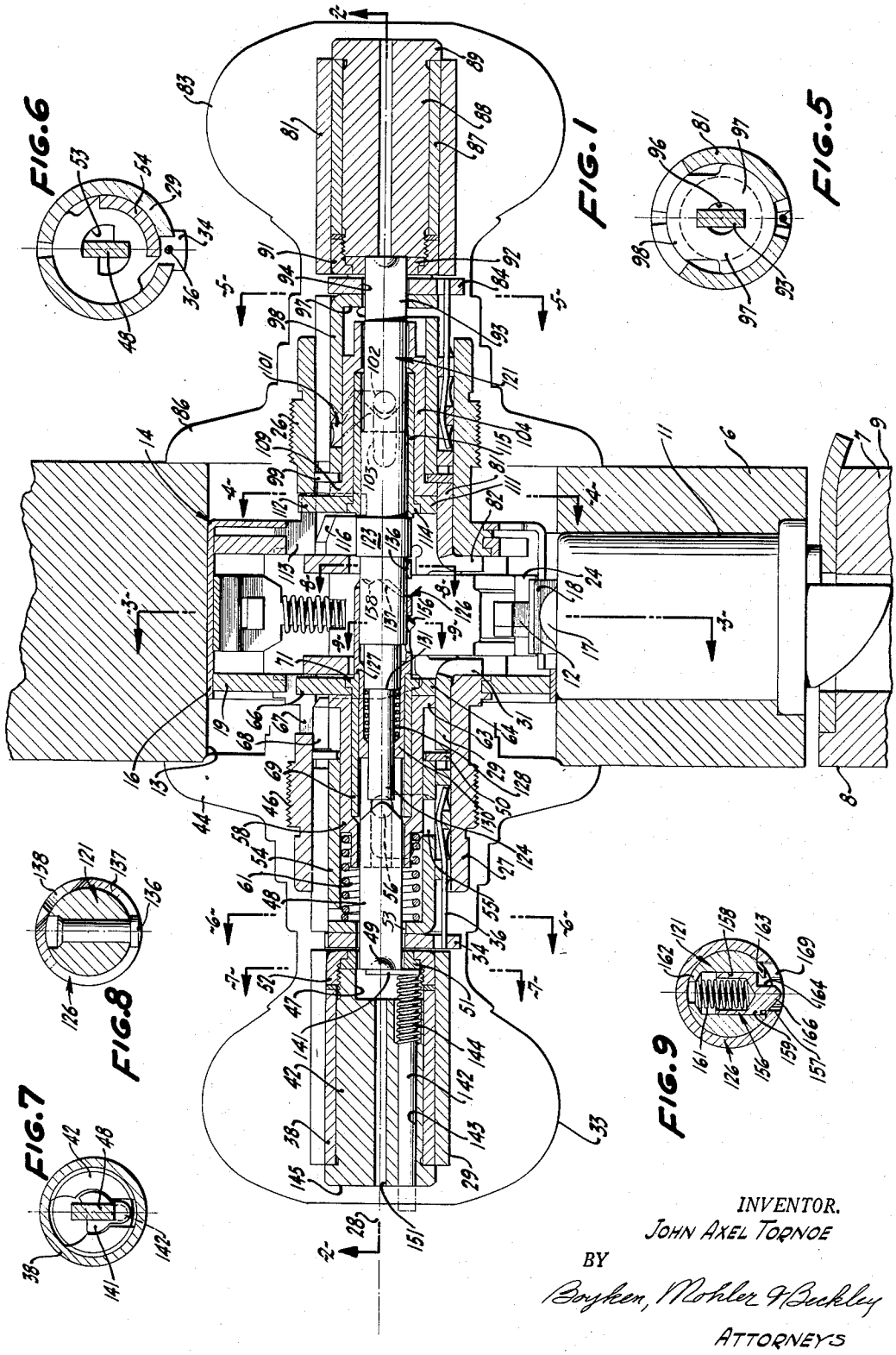


FIG. 1

FIG. 6

FIG. 5

FIG. 8

FIG. 7

FIG. 9

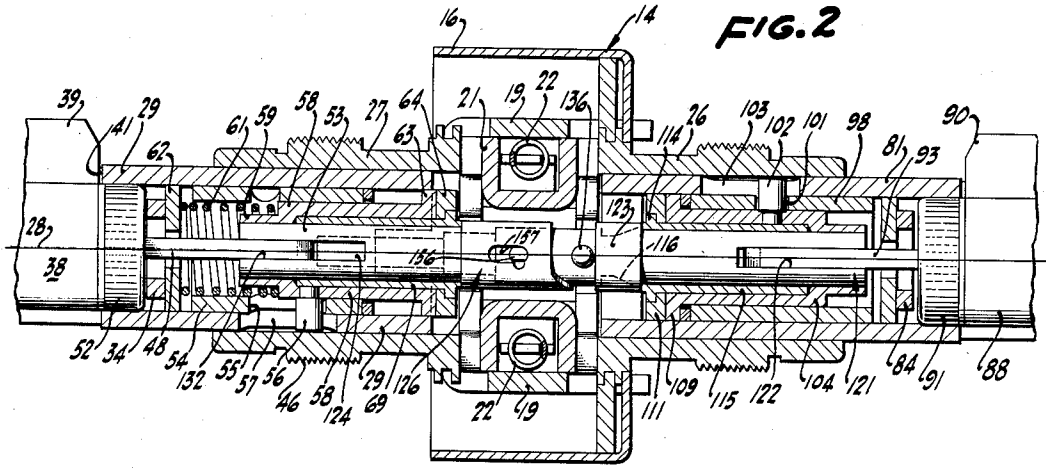
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LOCKING MECHANISM

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FIG. 2



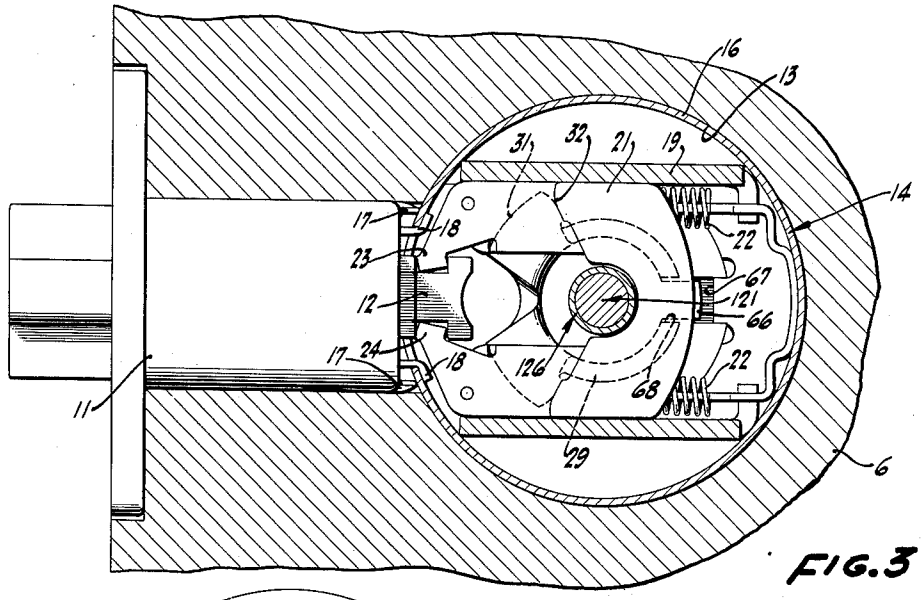


FIG. 3

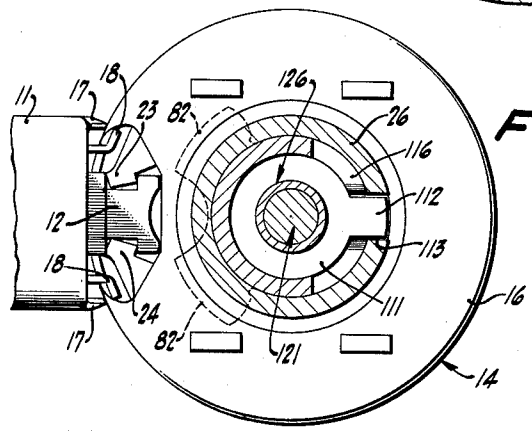


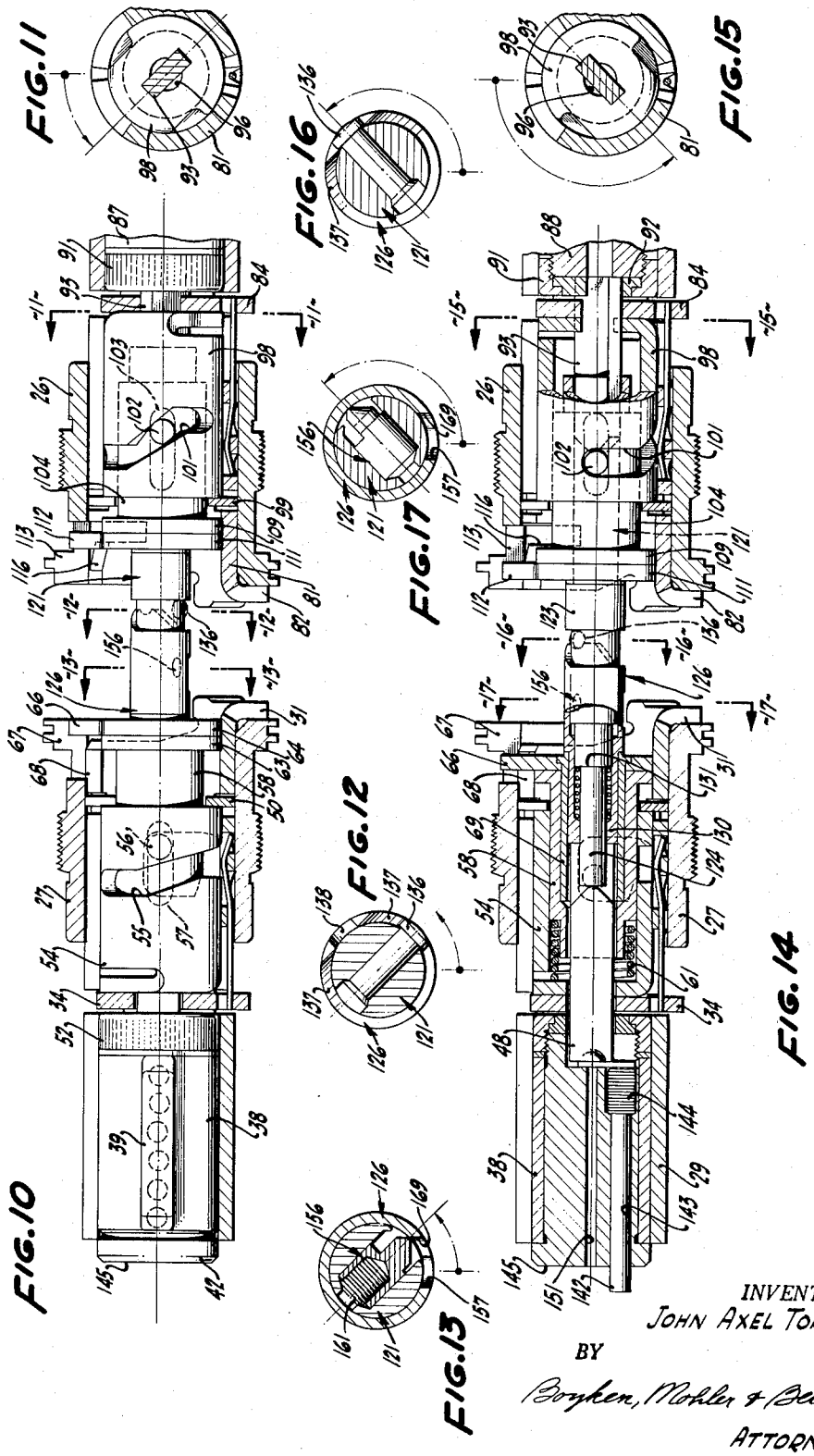
FIG. 4

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LOCKING MECHANISM

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LOCKING MECHANISM

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FIG. 18

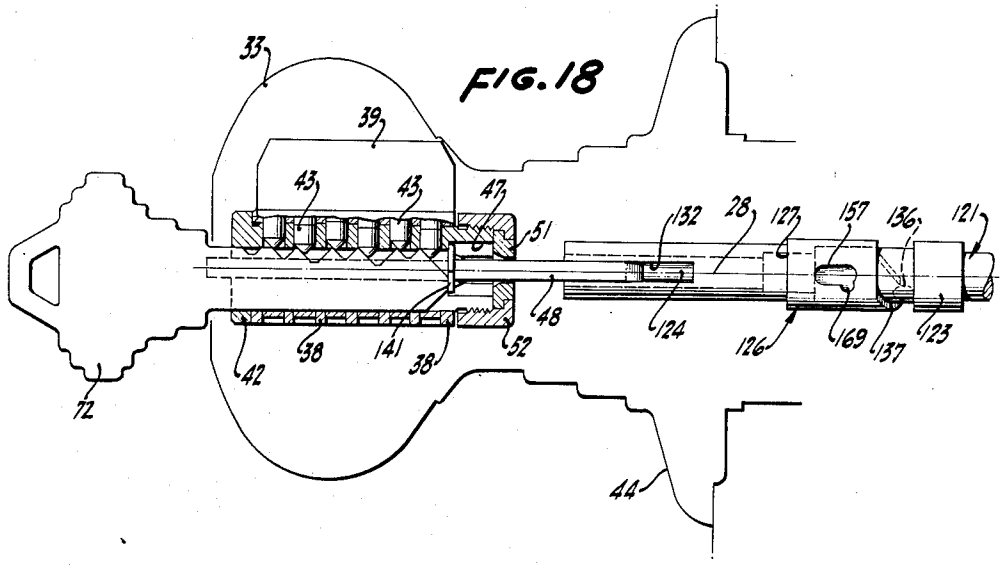


FIG. 19

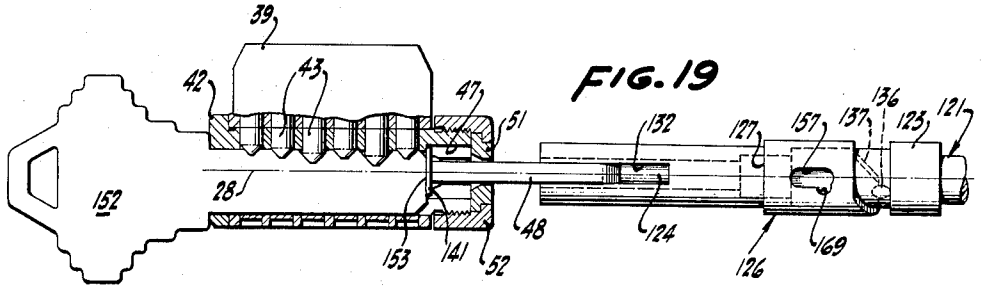


FIG. 22

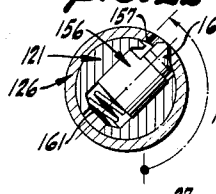


FIG. 21

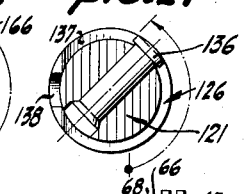


FIG. 24

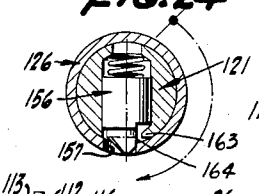
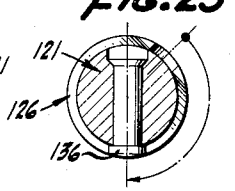


FIG. 23



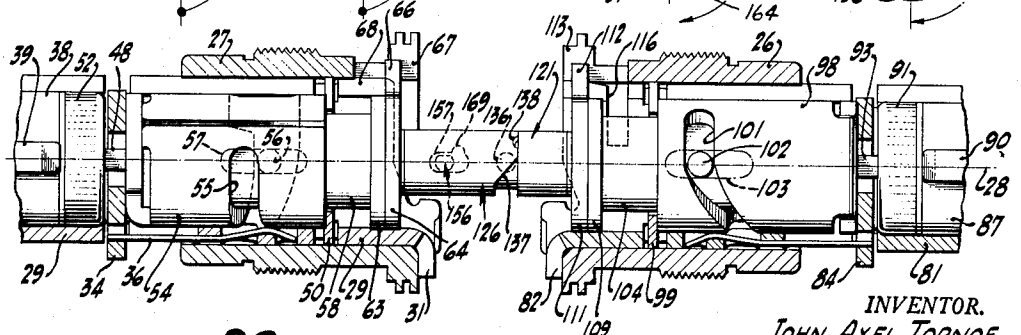


FIG. 20

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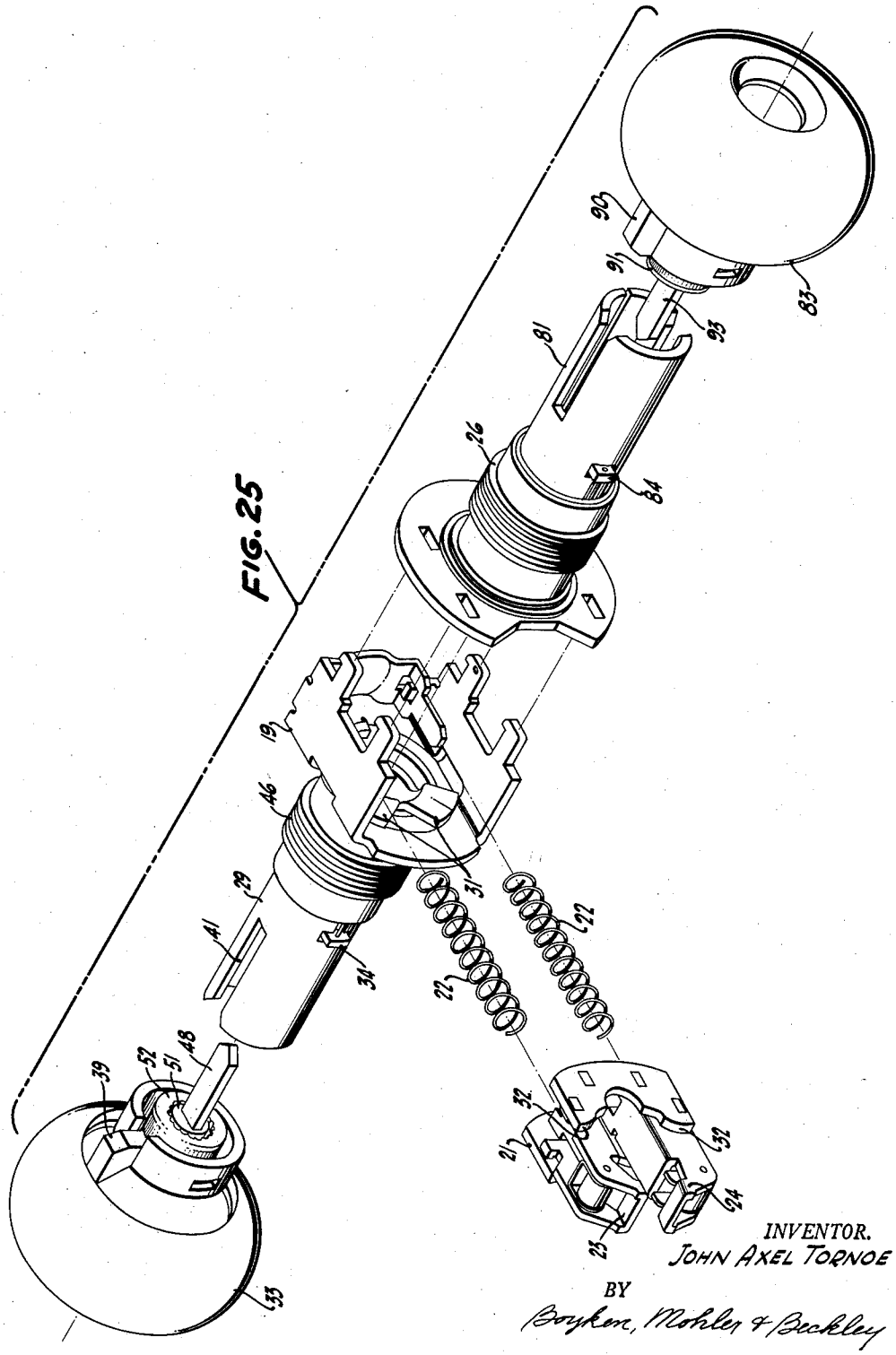
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LOCKING MECHANISM

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FIG. 25



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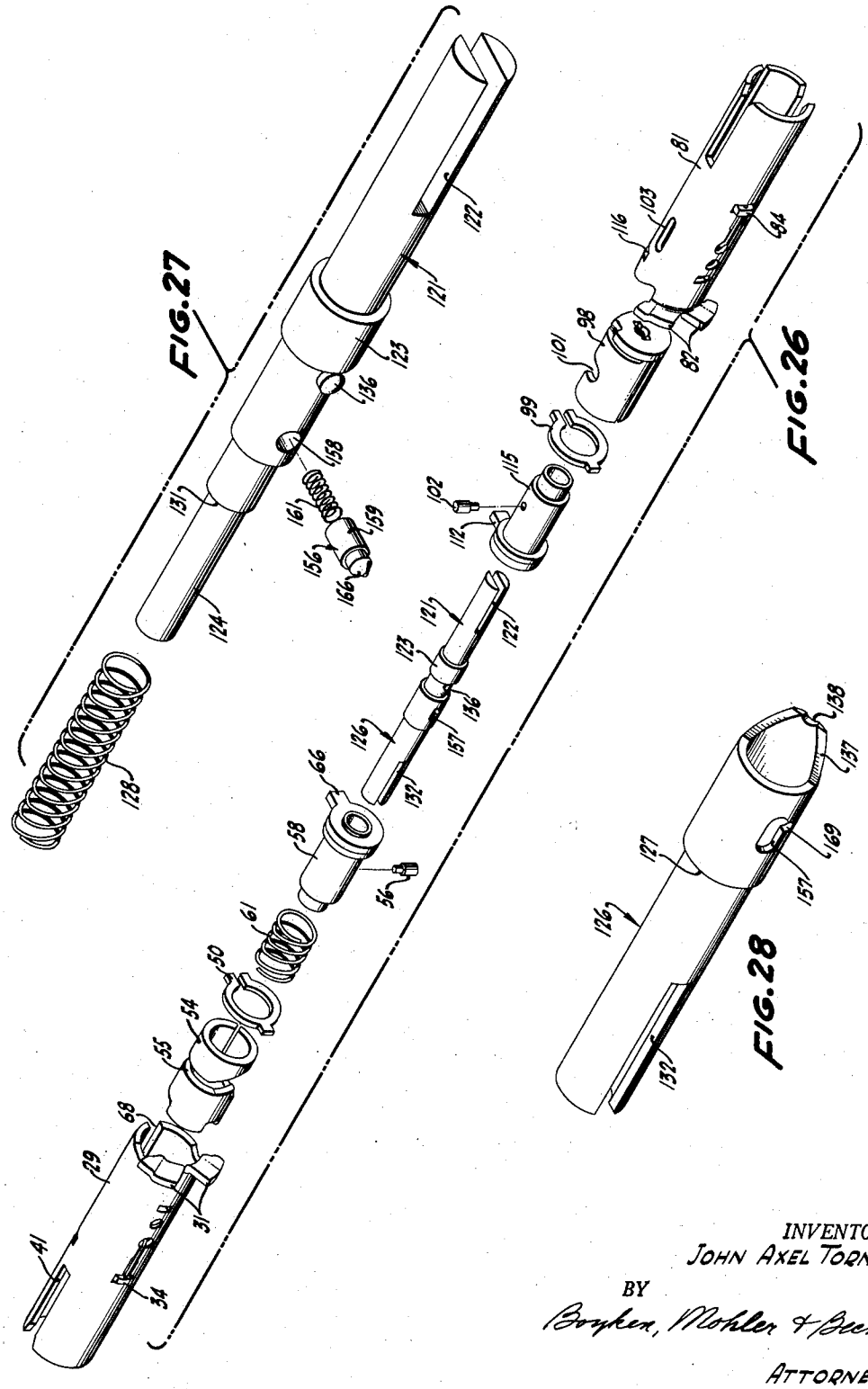
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LOCKING MECHANISM

Filed Dec. 1, 1952 6 Sheets-Sheet 6



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United States Patent Office

2,738,666

Patented Mar. 20, 1956

2,738,666

LOCKING MECHANISM

John Axel Tornoe, San Francisco, Calif., assignor to Schlage Lock Company, a corporation

Application December 1, 1952, Serial No. 323,416

12 Claims. (Cl. 70—216)

My invention relates primarily to door locks and is especially concerned with a door lock applicable among other installations to use in hotel rooms opening onto hallways. In an installation of this kind, the door lock is preferably of a special nature in that it is desirable that the guest's key serves to lock the door from the outside knob or to lock the door from the inside knob. Furthermore, in order that when locked the door will be what is known as "panic proof," provision is preferably made so that the lock will be releasable by the inside occupant. Also, it is advisable to arrange the lock so that if it is locked from the inside, it cannot subsequently be opened from the outside with the guest key, but only by special means.

It is also advisable to have on the outside of the lock an indicator or indicators available to show the condition of the lock, that is, whether or not it is locked from the inside. An indicator for indicating whether or not the lock is locked from the outside and applicable to the present construction is disclosed separately in my copending application entitled Lock Indicator, Serial Number 292,491, filed June 9, 1952, and assigned to the assignee of the present application.

Furthermore, the locking mechanism of my invention is especially concerned with a structure which fulfills the foregoing requirements and is of the general type disclosed in Walter R. Schlage's Patents 2,366,934 of January 9, 1945, and 2,339,725 of January 18, 1944.

It is an object of my invention to provide a locking mechanism effective for key operation on both the outer knob and the inner knob securely to lock a door with respect to its door frame.

Another object of the invention is to provide a lock in which operation of the inner key serves to secure both the outer knob and the inner knob in locked condition.

A still further object of my invention is to provide a locking mechanism in which the outer knob can be independently secured in locked condition.

A still further object of my invention is to provide a lock in which, after the inner knob has been locked, it is not possible to unlock the outer knob by any ordinary means.

A still further object of the invention is to provide a locking mechanism in which the inner knob locking structure is subject to release readily by the room occupant even though previously in locked condition.

A still further object of the invention is to provide a locking mechanism having an exterior indicator showing the condition of the lock.

A still further object of the invention is to provide means for preventing the operation of the regular key in the outer knob when the locking mechanism has been locked from the inside.

A still further object of my invention is to provide a generally improved locking mechanism.

Another object of the invention is to provide a locking mechanism having all of the foregoing attributes in which all of the locking and indicating structure is contained

within the general compass of a lock actuator unit of the type disclosed in the mentioned Schlage patents.

A still further object of my invention is to provide a locking mechanism having the mentioned attributes which is substantially interchangeable with standard lock actuating mechanisms of a less versatile kind.

A still further object of my invention is generally to improve lock sets.

A further object of the invention is to provide a locking mechanism of improved characteristics primarily for hotel requirements.

Other objects, together with the foregoing, are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings, in which

Figure 1 is a cross section on a generally horizontal transverse plane showing the locking mechanism of my invention with both the inner knob and the outer knob in unlocked condition.

Figure 2 is a cross section showing substantially the same structure as disclosed in Figure 1 with portions being broken away to reduce the size of the figure, and the plane of the section being indicated by the line **2—2** of Figure 1.

Figure 3 is a cross section, the plane of which is indicated by the line **3—3** of Figure 1.

Figure 4 is a detailed cross section, the plane of which is indicated by the line **4—4** of Figure 1.

Figure 5 is a cross section in detail, the plane of section being indicated by the line **5—5** of Figure 1, the parts of the structure nearest the latch bolt or edge of the door being disposed at the bottom of Figure 5.

Figure 6 is a view similar to Figure 5, the plane of section being indicated by the line **6—6** of Figure 1.

Figure 7 is a view like Figure 5 but double in size, the plane of section, however, being on the line **7—7** of Figure 1.

Figure 8 is a view positioned like Figure 5 but double in size, the plane of section being indicated by the line **8—8** of Figure 1.

Figure 9 is a view positioned like Figure 5 but double in size, the plane of section being indicated by the line **9—9** of Figure 1.

Figure 10 is a view showing many parts of the structure disclosed in Figure 1, most parts being in a position comparable to that shown in Figure 1 except that the parts are no longer in unlocked condition.

Figure 11 is a cross section, similar to Figure 5, the plane of section being indicated by the line **11—11** of Figure 10, and the parts being rotated as indicated by the arrow.

Figure 12 is a cross section similar to Figure 8, the plane of section being indicated by the line **12—12** of Figure 10, and the parts being rotated as indicated by the arrow.

Figure 13 is a cross section similar to Figure 9, the plane of section being indicated by the line **13—13** of Figure 10, the parts being rotated as indicated by the arrow.

Figure 14 is a cross section comparable to Figure 10 and to Figure 1 but showing the parts in a different location out of unlocked condition.

Figure 15 is a cross section similar to Figure 11, the plane of section being indicated by the line **15—15** of Figure 14, the parts being rotated as indicated by the arrow.

Figure 16 is a cross section comparable to Figure 12, the plane of section being indicated by the line **16—16** of Figure 14, and the parts being rotated as indicated by the arrow.

Figure 17 is a cross section comparable to Figure 13, the plane of section being indicated by the line **17—17**

of Figure 14, and the parts being rotated as indicated by the arrow.

Figure 18 is a detail showing schematically and partly in cross section the outside knob of the locking mechanism with its interior structure and the shut out structure.

Figure 19 is a view somewhat comparable to Figure 18 and shows the use of a special key to overcome the shut out feature.

Figure 20 is a cross section comparable to Figures 1, 10 and 14 and shows the locking mechanism in a still different position.

Figure 21 is a cross section similar to Figure 16, the parts being rotated as indicated by the arrow.

Figure 22 is a view similar to Figure 17, the parts being rotated as indicated by the arrow.

Figure 23 is a view similar to Figure 21, the parts being rotated as indicated by the arrow.

Figure 24 is a view similar to Figure 22, the parts being rotated as indicated by the arrow.

Figure 25 is an exploded view showing in perspective some of the exterior aspects of a locking mechanism constructed in accordance with my invention.

Figure 26 is an exploded view of some of the interior parts of a locking mechanism in accordance with my invention.

Figure 27 is an exploded view to an enlarged scale of one of the subassemblies disclosed in Figure 26.

Figure 28 is a perspective view to an enlarged scale comparable to that of Figure 27 showing one of the parts of my locking mechanism disclosed in Figure 26.

In the usual installation, especially as shown in Figure 1, the locking mechanism is incorporated in the body of a swinging door panel **6** mounted to move with respect to a door frame or jamb **7** located so that the side **8** is the exterior and the side **9** is the interior. Disposed in the door is a latch bolt unit **11** of a standard sort actuated by means of an actuator bar **12** (Figure 3) reciprocably mounted in the housing of the latch bolt unit. In accordance with the invention, the door panel **6** is provided with a through bore **13** in which is disposed an actuator unit, generally designated **14**, inclusive of the locking mechanism of my invention. The actuator unit **14** is intended for the usual connection with the standard latch bolt unit **11** and is situated within the cross bore **13** in the usual way. Included in the actuator unit is a circular cylindrical housing **16** which interengages with appropriate terminals **17** and **18** on the latch bolt unit **11**. Within the housing **16** is mounted a framework **19** carrying a slide **21** disposed for reciprocation thereon, there being springs **22** for urging the slide **21** into one extreme or projected position. The slide **21** includes a pair of jaws **23** and **24** interengaging with the actuator bar **12** so that sliding movement of the slide **21** is accompanied by similar movement of the actuator bar.

In order that the slide **21** can be appropriately moved from its projected or neutral position in which it is normally retained by the urgency of the springs **22**, suitable actuating mechanisms are provided for operation individually from the outside of the door and from the inside of the door.

As part of the actuating mechanism, the framework **19** is extended on opposite sides by means of an inner hub **26** and an outer hub **27**, both being firmly fixed with respect to the framework **19** and being in alignment with each other on a generally transverse axis **28** normal or perpendicular to the central plane of the door **6**. Journalled within the outer hub **27** and mounted for rotation with respect thereto about the axis **28** is an outer spindle **29**. This is preferably a tubular member formed of a rolled up sheet and is provided, within the frame work **19**, with a roll back segment **31**. This is of a shape and disposition to abut against a roll back plate **32** secured to and forming part of the exposed structure of the slide **21**. The arrangement is such that when the spindle **29** is rotated in either direction from its central or neutral position, the slide **21** is correspondingly translated and retracts the actuator bar **12**.

In order that the outer spindle **29** can be readily rotated, it is extended to carry an outer knob **33**. A transverse plate **34** is engaged nonrotatably with the outer spindle **29** and projects into a key way in the structure of the knob **33**, being impelled into a projected position by a rod spring **36** mounted in recesses in the wall of the outer spindle **29** (Figure 1). The transverse plate **34** is not entirely relied upon to transmit torque between the outer spindle **29** and the outer knob **33**. Rather, the knob itself serves as a mounting for a lock cylinder unit including a cylinder body **38** having a tumbler extension **39** thereon which extends into a suitable recess eccentrically formed in the outer knob **33** and which also passes through a receiving slot **41** in the outer spindle **29** (Figure 25).

Within the lock cylinder unit, a cylinder plug **42** is mounted for rotation about the axis **28**. Especially as shown in Figure 18, the cylinder plug **42** is provided with transverse tumblers **43** cooperating with the interior construction of the extension **39** to afford the customary pin tumbler cylindrical combination lock. When the tumblers **43** are out of shearing position, the cylinder plug **42** is not rotatable with respect to the cylinder body **38**. When the tumblers are in shearing position, the cylinder plug is freely rotatable with respect to the cylinder body. The cylinder body in turn is prevented from rotation relative to the knob inasmuch as the extension **39** extends through the slot in the outer spindle into interengagement with the material of the knob itself. This supplements the interconnection of the knob and spindle effectuated by the transverse plate **34**. The knob and spindle structure is also kept in position with respect to the door **6** by a surrounding escutcheon plate **44** abutting the outside face of the door panel **6** and in engagement with threads **46** on the exterior of the outer hub **27** (Figure 1). The detailed construction of the escutcheon and adjoining parts is not described minutely since they are all disclosed in prior patents and are not essential to the practice of the present invention.

As so far described, the outer spindle is freely rotatable in conformity with the rotation of the knob **33** with respect to the frame **19**. In order to secure the spindle and knob against rotation relative to the frame and thus to lock the exterior knob, advantage is taken of the relative rotation between the cylinder plug **42** and the cylinder body **38**. For this reason, the outer plug **42** is provided with a recess **47** in which is situated a spindle blade **48** of generally rectangular cross section and having a strengthening enlargement **49** (Figure 1). A driving plate **51** positions the blade **48** and is itself retained by a cylinder cap **52** secured in a position in any suitable fashion, the assemblage being such that the spindle blade **48** rotates in unison with the rotation of the outer cylinder plug **42** (Figure 1).

The blade **48** extends through a suitable aperture in the transverse plate **34** and extends through an incomplete or non-circular aperture **53** in one end of an outer cam sleeve **54** disposed coaxially with the axis **28** and positioned between the transverse plate **34** and a locking ring **50**. The cam sleeve **54** is freely rotatable with respect to the outer spindle **29** within which it is seated.

As shown particularly in Figure 2, an outer cam pin **56** passes through a cam opening **55** in the outer cam sleeve **54** and is also received in a longitudinal slot **57** formed in the body of the outer spindle **29**. The cam pin **56** is fast in a tube **58** nested within the cam sleeve **54**. At one end the tube **58** has a reduced collar **59** leaving a shoulder against which a coiled spring **61** rests. The other end of the coiled spring is pressed against the end plate **62** of the cam sleeve **54**. The opposite end of the tube **58** is provided with an enlarged guiding flange **63** against which rests a locking plate **64**. This plate is

generally circular and is of the same diameter as the flange 63 except that for a portion of its periphery it is extended to provide a projection 66 (Figure 1). A slot 67 cut into the central portion of the outer hub 27 slidably receives the projection 66.

To secure the plate 64 in position for rotation relative to the tube 58, I provide a retaining tube 69 having a flange 71 at one end and having a tight pressed fit within the tube but loose within the plate so that although the tube 58 itself rotates with respect to the cam sleeve 54, the projection 66 is not rotatable with respect to the hub 27 but is translatable with respect thereto. Translation is accomplished upon rotation of the cylinder plug 42 with respect to the cylinder body 38. Rotation of the blade 48 occurs freely until such time as the blade contacts the walls of the non-circular aperture 53 in the cam sleeve 54. When that occurs, the cam sleeve 54 is rotated in unison with the further rotation of the blade 48 and displaces the walls of the cam opening 55.

The rotation of the cam sleeve relative to the cam pin 56 which is translatable but nonrotatable relative to the outer spindle because of its bearing in the slot 57 is then effective to translate the pin and its attached sleeve 58 toward the left in Figure 1 or outwardly in order to compress the spring 61. This simultaneously translates the locking plate 64 and translates the extension 66 within the slot 67. Ultimately, the extension 66 is drawn into the converging entrance of a locking slot 68 cut in one end of the outer spindle 29. When the parts are in this position, the extension 66 lying both within the walls of the slot 67 and within the walls of the slot 68 prevents relative rotation of the outer spindle with respect to the outer hub and consequently prevents rotation of the outer knob 33. Since the spindle cannot be rotated and the roll back member 31 cannot therefore be rotated either, it is considered that the outer knob is locked and the lock set as a whole is locked from the outside.

Upon reverse relative rotation of the cylinder plug relative to the cylinder body, there is at first some lost motion as the blade 48 turns within the non-circular opening 53 but ultimately rotation is also imparted to the cam sleeve 54. This again rotates the walls of the cam opening 55 relative to the pin 56 which is then translated to its original position due to the expansive energy of the spring 61. The conformation of the cam opening 55 is such that there is lost motion between the walls of the sleeve and the pin on the return stroke. The actual impetus of translating the member 58 comes from the spring 61 and causes the pin 56 to follow the innermost surface of the cam wall. The inward translation of the sleeve member 58 eventually moves the extension 66 out of contact with the walls of the slot 68 and restores it to its original position as shown in Figure 1. It is then considered that the outer knob is unlocked with respect to the latch bolt mechanism 11.

If desired, an indicator can be provided within the outer hub mechanism to show the locked or unlocked condition of the outer knob. A suitable device is disclosed in my copending application, above identified.

The mechanism as so far described serves primarily as an independent means of locking the outside knob with respect to the door frame and precludes exterior operation of the latch bolt mechanism 11 when the outer knob or actuator is so locked. The usual means of operating the cylinder plug is a suitably contoured key 72 shown partially in position in Figure 18. A proper key, after introduction into the outer cylinder plug, can be rotated to lock the outer knob, and can be withdrawn. Also, a proper key can be inserted and counter-rotated to unlock the outer knob and can be withdrawn to leave the lock in its original unlocked condition. When it is locked, the outer knob is nonrotatable with respect to the door but when it is unlocked it is freely rotatable in either direction from its neutral position to operate the roll back mechanism to withdraw the latch bolt.

In a somewhat comparable fashion there is provided a similar structure for operation on the inside of the door 6, (Figure 1). Parts which are not specifically described in connection with the inner knob environment are duplicates substantially of comparable parts in the outer knob environment. Mounted to rotate within the inner hub 26 and in concentric alignment with the axis 28 is an inner tubular spindle 81 having appropriate roll back mechanism 82 on its inner end to cooperate with the slide projections 32. The outer end of the spindle is provided with a knob 83 held in position by a transverse slide plate 84 and finished by means of an escutcheon 86 surrounding the hub 26 and abutting the inside of the door 6. The inner spindle 81, being fastened by the plate 84 to the knob 83, rotates simultaneously therewith. Additional rotary interconnection is afforded by an inner cylinder body 87 having an extension 90 for the tumbler mechanism which projects eccentrically into the interior body of the knob 83 through a slot provided in the inner spindle 81 for that purpose.

Disposed within the inner cylinder body 87 is an inner cylinder plug 88 comparable in construction to the interior of the outer lock as shown in Figure 18 and adapted to receive a similar key. The construction is such that when the appropriate key is utilized the cylinder plug 88 is rotatable with respect to the cylinder body 87. The inner cylinder plug 88 is held against longitudinal displacement by an outer flange 89 which abuts the inner cylinder body 87. Also abutting the body 87 is a cylinder cap 91 engaging and rotating with the inner end of the inner cylinder plug 88. The cylinder cap 91 also secures in position a driving plate 92 nonrotatably associated with a key blade 93 rotatable about the axis 28 simultaneously with the rotation of the cylinder plug 88. An enlarged circular aperture 94 is afforded in the transverse locking plate 84 so as not to interfere with the rotation of the key blade 93.

Additionally surrounding the blade 93 is a substantially conforming aperture 96 in the end plate 97 of an inner cam sleeve 98. This latter is rotatably mounted within the inner spindle 81 but is held against endwise motion. At one end, the inner cam sleeve abuts the plate 84 and at the other end abuts a locking ring 99. The cam sleeve 98 is provided with a substantially helical cam opening 101 therein accommodating a pin 102 which also extends into a longitudinal slot 103 cut in the tubular spindle 81. The pin 102 is firmly mounted in a sleeve member 104 identical with the member 58 and carrying a flange 109 at its innermost end.

The flange abuts against a disc 111 which is generally circular except for an extension 112 (Figure 4) passing into a longitudinal slot 113 in the inner hub 26. The disc 111 is held rotatably against the flange 109 on the enlarged end 114 of a tube 115 pressed into the interior of the sleeve member 104 and serves as an anchor for the rotatable mounting of the disc 111. The extension 112 is therefore kept from rotation with respect to the inner hub 26 and when longitudinally or axially translated, is received in the converging end of a slot 116 formed in the inner end of the inner spindle 81.

With this arrangement, when the extension 112 is translated from right to left as seen in Figure 1 of the drawings, the spindle is locked against the hub 26 so that the inner knob 83 is in locked condition. This is the same direction of translation taken by the extension 66 in locking the outer knob 33. That is, both the inner and the outer knobs are locked when their locking mechanisms translate from the inside of the lock unit toward the outside thereof or from right to left in Figures 1 and 2, for example. When the extension 112 is in its innermost locked position, the roll back structure cannot be effective against the slide 21 and the latch bolt unit cannot be actuated because the knob 83 cannot be turned.

Direct cam engagement between the cam sleeve 98 and the pin 102 serves to translate the extension 112 inwardly

to lock the inner spindle and the reverse operation is employed to unlock the inner spindle unit. This is in contradistinction to the outer spindle unit wherein a spring 61 is utilized for the unlocking operation. In the case of the inner spindle unit, the contour of the cam groove 101 is such that a reverse rotation of the cylinder plug 88 causes a translation of the pin and correspondingly of the extension 112 from the locked position to the unlocked position. The cylinder plug 88 is designed for the reception of a key like the key 72 (in most cases identical with it) so that upon manipulation of a key in the inner cylinder plug 88 the inner door knob is locked and upon reverse rotation of the key the inner door knob is unlocked.

So that a key in the inner knob 83 cannot be removed unless the door is unlocked, I provided that the rotation of the cylinder plug 88 in the lock body 87 is something less than a complete rotation. The key does not return to its starting poistion when the lock is locked but rather is stopped in an intermediate position and therefore cannot, in accordance with the customary operation of the tumblers, be withdrawn. After the key and the cylinder plug 88 are restored to their original unlocked position the key can be withdrawn easily.

In accordance with my invention I provide means so that when the inner knob 83 is locked the outer knob 33 is also locked and I further provide means for then shutting out a key from the outer cylinder. Once locked from the inside, the locking mechanism cannot be unlocked with the regular key from the outside, nor can the latch unit be actuated by the regular key from the outside. For that reason I dispose within the tube 115 a plunger 121 which at its inner end is provided with a slot 122 (Figure 2) to receive the end of the blade 93. The plunger 121 otherwise is a circular cylindrical member which fits easily within the inside of the tube 115. A collar 123 is formed on the plunger and rests against the inner end of the tube 115. However, the plunger 121 is otherwise rather freely slidable in the direction of the concentric axis 28. The opposite end of the plunger 121 is finished in a terminal rod 124 closely adjacent the innermost end of the blade 48.

Surrounding the plunger 121 is a plunger sleeve 126 having a shoulder 127 abutting the innermost end of the tube 69 and then extending within such tube to serve as a support for the terminal rod 124. An expansion spring 128 is interposed between an inturned collar 130 on the plunger sleeve and a shoulder 131 on the plunger 121 so that the sleeve 126 and the plunger 121 are normally urged apart. The sleeve 126 at its outermost end is provided with a transverse slot 132 receiving the innermost end of the blade 48. In this fashion the blade and the sleeve 126 are connected together against relative rotation just as the plunger 121 is connected to the blade 93 against relative rotation.

During the initial part of the rotation of the inner cylinder plug 88 with respect to the inner key body 87, in addition to the other functions described, the plunger 121 is simultaneously rotated. Also, since the collar 123 is in close abutment with the end of the tube 115 the collar 123 causes a simultaneous translation of the plunger 121 with the tube. The combined rotation and translation so imparted to the plunger 121 moves a projecting button 136 radially disposed in the plunger 121 from its position shown in Figure 1 into a position in which it cams against and rides along a collar cam 137 formed on the inner end of the plunger sleeve 126.

At an appropriate point in its rotation and translation, the button 136 rides into a summit depression 138 in the collar cam which theretofore has been held against rotation by the stationary outer knob 33. During this time some axial displacement of the plunger sleeve 126 takes place since the tube 58 can yield against the urgency of the spring 61 and snap back slightly as the button 136 seats in the depression 138. As the button 136 rides against the cam collar 137 it translates the plunger sleeve 126 toward the left in Figure 1 so that the shoulder 127 begins also to translate the tube 69 and to commence the entry of the projection 66 into the locking slot 68. There is some rotational force exerted on the plunger sleeve 126 by the button 136 but the plunger sleeve 126 is kept from rotation since its slotted end is in engagement with the blade 48 itself confined in the slot 53 held in the outer knob spindle 29 centralized by the springs 22.

In this fashion, when the inner cylinder plug 88 is rotated through a partial revolution the plunger 121 is rotated and translated and produces a simultaneous translation of the plunger sleeve 126. This then moves or translates the locking extension 66 so that the outer knob 33 is locked simultaneously with the locking of the inner knob. The motion of the locking disc 66 carries the cam sleeve 58 with it but since the contour of the cam groove 57 is such as to afford a lost motion in connection with the pin 56, there is no hindrance to the locking translation of the cam sleeve itself.

Motion of the terminus 124 of the plunger 121 causes it quickly to abut the blade 48 and also to translate the blade with respect to its mounting disc 51 through the aperture 53. Since the blade is not otherwise confined it can translate freely within the cavity 47 provided for that purpose.

Inside the cavity and in the path of the blade 48 is a foot 141 fastened on an indicator rod 142 slidably mounted in a bore 143 in the outer cylinder plug 42. A coil spring 144 is interposed between a shoulder at the bottom of a counterbore and the foot 141. Normally the length and position of the indicator rod 142 are such that it is exactly flush with the face 145 of the outer cylinder plug when the lock is in unlocked condition. However, when the lock is moving into locked condition, the translation of the blade 48 causes it to abut and simultaneously translate the foot 141. This compresses the spring 144 and moves the rod 142 into a projected position. Thus, when the locking mechanism has been put in locked condition by a key operation of the inner cylinder plug 88, the indicator or projected rod 142 clearly displays that fact by the difference in elevation between the extended end of the rod 142 and the adjacent face 145.

Since the locking extension 66 for the outer knob is put in locked position by the simultaneous or substantially simultaneous locking movement of the inner structure, the entire lock set is locked both on the inside and on the outside. If the outer cylinder plug 42 is subsequently rotated toward locked position by the introduction and rotation of a special key, it affords a partial movement of the plunger sleeve 126 but primarily serves to rotate the cam sleeve 54 in such a way that the walls of the opening 55 again abut the pin 56. A subsequent unlocking motion of the special key in the outer cylinder plug 42 then restores the plunger sleeve 126 and the cam sleeve 54 to the previous location but since there is lost motion in the cam opening contour 55 the pin 56 is simply left behind and the spring 61 remains compressed pending release.

Release of compression of the spring 61 normally takes place by a rotation of the inner key in the inner cylinder plug 88 in the opposite direction from the locking rotation. When that occurs the retraction of the extension 112 is accomplished as before, and the spring 61 is effective to urge the translation of the projection 66 into its own unlocked condition. At the same time the plunger sleeve 126 is urged back to its former location by abutment of the tube 69 against the shoulder 127 and the spring 128 assists in separating the button 136 from the summit notch 138 in the collar cam 137 as the parts are separated. The spring 144 also serves to restore the foot 141 to its innermost position and to retract the indicator rod 142 into a flush condition. The blade 48 is also restored to the same position that it occupied previously.

In many installations, it is preferred that when the

locking mechanism is locked from the inside, not only will there be an indication of this fact by projection of the rod **142**, but in addition it will be impossible even for the usual key for the outer cylinder plug **42** to unlock the locking mechanism from the outside. For that reason, it is arranged for the foot **141**, when it is translated by translation of the blade **48** during the locking operation initiated by the inner plug **83**, to overlie and block the inner end of the keyhole or key channel **151**, especially as shown in Figure 14 and in Figure 18. Thus, when the regular key **71** is introduced into the keyhole **151** it cannot enter fully since it encounters the obstructing foot **141**. The foot is held by a non-yielding mechanical train so that it is impossible for the key **71** to be introduced far enough to actuate the tumblers **43**. Even the usual key, therefore, is shut out and will not serve to unlock the locking mechanism when it is held in locked position from the inside.

It is preferred, although the shut out feature is incorporated in the locking mechanism so that the outer knob **33** cannot be rotated when the lock is locked from the inside and so that even the regular key **72** cannot be utilized to unlock the lock from the outside, that in emergencies the locking mechanism can still be unlocked from the outside even though it is in locked condition as determined by the inner cylinder plug and even though the inner key is held in the inner cylinder plug.

This is particularly accomplished, especially as shown in Figure 19, by the provision of a special key **152**. This is identical with the key **72** so far as its contour to actuate the tumblers **43** is concerned, but it is curtailed or shortened or cut off on its forward portion to provide a forward flat **153** (Figure 19) just short of abutment with the projected foot **141** when the key is in position to actuate the tumblers **43**. When the key **152** is properly in position, the tumblers **43** are actuated so that there is no restriction upon the rotation of the outer cylinder plug **42**. The locking direction of rotation of both the inner cylinder plug **88** and the outer cylinder plug **42** is the same, preferably with the top of the key turning toward the jamb **7** from either side of the door. Stated differently, a user standing and looking at the inner knob **83** rotates his key counterclockwise for a locking operation whereas a user standing on the outside and looking at the outer knob **33** rotates his key clockwise to lock the door.

When the key **152** is rotated, it causes a corresponding rotation of the blade **48** which then also causes rotation of the plunger sleeve **126**. This rotation of the sleeve **126** is not accompanied by any particular translation thereof until such time as the sleeve is rotated sufficiently to disengage the cam notch **138** from the button **136** and to rotate the collar cam **137** so that there is substantial endwise clearance between the collar cam and the button **136**. When such clearance is available, or as it becomes available, the effect of the spring **61** is to urge the inner lock sleeve **58** toward unlocked position to withdraw the extension **66** from the notch **68**. Also, the translational movement of the tube **69** in abutment with the shoulder **127** translates the plunger sleeve **126** toward the right against the urgency of the spring **128** until such time as the collar cam **137** is again nearly in abutment with the button **136**. The collapse of the plunger sleeve with respect to the plunger affects the position of a spring pressed detent **156** with respect to a slot **157** in the plunger sleeve **126**.

As shown for example in Figures 9 and 27, the plunger **121** is provided with a cross bore **158** within which a piston **159** forming the body of the detent **156** is reciprocable. A spring **161** is nested within the piston and seats against an inturned flange **162** at the terminus of the bore **158**. An indentation **163** in the path of a cutout **164** on the piston precludes dislodgement of the piston from the bore **158** and limits its reciprocating travel. The piston **159** is finished in the shape of a detent cone **166**, interrupted by the cutout **164**, but otherwise of a shape and configuration to cooperate with the generally chordal walls of the aperture **157**.

As shown particularly in Figures 18 and 19, the shape of the aperture **157** is approximately that of an L, the major portion extending in an axial direction while there is an additional side or circumferential portion **169**. The relationship of these surfaces is such, particularly as shown in Figures 9 and 13, that when the detent piston **159** is fully extended it is in a position, when the plunger sleeve **126** is rotated counterclockwise (in Figure 22) with respect to the plunger **121**, to be cammed radially inward by the adjacent aperture wall to permit continued relative rotation of the plunger and sleeve in that direction. When the plunger sleeve **126** is rotated in the opposite direction (clockwise in Figure 24) with respect to the plunger **121**, then the flat radial face of the cutout portion **164** is abutted by the chordal wall of the aperture **157** and precludes further rotation of the plunger relative to the plunger sleeve.

In effect, therefore, the piston detent **156** and its associated parts constitute a uni-directional overrunning clutch. That is, the plunger **121** is freely rotatable in an indefinite amount with respect to its encompassing sleeve **126** in one direction of relative rotation but in the opposite direction of relative rotation the detent plunger **156** serves to lock the plunger and the plunger sleeve together in properly oriented relationship so that they then turn in unison or are securely clutched together. That is the situation when the plunger and the plunger sleeve are in their short or relatively collapsed position with the piston detent **156** and cone **166** occupying a location in the longitudinal portion of the aperture **157**.

When the plunger and plunger sleeve are spaced in their relatively long or farthest apart or extended positions, for example as shown in Figure 9 and Figure 13, then the cone **166** is able to cam against the bordering wall of the aperture **157** during counterclockwise (Figure 13) rotation of the plunger with respect to the outer plunger sleeve. The detent therefore does not preclude the relative rotation in that direction. The extension **169** of the L-shaped aperture **157** is sufficiently offset itself to serve as a cam surface even against the cutout face **164**.

Thus, as shown in Figures 9 and 13, when the plunger **121** is rotated counterclockwise relative to the surrounding plunger sleeve, the flat face of the cutout **164** of the cone **166**, cams within the plunger sleeve. It does not lock and does not serve to preclude rotation and therefore does not act as a clutch. The situation is such that when the plunger and the plunger sleeve are in their relatively extended position, they are not coupled together by the detent for rotation in any way. In other words, they are unclutched or declutched, and do not transmit rotation to each other through the detent. However, when the plunger and the plunger sleeve are in their relatively retracted position, for example as shown in Figure 20, then the piston detent and the corresponding portion of the aperture **157** serve to clutch the plunger and plunger sleeve together for rotation in one direction only, but to overrun in the opposite direction without transmitting rotation.

Consequently, when the key **152** has initiated an unlocking motion and has revolved the blade **48** and has correspondingly revolved the plunger sleeve **126** and, after the spring **61** has served to move the plunger sleeve into a collapsed condition with respect to the plunger, the detent piston **159** is in a position so that the flat face of the cutout portion **164** of the cone **166** abuts the narrow portion of the aperture **157** and serves as a unidirectional clutch. The continued rotation of the plunger sleeve **126** is accompanied by rotation of the plunger **121** in unison therewith and driving force is exerted through the detent **156**.

When the plunger **121** is revolved, it rotates the blade **93** of the inner cylinder and rotates the inner cylinder plug **88** with respect to the inner cylinder body **87**,

rotating the inner key correspondingly, and serving also to rotate the inner cam sleeve **98**. This action serves to withdraw the extension plate so that the extension **112** is withdrawn from the locking notch **116** and the inner cylinder therefore is unlocked. At the same time, the withdrawal or unlocking translation of the plate **64** is accompanied by a withdrawal of the plunger **121** under the urgency of the spring **61**. This serves to translate the projection **66** of the locking plate **64** from the locking slot **68** and the locking mechanism is thus completely restored to its unlocked condition. This includes, of course, the return and release of the blade **48** from its shutout position and the retraction of the indicator rod **142** into the outer cylinder plug **42**. The inner key plug is restored to its normal position so that the inner key can be withdrawn and the entire structure is back in its original situation.

According to the present disclosure, therefore, there has been provided a locking mechanism particularly designed for hotels and the like, in which there are two locking instrumentalities, or cylinders, an inner one and an outer one, assembled on a door. The outer cylinder can be locked and unlocked from the outside with an appropriate key such as a guest key. It does not affect the inner cylinder. The inner cylinder can be locked and unlocked from the inside by means of a guest key and serves also to lock and unlock the outer lock. Additionally, the inner key cannot be withdrawn when the lock is in locked condition. Furthermore, the locking of the inner cylinder serves to provide an indication of the condition of the lock observable from a vantage point adjacent the outer cylinder. Even further, the locking of the inner cylinder serves to shut out or prevent the introduction of a normal guest key for regularly operating the outer cylinder. In addition to that, the locking mechanism, even though locked from the inside can be unlocked from the outside by the use of a special, short key. The special key operates to unlock the inside cylinder, to unlock the outside cylinder, to withdraw the indicator mechanism, and to withdraw the shutout mechanism, thereby restoring the entire locking mechanism to its normal unlocked condition, in which rotation of either of the knobs in either direction from neutral position serves freely to actuate the latch bolt.

I claim:

1. A locking mechanism comprising a frame, a retractor movable on said frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, roll backs on said spindles engageable with said retractor to move said retractor upon rotation of either of said spindles, first means movable into interengagement with said outer spindle and said outer hub to prevent relative rotation thereof, second means movable into interengagement with said inner spindle and said inner hub to prevent relative rotation thereof, an inner key plug mounted on said inner spindle for rotation relative thereto, and means responsive to relative rotation between said inner key plug and said inner spindle for moving both said first means into interengagement with said outer spindle and said outer hub and said second means into interengagement with said inner spindle and said inner hub.

2. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, first means movable into interengagement with said outer spindle and said outer hub to prevent relative rotation thereof, second means movable into interengagement with said inner spindle and said inner hub to prevent relative rotation thereof, an inner key plug mounted on said inner spindle for rotation relative thereto, and means operated by relative rotation of said inner key plug relative to said inner spindle for moving said first means into interengagement with said outer spindle and said outer hub and said second means into interengagement with said inner spindle and said inner hub.

3. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, first means for preventing relative rotation of said outer spindle and said outer hub, second means for preventing relative rotation of said inner spindle and said inner hub, an inner key plug mounted in said inner spindle for rotation relative thereto, and means responsive to said relative rotation of said inner key plug relative to said inner spindle for rendering said first means and said second means ineffective.

4. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, a first member translatable into and out of a position preventing relative rotation between said outer spindle and said outer hub, an outer key plug mounted in said outer spindle for rotation relative thereto, a first lost-motion connection between said outer plug and said first member for translating said first member into said position upon relative rotation between said outer key plug and said outer spindle, a second member translatable into and out of a position preventing relative rotation between said inner spindle and said inner hub, and inner key plug mounted in said inner spindle for rotation relative thereto, a second connection between said inner key plug and said second member for translating said second member into said position upon relative rotation between said inner key plug and said inner spindle, and means for connecting said first member and said second member for simultaneous translation.

5. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, a first member translatable into and out of a position preventing relative rotation between said outer spindle and said outer hub, an outer key plug mounted in said outer spindle for rotation relative thereto, a first lost-motion connection between said outer plug and said first member for translating said first member into said position upon relative rotation between said outer key plug and said outer spindle, a second member translatable into and out of a position preventing relative rotation between said inner spindle and said inner hub, an inner key plug mounted in said inner spindle for rotation relative thereto, a second connection between said inner key plug and said second member for translating said second member into said position upon relative rotation between said inner key plug and said inner spindle, and a lost-motion means for connecting said first member and said second member for simultaneous translation.

6. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, a first member translatable into and out of a position preventing relative rotation between said outer spindle and said outer hub, an outer key plug mounted in said outer spindle for rotation relative thereto, a second member translatable into and out of a position preventing relative rotation between said inner spindle and said inner hub, an inner key plug mounted in said inner spindle for rotation relative thereto, a connection between said inner key plug and said inner spindle, means for translating said first member in unison with said second member, and means

connecting said inner and outer key plugs for rotation together when a key is in said inner key plug.

7. A locking mechanism comprising a frame, inner and outer hubs projecting from said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, a first member translatable into and out of a position preventing relative rotation between said outer spindle and said outer hub, an outer key plug mounted in said outer spindle for rotation relative thereto, a second member translatable into and out of a position preventing relative rotation between said inner spindle and said inner hub, an inner key plug mounted in said inner spindle for rotation relative thereto, a connection between said inner key plug and said second member for translating said second member upon relative rotation between said inner key plug and said inner spindle, means for translating said first member in unison with said second member, and means for rotating said inner and outer plugs together in one direction when a key is in said inner key plug.

8. A locking mechanism comprising a frame, an outer spindle rotatable with respect to said frame, an outer key plug rotatable with respect to said outer spindle, an inner spindle rotatable with respect to said frame, an inner key plug rotatable with respect to said inner spindle, and means responsive to relative rotation between said outer key plug and said outer spindle for rotating said inner key plug relative to said inner spindle when a key is in said inner key plug, said responsive means including a unidirectional overrunning clutch precluding the transmission of rotational effort from said inner plug to said outer plug.

9. A locking mechanism comprising a frame, an outer spindle rotatable with respect to said frame, an outer key plug rotatable with respect to said outer spindle, an inner spindle rotatable with respect to said frame, an inner key plug rotatable with respect to said inner spindle, and means responsive to relative rotation between said outer key plug and said outer spindle for producing rotation between said inner key plug and said inner spindle when a key is in said inner key plug, said responsive means including a disconnecting clutch in a disconnected position precluding the transmission of rotation effort from said outer plug to said inner plug when said inner plug is in unlocked position.

10. A locking mechanism comprising a frame, an outer spindle rotatable with respect to said frame, an outer key plug rotatable with respect to said outer spindle, an inner spindle rotatable with respect to said frame, an inner key plug rotatable with respect to said inner spindle, and means responsive to relative rotation between said outer key plug and said outer spindle for producing rotation between said inner key plug and said inner spindle when a key is in said inner key plug, said responsive means including mechanism shiftable between two relationships, in one relationship serving as a unidirectional overrunning clutch when said inner plug is in locked position and in the other relationship serving as a disconnecting clutch when said inner plug is in unlocked position.

11. A locking mechanism comprising a frame, inner and outer hubs on said frame, an inner spindle journalled in and rotatable with respect to said inner hub, an outer spindle journalled in and rotatable with respect to said outer hub, a first member translatable into and out of a position preventing relative rotation between said outer spindle and said outer hub, an outer key plug mounted in said outer spindle for rotation relative thereto, a second member translatable into and out of a position preventing relative rotation between said inner spindle and said inner hub, an inner key plug mounted in said inner spindle for rotation relative thereto, means responsive to relative rotation between said outer key plug and said outer spindle for producing rotation between said inner key plug and said inner spindle when a key is in said inner key plug, a normally disengaged clutch included in said responsive means, and a connection between said inner key plug and said second member for translating said second member into said position and for engaging said clutch upon relative rotation between said inner key plug and said inner spindle.

12. A locking mechanism comprising a frame, inner and outer spindles on opposite sides of said frame and independently rotatable relative thereto, inner and outer key plugs carried by said inner and outer spindles respectively and rotatable relative thereto, first locking means actuated by rotation of said outer plug relative to said outer spindle for locking said outer spindle relative to said frame and second locking means actuated by rotation of said inner plug relative to said inner spindle for locking said outer spindle relative to said frame said second locking means including a member movable toward said outer key plug and a blocking element actuated by said member for blocking said outer key plug against insertion of a conventional key therein.

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