Oct. 3, 1950 L. W. YOUNG ET AL 2,524,339

CYLINDER LOCK

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FIG. 1.

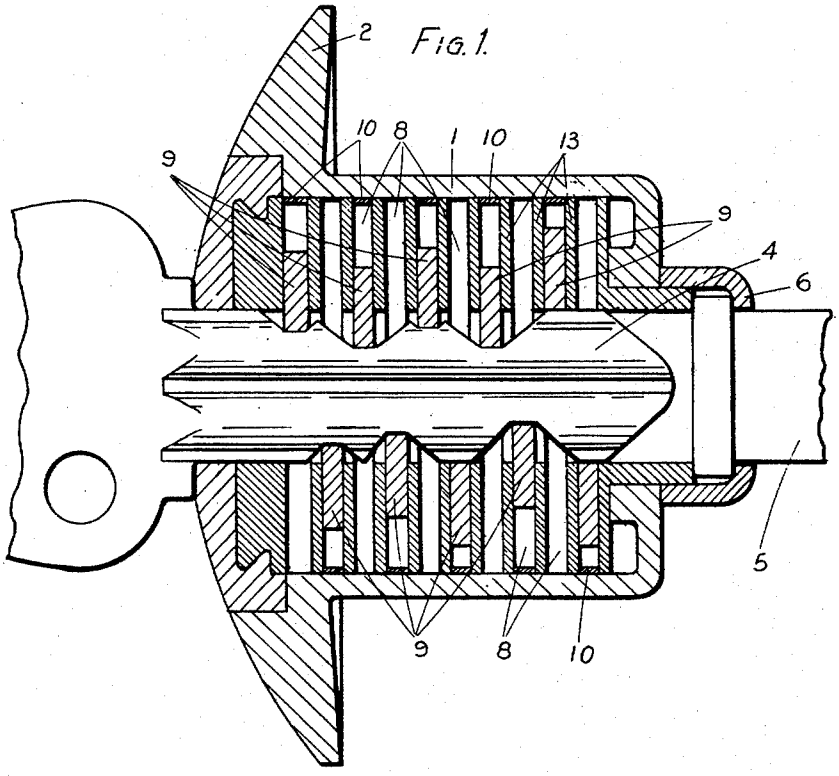
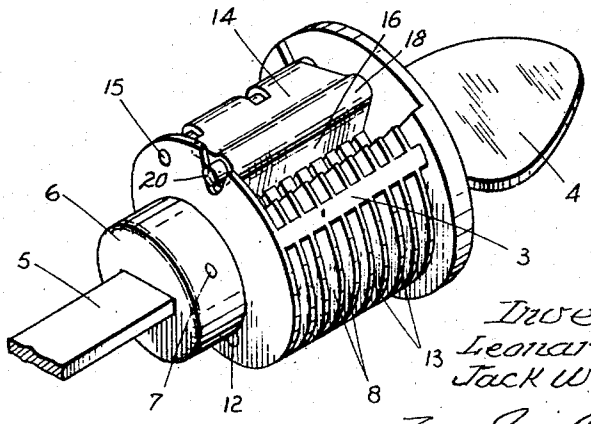


FIG. 2.



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FIG. 3.

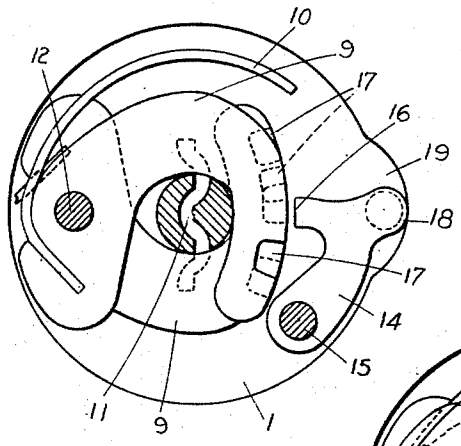


FIG. 4.

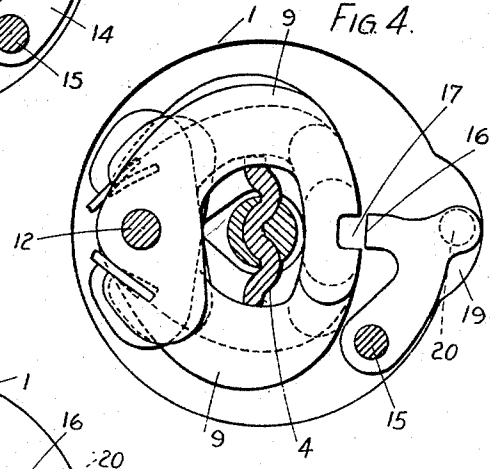


FIG. 5.

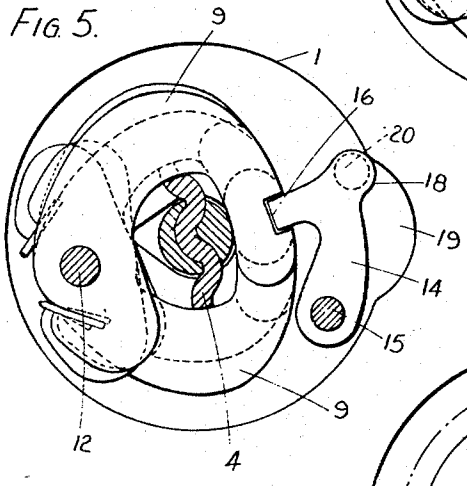
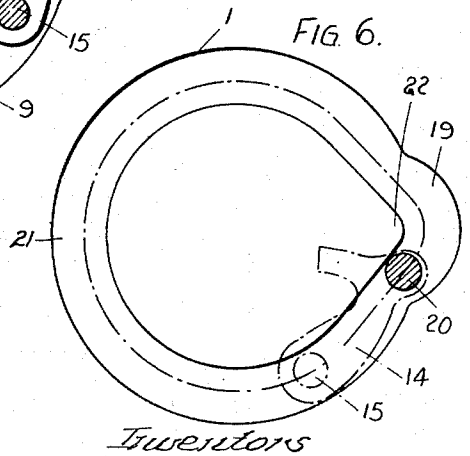


FIG. 6.



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FIG. 7.

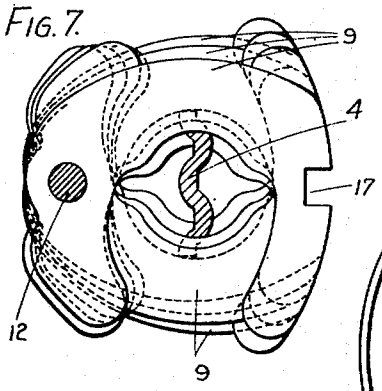


FIG. 8.

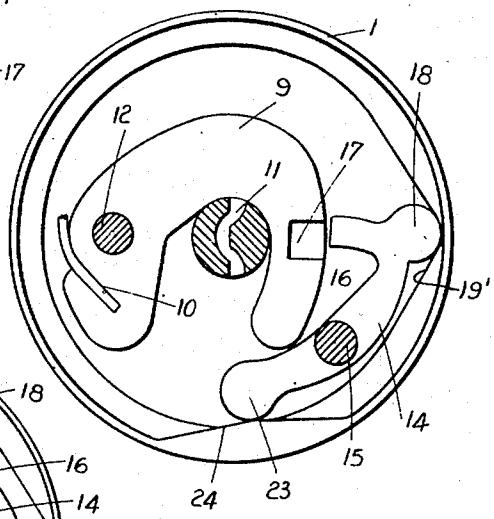


FIG. 9.

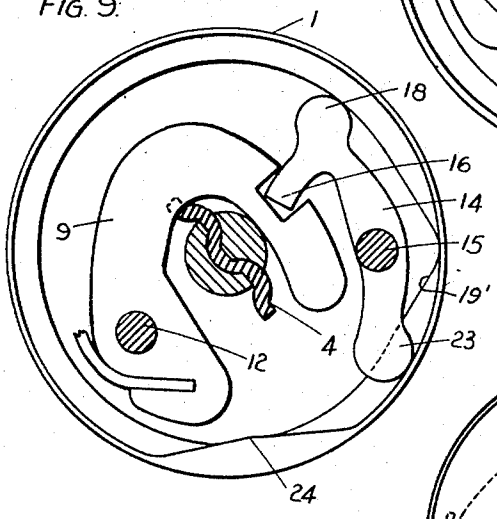


FIG. 10

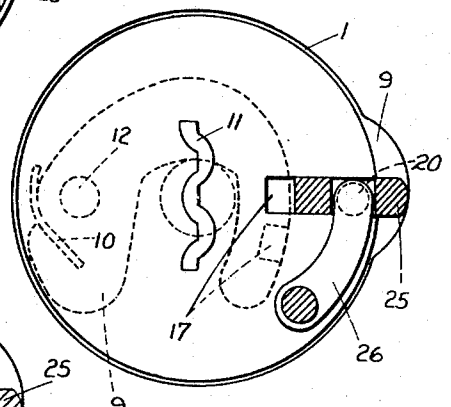
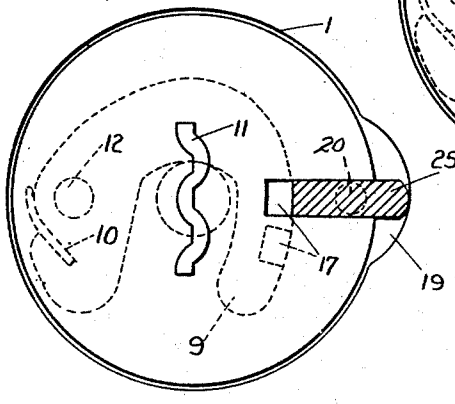


FIG. 11



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UNITED STATES PATENT OFFICE

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CYLINDER LOCK

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Application March 27, 1946, Serial No. 657,446
In Great Britain March 1, 1945

4 Claims. (Cl. 70—366)

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This invention relates to key-operated lock mechanism, and its principal object is to provide an improved construction which will combine the advantages of the tumbler lever-type of lock mechanism with those of the pin-tumbler type, while avoiding many of the disadvantages of both types. In particular, the improved lock mechanism permits of a much greater number of different combinations than tumbler lever locks as hitherto constructed, while at the same time it provides greater security than locks of the pin-tumbler type against opening by means of an instrument other than a correct key.

In an ordinary lock of the lever type the tumbler levers are actuated by rotation of the key, while in a pin-tumbler lock the pins are adjusted to release the plug for rotation by the preliminary insertion of the key. The improved lock mechanism according to the present invention comprises a cylinder, a key-receiving plug mounted for rotation therein but normally locked against rotary movement, means for connecting said plug to a lock proper so as to actuate the same as a result of such permitted rotary movement, a series of pivoted tumblers individually engageable by the key on insertion or rotation, said tumblers being pivotally mounted eccentrically of the axis of the plug, or linearly slidable said tumblers being formed with slots which are normally misaligned but are aligned as a result of the correct individual movement being imparted to the tumblers as a result of insertion or rotation of the correct key, and means for unlocking said plug to permit of its rotation on the slots being aligned comprising a lock-bar member normally engaging the cylinder or other fixed part to prevent rotation of the plug but movable into engagement with the slots on the latter being aligned and simultaneously movable out of locking engagement with the cylinder or other fixed part to permit of rotation of the plug under the control of the inserted correct key.

Preferably, the tumblers are enclosed within a cylinder which may be separate from the lock mechanism proper or may be attached thereto. Thus, one of the advantages of the pin-tumbler lock is secured, namely: that the position of the key mechanism is located relative to the face of the cylinder, which always appears on the face of the door, with the result that the length of the key is the same whatever the thickness of the door.

In order that it may be clearly understood and readily carried into effect, the invention is hereinafter described with reference to the accompanying drawings, wherein:

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Figure 1 is a longitudinal vertical section of a lock in accordance with the invention with the key inserted;

Figure 2 is a perspective view of the plug when removed from the cylinder;

Figures 3 to 6 are cross-sections showing the operation of the tumblers and their associated parts;

Figure 7 is a cross-section showing clearly the positions taken up by the various tumblers when the key is inserted;

Figures 8 and 9 are cross-sections illustrating an alternative construction of lock-bar and talon-operating cams;

Figure 10 is a cross-section showing a composite sliding and pivoted lock-bar;

Figure 11 is a cross-section illustrating a simplified lock-bar in the form of a single sliding member.

Referring in the first case to Figures 1 to 7, which illustrate the lock in its simplified and preferred form in which insertion of the correct key results in unlocking of the lock mechanism to permit operation of the lock proper as a result of rotation of the key, the lock comprises a cylinder 1 of tubular construction adapted to be screwed or otherwise attached to the door by means not shown, the cylinder at its forward end having an enlarged head 2 which projects from the door face. The cylinder contains a circular-section plug 3, which is shown removed from the cylinder in Figure 2, and which is adapted to receive the key 4, the latter having both edges serrated or notched.

The inner end of the plug is slotted diametrically to receive the end of a connecting-bar 5, the bar being attached to the plug by means of a dished retaining member 6 which is secured to the plug by a pin 7 (see Figure 2). The retainer 6 also serves to maintain the plug in position within the cylinder.

The plug is divided longitudinally into a series of spaced compartments 8 each containing a pivoted tumbler 9, which tumblers are urged into the position shown in Figure 3 by associated springs 10, i. e. into the position they assume when the key is not inserted in the keyhole. As will be seen clearly in Figures 3 to 6 and Figure 7, the tumblers are alternately arranged for movement in opposite directions, the one set of tumblers being engaged by the serrations on one edge of the key, the serrations on the other edge engaging the other set of tumblers. The slot 11

provided in the plug for the insertion of the key extends throughout the length of the plug and is of suitable cross-sectional form, such for example as that shown in Figure 3, to permit of the insertion of the key only when the latter is the correct way up. It will be appreciated, therefore, that insertion of a key of a section corresponding to the section of the keyhole will result in individual upward and downward pivotal movement of the levers, but unless the correct key is inserted the appropriate pivotal movement will not be imparted to the various tumblers and the lock cannot be operated for reasons hereinafter referred to. All the tumblers are carried by a common shaft or rod 12 about which they have limited pivotal movement. Although it is preferred that each compartment shall contain only one lever, each compartment may accommodate more than one if required.

In certain applications in which the length of the mechanism is not restricted, all the tumblers may be arranged for upward or downward movement. The key for such an arrangement has notches only on one side. However, the two opposed sets of tumbler levers for operation by a double-edged key, has definite security advantages over this latter organization.

The various compartments in the plug are provided by intermediate lever-spacing members 13, which may be constructed integrally with the plug body, the material of the body being removed where necessary by a machining operation to form the individual compartments, the material being left where necessary to form the spacing members, or the spacing members may be constructed separately from the body part of the plug.

By arranging the tumblers in spaced individual compartments they offer the minimum of resistance to the insertion or withdrawal of the key and prevent an accumulation of pressure on the tumblers as the key is inserted or withdrawn.

The lock proper is operated by the connecting bar 5 upon rotation of the plug within the cylinder under the action of turning the key, and to prevent such turning movement unless the correct key has been inserted, with consequential correct individual pivotal movement of the tumblers, the plug is fitted with a lock-bar 14 pivotally mounted upon a shaft 15, the inner extremity 16 of the lock-bar being adapted to enter a series of slots 17 in the tumblers when the slots are brought into an aligned position as a result of the correct pivotal movement being imparted to all the tumblers, the lock-bar co-operating with the inner surface of the cylinder in such a way as to prevent rotation of the plug unless the lock-bar has entered the aligned slots. In the arrangement shown in Figures 1 to 6 the lock-bar is formed with an outwardly-directed protuberance 18 which when the parts are in either the position shown in Figure 3 or Figure 4 enters a recess 19 in the inner surface of the cylinder. Any attempt to rotate the plug within the cylinder when the slots in the levers are out of alignment, as in the case of Figure 3, will merely result in the walls of the recess forcing the lock-bar inwardly until its extremity 16 contacts the edges of the tumblers, thus preventing any further turning movement of the plug in the cylinder. With the tumblers in the position shown in Figure 4 however, which results from the insertion of the correct key, all the slots 17 will be aligned, and consequently the lock-bar end 16 can enter the slots when moved inwards by further rotation of the plug, and permit free and complete rotation of the plug in the cylinder. Actual entry of the lock-bar end 16 into the slots results from the engagement of the cam-like face bordering the recess 19 with the protuberance 18, as shown clearly in Figure 5.

In order to ensure the re-entry of the protuberance 18 into the recess 19, when the key has been turned a complete revolution and thereby has released the lock proper by means of the connecting bar 5, and it is desired to withdraw the key, the protuberance 18 carries a lateral projection or cam follower 20 which runs in a track 21 in the end of the cylinder, the track merging into the recess 19. The cylinder is formed with a cam face 22 which lies opposite the recess 19 and directs the protuberance into the recess when the plug has been returned to its initial position, thus disengaging the lock-bar from the slots 17 and permitting the key to be withdrawn and the tumblers to return to their initial position shown in Figure 3, under the action of their associated springs.

In Figures 8 and 9 is shown a modified construction, in which the lock-bar has a tail part 23 which co-operates with a cam surface 24 to withdraw the lock-bar end from the aligned slots, the protuberance 18 on the lock-bar then entering the recess 19', which is of somewhat different shape to the recess illustrated in Figures 3 to 6. In Figure 9, the key has been inserted and the tumblers lifted to bring the slots into alignment and permit the entry of the lock-bar end as a result of the protuberance 18 leaving the recess 19' as the plug commences its rotation. Instead of the arrangements described, the lock-bar may be spring-actuated, however, the positive camming thereof is preferred as it precludes inoperativeness due to spring breakage or the like.

Figure 10 shows a modified form of lock-bar in the form of a sliding plate 25 having a pivotal connection with a lever 26. In Figure 11 is shown a still more simplified construction, wherein the lock-bar comprises a single sliding member. In this arrangement return movement of the lock-bar may be effected by a projection 20 which may co-operate with a cam surface or track, such as is shown in Figure 6.

It will be appreciated from the foregoing description that lock mechanism such as is hereinbefore described cannot be readily operated by an instrument other than the correct key, as obviously all the tumblers have necessarily to be moved the correct amount to bring all the slots into alignment, the tumblers when eccentrically mounted relative to the axis of rotation of the plug necessitating the use of a key which has been machined to close limits to ensure accurate alignment of the slots and consequential entry of the lock-bar. The locking mechanism is suitable for use with any convenient form of lock proper, such for example as that forming the subject of British Patent No. 561,538.

We claim:

1. In lock mechanism of the type wherein a key-receiving plug is rotatably mounted in a casing bore, a recess is in said casing and opens in the periphery of said bore, a series of slotted tumblers are individually movable within the plug so that their slots are normally misaligned but become aligned upon proper displacement by a key, and a lock-bar normally engages in said recess to prevent rotation of said plug but is movable into the aligned slots to permit complete rotation of said plug, the combination with said casing of the improvement comprising cam guide means in said casing and including a pair of cam sur-

faces completely around said bore, and cam follower means on said lock-bar and cooperative with said cam surfaces for positively guiding said lock-bar into and out of said recess and aligned slots respectively to selectively permit complete rotation of said plug.

2. Lock mechanism of the type defined in claim 1 wherein said cam means comprises a cam groove in the end wall of said casing and extending completely around said bore, the opposed sides of said cam groove providing said pair of cam surfaces, and said cam follower means comprising a cam follower on the end of said lock-bar and extending into said cam groove for positively guiding said lock-bar through engagement between and with said cam surface forming groove sides.

3. Lock mechanism of the type defined in claim 1 wherein a lever supports said lock-bar and is centrally pivoted on said plug, said cam follower means comprises cam followers on each end of said lever, and said cam means comprises a pair of cams completely encircling said bore in axially displaced relation and with their inner sides respectively defining said cam surfaces for respectively cooperating with said cam followers.

4. In lock mechanism, in combination, a casing defining a cylindrical bore, a recess in said casing and opening into said bore, a cylindrical key plug rotatably mounted in said bore and having a longitudinally extending keyway, a plurality of tumblers pivotally mounted in said plug for individual movement transverse said keyway, said tumblers being alternately mounted on opposite sides of said keyway and for movement in opposite directions, each of said tumblers having a slot in a longitudinally movable edge and positioned for misalignment when said tumblers are in normal position but for alignment upon proper displacement by a key inserted in said keyway, a lock-bar extending longitudinally of said plug and supported for movement to engage in said recess to prevent rotation of said plug or for movement to nest within said slots when they are aligned to permit complete rotation of said plug, a guide cam groove in the end wall of said casing and extending completely around said bore, said groove including a cam portion juxtapositioned relative to said recess, and a cam follower projecting from the end of said lock-bar and extending into said groove for positively guiding said lock-bar through its complete cycle of movement during the complete rotation of said plug.

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