Feb. 4, 1969 R. A. DUVAL 3,425,248

KEY EJECTOR LOCK WITH ANTI-PICK FEATURE

Filed April 13, 1967 Sheet 1 of 2

FIG. 1

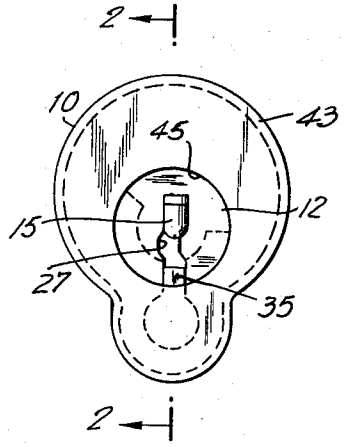

FIG. 2

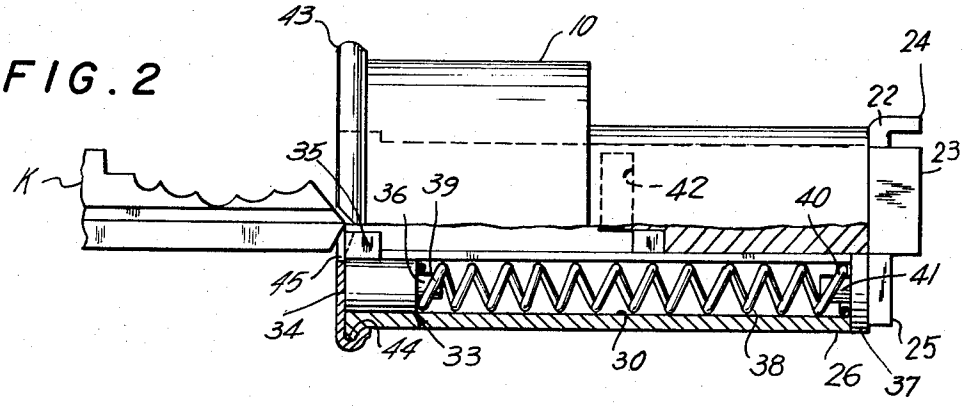

FIG. 3

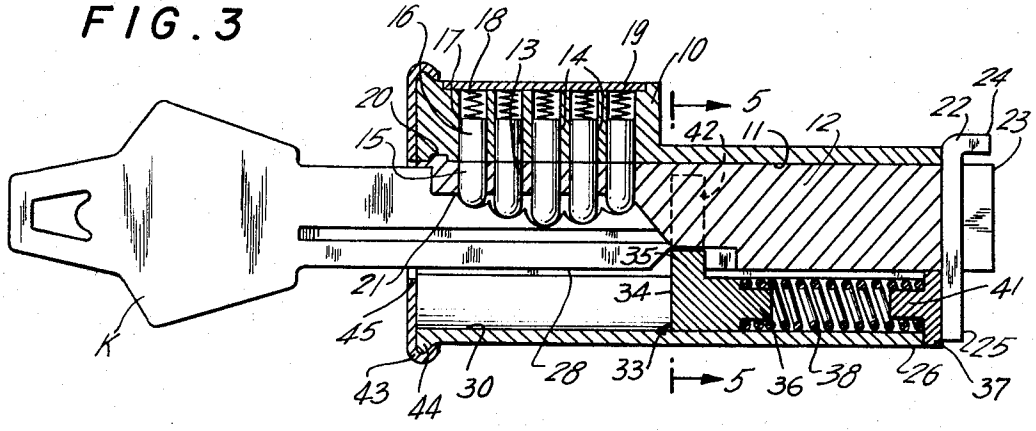

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FIG. 4

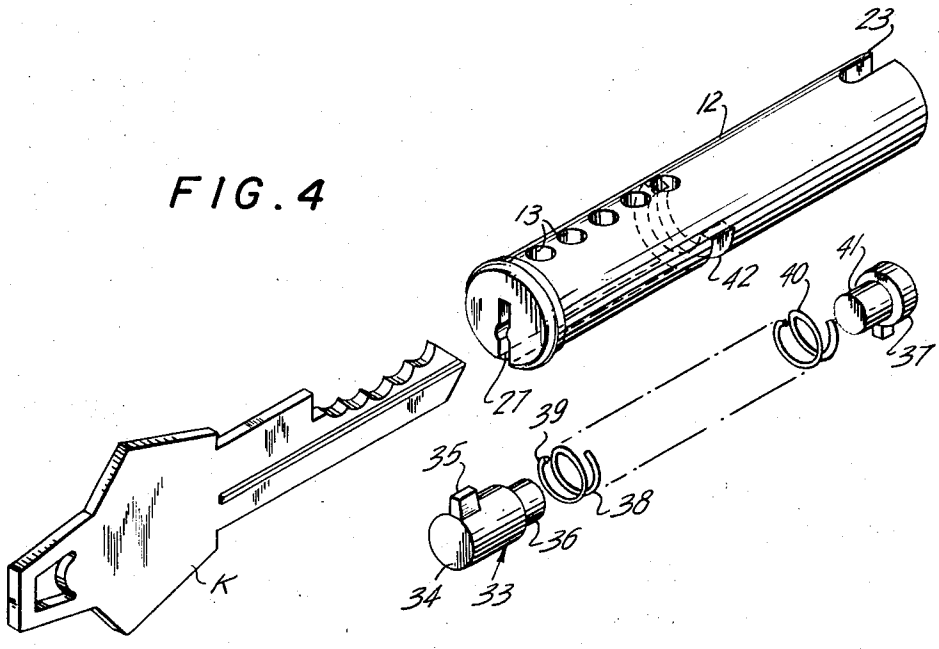


FIG. 5

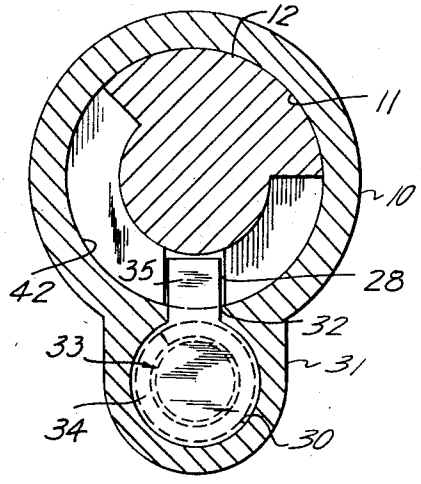
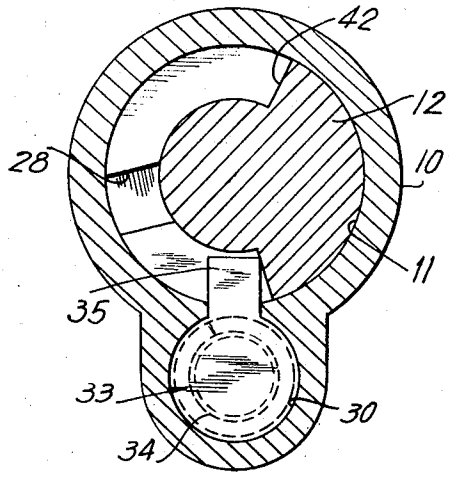


FIG. 6



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3,425,248

KEY EJECTOR LOCK WITH ANTI-PICK FEATURE

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U.S. Cl. 70—421 2 Claims
Int. Cl. E05b 17/12, 27/02, 63/00

ABSTRACT OF THE DISCLOSURE

A lock apparatus having key ejector means which automatically remove the key from the lock in the locked position thereof, the ejector mechanism functioning in the locked position to maintain the lock plug and housing in predetermined aligned position, thus to prevent picking the lock by torque wrenching techniques.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to a lock mechanism of the type in which a plug having a keyway is rotatable within a lock housing, the customary tumblers or disks being employed to lock the mechanism against rotation. Devices of this sort are customarily used as ignition and door locks for automobiles, etc.

A common cause of automobile thefts has been the tendency of owners to forget to remove the key from the lock.

Further encouragement to theft lies in the vulnerability of some locks to picking by the so-called torque wrenching or riffling technique. In this technique, a constant torque is applied to the plug while the locking pins are caused to be scanned across the shear line. The slight offset of the plug from the housing which results from the application of a torque may cause the upper follower pins to catch on the periphery of the slightly offset plug and eventually, when all of the tumblers are caught, the lock may be operated.

In large measure, car thefts are attributable to one or the other of the above noted problems.

Prior art

Heretofore various devices have been suggested to prevent lock picking by the so-called torque wrenching or riffling technique. Some such improvements have taken the form of aligning means independent of the locking pins or disks, which maintain the plug and housing in a predetermined aligned condition when a key is not disposed within the keyway of the plug. By this means, torque applied to the plug is absorbed, not by the locking mechanism, but by the aligning device. Such aligning means have heretofore been relatively ineffective against skilled lock pickers since it has been possible to deactivate the auxiliary alining means, leaving the pins or disks vulnerable to previously described picking techniques.

To offset the possibility that an owner may inadverently leave his key in his car, certain known mechanisms have been provided which apply a spring pressure to the key when the lock is in a locked condition, the spring pressure serving to eject the key forcibly from the keyway slot. In such known mechanisms, the ejector assembly is ineffective to discharge the key when the lock is in open position.

Summary of the invention

It is therefore an object of this invention to provide a lock which has high resistance to lock picking techniques and which includes key ejector features which will assure against inadvertently leaving a key in the lock.

A further object of the invention is the provision of improved mechanism serving the double function of key ejection and security against picking.

Still a further object of the invention is the provision of a high security locking mechanism.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, reference is made to the accompanying drawings, forming a part hereof, in which:

FIGURE 1 is a front view of a lock assembly in accordance with the invention;

FIGURE 2 is a fragmentary vertical section taken on the line 2—2 of FIGURE 1;

FIGURE 3 is a section similar to FIGURE 2 showing the position of the parts with a proper key inserted;

FIGURE 4 is an exploded perspective view of certain components of the lock assembly;

FIGURE 5 is a section taken on the line 5—5 of FIGURE 3;

FIGURE 6 is a section similar to FIGURE 5, showing the position of the parts when the lock is in the unlocked position.

In accordance with the invention, **10** is a lock housing which may be mounted on the dashboard of an automobile, for instance, although the use of the present apparatus is not restricted to automobiles. The housing **10** includes an elongated cylindrical bore **11**, within which is mounted the lock plug assembly **12**.

The plug assembly **12** is provided in the usual manner with a row of radially extending locking bores **13** which are disposed in alignment with a series of comparable bores **14** in the housing. A series of driver pins **15** and follower pins **16** are loaded into the bores in the usual manner through an access slideway **17**, driver springs **18** being loaded on top of the follower pins, normally to project portions of the follower pins across the shear line defined between the plug and the housing, thus to prevent relative rotation of these parts. A cap member **19**, fitted in the slideway, maintains the springs in the desired position.

The plug assembly **12** is provided with a raised annular shoulder portion **20** adjacent the outer end thereof, which bears against an annular shoulder **21** formed in the housing, axially to position the plug and housing. A latch operator cam **22** is fastened to the inner end of the plug assembly **12** and prevents removal of the plug from the housing **10** in an outward direction. The outer end **23** of the plug is bifurcated, with the cam **22** being supported between the bifurcations.

The cam member **22** includes the usual latch operator extension **24** and at its lower end is provided with a retainer extension **25** which extends radially beyond the plug and in spaced registry with a lower, innermost part **26** of the housing **10**. The plug is formed with the usual axially extending keyway slot **27**, the slot in the device of the present invention being open at its lowermost end in the area **28**—see FIGURES 2 and 3.

An ejector plunger assembly next to be described is mounted within the housing and includes portions which extend into the open lower end portion **28** of the keyway slot **27**. The plunger assembly is mounted for axial movement within a generally cylindrical bore **30** formed in a downwardly extending lobe **31** of the housing **10**. The cylindrical bore **30** is open at its uppermost part to define an axially extended slot portion **32**, the slot **32**, in the locked position of the plug, being disposed in registry with the downwardly open portion **28** of the keyway slot.

An ejector plunger **33**, having a generally cylindrical

body portion **34**, is slidably mounted within the bore **30**. The plunger **33** includes an offset ejector arm **35** which extends beyond the periphery of the cylindrical portion **34** through the slots **32** and **28**, i.e. crosses the shear line between the plug and the housing. The uppermost portion of the arm **35** lies in partially blocking position within at least the lower portion of the keyway.

The plunger **33** includes a rearwardly directed spring seat **36** which comprises a reduced cylindrical portion. A capping member **37** is disposed in closing relation of the bore **30**, the member **37** being maintained in position at the innermost end **26** of the housing by the downwardly directed retainer extension **25** of the latch operating cam member **22** which is fixed to the plug.

A coil spring **38** has its forward end **39** sleeved over the cylindrical portion **36** of the plunger **33**, the rearward end **40** of the coil spring being sleeved over an outwardly directed spring seat **41** formed on the capping member **37**.

From the foregoing it will be evident that the spring **38** will normally bias the plunger **34** to a forward position in the housing, as shown in FIGURE 2, and since the offset arm **35** of the plunger spans the shear line between the plug and the housing, said offset portion will act to lock the plug against rotation within the housing. The fit defined between the plunger member **33** in the bore **30**, and particularly between the offset arm **35** within the axially extending slot **32** in the housing and the downwardly open slot portion **28** of the keyway, provides minimal clearances so as to prevent, to the maximum possible extent, any relative rotation of the plug with respect to the housing so long as the offset arm **35** is simultaneously within any portion of the slots **32** and **28**.

The plug **12**, in a position rearwardly of the rearwardmost cross bore **13**, is provided with an arcuate clearance groove **42**, the radial extent or dimension of which is sufficient to accommodate the entirety of that portion of the offset arm **35** which extends into the plug. Similarly and preferably, the axial extent of the arcuate groove **42** is such that the axial or lengthwise dimension of the offset arm will just fit within the groove with minimum clearances.

The plunger is prevented from shifting outwardly of the lock assembly by a decorative scalp **43** which is spun over a rim **44** at the outer end of the housing, the scalp being provided with a central circular aperture **45** which provides clearance for rotation of a key inserted within the keyway, while blocking the body portion **34** of the plunger **33**.

The operation of the device will be obvious from the foregoing description.

In the locked position of the assembly wherein the tumblers cross the shear line **11**, the plunger **33** will be projected to its forwardmost position with the offset arm **35** extending from the housing into partial blocking position of the keyway **27**. When a key K is inserted, the tip of the key will engage the offset arm **35** and shift the plunger **33** rearwardly to the position shown in FIGURE 3, at the same time compressing the spring **38**.

In the usual manner and assuming that the key K is properly fitted to the lock, the junction between the driver and follower pins will be aligned at the shear line and the tip of the key will align the offset arm **35** of the plunger precisely with the arcuate groove formed in the periphery of the plug **12**. With the parts positioned as recited, the plug may be rotated, carrying the operator cam **22** into operative contact with any desired latch or switching mechanism.

The degree of rotation permitted the plug is dictated by the angular extent of the arcuate groove **42**, a limiting rotated position being shown in FIGURE 6 wherein the offset arm **35** abuts against a radially directed end wall of the arcuate groove **42**. In some instances, a rotation of the plug less than that permitted by the extent of the groove may be dictated by the latching mechanism with which the cam **22** is associated.

When the lock plug is in the operative or unlocked position shown in FIGURE 6, it will be impossible to remove the key from the plug since the outer ends of the drive pins **15** will abut against a solid wall section of the housing. Thus, the key will remain in operative position within the keyway despite the outward force exerted by the spring **38** through the plunger **34** against the key. However, when the key is again rotated to a position at which the cross bores in the housing and plug are again in alignment, the spring **38**, acting through said plunger, will be effective to project the key forcibly outwardly of the keyway. Thus, it is impossible to permit the key to remain in the keyway when the lock is rotated to the locking position thereof.

It will be observed from the described structure that the offset arm **35** of the plunger provides a multiplicity of functions heretofore not known. For instance, unless the offset arm **35** is disposed in precise axial alignment within the groove **42**, no rotation of the plug **12** will be permitted.

As previously noted, the clearance slot **28** is of greater length than the keyway section, permitting the offset arm **35** to be shifted rearwardly of alignment with the arcuate slot **42**. This rearward position of the offset arm **35** would be achieved in the event that the lock were attempted to be operated by a key which was longer than a proper key for operating the lock. Thus, unlike the usual tumbler lock assembly, the length of the key has a positive, cumulative security function together with the locking tumblers.

A further advantage of the device lies in the anti-picking function provided by the offset arm **35**. As previously noted, locks are typically picked by a riffling technique which involves the application of a constant torque to the plug to derive a slight angular disorientation of the plug with respect to the housing, which angular disorientation results in a slight offsetting of the cross bores of the plug from the cross bores of the housing. When this condition is achieved, and the tumbler pins are rapidly oscillated back and forth across the shear line, it is often possible to catch or hang the lower ends of the upper pins against the outer periphery of the plug adjacent the cross bores of the plug. When all of the pins are thus hung or caught, the plug may be rotated.

In the device of the present invention, the minimal clearances defined between the slots **28** of the keyway and **32** of the housing, which slots are simultaneously spanned by the offset arm **35**, will not permit even a minor rotation of the plug and housing and, thus, will positively prevent the condition which is essential to picking of a lock by the riffling technique.

The only time at which angular rotation of the plug and housing is permitted is when the offset arm **35** is in precise axial alignment with the close fitting arcuate slot **42**.

In contrast to prior known anti-pick devices which employ auxiliary means (aside from the tumblers) for holding the plug and housing in alignment, it is not possible to disable the alignment maintaining functions in the present apparatus by the means of forcing the plunger to the rearwardmost position. This is so because the slot **28**, at the lower edge of the keyway, extends a distance rearward of the arcuate slot **42** and any attempt to force the plunger to its rearwardmost position in the hope of "transferring" the alignment maintaining function solely to the cross pins will be defeated since said maintaining function is still performed by the offset arm at the rearwardmost position thereof.

From the foregoing description it will be clear that the apparatus of the present invention provides three distinct advantages not heretofore encompassed within any lock mechanism.

(1) A key ejector mechanism which provides, in addition, a high security anti-pick function;

(2) The anti-pick function, unlike other devices, cannot be disabled by a simple application of inward pressure against the anti-pick safeguard device;

(3) An additional measure of security to that afforded by the locking tumblers is provided by the lengthwise dimension of the key, which lengthwise dimension is critical to the proper operation of the lock.

Various modifications from the form of the illustrated embodiment of the invention may be made without departing from the spirit thereof. For instance, it is possible to reverse the position of the offset arm of the plunger so that it extends from the plug across the shear line into the housing, the arcuate clearance slot, in this instance, being formed in the housing.

Having thus described the invention and illustrated its use, what is claimed as new and is desired to be secured by Letters Patent is:

1. A pick resistant lock device comprising a housing member having a bore, a lock plug member rotatably mounted in said bore, said plug member having a keyway, locking means mounted in said plug and housing members and shiftable between locking and unlocking positions of said plug member, an axially directed, outwardly open first groove formed in said plug member in communication with said keyway, a second groove formed in said housing member and opening onto said bore, said first and second grooves being in registry in the locked position of said plug member, a plunger member axially movably mounted in one of said grooves, said plunger including an offset portion extending into the other said groove, thereby to key said plug and housing members together against relative rotation, the clearances between said offset portion and said other groove being less than the clearances between said locking means and plug member, said plunger including portions extending into said keyway, an arcuate clearance slot formed in one of said members at a position intermediate the length of said grooves, and key means insertible into said keyway for shifting said locking means to the unlocking position of said lock plug member and for positioning said offset portion in axial registry with said clearance slot, thereby to permit rotation of said plug member in said housing member with said portion in said slot.

2. A device in accordance with claim **1** wherein the axial extent of said clearance slot slightly exceeds the axial dimension of said offset portion and wherein said plunger is shiftable axially through a range of positions wherein said offset portion is disposed forwardly and rearwardly of said arcuate slot, said plug and housing members being keyed against relative rotation in both said forward and said rearward positions.

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U.S. Cl. X.R.

70—388

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,425,248 February 4, 1969

Robert Armand Duval

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, line 5, "Independent Lock Company, Fitchburg, Mass.," should read -- Ilco Corporation, --.

Signed and sealed this 17th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents