

[54] **REMOVABLE CYLINDER FOR A LOCK**

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[51] Int. Cl. **E05b 33/00**

[58] Field of Search 70/368, 224, 367, 371, 370, 70/369

[56] **References Cited**

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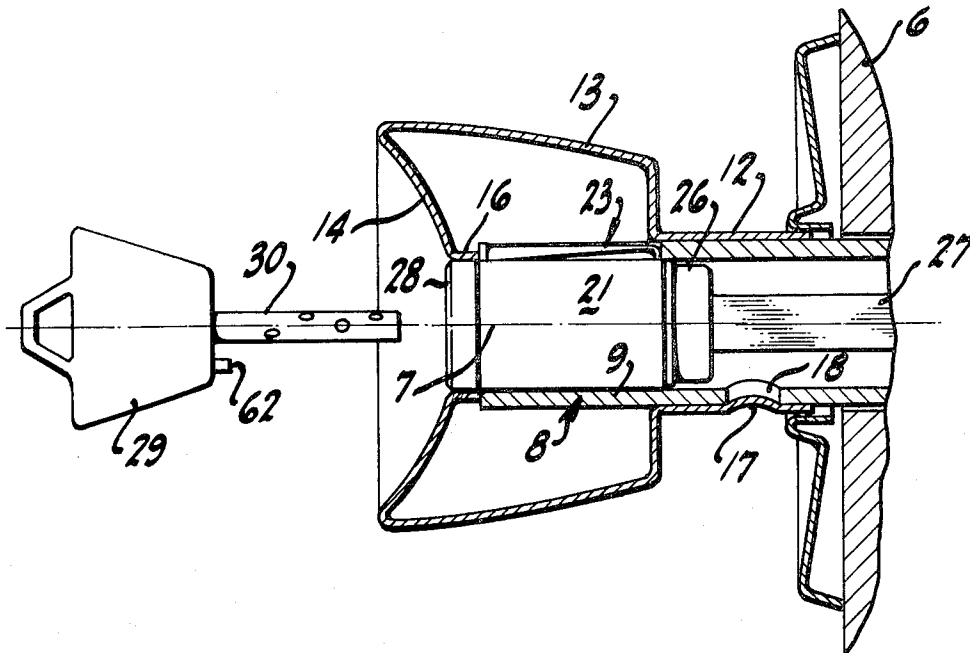
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Attorney, Agent, or Firm—Lothrop & West

[57] **ABSTRACT**

A lock includes a spindle tubular about an axis and having a wall opening. A knob is fastened to the spindle and has an aperture in axial alignment with the spindle. A cylinder body having a radially projecting tongue is disposed to slide in the spindle and move through the aperture except as obstructed by the tongue situated in the opening and confined by the marginal walls of the spindle and of the knob. The tongue can be moved radially into a non-obstructing position by a tool moved in an arcuate path to engage and move the tongue or a connector thereon. A key-actuated plug is rotatable within the body between a locked position and other positions and carries the tool from the locked position of the plug into the other positions, in which the tool engages and moves the tongue or the connector thereon.

7 Claims, 14 Drawing Figures



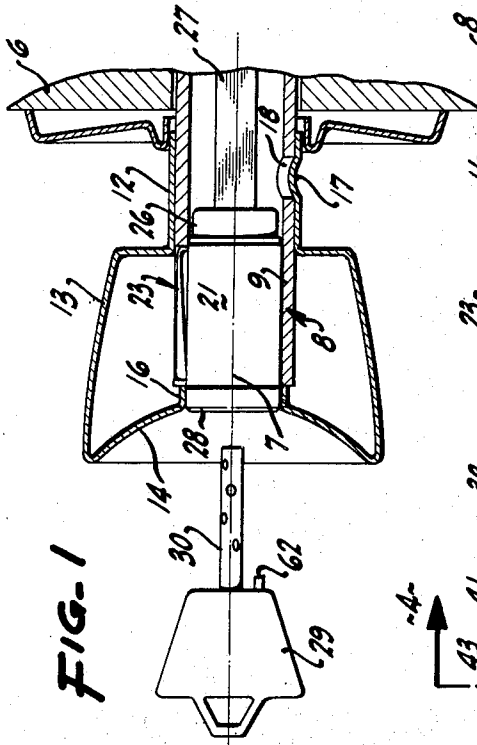


FIG-1

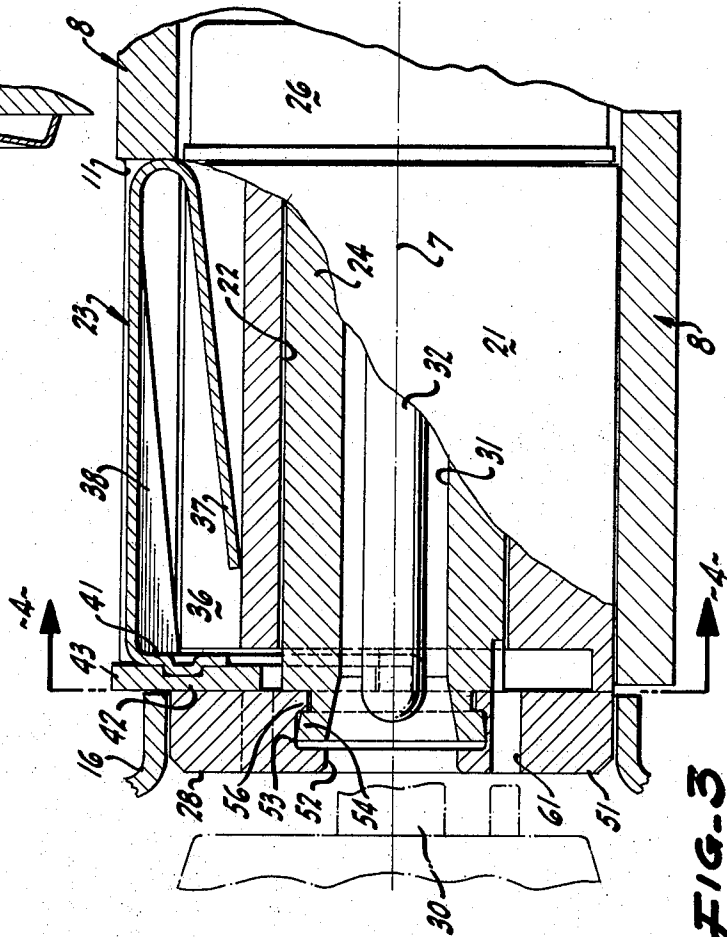


FIG-3

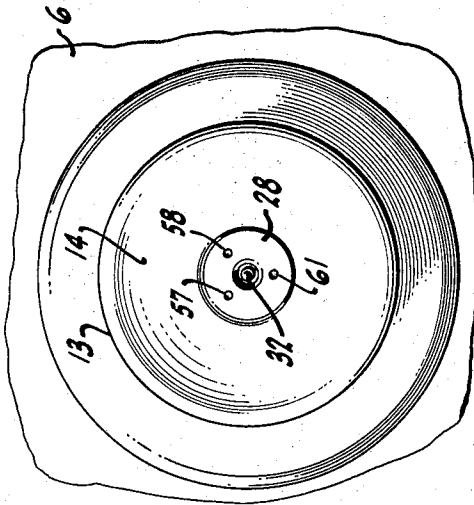


FIG-2

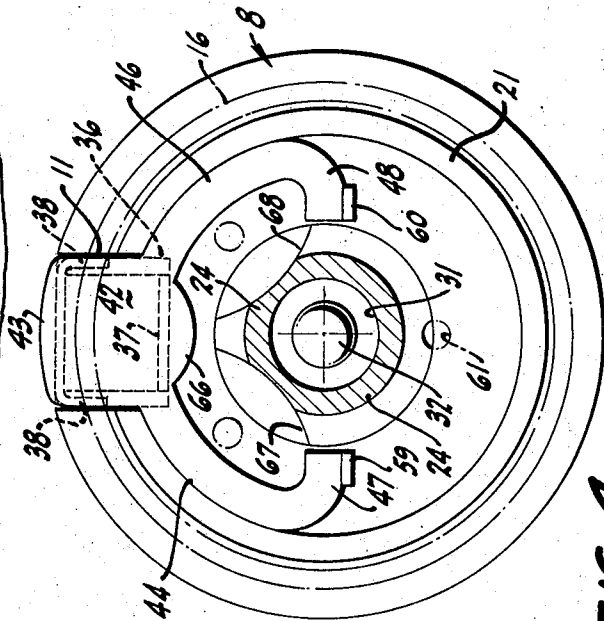


FIG-4

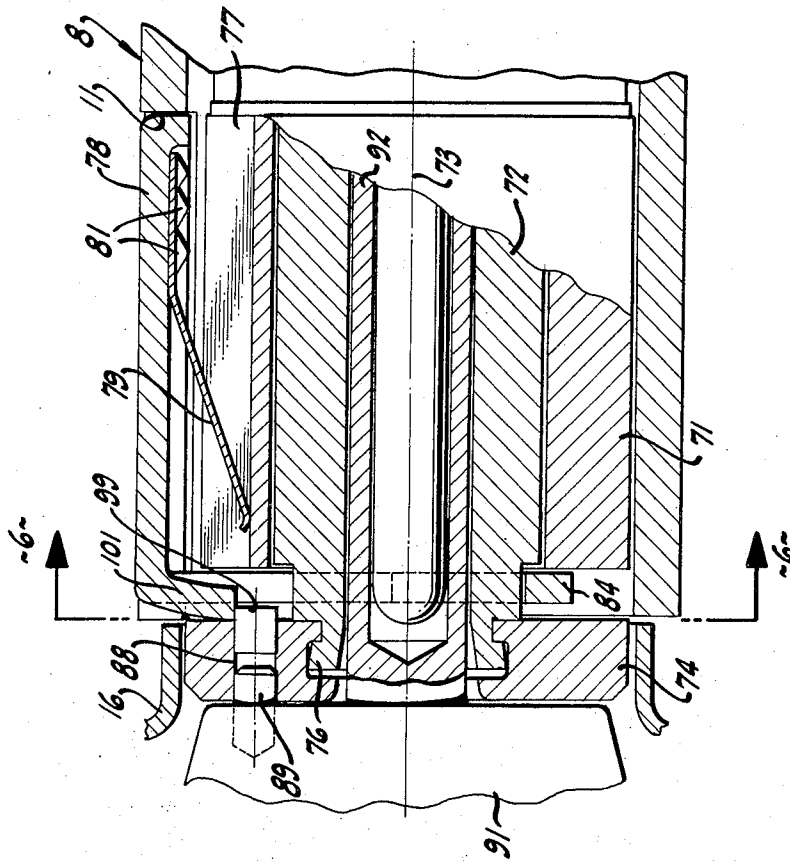


FIG-5

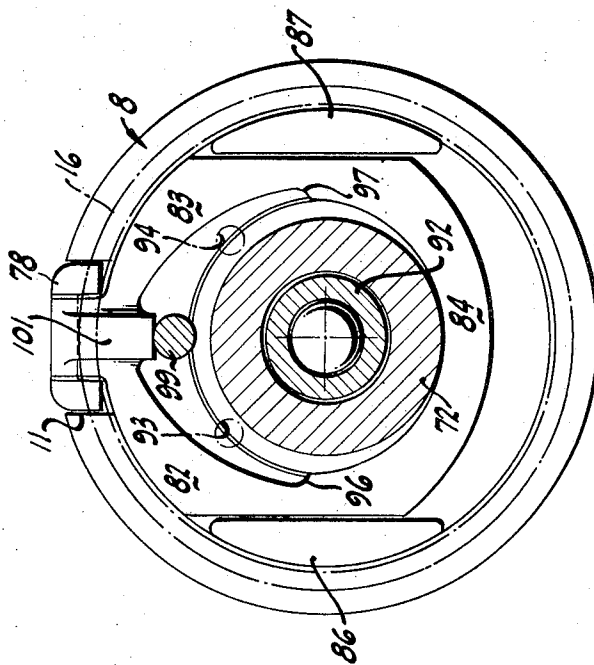


FIG-6

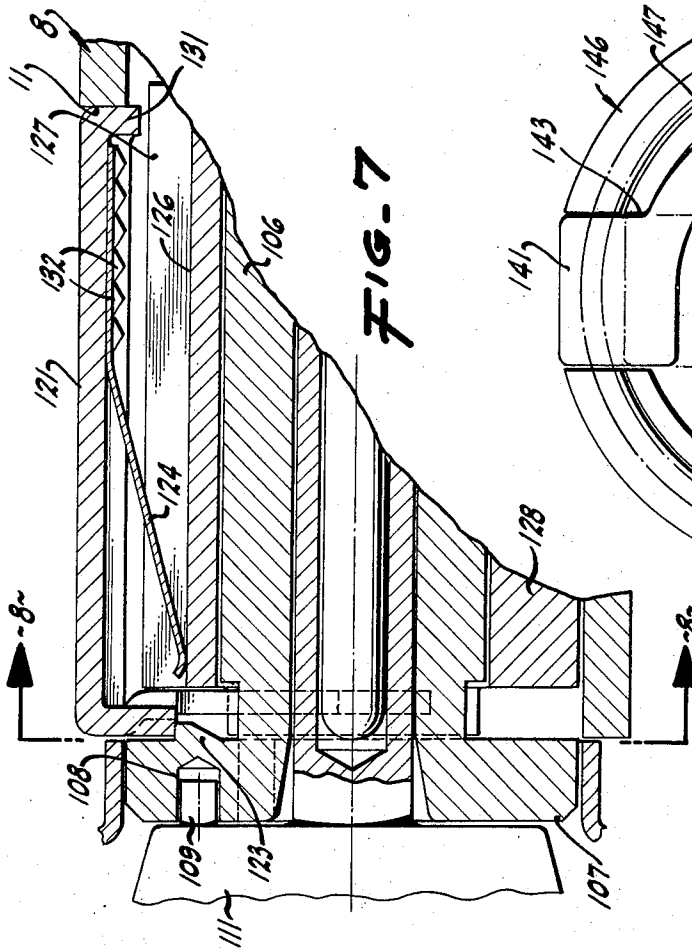


FIG. 7

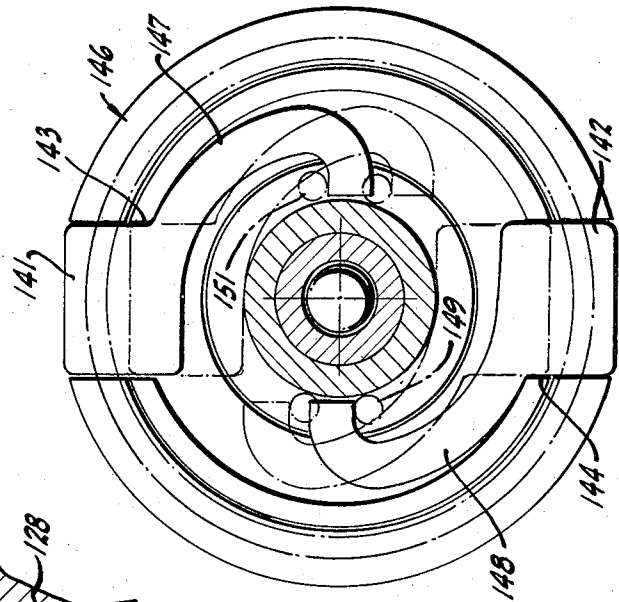


FIG. 9

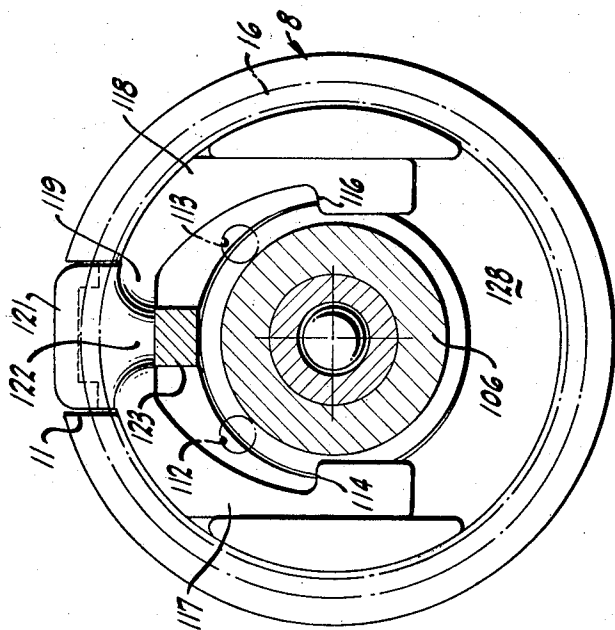
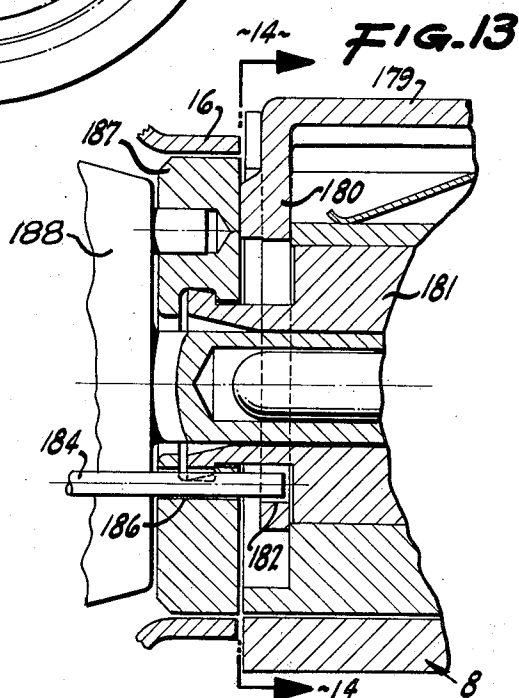
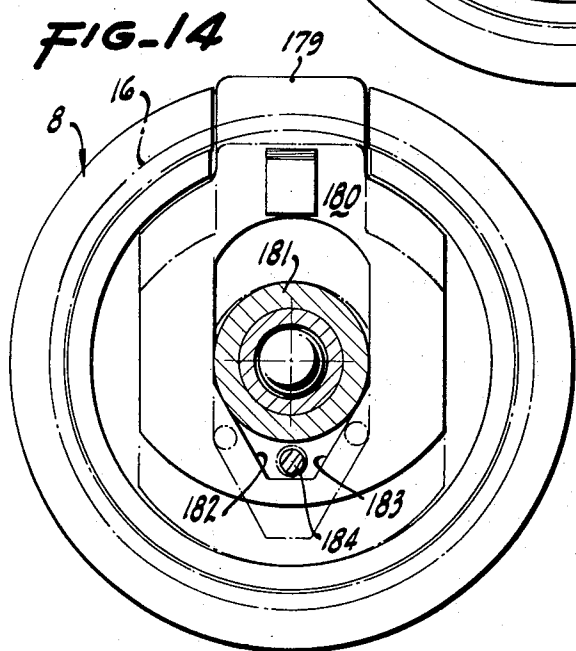
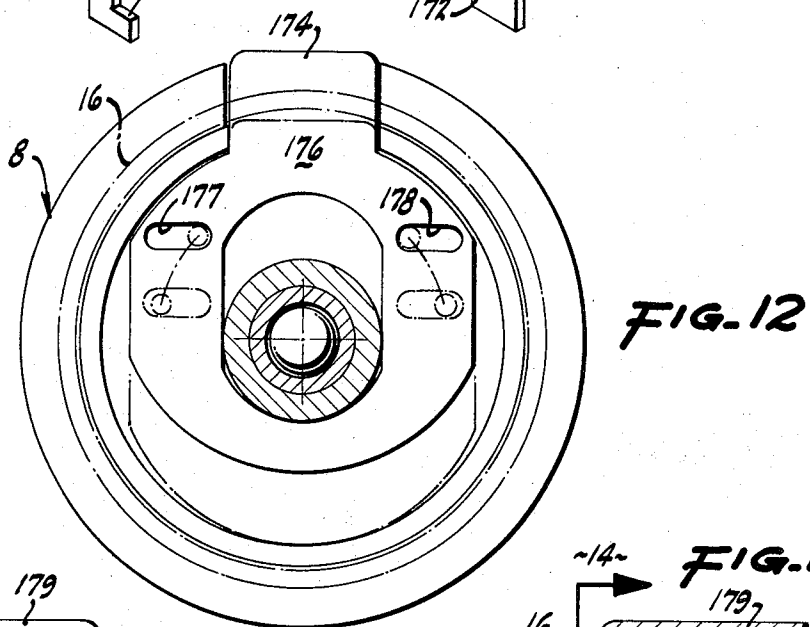
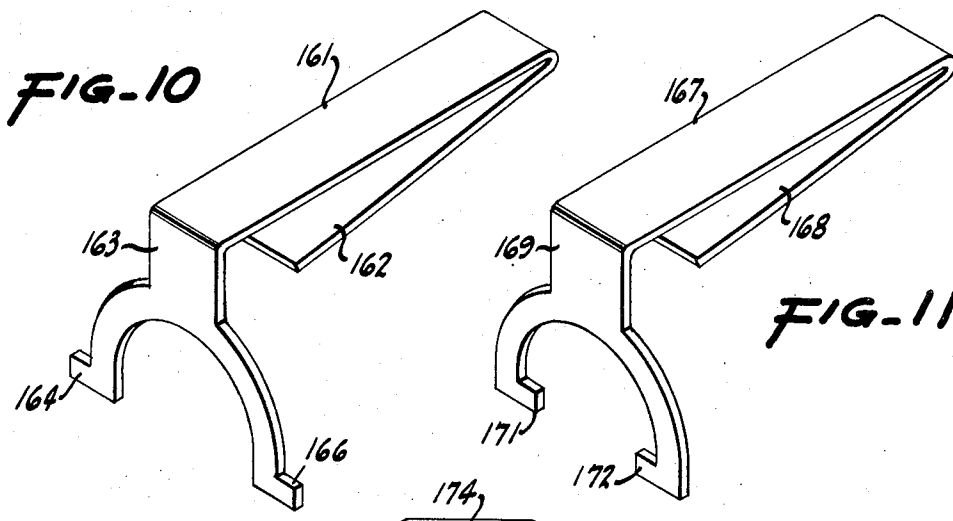


FIG. 8



REMOVABLE CYLINDER FOR A LOCK

Locks; for example, of the sort utilized in buildings, on doors and the like, customarily include a mechanism for locking the door panel. The mechanism incorporates a horizontally extending spindle rotatable about an axis normal to the plane of the door. The spindle is tubular or hollow and on each of its opposite ends carries a manual operator such as a knob. At least one of the knobs usually has a central, exterior opening aligned with the spindle. The exterior knob also serves as a housing for an enclosed lock cylinder and lock plug. The plug is rotatable from outside the knob by a proper key, to actuate the locking mechanism. Usually the lock cylinder has a tongue which projects radially from it and resides in a slot extending axially along the spindle. The tongue may or may not include some of the lock mechanism. The tongue is utilized to retain the lock cylinder in position, since the tongue is not movable axially or endwise because it contacts a portion of the spindle and contacts a portion of the knob and cannot rotate because of the spindle walls defining the slot. With this construction, the lock cylinder cannot be removed from or through the exterior opening of the knob. However, there are many reasons for wishing to remove the lock cylinder from the exterior knob; for example, to change the combination, to change or repair some of the parts of the lock cylinder, or to replace it.

It is therefore an object of the invention to provide a lock that has a cylinder and related mechanism substantially as above described but is removable from the front or exterior of the lock through the knob opening, but only by the appropriate key and utilizing some simple auxiliary tool, such as a small nail or rod or wire.

Another object of the invention is to provide a removable cylinder for a lock that can readily be incorporated in locks already available.

Another object of the invention is to provide a removable cylinder for a lock that is generally a substantial improvement on removable cylinder units heretofore available.

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

FIG. 1 is a cross-section on an axial, vertical plane through a lock pursuant to the invention, much of the standard mechanism of the lock being omitted for clarity and the key being shown in position near engagement;

FIG. 2 is a front elevation of the structure shown in FIG. 1;

FIG. 3 is a view similar to FIG. 1 but to an enlarged scale and disclosing much of the interior mechanism in cross-section on a vertical, axial plane, various portions being broken away to reduce the size of the figure;

FIG. 4 is a cross-section, the plane of which is indicated by the line 4-4 of FIG. 3;

FIG. 5 is a view similar to FIG. 3 but showing a modified form of construction and in a different phase of operation;

FIG. 6 is a cross-section, the plane of which is indicated by the line 6-6 of FIG. 5;

FIG. 7 is a view like FIG. 5 but showing a modified form of construction;

FIG. 8 is a cross-section, the plane of which is indicated by the line 8-8 of FIG. 7;

FIG. 9 is a view similar to FIG. 8 but showing a modified form of construction in similar cross-section;

FIG. 10 is an isometric view of a structure that may be utilized in the FIG. 3 arrangement;

FIG. 11 is a modified form of the structure of FIG. 10;

FIG. 12 is a cross-sectional view of a still further modified form of construction;

FIG. 13 is a cross-section on an axial plane of a further modified form of structure; and

FIG. 14 is a cross-section of the structure shown in FIG. 13, the plane of section being indicated by the line 14-14 of FIG. 13.

In one form of the invention, as particularly illustrated in FIGS. 1-4 inclusive, an installation is made on a door panel 6. Arranged to turn about a rotational axis 7 disposed normally to the general plane of the door is a rotary spindle 8. The spindle is connected to the customary lock mechanism, not shown, and is considered to be on the exterior side of the door panel. The spindle is conveniently a tubular member of rolled sheet metal and has a wall 9 with a slot 11 extending axially thereinto from one end.

Engaged with the spindle is the shank 12 of a knob 13 or other operating device. Sometimes a lever is utilized instead of a knob, and it is intended that the knob 13 represent any sort of actuating device. The knob 13 in its outermost portion has a reentrant curved face 14 ending in an inturned flange 16 adapted to abut the end of the spindle concentric with the axis 7. After the knob has been correctly positioned, it is conveniently secured to the spindle by a portion 17 depressed into an opening 18 in the spindle wall 9. There is a substantially permanent interconnection of the knob and the spindle.

Designed to be slidably received within the spindle 8 and also to be generally housed by the knob 13 is a lock body 21. This is preferably a circular cylindrical member having a central bore 22 extending coaxially there-through and having some sort of radially projecting tongue 23. Normally, the tongue extends beyond the diameter of the body and lies within the slot 11, so that the body is not rotatable with respect to the spindle and also is held against axial translation toward the panel 6. This is because the tongue is in abutment or nearly so with the end wall of the spindle at the inner end of the slot 11. The tongue 23 is obstructed in the other axial direction of motion by the knob flange 16. The tongue prevents the body from rotating within the spindle and likewise fixes the body axially within the spindle.

Designed to operate within the body 21 is a plug 24 rotatable within the bore 22. At one end the plug has a threaded collar 26 screwed thereon. The collar abuts the body and also holds in place a driver bar 27 slidably connecting with the operative part of the lock mechanism. When the plug 24 is rotated the driver bar 27 is similarly rotated and the lock mechanism is actuated. The lock plug 24 at its outer end has an enlarged flange 28 bearing against the forward end face of the body 21. The plug, although freely rotatable, is restrained against axial movement with respect to the body in both directions.

There may be a locking mechanism included in the plug, the body and the tongue. While it is immaterial what the particular details of the locking mechanism

may be, it is conveniently of the sort shown in the copending application of Ernest L. Schlage Ser. No. 178,561 filed Sept. 8, 1971 and entitled "Binary Multi-Plane Cylinder." In the mentioned instance the locking mechanism is contained within the plug and the body and does not extend into the tongue. In other instances the tongue is utilized as a housing for springs and radially movable tumbler pins.

In a representative case, the lock mechanism is actuated by a key 29 having a tubular shank 30 which enters into an annular bore 31 within the plug 24. A centralizing pin 32 occupies some of the space within the bore and serves as a guide for the shank 30 of the key. In the operation of this arrangement, the key shank 30 is inserted into the opening 31 surrounding the pin 32 and actuates the locking mechanism to permit rotation of the plug 24 within the body and corresponding rotation of the driver bar 27.

It is often desired, as indicated above, to provide means for removing the lock body 21 from the forward portion of the lock in order that it may be recombinated, repaired or replaced. Preventing such movement, however, is the tongue 23. Pursuant to the invention, I provide means for displacing the tongue 23 under appropriate conditions so that when displaced the tongue and the body 21 can be removed through the opening defined by the annular flange 16 of the knob 13.

The body 21 is provided with a longitudinally and radially extending channel 36 in which a separate tongue 23 is disposed. The tongue is conveniently fabricated of a folded strip 37 of spring material and has a pair of side walls 38 acting as stiffeners. The tongue 23 is normally urged into its expanded position, shown in FIG. 3, under the influence of the spring 37. When the tongue is pressed inwardly a front plate 41, forming part of the tongue 23, is displaced. Overlying and fastened to the plate 41 is a hard steel tablet 42 to protect the internal mechanism from tampering; for example, by drilling through other parts from outside and so making the tongue available for depression. The plate and tablet are depressed together until a high shoulder 43 is well within the radial extent of the annular flange 16 of the knob. The tongue and the body can then be withdrawn through the opening defined by the flange 16.

To accomplish depression of the tongue, the tablet 42 is provided with a pair of arms 44 and 46 diverging laterally and then intumed about at a diameter of the plug and finally ending in radially projecting feet 47 and 48.

For affording proper operation of the tongue mechanism, the plug 24 is provided with special means. Conveniently, the flange 28 is not made as part of the remainder of the plug, but preferably is initially a separate element 51. It is preferably of hard material. There is a central opening 52 merging into an undercut groove 53. The plug 24 itself is provided with an out-turned flange 54 of relatively soft material. Prior to assembly the flange 54 is of lesser diameter than an internal flange 56 bounding the groove 53 and can pass freely therethrough. At assembly an expanding tool is put into the plug and expands the flange 54 radially outward so that it lies within the groove 53. An extremely tight unitary fit is usually made between the two parts. There is a possibility of leaving the fit suffi-

ciently free so that the flange 28 may be rotatable with respect to the remainder of the plug 24.

Symmetrically disposed at either side of the vertical center line, because the device may be used with right-hand or left-hand installations, the flange 28 (or the piece 51) is provided with through bores 57 and 58 extending in an axial direction. Additionally, the flange 28 is provided with a through bore 61 designed to receive a pin 62 (FIG. 1) carried by the key and extending parallel to the shank 30 thereof. Preferably the bores 57 and 58 are at the same radius from the axis 7, but the bore 61 is at a different radius therefrom.

In the use of this arrangement, the key is introduced into the opening 31 telescoping over the pin 32. Initially or upon rotation of the key the pin 62 picks up and enters the bore 61. If the key is a proper one, the configuration of the key interrelates with the configuration of the plug 24 and the locking mechanism therein, so that rotation of the key also rotates the plug and the driver bar 27 to actuate the lock.

When it is desired to remove the lock body and its attendant locking mechanism, a special technique is used to withdraw the tongue 23. Introduced through either of the bores 57 or 58, depending on the hand or the lock, is a small bar, pin or rod which projects through the flange 28 (or 51) and into the general plane of either the foot 47 or the foot 48. Then, upon rotation of the proper key through approximately a quarter or so turn, the projecting temporary rod carried by the bore 57, for example, cams or abuts against the intumed portion of the foot 47 and lowers the tablet 42 and the plate 41 being guided by lugs 59 and 60 on the plate. This lowers the shoulder 43 and the tongue 23 against the urgency of the spring 37 so that the assembly may be completely withdrawn through the opening in the flange 16.

Should the flange 51 be rotatable by itself, the tongue may be lowered and the body 21 withdrawn. This, of course, is not desired since body removal should be restricted to proper keys only. To compensate for a separately rotatable flange 28 (or piece 51), the hardened tablet 42 is contoured to provide an inwardly extending projection 66 of an arcuate configuration. Comparably the plug 24 is provided with a pair of lunar cutouts 67 and 68. When an improper key is utilized, the plug 24 cannot be rotated. Even though the tongue may be partially withdrawn upon rotation of a wire carried by the piece 51, the projection 66, after a short travel, hits against the outside of the plug 24 between the cutouts and the tongue cannot be sufficiently withdrawn to permit the lock unit to be removed. When a proper key is utilized a long pin on it engages both the flange and a marginal notch in the plug 24 and they both turn together. As the projection 66 moves inwardly it is accommodated by one or the other of the lunar cutouts 67 or 68. The tongue can be fully withdrawn and the lock unit can be taken out.

As shown particularly in FIGS. 5 and 6, a somewhat modified version of a device for similar purposes is disclosed. In this instance the parts are substantially the same as before, in that there is provided a body 71 within which a plug 72 is rotatable about an axis 73. The plug has a similar forward formation to receive a flange 74, but in this instance the flange is not rotatable on the plug, but rather the interengagement of the bead 76 with the piece 74 is tight, so that the flange 74 and the plug 72 revolve in unison.

The body 71 has a channel 77 within which a tongue 78 is disposed. A leaf spring 79 engages the tongue 78 and has edge teeth 81 which dig into the material of the tongue. At its forward end the tongue is down-turned and bifurcated to provide a pair of arms 82 and 83 which straddle the forward portion of the plug 72 and again unite in a bridge 84 for strength. The arms 82 and 83 are guided by low bosses 86 and 87 extending forwardly from the body 71 a short distance sufficient to act as guides but not sufficient to interfere with the assembly and operation of the parts.

The flange 74 is provided with a bore 88 to receive a pin 89 on the key bow 91 and eccentrically to the key shank 92, which is as previously described. In this instance the flange 74 is likewise provided with a pair of bores 93 and 94 extending through the flange, so that a rod or wire can be inserted therethrough. When this occurs and the proper key is inserted and rotated, the wire or rod in either of the bores 93 or 94 is carried around until it abuts against a shoulder 96 or 97. Further rotation of the key carries the flange together with the wire against the shoulder and moves the tongue 78 radially inwardly and permits removal of the locking unit.

To provide a special degree of surety, there is provided, in addition to the parts previously described, a pin 99 lodged in the bore 88 and projecting therefrom. To engage the pin 99, the tongue 78 in its upper central portion is provided with an offset projection 101. This substantially rests against the pin 99 when the lock is locked and the key is in central position. Thus any withdrawal of the tongue 78 cannot occur until a proper key has been introduced and rotated through a substantial fraction of a turn and the pin 99 has cleared the projection 101. Then the tongue can move freely inwardly.

Another version for somewhat similar results is shown in FIGS. 7 and 8. In this instance the construction is substantially the same as before, except that the plug 106 is made integrally with the flange 107. The flange has a bore 108 for receiving a pin 109 on the key bow 111 and also has at least one or preferably two bores 112 and 113 extending therethrough. A tool or rod introduced thereinto can be rotated with the proper key into a position abutting a shoulder 114 or 116 on arms 117 and 118 forming parts of a front yoke 119 attached to the tongue 121. In this instance the tongue is somewhat offset in the yoke portion, so that an inwardly extending lip 122 upset from the general body of the yoke rests normally against a projection 123 outstanding from the flange 107. The tongue 121 is spring-pressed upwardly by a leaf spring 124 resting against the bottom 126 of a channel 127 in the body 128. Conveniently, the tongue 121 not only has the in-turned portion 122 at one end, but likewise has an in-turned leg 131 at the other end, so that the spring tongue is well confined against axial displacement. The spring 124 has teeth 132 which dig into the side walls of the tongue 121. With this arrangement, the rotation of the plug by a proper key and with a tool in position in either of the openings 112 or 113 serves to withdraw the tongue 121, provided by a proper key is utilized in order to rotate the mechanism; otherwise the tongue cannot be depressed because of interference between the projection 122 and the projection 123. Sufficient rotation, however, frees the parts so that the tongue is depressed and the lock can be replaced.

A variation on this theme is shown in FIG. 9, except that in this instance two tongues 141 and 142 are individually disposed in two slots 143 and 144 in the spindle 146. The tongues have arms 147 and 148 that can be engaged by a pair of projecting, temporarily inserted tools 149 and 151 upon rotation of the plug. Simultaneously both tongues 141 and 142 are drawn inwardly and the lock unit can be taken out.

In place of the tongue and yoke arrangement shown in FIGS. 7 and 8, I sometimes prefer an arrangement in which the tongue 161 as shown in FIG. 10 has an integral spring 162 and is provided with a yoke 163 having out-turned feet 164 and 166 disposed to be contacted by inserted tools similar to the arrangement shown in FIG. 8. Comparably, as shown in FIG. 11, a tongue 167 with an integral spring 168 is provided with a yoke 169 having intumed feet 171 and 172. This mechanism operates the same as the structure in FIGS. 8 and 10, except that the openings for the tool are in the paths of the feet 171 and 172.

As another alternative, as shown in FIG. 12, the tongue 174 is provided with a yoke 176 having a pair of slots 177 and 178 therein, the slots being engageable by a suitable tool, which upon rotation of the lock plug will withdraw the tongue 174 to the inside of the spindle.

A variation is shown in FIGS. 13 and 14, in which the tongue 179 has a yoke 180 extending around the plug 181. The yoke has a pair of internal cam surfaces 182 and 183 against which a tool 184 introduced through a bore 186 in the flange 187 of the plug 181 is carried. When the key 188 is rotated with the flange 187 and the plug 181, the extended tool 184 itself cams against either of the internal, inclined surfaces 182 and 183 and draws the tongue 179 into an inner position so that the lock unit can be withdrawn.

What is claimed is:

1. A removable cylinder for a lock having a tubular spindle concentric with and rotatable about an axis, said spindle including a wall having a slot extending axially thereinto from one end and having means for closing said slot at said one end comprising a cylinder body adapted to be moved axially into and out of a position within said spindle at least partly overlapping said closing means and said one end of said slot, a tongue mounted in said body for movement transversely of said axis between an outer position projecting from the outside of said body into said slot and against said closing means and an inner position near the outside of said body out of said slot, a plug mounted for rotation in said body about said axis, and means on said plug adapted to receive a tool and to move said tool by said rotation of said plug in a path engaging said tool with said tongue and moving said tongue from said outer position to said inner position.

2. A device as in claim 1 in which said tool is moved in either selected one of a pair of arcuate paths, and a connector extends from said tongue to points on opposite sides of said plug, and means on said connector at said points defining axially extending surfaces disposed in said paths.

3. A device as in claim 1 in which said plug includes a flange extending radially outwardly therefrom, and said tool-receiving means is an opening extending axially through said flange outwardly of said plug.

4. A removable cylinder for a lock having a supporting structure with an axis, said supporting structure

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having an opening therein, comprising a cylinder body adapted to be moved axially into and out of a position in said supporting structure overlapping said opening, a retaining member mounted in said body for movement between an outer position projecting from the outside of said body into said opening and an inner position near the outside of said body out of said opening, a plug mounted in said body for rotation about said axis between a central position and two side positions one on each side of said central position, means carried by said plug and effective upon movement thereof between said central position and either of said side positions for moving said retaining member from said outer position to said inner position, and means on said plug effective in only said central position thereof for limiting movement of said retaining member toward said inner position.

5. A removable cylinder for a lock having a tubular spindle concentric with and rotatable about an axis, said spindle including a wall having a slot extending axially thereinto from one end, and a knob on said spindle and forming a closure for said slot at said one end comprising a cylinder body adapted to be axially moved through said one end into and out of a position within

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said spindle at least partially overlapping said slot, means in said cylinder body defining an axially extending channel in communication with said slot, an axially elongated tongue mounted on said body for movement between an outer position extending into said slot and in axial alignment with said closure and an inner position out of said slot and at least partially disposed in said channel out of axial alignment with said closure, a plug mounted for rotation in said body about said axis, means on said plug adapted to receive an axially extending tool and to carry said tool upon rotation of said plug in a path engaging said tool with said tongue in said outer position and moving said tongue from said outer position to said inner position.

6. A removable cylinder as in claim 5 in which said body has a substantially planar end surface adjacent said one end of said spindle, and said means on said plug is a bore through a flange on said plug in position for said tool to abut said end surface.

7. A removable cylinder as in claim 6 in which said flange and said end surface are axially separated by a space and means on and movable with said tongue extend into said space in said path of said tool.

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