Aug. 26, 1969 E. H. LEBLANC 3,462,981

COMBINATION LOCK MECHANISM

Filed Feb. 1, 1967 4 Sheets-Sheet 1

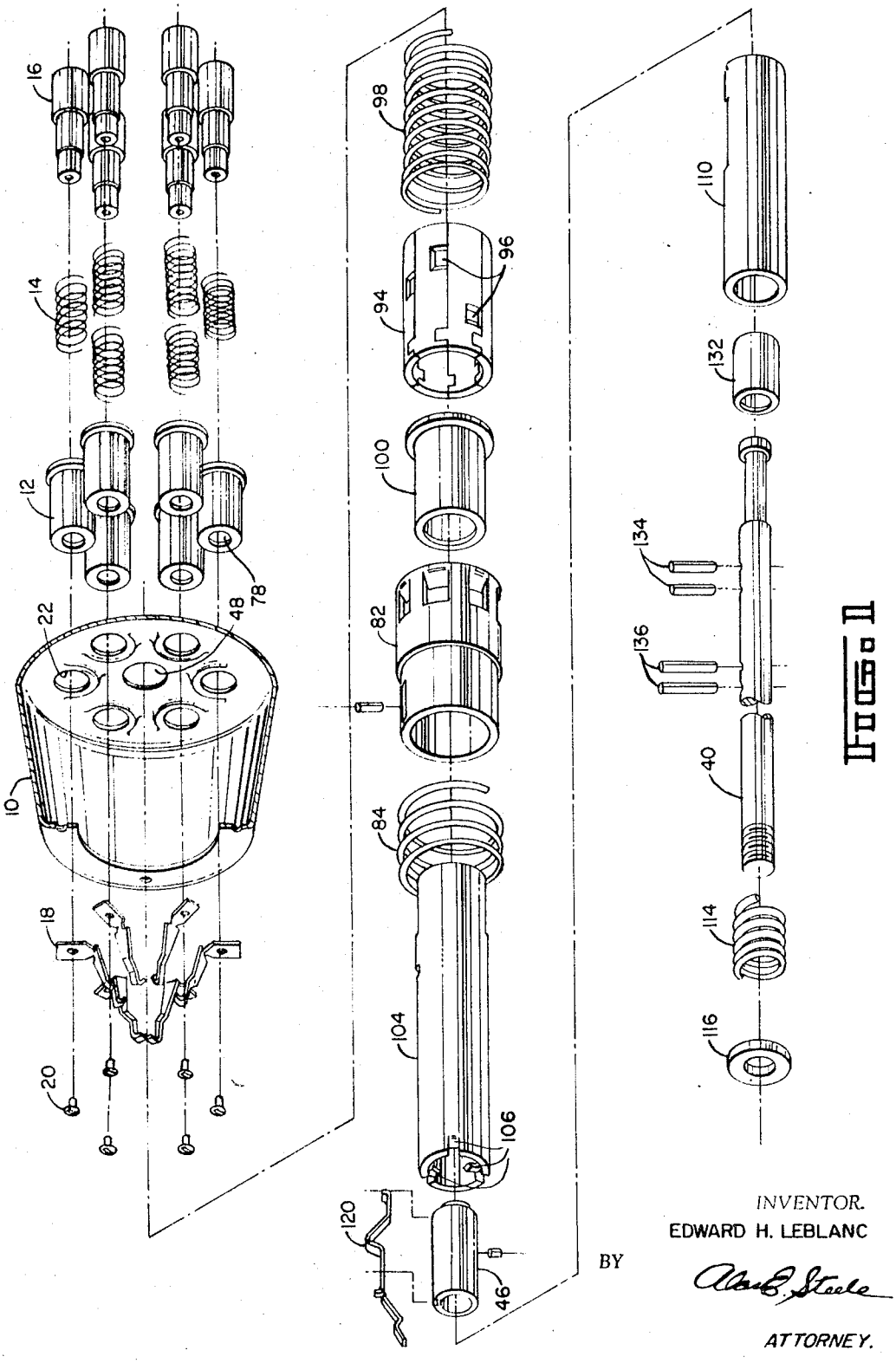


FIG. 11

INVENTOR.
EDWARD H. LEBLANC

BY

ATTORNEY.

Aug. 26, 1969 E. H. LEBLANC 3,462,981

COMBINATION LOCK MECHANISM

Filed Feb. 1, 1967 4 Sheets-Sheet 2

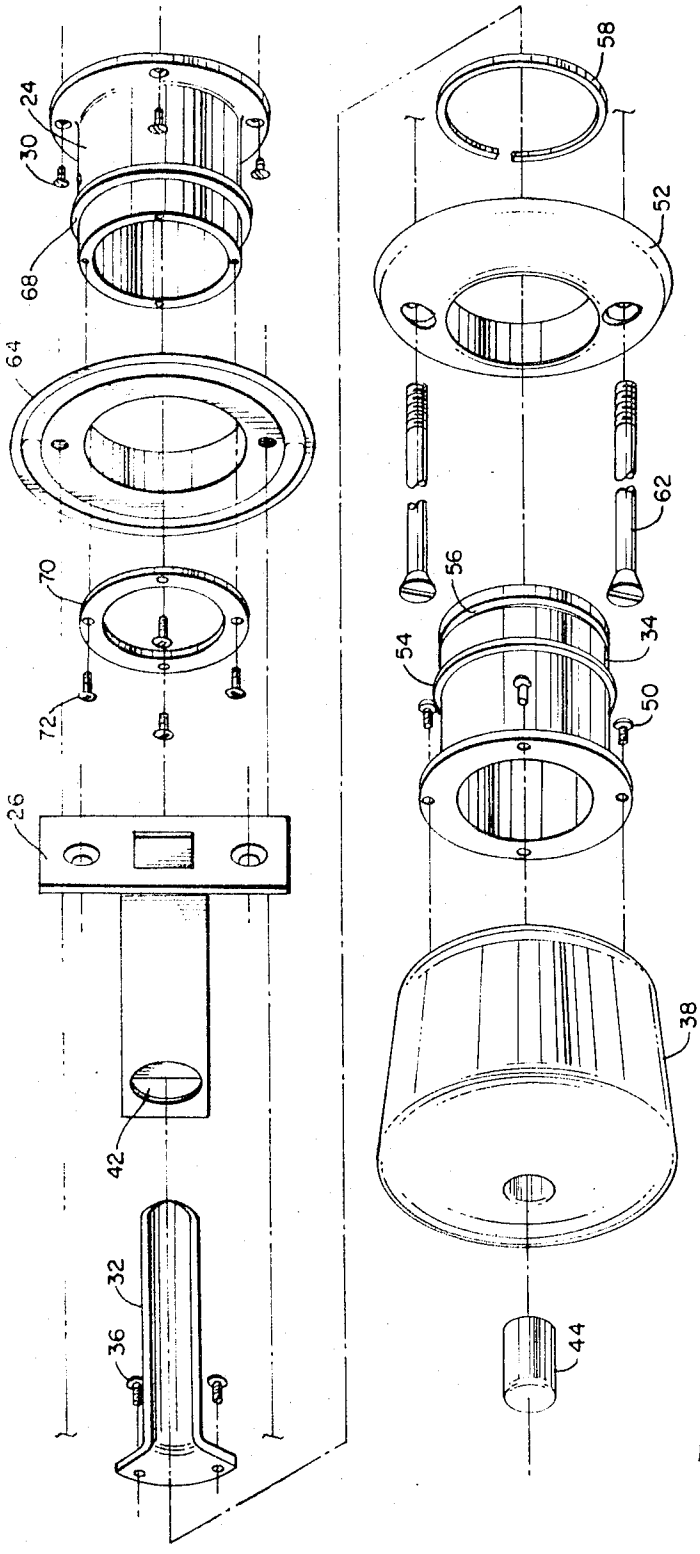


FIG. 11A

INVENTOR.
EDWARD H. LEBLANC
BY
ATTORNEY.

Aug. 26, 1969 E. H. LEBLANC 3,462,981

COMBINATION LOCK MECHANISM

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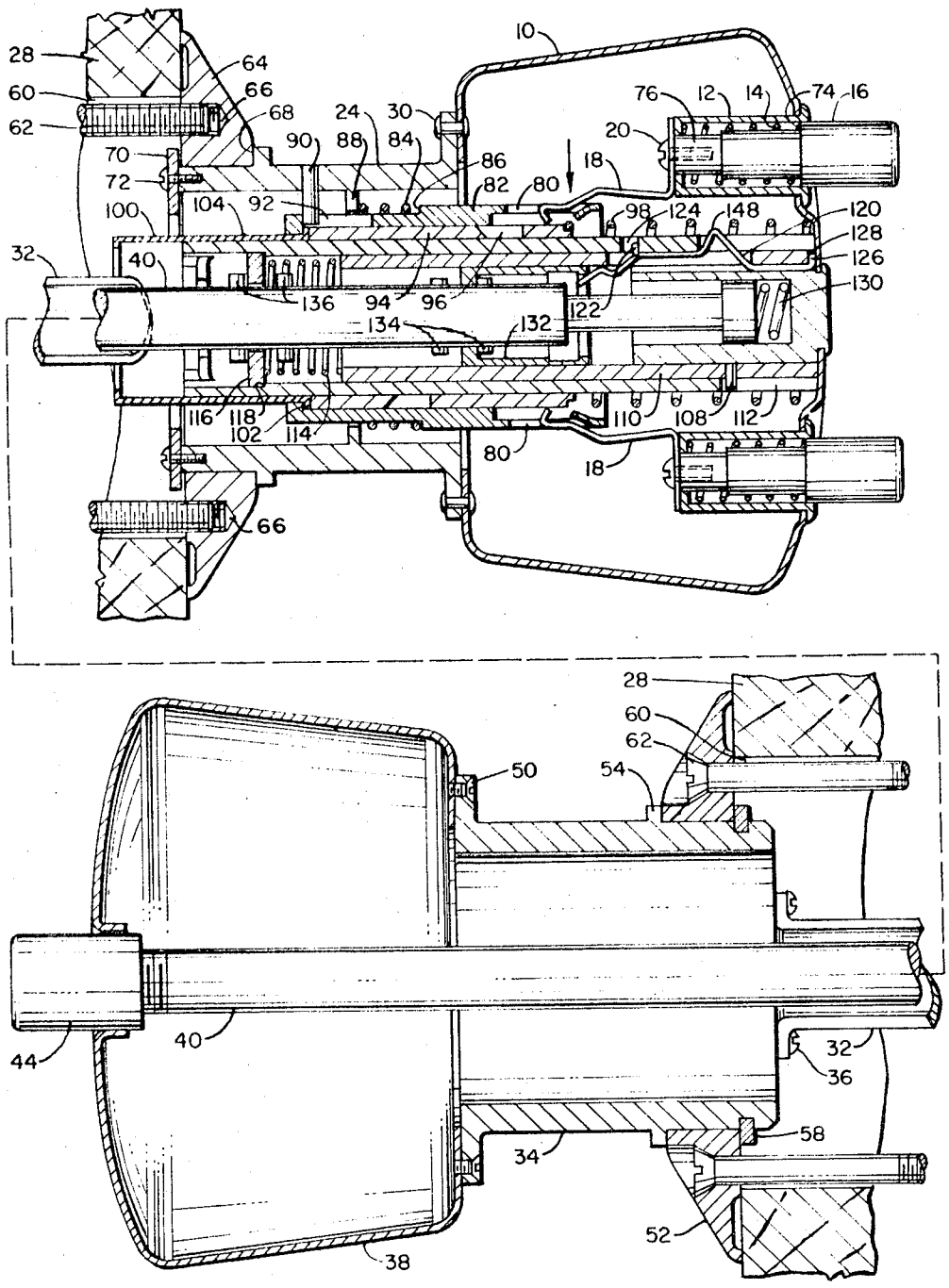


FIG. 2

INVENTOR.
EDWARD H. LEBLANC
BY
Alan E. Stule
ATTORNEY.

Aug. 26, 1969 E. H. LEBLANC 3,462,981

COMBINATION LOCK MECHANISM

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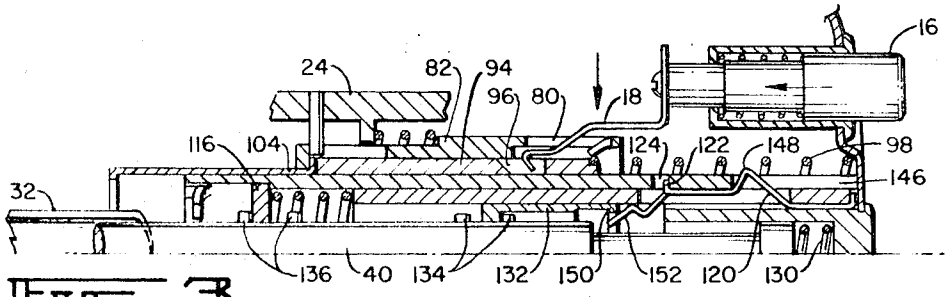


FIG. 3

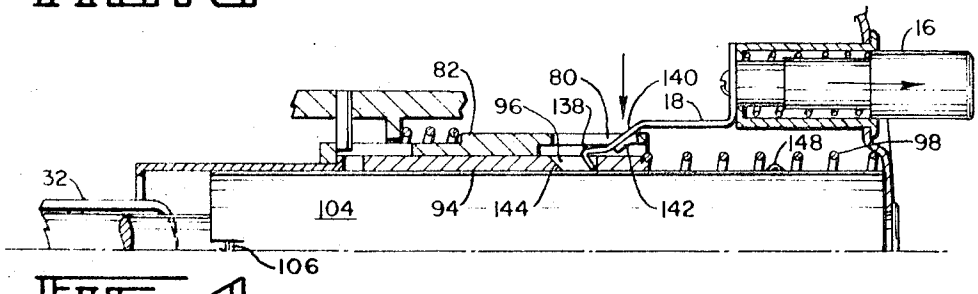


FIG. 4

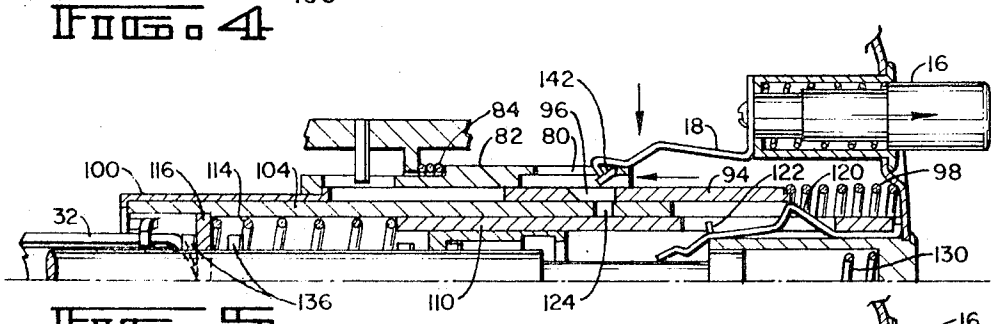


FIG. 5

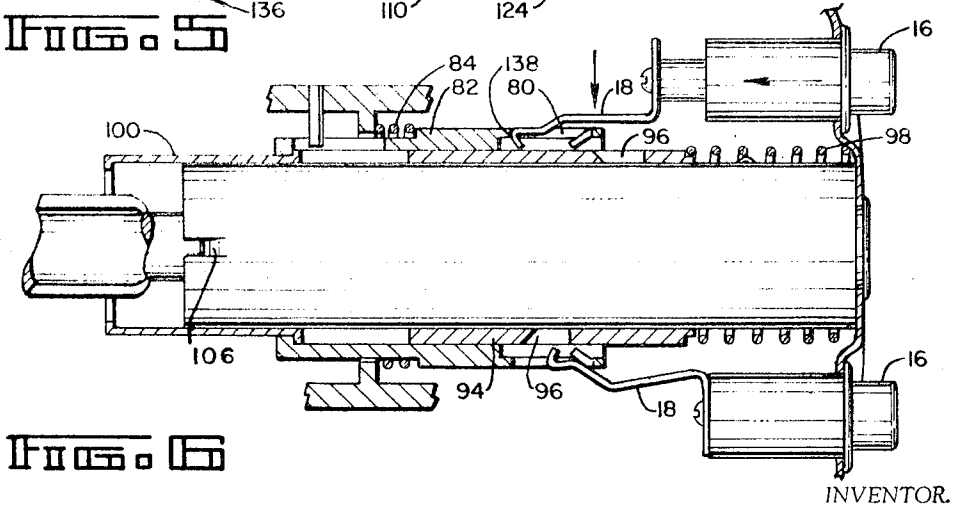


FIG. 6

INVENTOR.
EDWARD H. LEBLANC
BY
Alan E. Steele
ATTORNEYS.

United States Patent Office 3,462,981
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3,462,981

COMBINATION LOCK MECHANISM

Edward H. LeBlanc, Cromwell, Conn.
(2944 Hopkins Ave., Redwood City, Calif. 94062)

Filed Feb. 1, 1967, Ser. No. 613,168
Int. Cl. E05b 37/16
U.S. Cl. 70—156 12 Claims

ABSTRACT OF THE DISCLOSURE

A pushbutton combination lock mechanism having axial elements which are acted upon by pressing the pushbuttons in proper sequence and thereby causing engagement of a latch plunger and latch actuator to open the lock mechanism, and the automatic resetting of these axial elements when the wrong pushbutton is pressed during any time of the combination cycle.

This invention relates to a combination lock mechanism utilized to secure doors in dwellings and actuate automobile ignition switches without the need for keys and more specifically a novel combination lock mechanism which does not employ conventional tumblers but utilizes axial members which are positioned by depressing buttons, for example, on a doorknob in proper sequence to unlock the door.

Combination lock mechanisms for doors, per se, are old and many designs are well known in the art, however, to my knowledge none of these designs have ever been successfully manufactured or sold to the public. It appears that one or more of the reasons for the shortcomings of the combination door locks known in the prior art are their bulk, complexity of design, susceptibility to diagnosing the combination and the ability to be overridden by the use of force. I believe the combination door lock that I have conceived utilizing pushbuttons in the manner described below has overcome all of the shortcomings previously described, namely is readily adaptable to conventional door knobs, is a simple design, is foolproof and cannot be opened by use of force. It is these features which will make my combination door lock most desirable both from the design and commercial viewpoints. Therefore a particular feature of my invention is a cylindrical housing enclosing my combination lock mechanism which is smaller than the conventional doorknobs and easily adaptable to such doorknobs.

A further feature of my invention is that the cylindrical housing carries a series of axial elements for actuation by pushbuttons located on the doorknob. Proper depression of the right buttons in sequence causes incremental movement of said elements which releases a latch plunger to engage a latch actuator. It should be noted that prior to depressing the pushbuttons in proper sequence the latch plunger and latch actuator are not engaged. Therefore as an important feature the doorknob is free to rotate when the door is locked and therefore the door cannot be opened by forcing or twisting the doorknob.

As a further particular feature, I prevent the ability of one not familiar with the proper sequence from diagnosing the proper combination by means of automatically resetting the axial elements to its original position at any time the wrong button is pressed regardless of the number of increments the axial members have moved prior to depressing the wrong button. Those skilled in the art will appreciate that this novel feature will frustrate the attempts of one attempting to diagnose the proper combination by trial and error.

Another important feature of my invention is that the door can easily be locked or opened from the inside of a dwelling by simply depressing a single button located on the inside knob. A slight depression of the inside button will close the door and further depression will open it.

The more important features of my invention have been outlined broadly above in order that the more detailed description that follows may be better understood. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto.

The objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is an exploded view showing an outside doorknob and the mechanism of my lock.

FIGURE 1*a* is an exploded view showing an inside door knob, latch case and housing for the mechanism of my lock.

FIGURE 2 shows a cross section of my combination lock mechanism and knobs.

FIGURE 3 shows position of my mechanism with the door locked.

FIGURE 4 shows an incremental movement of one of the elements in my mechanism.

FIGURE 5 shows my mechanism engaged for opening the door.

FIGURE 6 shows the mechanism repositioning itself upon depressing the wrong pushbuttons.

Referring to the drawings which illustrate preferred embodiments of the mechanism constructed in accordance with the present invention, FIGURES 1, 1*a*, and 2 show the general arrangement of the combination lock mechanism and a doorknob assembly which includes an outside doorknob **10**, a combination lock mechanism housing **24** attached to knob **10** by means of four blind rivets **30**, a door latch case **26**, mounted in door **28**, and a latch actuator **32** attached to the lower portion of inside doorknob **34** by means of screws **36**. Shaft **40** communicates with the inside doorknob **38** and outside doorknob **10** by passing axially and centrally between both knobs and axial along the curved inner portion of latch actuator **32**, through opening **42** of latch case **26**. Shaft **40** is supported at the inside doorknob **38** by engaging and being threaded into the internally threaded button **44** centrally located on knob **38**. It is slidably supported at its other end by engaging the inner portion of the knob anchor **46** which is peened to outside knob **10** through the central opening **48**.

It should be noted that the lower portion of inside doorknob **34** can be manufactured as an integral portion of doorknob **38**, but in my present embodiment it is attached to doorknob **38** by means of four screws **50**. The doorknob **38** is attached to inside flange **52**, by sliding the flange **52** up against shoulder **54** of the lower portion **34** and then placing snap ring **58** in groove **56** so that the flange **52** is secured to lower portion **34** by abutting shoulder **54** on one side and abutting snap ring **58** on the other side. The inside doorknob assembly including the latch actuator **32** and shaft **40** and button **44** is mounted to the door **28** through opening **60** by means of two screws **62** which pass through flange **52**, opening **60** and engage the two blind threaded holes **66** in outside door flange **64** on the opposite side of the door. Outside doorknob **10** and housing **24** abut the outside flange **64** at shoulder **68** on one side, and plate **70** attached to housing **24** by four screws **72** abut the inside of flange **64**. It should be noted that both the inside doorknob **38** and outside doorknob **10** are free to rotate in the manner that they are assembled and attached to door **28**.

Having so far described the shell of a more conventional doorknob assembly, we shall now proceed to the

combination lock mechanism located in housing **24** and outside doorknob **10**. Referring to FIGURES 1 and 2, a plurality of apertures **22** located around the outer edge of knob **10** receives a series of pushbutton assemblies. In my embodiment six apertures are shown to receive six pushbutton assemblies. Each pushbutton assembly consists of a cup **12** which receives a spring **14** and inserted through the center of spring **14** is a pushbutton **16** wherein the shoulder **74** abuts against the right end portion of spring **14**. The left end portion of pushbutton **16** has a threaded hole **76**, and this end portion has a diameter which slidably fits hole **78** in the bottom portion of cup **12**. Finger **18**, which is made of spring steel, is attached to the underside of cup **12** by screw **20** which engages threaded hole **78** on pushbutton **16**. This assembly is then press fit into aperture **22** until the upper lip of cup **12** abuts the periphery of aperture **22**. Finger **18** is so designed that the inclined hooked portion engages a slot **80** in cylindrical guide ring **82**. There are six such slots located around the surface of ring **82**, one for each finger **18**. Guide ring **82** is urged rearward towards knob **10** by spring **84** agaist shoulder **86**. Spring **84** abuts rim **88** on stationary housing **24** at its other end. Pin **90** is press fit into housing **24** and engages slot **92** on guide ring **82** and acts as a stop to keep guide ring **82** from being urged completely rearward. It also keeps the guide ring **82** from rotating relative to housing **24**. Guide ring **82** slidably engages the outer surfaces of segments **94**. There are six such segments **94** interlocked to form a hollow cylinder. In each of these segments there is a slot **96**. Slots **96** are laterally displaced a discrete distance from one segment to the next. It should be noted that each slot **96** is radially aligned with a given slot **80** on guide ring **82**, although it is laterally displaced from these slots. Similarly each finger **18** is radially aligned with a given slot **80** as shown in FIGURE 2. Segments **94** are urged forward by spring **98** against the outer lip of cup **100**. The cup **100** is freely mounted so that it engages the end of guide ring **82** on the underside of its lip at **102**. The inner surface of cup **100** is aligned with the inner surface of segments **94** so as to form a continuous surface. Spring **98** is softer than spring **84** so that the resultant effect of these two springs, without any outside forces acting upon the elements, is to keep guide ring **82** in its rearward position. The continuous surface formed by the inner surface of cup **100** and segments **94** slidably engage the outer surface of latch plunger **104**. Latch plunger **104** is a hollow cylinder which has three tabs **106** bent over at its forward end, each of these tabs **106** is located at intervals of 120 degrees around the periphery of the forward end of latch plunger **104**. Latch actuator **32** is formed by a curved portion of metal forming slightly less than a 120 degree arc which readily can engage latch plunger **104** between two of the adjacent tabs **106** thereon. Since alignment between the tabs **106** and latch actuator is important, latch plunger **104** is kept from rotating relative to latch plunger guide **110** by pin **108** which is press fit in latch plunger guide **110** and engages slot **112** on latch plunger **104**. Latch plunger **104** is slidably mounted on the otuer surface of latch plunger guide **110**. Latch plunger guide **110** is brazed at its rearward end to doorknob **10**. Spring **114** which abuts the forward end of latch plunger guide **110** at one end and against washer **116**, which is press fit against shoulder **118** on latch plunger **104**, at its other end, tends to urge latch plunger **104** forward. However trigger spring **120** is mounted in such a way as to keep latch plunger **104** in its rearward position having a hook portion **122** engaging hole **124** in latch plunger **104**, while its sloping portion and rear end hook **126** in slot **128** embrace the rear of latch plunger guide **110**.

As previously mentioned, shaft **40** is supported by button **44** at the inside knob **38** and also supported by knob anchor **46** at the outside knob **10**. Knob anchor **46** is of a cylindrical hollow shape with its rearward end closed, and nestled in this hollow portion is spring **130** against which the end of shaft **40** abuts. Mounted around shaft **40** is the trigger release **132** which is a hollow cylindrical cup having its outside surface slidably engaging the inner surface of the latch plunger guide **110**. The trigger release **132** has a larger internal diameter at one end and a smaller internal diameter at the end which slidably engages shaft **40**. Shaft **40** has two pins **134** pressed diametrically through its center so that portions of these pins extend equal amounts on both sides of shaft **40**. These pins **134** are spaced a given amount from one another with one pin located on the inside of trigger release **132** and the other outside and to the left of it. Similarly there are two pins **136** pressed into shaft **40** at a given amount apart, one on either side of washer **116**. The function of pins **134** and **136** and the reason for the spacing therefore will be described below. However, it should be noted at this time that these pins have a constraining effect on shaft **40** from having excessive lateral movement.

The operation of my combination lock mechanism can best be observed by referring to FIGURES 2, 3, 4 and 5. FIGURE 2 shows the position of the elements of my mechanism when the door has been locked. As will be described later, the door is locked from the inside of the door. With the door in the locked position, latch actuator **32** and latch plunger **104** are disengaged so that the outer doorknob rotates freely when one tries to open the door without applying the combination. The inner doorknob **38** will always open the door when it rotates because latch actuator **32** engages the opening **42** in latch case **26**. One proceeds to open the locked mechanism by depressing one or more buttons **16** in the proper sequence. Buttons **16** may have numerals, letters or other marks on their faces so that a person knowing the combination can identify the proper buttons to be pressed. Upon pressing a proper button **16** (please refer to FIGURE 3), as indicated by the arrow, finger **18** moves laterally to the left. Since finger **18** is designed so that it is urged downward (as indicated by arrow in FIGURES 2 and 3). As it moves toward the left it will slide off the top of one of the segments **94** and into slot **96** as indicated in FIGURE 3. Upon releasing button **16**, it will return to its original lateral position (please refer to FIGURE 4) thereby also moving the segment **94** an equal distance to the rear with it, since hook portion **138** engages the rear side of slot **96**. The elements are so designed that when pushbutton **16** has returned to its original lateral position, the sloping portion **140** of finger **18** is resting against the inclined shoulder **142** of slot **80** in guide ring **82**. By thus moving segment **94** an incremental portion rearwardly against spring **98**, all the segments **94** move an equal distance rearwardly since they are interlocked. When these segments **94** are so moved rearwardly another slot **96** in one of the segments is aligned beneath one of the slots **80** in guide ring **82**. In order for another finger **18** to engage the slot **96** now aligned beneath slot **80** one must press the proper button **16** in the sequence of the combination. Let us assume that the proper button is now pressed, then the motions described above upon pressing the first proper button **16** will be repeated. However, as soon as the second proper button **16** is pressed and finger **18** engages slot **96** and starts to move it rearward an additional incremental distance, the first finger **18** will ride up against inclined shoulder **144** of the first slot **96** and disengage first segment **94**. Similarly upon pressing the proper button **16** for the third time in sequence, elements **94** will move an additional incremental distance rearwardly. Upon pressing the proper number of buttons **16** in sequence, segments **94** will have moved a sufficient distance to ride over and depress the U-shaped portion **148** of trigger spring **120** which protrudes above latch plunger **104** in slot **146** (please refer to FIGURE 5). As the segments **94** depress trigger spring **120**, the hooked portion **122** of trigger spring **120** is also moved downward out of hole **124** of latch plunger **104** and latch plunger **104** is shot forward by the urging

of spring 114, to engage latch actuator 32. Upon engagement of latch plunger 104 and latch actuator 32 rotation of the outside doorknob 10, will open the door. By rotating outer doorknob 10, latch plunger guide 110 rotates with it since they are brazed together, and the rotation of latch plunger guide 110 causes latch plunger 104 to rotate by means of pin 108 which engages slot 112. Since the latch plunger 104 is engaged to latch actuator 32, rotation of the latch plunger 104 will cause tabs 106 thereon to rotate latch actuator 32. Rotation of the inside doorknob 38 at any time causes the latch actuator to rotate, and since it always is in engagement with opening 42 in latch case 26, its curved portion is cammed against a surface in such a manner to open the door.

Upon release of the latch plunger 104 and shooting it forward, its forward end engages the bottom of cup 100 and moves it forward to a given distance. The movement of cup 100 causes guide ring 82 to move a similar distance since the lip 102 on cup 100 engages the forward end of guide ring 82. Guide ring 82 moves forward against spring 84 and as it so moves, any finger 18 which may have engaged slots 80 or 96 are disengaged therefrom and are moved up by the action of inclined shoulder 142 on them and also rest on shoulder 142 as shown in FIGURE 5.

It should be noted that the arrangement of segments 94 and the corresponding axial position of the slots 96 thereon determine the proper combination to open the locked mechanism. Therefore, if one wishes to change the combination, one has to rearrange the segments 94 to correspond to the desired combination. Similarily, the initial distance the segments 94 are spaced from trigger spring 120 determines the amount of buttons 16 which have to be pressed and present in the combination to open the mechanism. As a preferred embodiment, I have chosen a set of segments 94 and their initial distance from the trigger spring 120 in such a manner that three buttons 16 have to be pressed in the proper sequence to actuate the mechanism to open the door.

Previously we have assumed that the proper combination was known, and that pushbuttons 16 were pressed in proper sequence to open the combination door lock. Let us now assume that at any stage of pressing buttons 16, the wrong button was pressed. Referring to FIGURE 6, let us assume for example that a proper button 16 has been previously pressed (bottom portion of FIGURE 6) and engaged slot 96 in segment 94 thereby moving segment ring 94 rearward an incremental distance against spring 98. Now upon pressing the next button which is not in proper sequence (top portion of FIGURE 6) finger 18 will fall into slot 80 of guide ring 82, but since slot 80 is not aligned with slot 96 of segment 94 the lowermost portion of finger 18 will ride on the surface of segment 94. The hook portion 138 of finger 18 will abut the forward end of slot 80 forcing guide ring 82 forward against spring 84. This motion of guide ring 82 forward will release any finger 18 which may be engaged in slot 96 by causing such finger to ride up on sloping portion 140 (lower portion of FIGURE 6). Therefore, segments 94 will be repositioned to its original position, before any buttons 16 are pressed, by the action of spring 98 moving it forward until it abuts the lip of cup 100. Upon releasing the button 16 which was not pressed in proper sequence (upper portion of FIGURE 6) guide ring 82 will be returned to its original position by action of spring 84. The mechanism has now been completely repositioned and one may start the combination sequence again. It should be noted that this repositioning will occur at any time of the cycle. That is, regardless whether it is the first, middle or last button which is not pressed in proper sequence, the mechanism will reposition itself when the wrong button is pressed.

As was mentioned earlier, thecombination lock mechanism may be locked and also opened from the inside knob 38. This is accomplished in the following manner. First assume that the combination lock mechanism is open, FIGURE 5, and we shall close it from the inside. By depressing button 44 on knob 38, shaft 40 will move toward the right against spring 130 in knob anchor 46. As shaft 40 moves toward the right, the left pin 136, of the pair of pins 136 on shaft 40 which is in engagement with washer 116, will cause latch plunger 104 to move rearwardly until trigger spring 120 is repositioned in the latch plunger 104 as shown in FIGURE 2. That is the hooked portion 122 of trigger spring 120 engages hole 124 in the latch plunger 104 and U-portion 148 of trigger spring 120 protrudes above the rear end slot of the latch plunger 104. Normally one will close the lock mechanism, as described above, and then swing the door shut as they go outside.

Now, if the combination lock mechanism is in the closed position, one may open it from the inside by further depressing button 44 on the inside knob 38. As can be seen in FIGURE 3, further movement of shaft 40 to the right will move latch plunger 104 against trigger spring 120 by the action of left pin 136 against washer 116. This will attempt to depress trigger spring 120, but due to the design of this spring, U-shaped portion 148 will abut the shoulder in slot 146 and resist being depressed. However as shaft 40 is moving toward the right, left pin 134 of the pair of pins 134 comes into engagement with the forward end of trigger release 132 and begins to move it rearward. The movement of trigger release 132 rearward causes the rim 150 on trigger release 132 to abut the lower sloping portion 152 of trigger spring 120. Continued movement of shaft 40 to the right causes rim 150 to depress trigger spring 120 so that latch plunger 104 is now freed from hook portion 122 of trigger spring 120. As soon as this occurs, latch plunger 104 is freed and shoots forward to engage the latch actuator 32. It should be noted that the two pins 134 are so spaced on either side of the trigger release 132 so that upon releasing pressure on button 44 there is a time lag before right pin 134, by action of spring 130 on shaft 40, engages trigger release 132 to move it forward away from trigger spring 120. This is done to assure that latch plunger 104 has had sufficient time to shoot forward before trigger spring 120 is allowed to move up again. For if trigger spring 120 moved up too soon, hook portion 122 might again engage hole 124 and keep latch plunger 104 from shooting forward to open the mechanism.

It has thus been described how the combination lock mechanism may be opened or closed from the inside of the door. Whether the mechanism will be closed or opened from the inside depends upon the amount button 44 is depressed. If the mechanism is locked to begin with there is no problem as to how much the button 44 has to be depressed. However if the mechanism is open, depressing the button a small amount will close the mechanism and further depression will open it. Now one may ask how do you know the amount to depress the button 44 to get the desired result. As can be seen from the previous description in closing the mechanism one presses button 44 against a spring 130 and a trigger spring 120 falls into place. The falling into place of the trigger spring 120 causes a definite audible click which can also be felt. Further depression of the button meets greater resistance by spring 130 and trigger spring 120 which is now also under pressure. One can therefore definitely tell by feel and hearing when the mechanism is locked and also tell by increased resistance that he has locked the mechanism and any additional pressure will open it.

While I have described the structure and operation of the combination lock mechanism of the present invention in considerable detail as applied to doors for purposes of illustration, it will be understood that many of these details may be varied considerably and my combination lock mechanism may be utilized in ways other than doors such as automobile ignition switch actuation,

without departing from the spirit and principles of my invention.

I claim:

1. A combintion lock mechanism which engages a latch, said mechanism comprising a casing, a plurality of pushbuttons mounted on the face of said casing and each adapted to be depressed from a normal projected position to a fully depressed position and upon release to be returned to its initial projected position, a stationary cylinder mounted in and affixed to one end of said casing, a latch plunger slidably mounted on said cylinder, biasing means urging said latch plunger toward one end of said casing, means for holding said latch plunger in a retracted position, a latch actuator rotatably mounted in the other end of said casing, means for releasing said latch plunger and shoot it toward one end of said casing to engage said latch actuator upon completion of depression of said pushbuttons in proper sequence.

2. A combination lock mechanism as defined in claim 1 wherein means for holding said latch plunger in a retracted position is a spring.

3. A combination lock mechanism as defined in claim 2 wherein each of said push buttons has a finger attached at its end located in said casing.

4. A combination lock mechanism as defined in claim 3 wherein means for releasing said latch plunger comprises a series of interlocked elements slidably mounted on said latch plunger and each having an opening therein and each opening cooperating with a corresponding finger upon depression of the proper pushbutton in proper sequence.

5. A combination lock mechanism as defined in claim 4 wherein the cooperation of a finger and an opening in one of said elements upon release of its corresponding pushbutton moves said elements against the action of said spring retracting means.

6. A combination lock mechanism as defined in claim 5 wherein completion of depressing the pushbuttons in proper sequence moves said elements to a position where it disengages said spring retracting means and thereby allowing said forward biasing means to shoot said latch plunger toward one end of said casing and means for resetting said elements to its original position upon depression of a pushbutton in improper sequence.

7. A combination door lock mechanism comprising a door lock, a knob which is free to rotate at all times attached to said door lock, a plurality of pushbuttons peripherally mounted around the face of said knob, first means for unlocking said door lock mounted in said knob and door lock when said knob is rotated atfer completion of depression of said pushbuttons in proper sequence, said means comprising a series of coaxial elements, a latch plunger, a spring cooperating with said plunger and at least one of said coaxial elements, and second means for resetting first means to its original position upon depression of a pushbutton in improper sequence.

8. A combination door lock mechanism as defined in claim 7 wherein said latch plunger is biased to move in one direction but is constrained from moving by said spring.

9. A combination door lock mechanism as defined in claim 8 wherein said pushbuttons have fingers attached to the ends thereof located inside said knob, and each of said pushbuttons are adapted to be depressed from a normal projected position to a fully depressed position and upon release to be returned to its initial projected position.

10. A combination door lock mechanism as defined in claim 9 wherein several of said coaxial elements are interlocked and each has an opening therein which cooperates with at least one of said fingers upon depression of the proper pushbutton and moves a given distance against the action of said spring upon releasing said depressed pushbutton.

11. A combination door lock mechanism as defined in claim 10 wherein completion of depressing the push buttons in proper sequence moves said interlocked coaxial elements to a position where it disengages said spring thereby allowing said latch plunger to shoot toward the direction in which it was biased to engage a latch actuator rotatably mounted in said door lock.

12. A combination door lock mechanism comprising a first doorknob having a plurality of pushbuttons mounted on its face, a second doorknob, a casing containing a door lock attached at either end to said first and second doorknobs, a door lock closing and opening mechanism mounted in said casing, a spring mounted at one end of said door lock closing and opening mechanism, a release mechanism axially mounted in said door lock closing and opening mechanism, an opening in said second doorknob having a button mounted therein, a shaft which is attached to said button, said shaft cooperates with said release mechanism at a point intermediate the ends of said shaft and also abuts against said spring which biases said shaft toward said second door knob whereby, depressing said button a given distance against said spring closes the door lock, and further depression of said button actuates said release mechanism to open said door lock.

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MARVIN A. CHAMPION, Primary Examiner

EDWARD J. McCARTHY, Assistant Examiner

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