

March 12, 1935.

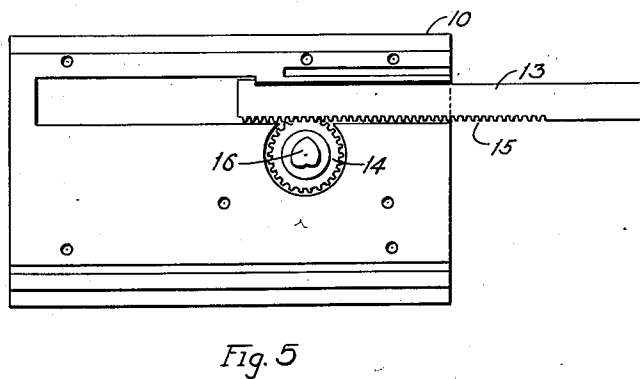
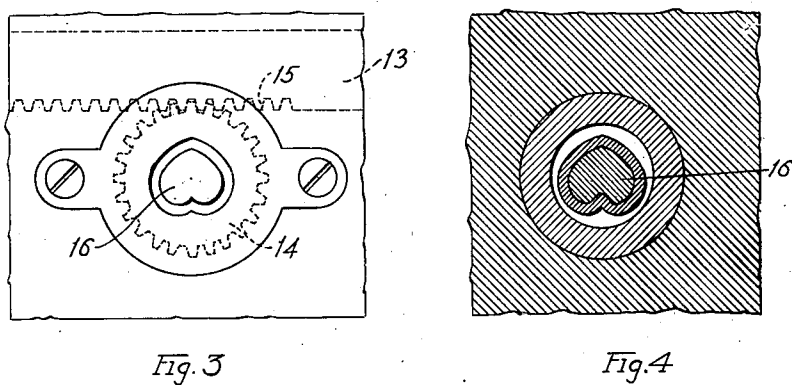
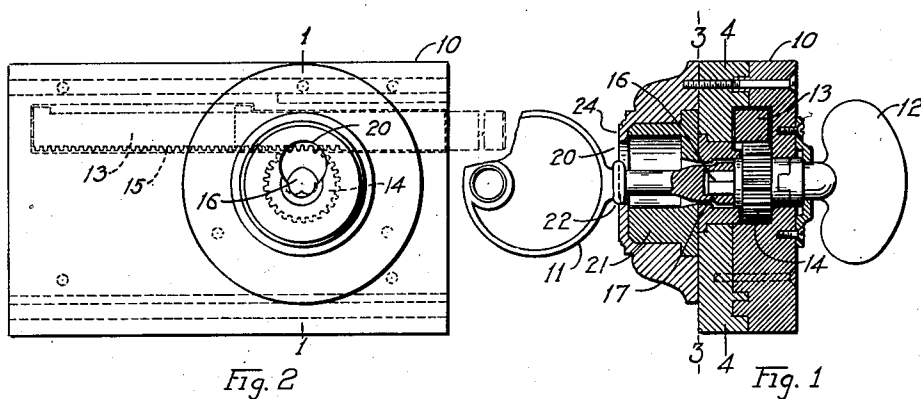
T. J. CALDWELL

1,994,095

LOCK

Filed Jan. 10, 1934

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

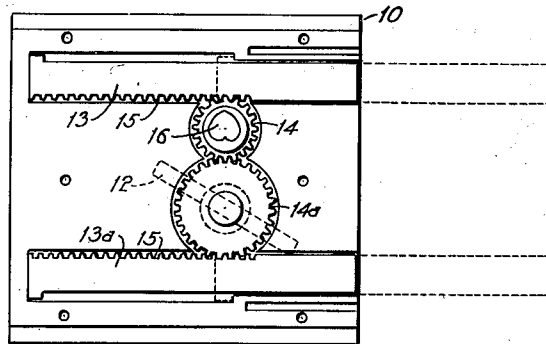


Fig. 6

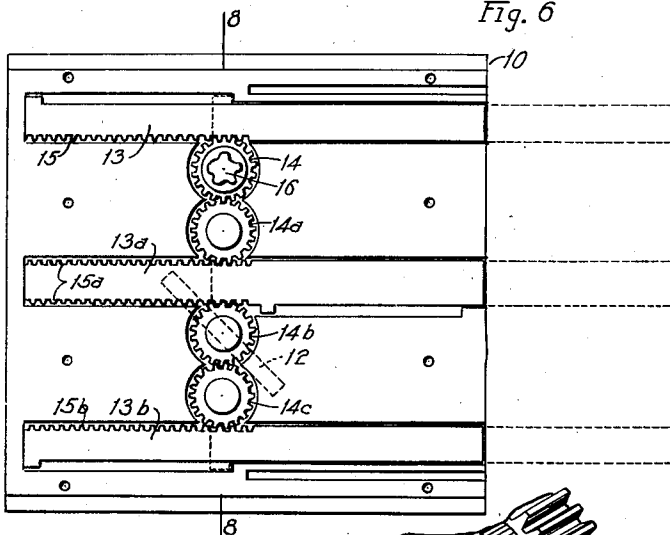


Fig. 7

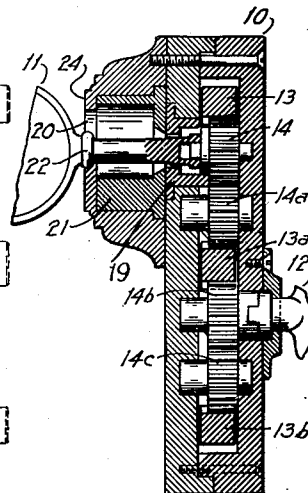


Fig. 8

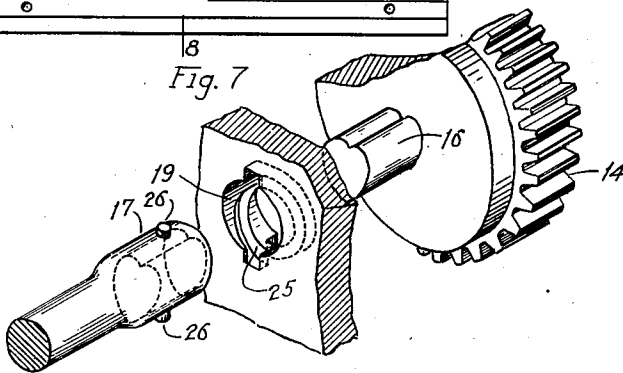


Fig. 9

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3 Sheets-Sheet 3

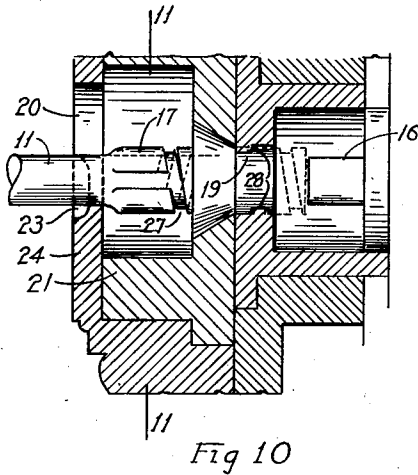


Fig 10

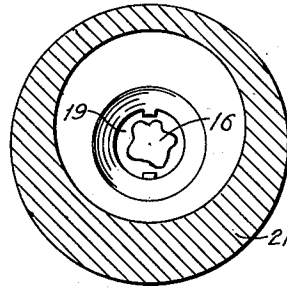


Fig 11

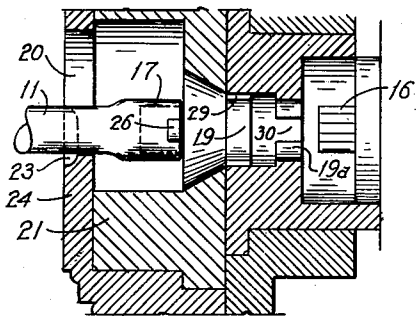


Fig 12

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UNITED STATES PATENT OFFICE

1,994,095

LOCK

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Application January 10, 1934, Serial No. 706,092

16 Claims. (Cl. 70-14)

This invention relates to locks and locking devices, and one particular object is to provide a lock without springs, pins or tumblers which is practically proof against picking. A further object is to provide means for guarding locking devices against the entrance of foreign keys and the like.

My invention in its several forms is illustrated in the accompanying drawings in which:

Fig. 1 is a section of a single bolt lock.

Fig. 2 is a side view of the single bolt lock of Fig. 1.

Fig. 3 is an enlarged partial sectional view on the line 3-3 looking toward the night latch side.

Fig. 4 is an enlarged partial sectional view on the line 4-4 looking toward the night latch side.

Fig. 5 is a side view of a single bolt lock with the outside cover plate removed.

Fig. 6 is a side view of a two bolt lock with outside cover plate removed.

Fig. 7 is a side view of a three bolt lock with the outside cover plate removed.

Fig. 8 is a section of a three bolt lock taken on the line 8-8.

Fig. 9 is an enlarged isometric view of key and key guard assembly and hub on pinion, with spiral groove in guard ring and hobs on the key socket.

Fig. 10 is an enlarged section of a lock showing a spiral design on the external surface of the key and bosses on the guard, and a slip design on the hub, and in the socket cavity.

Fig. 11 shows a section on line 11-11 of Fig. 10.

Fig. 12 is an enlarged section of a lock showing bosses on the external surface of the key socket and slots in a double guard, the pairs of slots being revolved through an angle.

Corresponding and like parts are designated in the drawings and the following description by like reference numerals.

Referring to the figures, 10 represents generally the lock casing, 11 is the removable socket key, 12 is a knob for hand operation of the bolt 13 as a night latch. The pinion or rotatable element 14 operates the bolt 13 or other mechanism, through engagement with the rack teeth 15. The interior hub 16 of the pinion 14 protrudes into the key channel and is shaped externally to slip fit in the cavity of the socket 17 of the key 12. The external surface of the key socket 17 is shaped to pass through the guard 19, by slipping or by rotation and slipping. The key hole 20 is made larger than the key socket, and may be off-set from the center line of rotation of the pinion 14. A baffle plate 21 may be interposed between the entrance key hole and the

guard 19, in which structure the shaft of the key 12 is moved up or down or sidewise into the line of rotation of the hub. The key shaft may be provided with a collar 22 shaped to form a bearing in a corresponding depression in the front plate 24.

A single bolt structure is shown in Figs. 2 and 5 and a double bolt mechanism is illustrated in Fig. 6, the pinion 14 not only actuating the bolt 13 but also driving the gear 14a which in turn operates the bolt 13a through the rack teeth 15a. Obviously any number of bolts may be driven by suitable gear trains or other equivalent mechanisms, and a three-bolt structure is shown in Fig. 7 in which the driving pinion 14 operates the bolt 13 and also the gear 14a and the bolt 13a which has double rack teeth trains shown at 15a and 15b. The rack 15b on the bolt 13a drives the gears 14b and 14c to actuate the third bolt 13b. Any type of gears may be used, and the projection of the bolt or bolts may be regulated by adjusting and selecting the suitable gear trains. The night latch knob 12 may be attached to any one of the gears directly or through an intermediate gear or pinion, to provide means for manually operating the bolts from the side of the lock opposite the keyhole without the use of the key. To avoid accidental movement of the bolts, they may be made to closely fit the seats, or tension springs or other means may be supplied to increase their sliding friction.

The patterns of the opening of the guard 19 and on the pinion hub 16 may be the same or they may be different and their orientation relative to each other may be different. The pattern of the guard opening is preferably but not necessarily asymmetric, in which case the pinion must be rotated one or more complete revolutions to permit the removal of the key. The pattern on the hub is also preferably asymmetric so that the key socket 17 may be slipped over the hub 16 only when the bolt 13 is completely retracted, or is projected out the equivalent length of one or more complete revolutions of the pinion 14. By hand turning the night latch knob 12 less than one complete revolution if the pattern is symmetric, or through less than one angle of symmetry, the hub is rotated out of orientation with the selected relative orientations of the hub 16 and the guard 19 patterns, and the key may then not be inserted past the guard. This feature provides an effective night-latch arrangement, in the case of door locks.

The relative sizes of the opening in the guard ring 19 and of the hub 16 are preferably made

as near the same as is practicable, with due regard to allowing for sufficient thickness in the key socket walls to give the necessary strength and rigidity. For this reason the designs, if the same are preferably concentric, so that when the bolt is completely retracted the design of the hub 16 will be concentric with the design or shape of the guard opening, and correspondingly the design of the inside of the key socket 17 and the outside of the key socket will be concentric. The smaller the clearance between the pattern on the hub and the pattern on the guard, the more difficult it becomes to turn the hub by the insertion of a burglar's tool or the like through the guard opening.

The design of the hub 16, and the corresponding design of the cavity of the key socket 17 are, for a given lock and key, identical in shape and size except for the necessary allowance for a slip fit. This cross-sectional design may be any closed figure, such as a square, triangle, heart, leaf, pear, or any irregular closed shape, but it is preferably one which does not provide any projections, depressions, parallel edges or sharp angles which might be grasped for rotation by a burglar's tool or a foreign key. The designed parts, that is the hub, the guard, the key cavity surface and the key socket external surface, are preferably made of hard or hardened metal, to avoid fouling and to avoid picking of the lock. Non-magnetic metal may also be desirable in some cases.

The cross-sectional design of the guard 19 opening and the design of the outside of the key socket 17 may be a slip fit in which case the key is passed through the guard by movement parallel to the key axis, or they may also be spiral threads and grooves, or portions of threads and grooves, in which case the socket outside pattern is threaded through the opening in the guard 19 by a turning movement around the key axis. Figs. 9, 10, and 11 illustrate two possible combinations of this modification.

On Fig. 9, the interior of the key socket 17 is shown as a heart shape, adapted to be slipped over the hub 16 of the pinion 14 which is heart shaped in cross-section. The guard 19 has cut in the walls or surface of its opening a spiral groove 25 adapted to permit the passage therethrough of the projections or knobs 26 on the exterior of the key socket 17. Figs. 10 and 11 represent an arrangement in which the spiral groove 27 is cut in the exterior of the key socket 17 and knobs or projections 28 are in the opening of the guard 19. Other arrangements of spiral threads and grooves may be used. In each case it is necessary to the action of the lock that the guard pattern and the exterior pattern of the key socket must be out of register before the interior of the socket key engages the hub 16 of the pinion 14. The hub may be engaged immediately after the spiral movement is completed, which is preferred, or enough clearance may be allowed so that the key may be rotated freely before coming into engagement with the patterned hub 16 to revolve it.

When the outside of the key socket is designed to pass through the guard by simple movement parallel to the key axis (in distinction to the spiral movement described for Figs. 9, 10 and 11) the interior of the key socket may begin to engage the hub before the guard design and the exterior socket design are out of register. However, rotation of the hub is only possible when the key has been pushed inwardly so far that the external pattern of the key socket has passed the

guard and been disengaged from it. Similarly, in removing the key, the hub design must be oriented in the proper relation to the guard ring design before the key may be removed from the hub and through the guard. It is obvious that the key may not be removed unless the hub has been revolved through the exact angle of symmetry, or a multiple of it, (which angle will be 360 degrees or one complete revolution in the case of an asymmetric design).

Fig. 12 represents another modification having two guards 19 and 19a, each having parallel grooves 29 and 30 but the grooves in the two guards being set at an angle of rotation with each other. The knobs 26 on the exterior of the key socket 17 are adapted to slide first through the grooves 29 of guard 19, then the key is rotated until the knobs 26 will pass through the grooves 30 of the second guard 19a, after which the interior of the key socket engages the patterned hub 16, to rotate the pinion 14 and actuate the bolt 13. One advantage of this double guard is the obstruction of the view of the interior designs, which aids in preventing picking of the lock.

I may use my invention of a guard plate having an opening of selected design through which may pass, when in register, a socket key whose exterior is of corresponding design, to locking devices other than door bolts as illustrated, for example for operating valves, locking spare tires, opening meters and other similar applications, in which the interior of the socket after the socket passes the guard ring, coacts with shaped knobs or hubs which may then be rotated by the key to produce the desired movement, for example opening or closing a valve.

While I have shown and described certain preferred embodiments of my invention, it will be understood that the invention is not limited to the illustrated embodiments, but may be otherwise embodied within the scope of the appended claims.

I claim:

1. In a lock having a key hole on one side, a bolt, means including a rotatable element to retract and project said bolt, a hub of selected external design attached to said rotatable element and operable by a socket key whose unobstructed cavity is adapted when in register to fit over and engage said hub, a fixed guard interposed between the key hole and said hub, the opening of said guard being of selected non-rotatable design adapted to permit the passage therethrough of the socket of said key and to permit disengagement of the socket key by the guard.

2. In a lock, a bolt, a rotatable element operable by a key having at one end a socket whose unobstructed cavity in cross-section perpendicular to the axis of rotation is of selected design and whose exterior shape is also of selected non-rotatable design, a fixed guard having an opening adapted to permit the passage therethrough of the outside key socket design when the designs are in register and to permit disengagement of the socket key by the guard, a hub attached to said rotatable element of cross-sectional design conforming to the inside of said key socket, and means operatively connected with said rotatable element to actuate said bolt upon rotating the key.

3. In a lock, a bolt, a rotatable element operable by a key having at one end a socket whose unobstructed cavity in cross-section perpendicular to the axis of rotation is of selected design and whose exterior shape is also of selected design, a

non-rotatable guard having an opening adapted to permit the passage therethrough of the outside key socket design when the designs are in register, a hub attached to said rotatable element of cross-sectional design conforming to the inside of said key socket, means operatively connected with said rotatable element to actuate said bolt upon rotating the key, and hand operated means for altering the orientation of the hub design relative to the guard design.

4. In a lock, a bolt, a rotatable element operable by a key having at one end a socket whose unobstructed cavity in cross-section perpendicular to the axis of rotation is of selected design and whose exterior surface has cut thereon a selected spiral design, a non-rotatable guard having an opening adapted to permit the passage therethrough, when in register and upon rotation, of said key socket, a hub attached to said rotatable element of cross-sectional design conforming to the inside of said key socket, and means operatively connected with said rotatable element to actuate said bolt upon rotating the key.

5. In a lock, a bolt, a rotatable element operable by a key having at one end a socket whose cavity in cross-section perpendicular to the axis of rotation is of selected design and whose exterior shape is adapted when in register and upon rotation to pass through the spirally cut design of a guard ring, a guard ring having an opening whose lateral surface is of spirally cut design and adapted to permit the passage therethrough when in register and upon rotation, of said key socket, a hub attached to said rotatable element of cross-sectional design conforming to the inside of said key socket, and means operatively connected with said rotatable element to actuate said bolt upon rotating the key.

6. In a lock, a bolt, a pinion operable by a key having at one end a socket whose unobstructed cavity in cross-section perpendicular to the axis of rotation is in asymmetric design relative to said axis and whose external shape in cross-section is of selected design, a non-rotatable guard having an opening adapted to permit the passage therethrough when in register, of said key socket, a hub attached to said pinion and of cross-sectional design conforming to the inside of said key socket, and means operatively connected with said pinion to actuate said bolt upon rotating the key.

7. A lock operable by a removable key having a socket whose unobstructed cavity in cross-section is of selected design and whose exterior is also of selected non-rotatable cross-sectional design, comprising a bolt, a casing including a front plate having an opening for the key, a guard fixed relative to said casing and having an opening of cross-sectional design conforming to the external design of the key socket and adapted to permit the passage therethrough when in register, of said key socket, a pinion whose axis is aligned with the axis of rotation of the key when inserted in the lock, a hub attached to said pinion projecting toward the key opening and having a cross-sectional design conforming to the cross-sectional design of the key socket cavity, and means operatively connected with said pinion to actuate the said bolt upon rotating the key.

8. A lock operable by a removable key having a socket whose unobstructed cavity in cross-section is of selected design and whose exterior is also of selected cross-sectional design, comprising a bolt, a casing including a front plate having an opening for the socket portion of the key out

of line of the axis of rotation of said key and having a bearing for the key shank concentric to the axis of rotation, a baffle plate disposed inward and in spaced relation to the front plate, a guard fixed relative to said casing and having an opening of cross-sectional design conforming to the external design of the key socket and adapted to permit the passage therethrough when in register, of said key socket, a rotatable element, a hub attached to said rotatable element and projecting toward the key opening and having cross-sectional design conforming to the cross-sectional design of the key socket cavity, and means operatively connected with said rotary element to actuate said bolt upon rotating the key.

9. A lock operable by a removable key having a socket whose unobstructed cavity in cross-section is of selected design and whose exterior is also of selected design, comprising a plurality of bolts, a casing including a front plate having an opening for the socket key out of line of the axis of rotation of said key and having a bearing for the key shank concentric to the axis of rotation, a baffle plate disposed inward and in spaced relation to the front plate, a guard fixed relative to said casing and having an opening of selected design conforming to the external design of the key socket and adapted to permit the passage therethrough when in register, of said key socket, a pinion whose axis is aligned with the axis of rotation of the key, a hub attached to said pinion projecting toward the key opening and having cross-sectional design conforming to the cross-sectional design of the key socket cavity, and means operatively connected with said pinion to project or retract a plurality of said bolts upon rotating the key.

10. A lock operable by a removable key having a socket whose unobstructed cavity in cross section is of selected design and whose exterior is also of selected non-rotatable design, comprising a bolt, a casing including a front plate having an opening for the key, a guard fixed relative to said casing and having an opening of selected design conforming to the external design of the key socket and adapted to permit the passage therethrough when in register, of said key socket, a pinion whose axis is aligned with the axis of rotation of the key, a hub attached to said pinion projecting toward the key opening and having cross-sectional design conforming to the cross-sectional design of the key socket cavity, and means operatively connected with said pinion to project or retract said bolt upon rotating the key.

11. A lock operable by a removable key having a socket whose unobstructed cavity is of selected non-rotatable design and whose exterior is also of selected design, comprising a bolt, a casing including a front plate having an opening for the key, a primary guard non-rotational having an opening of design conforming to the external design of the key socket, a secondary non-rotational guard plate of similar design disposed inwardly of the primary guard, a pinion whose axis is aligned with the axis of rotation of the key, a hub attached to said pinion projecting toward the key opening and having cross-sectional design conforming to the design of the key socket cavity, and means operatively connected with said pinion to project or retract said bolt upon rotating the key.

12. A lock operable by a removable key having a socket whose unobstructed cavity in cross section is of selected design and whose exterior is also of the same selected cross-sectional design

and identically oriented with the axis of rotation, comprising a bolt having rack teeth, a casing including a front plate having an opening for the socket portion of the key out of line of the axis of rotation of said key when fully inserted, a baffle plate disposed inward and in spaced relation to the front plate, a guard fixed relative to said casing and having an opening of cross-sectional design conforming to the external design of the key socket and adapted to permit the passage therethrough when in register, of said key socket, a pinion whose axis is aligned with the axis of rotation of the key, and a hub attached to said pinion projecting toward the key opening and of cross-sectional design conforming to the cross-sectional design of the key socket cavity, the said pinion engaging the rack teeth of said bolt to project or retract the bolt upon turning the key.

13. The lock structure as claimed in claim 12, and means operatively connected with the bolt on the back side of said casing for manually retracting or projecting said bolt.

14. The lock structure as claimed in claim 12, the cross-sectional design of the hub being in corresponding register with the design of the opening of the guard when the bolt is completely retracted, and means on the back side of said casing operatively connected with said pinion for manually rotating the hub whereby the design

of the hub is moved out of register with the design of the opening of the guard to prevent the insertion of the socket key.

15. In a locking device operable by a socket key whose cavity is unobstructed and whose exterior shape is of selected cross-sectional design and is adapted to pass through a guard plate opening when the designs are in register, a non-rotatable guard plate having an opening of selected design, and an element engageable by the interior of said socket key to which a rotary motion may be imparted by the turning of said key.

16. A locking device operable by a removable key having a socket whose cavity in cross section is of selected design and whose exterior is also of selected cross-sectional design, comprising a casing including a front plate having an opening, a baffle plate disposed inward and in spaced relation to the front plate, a guard fixed relative to said casing and having an opening conforming to the cross-sectional design of the exterior of the key socket, a hub projecting toward the opening in the front plate and having a cross-sectional design conforming to the design of the key socket cavity, and means operatively connected with said hub to produce a rotary movement upon rotating the key.

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