Dec. 5, 1961 M. E. WILLIAMS 3,011,331

KEY ASSEMBLY RETENTION SYSTEM

Filed March 6, 1958 4 Sheets-Sheet 1

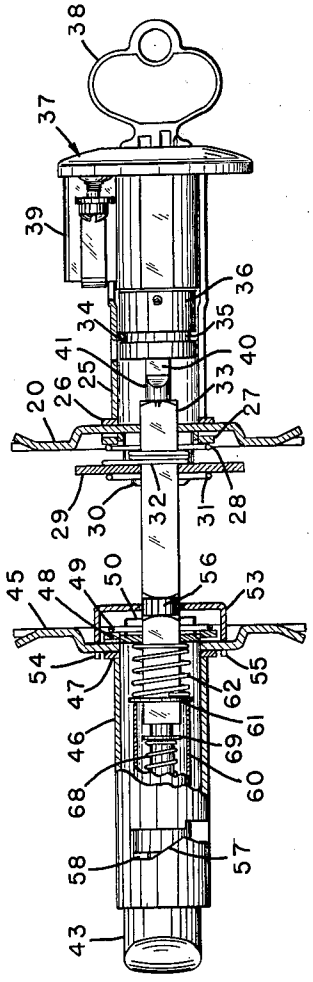



FIG. 1

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KEY ASSEMBLY RETENTION SYSTEM

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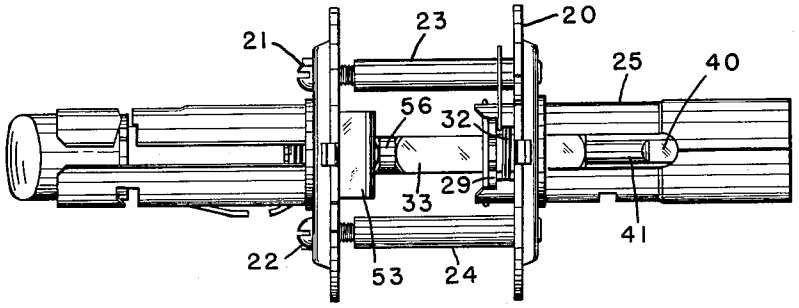



FIG. 2

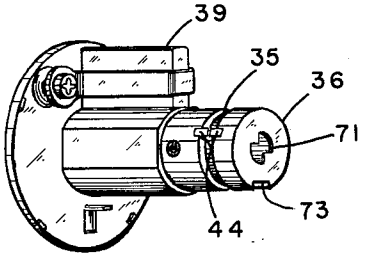



FIG. 3

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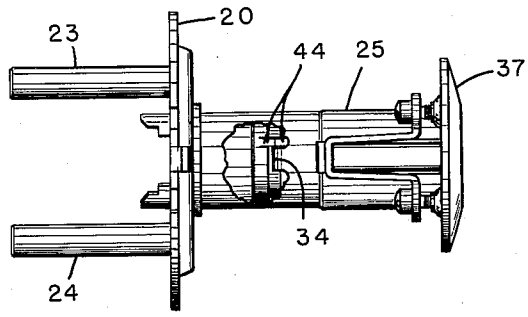



FIG. 4

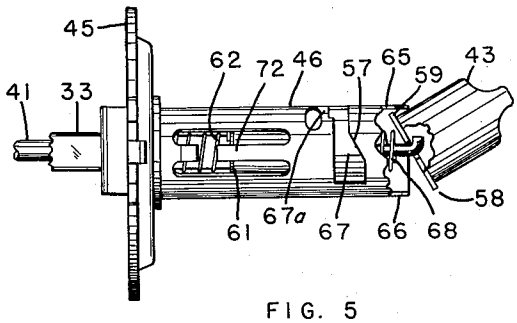



FIG. 5

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KEY ASSEMBLY RETENTION SYSTEM

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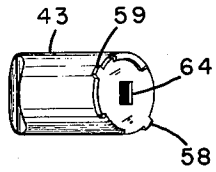



FIG. 6




FIG. 7

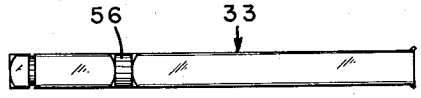



FIG. 8

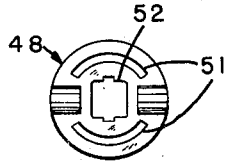



FIG. 9

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United States Patent Office 3,011,331 Patented Dec. 5, 1961



3,011,331

# KEY ASSEMBLY RETENTION SYSTEM

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2 Claims. (Cl. 70—216)

This invention relates to the construction of door locks of the type in which a key assembly is received within the outer door knob, and rotates coaxially with the knob. Occasions frequently arise in which it becomes desirable to change a key in an existing lock assembly, and the key-operated portion of the mechanism must be easily removable to permit this operation to be done without an excessive amount of time being involved. The required degree of dis-assembly of the lock mechanism must be held to a minimum, and yet the system must provide adequate safeguards against unauthorized entrance.

It is common practice to provide for the removability of the key assembly by the placement of the key in a position outside the normal range of operation. Various methods are used to establish the normal range of key movement and yet permit the key to be placed beyond this range under certain circumstances. This invention is associated primarily with the function of controlling the limits of key movement independently of the latch mechanism which is driven by the knob assembly. By excluding the latch mechanism as a factor in determining the normal range of key movement, an entire series of manufacturing tolerances is eliminated, as well as eliminating the possibility of overstraining the components of the latch mechanism.

In the system provided by this invention, the operating shaft controlled by the knobs is locked against rotation through the engagement with a member normally fixed with respect to the door. The operating mechanism is generally composed of two sections, which are installed coaxially on opposite sides of the door. As long as these sections are in the installed position, the normal range of key movement is completely determined. In order to place the key in position for removal of the tumbler assembly, it is necessary to disengage from the door the portion of the knob system which is mounted on one side of the door. This a very simple operation, requiring only the removal of a pair of mounting screws from the inside.

The several features of the invention will be discussed in detail through an analysis of the particular embodiments illustrated in the accompanying drawings. In the drawings:

FIGURE 1 presents a sectional elevation showing the inner and outer portions of the locking mechanism and knob-supporting assemblies, with the components in the unlocked condition.

FIGURE 2 presents a view of the inner and outer knob-supporting assemblies, with the key and tumbler assembly removed. FIGURE 2 shows the position of the manually-operated button for controlling the lock, and the main operating shaft, in locked position.

FIGURE 3 presents a perspective view from the inside of the key-operated assembly.

FIGURE 4 presents a view of the outer knob-supporting assembly, with a portion broken away to show the relative position of a stop in the annular groove on the key-driven actuator with respect to an ear on the knob-supporting structure for limiting the rotation of the key in one direction.

FIGURE 5 presents a view showing an intermediate stage in the assembly of the inner knob-supporting system; and in particular, the installation of the manually-operated button for controlling the locking action.

FIGURE 6 is a perspective view of the manually-operated button for controlling the lock.



FIGURE 7 is a side elevation of the rod driven by the key assembly.

FIGURE 8 is a side elevation of the main operating shaft through which torque is transmitted from the knob to the latch mechanism.

FIGURE 9 presents a plan view of a driving washer utilized for the transmission of torque from the knob-supporting assembly to the shaft shown in FIGURE 8.

Referring to the drawings, the outer knob-supporting assembly includes the plate **20** which is normally fixed with respect to the door, and is held in this position by the engagement of the mounting screws **21** and **22** with the tubular posts **23** and **24**. These posts are threaded on the inside for engagement with the screws, and are permanently secured to the plate **20**. The tubular member **25** is rotatably mounted in the plate **20**, and its axial position with respect to the plate is determined by the washers **26** and **27**, together with the snap ring **28**. A driving member **29** is engaged by the extension **30** of the tubular member **25**, and is locked in position by the snap ring **31**. The member **29** extends rigidly a sufficient distance to engage the mounting tubes **23** and **24** to limit the normal range of rotation of the knob. A return spring **32** surrounds the square tubular operating shaft **33**, and has its ends extended sufficiently to engage the tube **23** and **24** as shown in FIGURE 2 (one of the ends of this spring does not appear in this figure because of the concavity of the plate **20**).

An ear **34** is turned radially inward to engage the groove **35** in the rotary actuator **36** of the key assembly indicated generally at **37**. A conventional key **38** opertes in conjunction with suitable tumblers within the housing **39** in conventional fashion to determine the rotation of the actuator **36**. A proper key will permit rotation of the actuator, which has a driving connection with the flattened end **40** of the rod **41**. The opposite end **42** of this rod is similarly flattened to form a driving connection in rotation with the button **43** which is manually positioned to control the locking action of the mechanism.

The key-driven actuator **36** is axially slid into the assembled position shown in FIGURE 1 when the opposite sections of the mechanism are disengaged, and when the right-hand portion is isolated as shown in FIGURE 4. Under these conditions, the axial groove **73** can be engaged with the ear **34**. The axial groove **73** communicates with the annular groove **35**, and the assembly can then be shoved into the final position. The key is then used to rotate the actuator into the position shown in FIGURE 4. The staked area **44** on the actuator **36** forms an abutment which limits the rotation of the actuator, and the sector between the position shown in FIGURE 4 and that in which the axial groove **73** is in alignment with the ear **34** may be considered as the rotary freedom of movement of the actuator without passing a position of possible withdrawal.

The knob-supporting assembly on the opposite side of the door includes the fixed plate **45** which is removably secured to the door by the same forces generated by the mounting screws **21** and **32** in their engagement with the posts **23** and **24**. The tubular member **46** is rotatably mounted in the plate **45**, and axially fixed with respect thereto by the combined action of the washer **47**, the drive washer **48**, and the snap ring **49**. The details of the drive washer are shown in FIGURE 9. The extensions **50** of the tubular member **46** engage the arcuate openings **51** in the drive washer, and the square central aperture **52** engages the operating shaft **33**. Torque is transferred from the tubular member **46** through the drive washer **48** to the shaft **33** in this manner. A knob is normally mounted in conventional fashion on the exterior of the tubular member **46**, but is not shown in the drawings.

A U-shaped bar 53 is fixed with respect to the plate 45 through the engagement of ears 54 and 55 with suitable apertures in the plate, with these ears being staked over on assembly. The bar 53 has a central square opening for slideably receiving the shaft 33. When the square portion of the shaft is in engagement with the central opening of the bar 53, the shaft 33 is locked against rotation so that the forces applied to the knobs cannot operate the latch mechanism which the illustrated assembly is designed to manipulate. A reduced portion 56 is provided on the shaft 33, and is preferably circular in cross-section so that it is free to rotate within the square opening of the bar 53. When the shaft is in the position shown in FIGURE 1, it is free to rotate so that the latch mechanism can be operated by the knobs.

The tubular member 46 is provided with a cam surface 57 followed by the projection 58 on the manually-operated button 43, and a similar projection 59 is provided on approximately a diametrically opposite position and engaging a similarly-formed cam surface at the opposite side of the tubular member 46. Rotation of the control button 43 (preferably accompanied by a slight pushing action) from the position shown in FIGURE 1 to that of FIGURE 2 results in the axial displacement of the control button which results in the movement of the shaft 33 into a position where its square portion is in engagement with the bar 53. This displacement of the shaft 33 is caused by the action of the tube 60 which extends from the inner end of the button 43 to the retaining washer 61. This washer firmly engages a suitable groove in the shaft 33, and is consequently axially fixed with respect to the shaft. A spring 62 extends between this washer and the drive washer 48 to apply a continuous biasing action to the left as shown in FIGURE 1 to the shaft 33. The ears 58 and 59 serve as a stop limiting the movement induced by the spring 62 at a position selected to coincide with the position of the shaft 33 such that the reduced portion 56 can move freely within the central opening of the bar 53.

The rod 41 is slideable within the tubular interior of the shaft 33, and is assembled to the button 43 as shown in FIGURE 5. This same operation serves to assemble the button to the tubular member 46. The interior of the button 43 is hollow to permit some degree of retraction of the hooked end 63 of the shaft. This end is placed in engagement with the opening 64 in the control button, with the ear 59 moved laterally into engagement with the closed axial slot 65 in the tubular member 46. The opposite ear 58 engages the slot 66, which is open completely to the end of the tubular member 46. The slot 65 communicates with the opening 67 which defines the cam area 57, and the slot 66 communicates with a similar opening. After the control button has been placed in position and shoved axially inwardly to the point where the ears 58 and 59 can be rotated into the respective openings 67, an assembly operation is performed which displaces the material of the tubular member 46 at 67*a* to retain the ear 59 within this opening. The peripherally opposite ends of the opening 67 serve as stops which determine the sector of freedom of rotation of the control button 43, and consequently of the rod 41. The fact that the rod must accommodate itself to doors of various thicknesses requires that a considerable amount of axial movement of the rod be provided with respect to the operating shaft 33. The rod is biased into a position of maximum extension of the flattened end portion 40 by the action of the spring 68 operating between the control knob 43 and the retaining washer 69 received within the groove 70 on the rod.

When the outer knob-supporting assembly is rotated with a key to the position shown in FIGURE 4, and the illustrated mechanism is then connected to the inner knob-supporting assembly in the position shown in FIGURE 1, the engagement of the flattened end 40 of the rod 41 with the driving opening 71 of the key-driven



actuator (refer to FIGURE 3) establishes that the subsequent rotation of the key 38 can be limited by the freedom of rotary movement of the control button 43 which is, in turn, limited by the engagement of the ears 58 and 59 with the peripherally-opposite ends of the opening 67 in the tubular member 46. This freedom of movement is established such that the actuator 36 cannot be rotated clockwise away from the position shown in FIGURE 4 to a point where the axial groove 73 becomes aligned with the ear 34. Some degree of lost motion is provided through the shape of the opening 71 and the accumulation of tolerances in the various parts, but these factors are allowed for in the formation of the openings 67. Freedom of rotation of the key after the unit has been assembled is therefore limited by the rod 41 and its restraint under the influence of the inner knob-supporting assembly. The key assembly 37 can easily be removed for inspection or adjustment by disconnecting the mounting screws 21 and 22 and a withdrawal of the right-hand knob-supporting assembly shown in FIGURE 1 a sufficient amount to disengage the rod 41 from the opening 71. When both sections of the lock mechanism are assembled in the condition shown in FIGURE 1, there will normally be a latch mechanism (not shown) in between them which is engaged by the operating shaft 33. Suitable knobs are placed on both the tubular members 25 and 46, the knob which would be mounted on the member 46 being retained by the latching action of the portion 72 shown in FIGURE 5.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claims. In these claims, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

I claim:

1. In a key-in-knob lock mechanism having separable sections for coaxial installation on the opposite sides of a door, respectively, each of said sections including a fixed plate adapted to be removably secured to a door, and each of said sections also including a tubular member rotatably mounted on said fixed plate, one of said tubular members having a configuration for receiving a key-driven assembly having a rotary actuator coaxially mounted with respect to said tubular member, and the opposite of said tubular members having a manually operable lock control, said lock control being angularly moveable in said tubular member coaxially therewith within a limited sector, a system for determining the removeability of said key-driven assembly comprising: means forming an annular peripheral groove in said key-driven actuator and an axial groove from said annular groove to the inner end of said actuator; an ear fixed with respect to the tubular member receiving said key-driven assembly and receivable in said annular and axial grooves; stop means in said annular groove limiting the rotation of said actuator with respect to said tubular member receiving said key-driven assembly; an operating shaft of tubular non-circular cross section for cooperation with a latch mechanism, said shaft being axially slideable with respect to said tubular members and normally angularly fixed with respect thereto, said shaft having a portion of its length reduced in cross section; a bar normally fixed with respect to said door and having an opening for receiving said shaft in non-rotative engagement, the reduced portion of said shaft being rotatable in said opening; interengaged cam and follower means on said lock control and on the tubular member associated therewith whereby rotation of said lock control induces axial movement thereof; means axially connecting said lock control to said operating shaft with freedom of rotary movement whereby said axial movement places the reduced portion of said operating shaft to and from engagement with said bar; biasing means

urging said operating shaft and lock control to a position corresponding to engagement of said reduced portion with said bar; a rod slideably and rotatably received within said tubular operating shaft and rotatively fixed with respect to said lock control, said rod having a driving connection in rotation axially engageable with said key-driven rotary actuator; stop means associated with said cam means establishing a sector of freedom of rotary movement of said lock control contained within and substantially less than the sector determined by said axial groove of said rotary actuator and said annular groove stop means, and disposed so that said axial groove said rotary actuator and said ear are not engageable except with said rod disengaged from said rotary actuator.

2. In a key-in-knob lock mechanism having separable sections for coaxial installation on the opposite sides of a door, respectively, each of said sections including a fixed plate adapted to be removeably secured to a door, and each of said sections also including a tubular member rotatably mounted on said fixed plate, one of said tubular members having a configuration for receiving a key-driven assembly having a rotary actuator coaxially mounted with respect to said tubular member, and the opposite of said tubular members having a manually operable lock control, said lock control being angularly moveable in said tubular member coaxially therewith within a limited sector, a system for determining the removeability of said key-driven assembly comprising: means forming an annular peripheral groove in said key-driven actuator and an axial groove from said annular groove to the inner end of said actuator; an ear fixed with respect to the tubular member receiving said key-driven assembly and receivable in said annular and axial grooves; stop means limiting the rotation of said actuator with respect to said tubular member receiving said key-driven assembly; an operating shaft of tubular non-circular cross section for cooperation with a latch mechanism, said shaft being axially slideable with respect to said tubular members and normally angularly fixed with respect thereto, said shaft having a portion of its length reduced in cross section; a bar normally fixed with respect to said door and having an opening for receiving said shaft in non-rotative engagement, the reduced portion of said shaft being rotatable in said opening; interengaged cam and follower means on said lock control and on the tubular member associated therewith whereby rotation of said lock control induces axial movement thereof; means axially connecting said lock control to said operating shaft with freedom of rotary movement whereby said axial movement places the reduced portion of said operating shaft to and from engagement with said bar; biasing means urging said operating shaft and knob control to a position corresponding to engagement of said reduced portion with said bar; a rod slideably and rotatably received within said tubular operating shaft and rotatively fixed with respect to said lock control, said rod having a driving connection in rotation axially engageable with said key-driven rotary actuator, the sector of freedom of rotary movement of said lock control being contained within and substantially less than the sector determined by said axial groove of said rotary actuator and said stop means, and disposed so that said axial groove, said rotary actuator and said ear are not engageable except with said rod disengaged from said rotary actuator.




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