March 13, 1934. J. W. FITZ GERALD 1,950,723

LOCK

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Fig. 1.

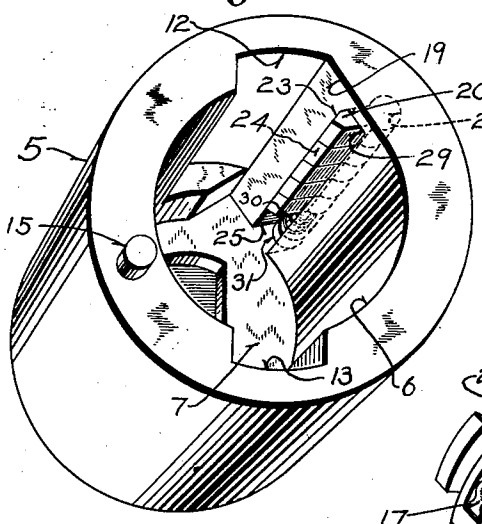


Fig. 2.

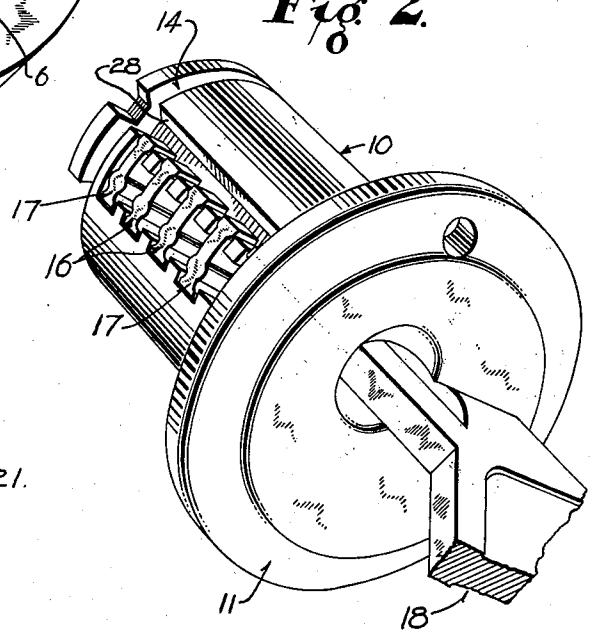


Fig. 6.

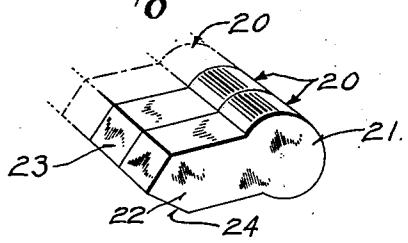
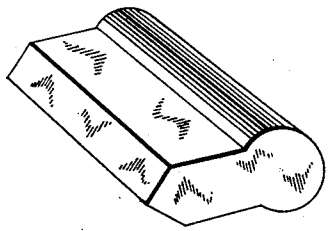


Fig. 7.



Inventor

John W. FitzGerald

By Dewitt & Jones

Attorney

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Fig. 3.

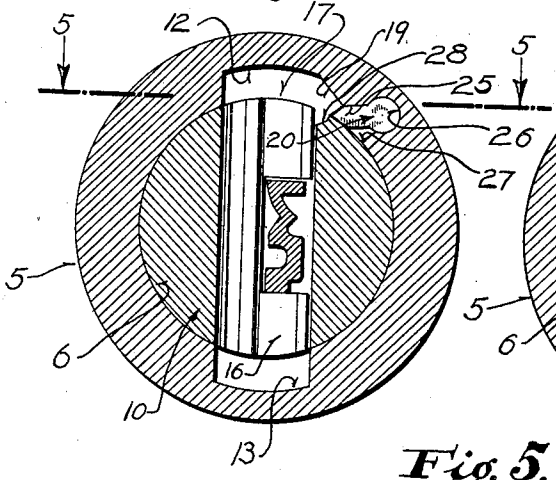


Fig. 4.

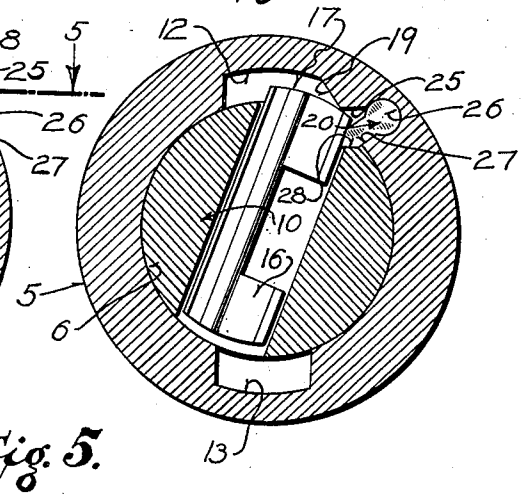
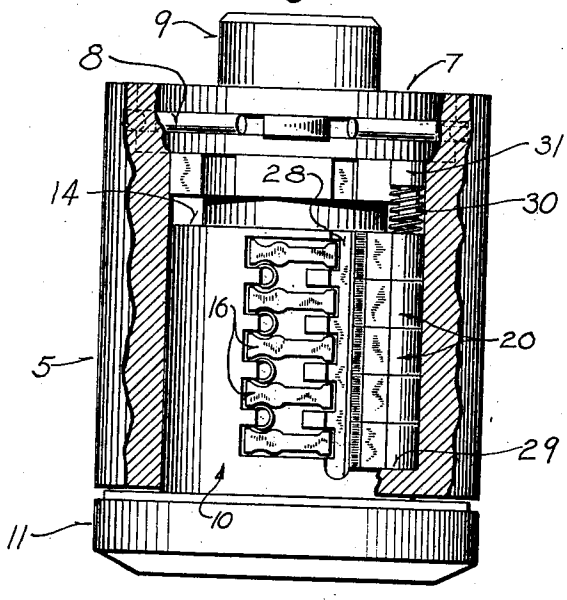


Fig. 5.



Inventor

John W. FitzGerald

By Dudley Jones

Attorney

Patented Mar. 13, 1934 1,950,723

UNITED STATES PATENT OFFICE

1,950,723

LOCK

John W. Fitz Gerald, Milwaukee, Wis., assignor to Briggs & Stratton Corporation, Milwaukee, Wis., a corporation of Delaware

Application March 2, 1933, Serial No. 659,264

19 Claims. (Cl. 70—46)

This invention relates to certain new useful improvements in locks and refers more particularly to key controlled tumbler locks.

As in the Letters Patent No. 1,866,886, issued to John W. Fitz Gerald, July 12th, 1932, it is an object of this invention to provide means for positively securing the lock cylinder against unlocking movement in the event of forced or unauthorized actuation of the lock cylinder.

Another object of this invention resides in the provision of a normally dormant locking element which is movable to a position positively restraining unlocking movement of the lock cylinder upon any movement of the lock cylinder not produced with a proper key.

And a further object of this invention is to provide a locking element for this purpose which is held against accidental movement to its operative position by the lock cylinder in its normal locked position.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings, I have illustrated two complete examples of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view looking into the front of the casing of a lock embodying this invention;

Figure 2 is a perspective view of the lock cylinder;

Figure 3 is a cross section through the assembled casing and cylinder and showing the locking element in its normal inoperative position;

Figure 4 is a view similar to Figure 3 but with the tumblers projected and the locking element moved to its operative position;

Figure 5 is a view partly in elevation and partly in section taken through Figure 3 on the plane of the line 5—5;

Figure 6 is a perspective view of the sectional locking element; and

Figure 7 is a perspective view showing a modified construction of the locking element.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views, the numeral 5 designates a lock casing having a longitudinal bore 6 extending entirely therethrough, but closed at its inner or rear end by an adapter 7. The adapter 7 is held assembled with the casing 5 in any suitable manner as by a spring ring 8 (see Figure 5). The adapter 7 is rotatable in the casing and has an eccentric cam 9 projecting therefrom to actuate any mechanism with which the lock is associated upon rotation of the adapter by the lock cylinder 10 which is rotatably mounted in the casing bore and is non-rotatably connected with the adapter in the conventional manner.

The lock cylinder 10 is of conventional construction having an enlarged flange 11 at its front end to overlie the front face of the casing and cover the adjacent open ends of the usual tumbler grooves 12 and 13 which are formed in the casing in communication with its bore 6.

Cooperating means carried by the casing and the lock cylinder and including a bayonet slot 14 at the inner end of the lock cylinder and a depressible pin 15 projecting from the front face of the casing, serve to removably secure the lock cylinder in the casing and to define its normal limits of movement. However, inasmuch as the specific manner in which the lock cylinder is retained assembled with the casing does not form any part of this invention, it has not been shown in detail.

As is customary, the lock cylinder has a plurality of spring pressed locking tumblers 16 mounted transversely therein to project their operative end portions 17 beyond the peripheral wall of the cylinder and into one of the tumbler grooves. In the present instance, the tumblers project into the groove 12 when the cylinder is in its locked position, the groove 13 being provided merely to accommodate the opposite ends of the tumblers which are projected beyond the cylinder surface during insertion and removal of the key 18.

Ordinarily, both sides of the tumbler groove which receives the operative ends of the tumblers are parallel to the sides of the tumblers as are the opposite sides of the groove 13. This construction is objectionable in that it enables picking by means of a vibrator inserted into the keyway of the cylinder to shake the successive tumblers down where they are held by forcibly twisting the cylinder through the medium of a tool inserted in the end of the keyway so that the successive tumblers as they are vibrated down are hooked or engaged on the edge of the tumbler groove.

It is this disadvantage of conventional tumbler lock constructions which this invention over-

comes, and to this end, that side of the tumbler groove 12 toward which the tumblers move upon unlocking movement of the cylinder, instead of being parallel to the other side and affording a sharp edge, is inclined as at 19. This permits the cylinder to be turned toward its unlocking position without the use of a key and without retracting the tumblers, the tumblers being cammed down into the cylinder upon such rotation of the cylinder.

However, this permitted movement is restricted to but a few degrees and is employed to effectuate a positive interlocking connection between the cylinder and casing which cannot be released to free the cylinder for further unlocking movement by any known method of picking a lock. This interlocking connection is afforded by a series of locking elements 20 mounted in the casing and adapted to engage in a groove 28 formed in the cylinder adjacent the end portions 17 of the tumblers.

In cross section, the elements 20 comprise a cylindrical head 21 from which a flat extension 22 projects, the end of the extension 22 being V-shaped to provide angled faces 23 and 24. The locking elements are assembled in a groove 25 formed in the casing with one element aligned with each locking tumbler. The groove 25 has a cylindrical portion 26 to receive the heads of the locking elements and an elongated slot 27 leading from the cylindrical portion 26 to the angled face 19.

As best illustrated in Figures 3 and 4, the slot 27 is of such width as to permit the locking elements to swing on the axis of their cylindrical head portions, a limited degree. In their inoperative positions, the locking elements engage the uppermost side of the slot 27 with their angled end faces 24 just engaging the adjacent surface of the cylinder 10, providing the cylinder is in its locked position illustrated in Figure 3.

With the parts in this position, accidental movement of the locking elements out of their inoperative positions is positively prevented by the cylinder, and inasmuch as the operative ends 17 of the tumblers are yieldably projected into the groove 12 when the key is withdrawn, it is evident that the cylinder is normally yieldably held in its locked position. Only a forced rotation of the cylinder, as when an attempt is made to pick the lock, will move the cylinder out of its locked position.

Assuming that the cylinder is in its locked position and that the key is withdrawn and an attempt is made to pick the lock, the initial application of a turning force on the cylinder, which is the first step in picking, will move the parts into their positions illustrated in Figure 4. Here the locking tumblers have been partially cammed down by the inclined face 19 of the groove 12, and the locking elements 20 have been moved to their operative positions by the advancing edges of the tumblers to project into the groove 28.

In their operative positions depicted in Figure 4, the locking elements 20 have their inclined outer end faces 23 in direct flat engagement with the advancing edges of the tumblers and have their lower sides abutting the adjacent side of the slot 27 so as to be positively restrained against further movement and positively lock the cylinder against further rotation toward unlocked position.

The outer ends of the locking elements 20 when in this operative position are inward of the cylindrical surface of the cylinder 10, and as the tumblers are turned out of line with the groove 13, it is thus impossible to vibrate the tumblers down sufficiently far to permit them to hook under the outer ends of the locking elements. Hence, it follows that it is absolutely impossible to pick the lock with any known method. The only way in which the locking elements 20 can be returned to their inoperative positions is by retracting the cylinder to its fully locked position.

In normal use, when the cylinder is actuated with the proper key, the locking elements are prevented from dropping down into the slot 28 by frictional contact between their foremost faces and the closed front end 29 of the groove 25, afforded by a spring 30. The spring 30 is confined between the innermost element 20 and a plug 31 closing the inner end of the cylindrical portion 26 of the groove 25. The plug 31 is held against displacement by the adapter 7 which extends across the rear end of the groove 25.

While it is preferable to have an individual locking element for each tumbler, if desired, a single solid element as illustrated in Figure 7 may be employed in place of the sectional unit shown in the preferred embodiment. Also, while the disclosure shows a locking unit engageable with only one edge of the tumblers, a second unit may be provided diametrically opposite that shown, to engage the diagonally opposite corners of the tumblers. This duplication is particularly desirable where the lock is of the type in which the tumblers operate in both directions, and even with locks of the type shown, such dual provision of locking elements would afford added security.

What I claim as my invention is:

1. In a lock comprising a casing and a lock cylinder movable therein, locking tumblers carried by the cylinder and adapted to normally secure the lock cylinder in a predetermined position in the casing, said tumblers being movable to free the lock cylinder for movement upon the insertion of a proper key into the lock cylinder, and means normally positively held in an inoperative position by the cylindrical surface of the cylinder and operable by a tumbler to an active position interlocking the lock cylinder and casing upon movement of the lock cylinder while said locking tumbler is in any but fully inactive position.

2. In a lock comprising a casing and a lock cylinder movable therein, locking tumblers carried by the cylinder yieldably projected into an operative position securing the cylinder against movement in the casing and retractable to inactive positions within the cylinder upon the insertion of a proper key into the lock cylinder, and a locking element normally positively held in its inoperative position by the side of the cylinder and movable to an operative position positively interlocking the cylinder and casing against movement of the cylinder in one direction, said locking element being moved to its operative position by the projecting end of a tumbler upon movement of the lock cylinder in said direction while said tumbler is in any but fully retracted position.

3. In a lock comprising a casing and a lock cylinder movable therein, locking tumblers carried by the cylinder adapted to normally secure the cylinder in a locked position in the casing, said tumblers being retractable to free the cylinder for rotation upon the insertion of a proper key into the cylinder, a locking element normally held in an inoperative position by the side of the lock cylinder when in its locked position and having a part lying in the path of any tumbler projecting beyond its fully inactive position to be

moved thereby to an operative position interlocking the cylinder and casing and preventing rotation of the lock cylinder toward unlocked position beyond the slight degree necessary to move the locking element to its operative position.

4. In a lock comprising a bored casing and a lock cylinder rotatable in the casing bore, a locking tumbler carried by the cylinder and yieldably urged to project one end into a groove in the casing communicating with its bore, said tumbler being retractable by a proper key to withdraw its projected end from the groove and free the cylinder for rotation, a locking element movably mounted in the casing and having an end portion movable into the casing bore, said locking element being normally held in its inoperative position by a cylinder part and being movable to its operative position projected into the casing bore by the locking tumblers in the event of rotation on the part of the lock cylinder while the tumbler is in any but fully retracted position.

5. In a lock comprising a bored casing and a lock cylinder rotatable in the casing bore, a locking tumbler carried by the cylinder and yieldably urged to project one end into a groove in the casing in communication with its bore, one side of the groove being so located as to permit a degree of rotation of the cylinder without requiring retraction of the tumbler, and a locking element carried by the casing adjacent said side of the groove and operable to an operative position interlocking the cylinder and casing and preventing rotation of the cylinder in one direction, said locking element normally being held in an inactive position by the cylindrical surface of the cylinder, and having a part engageable by the locking tumbler upon rotation of the cylinder effected while the locking tumbler is in any but its fully retracted position to be moved by such rotation of the cylinder to its operative interlocking position.

6. In a lock comprising a casing and a lock cylinder mounted in the casing, a locking tumbler carried by the cylinder and operable to secure the cylinder in locked position within the casing, said tumbler being retractable to free the cylinder for rotation upon the insertion of a proper key into the cylinder, a locking element carried by the casing and movable to project a part thereof into a recess in the cylindrical surface of the cylinder to interlock the cylinder and casing and positively secure the cylinder against movement toward unlocked position, and said locking element being movable to project its part into the cylinder recess by the locking tumbler in the event of attempted rotation of the cylinder while the locking tumbler is in any but fully retracted position.

7. In a lock, a bored casing, a lock cylinder mounted in the casing bore, a locking tumbler carried by the cylinder and yieldably urged to project one end from the cylinder, means carried by the casing to receive the projected end portion of the tumbler and thereby normally restrain rotation of the cylinder, said means enabling a degree of rotation of the cylinder without requiring retraction of the locking tumbler, a locking element pivotally mounted in the casing to swing and project a part thereof into a recess in the surface of the cylinder, and said locking element having a part lying in the path of the tumbler upon movement of the cylinder effected without retracting the tumbler whereby such rotation of the cylinder swings the locking element into its operative position projecting its part into said recess in the cylinder.

8. In a lock having a bored casing and a lock cylinder therein, a locking tumbler carried by the cylinder and yieldably projected from the cylinder to engage the casing and normally hold the cylinder in a predetermined position with respect to the casing, said tumbler being retractable by a proper key to free the cylinder for movement, a locking element pivotally mounted in the side of the casing with a part projecting through a slot in the casing opening to the bore in which the cylinder is mounted, said locking element being movable about its pivotal mounting from an inactive position clearing the cylinder wall to an operative position projecting into a recess in the cylinder wall, and means whereby movement of the cylinder affected while the tumbler is in any but fully retracted position moves the locking element to its operative position.

9. In a lock comprising a bored casing and a lock cylinder movably mounted in the casing bore, a locking element pivoted in the side of the casing and having a part projecting through a slot opening to the casing bore, said part being movable to and from an operative position projecting into a recess in the cylinder wall to positively interlock the cylinder and casing and prevent movement of the cylinder in one direction, and means to move said locking element to so position its cylinder engaging part upon unauthorized movement of the lock cylinder in said direction.

10. In a lock including a bored casing and a lock cylinder movably mounted in the casing bore, a locking element having a substantially cylindrical head and a cylinder engaging part projecting therefrom, said locking element being disposed in a groove formed in the casing, said groove having a substantially cylindrical part to receive the cylindrical head of the locking element and having a slot extending from said substantially cylindrical part to open to the bore in the casing through which said cylinder engaging part of the locking element projects, said slot being of sufficient width to enable limited swinging movement of the locking element and said movement being sufficient to enable the projecting part of the locking element to move from an inoperative position to an operative position projecting into a recess in the cylinder wall to secure the cylinder against movement in one direction, and means to move said locking element to so position its projecting part upon unauthorized movement of the cylinder in said direction.

11. In a lock including a bored casing and a lock cylinder movably mounted in the casing bore, a locking element movably mounted in the casing and having a part projectable into a recess in the cylinder upon a predetermined movement of the locking element, friction means to hold the locking element in its inoperative position, and means to move the locking element to so project its part into the recess in the cylinder upon unauthorized movement of the cylinder.

12. In a lock, a bored casing, a lock cylinder movably mounted in the casing bore, a locking tumbler yieldably projected from the cylinder to engage the casing and hold the cylinder in a predetermined position, said tumbler being retractable by a proper key to free the cylinder for movement, a locking element movably carried by the casing and adapted to be moved to a posi-

tion projecting a part thereof into a recess in the cylinder wall, said part engaging the cylindrical surface of the cylinder when the cylinder is in its normal position at which it is held by the tumbler so that the locking element is thereby positively restrained against movement to its operative position engaging the cylinder recess, means including the locking tumbler to move said locking element to its operative position projected into the cylinder recess upon unauthorized movement of the cylinder, and friction means to hold the locking element in its inoperative position during proper operation of the cylinder by means of the key.

13. In a lock including a bored casing and a lock cylinder rotatable in the casing bore, a plurality of locking tumblers carried by the cylinder and yieldably projected from the cylinder to engage the casing and hold the cylinder in a predetermined position, said tumblers being retractable by a proper key to free the cylinder for rotation, a plurality of locking elements carried by the casing normally in an inoperative position and movable to an operative position projecting a part thereof into a recess in the cylinder, and means including the locking tumblers to move the locking elements to their operative positions interlocking the cylinder and casing against movement of the cylinder in one direction.

14. In a lock including a bored casing and a lock cylinder rotatable in the casing bore, a plurality of tumblers carried by the cylinder and yieldably projected into engagement with the casing to normally hold the cylinder in a predetermined position, said tumblers being retractable by a proper key to free the cylinder for rotation, a plurality of locking elements, one for each tumbler, mounted in a groove in the casing and movable from an inoperative position to an operative position projecting a part thereof into a recess in the cylinder to interlock the cylinder and casing against movement of the cylinder in one direction, means including the locking tumblers to move said locking elements to their operative positions projecting into the cylinder recess upon unauthorized rotation of the cylinder, and spring means maintaining the locking elements in frictional contact and frictionally holding all of the locking elements in their inoperative positions during rotation of the cylinder with its tumblers retracted by the proper key.

15. In a lock including a bored casing, and a lock cylinder movable in the casing bore, a locking tumbler yieldably projected from the cylinder to engage the casing and hold the cylinder in a predetermined position, said cylinder having a recess adjacent one edge of the tumbler, a locking element movably mounted in the casing with a part thereof normally resting on the cylindrical surface of the cylinder directly adjacent the recess, and means including the locking tumbler to move said locking element part into the recess to interlock the cylinder and casing against movement of the cylinder in one direction upon unauthorized movement of the cylinder.

16. In a lock, a bored casing, a lock cylinder movably mounted in the casing bore, a locking tumbler having a part yieldably projected from the cylinder to engage in a groove in the casing and hold the cylinder in a predetermined position, the tumbler being retractable by a proper key to free the lock cylinder for movement, said cylinder having a recess adjacent one edge of the projected tumbler part, a locking element movably mounted in the casing and having a part normally disposed adjacent the recess in the cylinder but outside the circumference of the cylinder so as not to interfere with movement of the cylinder upon retraction of the tumbler by the proper key, and means to guide the projected tumbler part into engagement with the locking element upon movement of the lock cylinder effected without retracting the tumbler whereby such movement of the cylinder moves the locking element part into engagement with the cylinder recess to interlock the cylinder and casing.

17. In a lock comprising a casing and a lock cylinder movable therein, a locking tumbler carried by the cylinder and yieldably projected into an operative position engaging the casing to hold the cylinder in a normal locked position from which it may be released by retraction of the tumbler by a proper key, and means carried by the casing and operable to engage the tumbler inwardly of the surface of the cylinder upon movement of the cylinder effected while the tumbler has any portion thereof projecting from the cylinder to thereby secure the cylinder against further movement.

18. In a lock comprising a casing and a lock cylinder movable therein, a locking tumbler carried by the cylinder and yieldably projected into an operative position engaging the casing to hold the cylinder in a normal locked position from which it may be released by retraction of the tumbler by a proper key, and a locking member movably mounted in the casing and movable by the tumbler to a position engaging the tumbler inwardly of the circumference of the cylinder upon movement of the cylinder effected while the tumbler is in any but fully retracted position.

19. A lock of the character described, comprising a bored casing, a lock cylinder rotatably mounted in the casing bore, said casing having a recess communicating with its bore, a transverse tumbler carried by the cylinder and yieldably projected into engagement with said casing recess to normally hold the cylinder in a locked position from which it may be released by retraction of the tumbler through the medium of a proper key, said recess in the casing being of such size and shape as to permit a degree of rotation on the part of the lock cylinder without retracting the tumbler, and a locking member carried by the casing with a part normally disposed in the path of the projected tumbler to be engaged thereby and moved to an operative position engaging the tumbler inwardly of the circumference of the cylinder upon rotation of the cylinder effected without first fully retracting the tumbler.

JOHN W. FITZ GERALD.