April 22, 1930. A. C. STEVENS 1,755,847

LOCK

Filed March 25, 1925

Fig. 1.

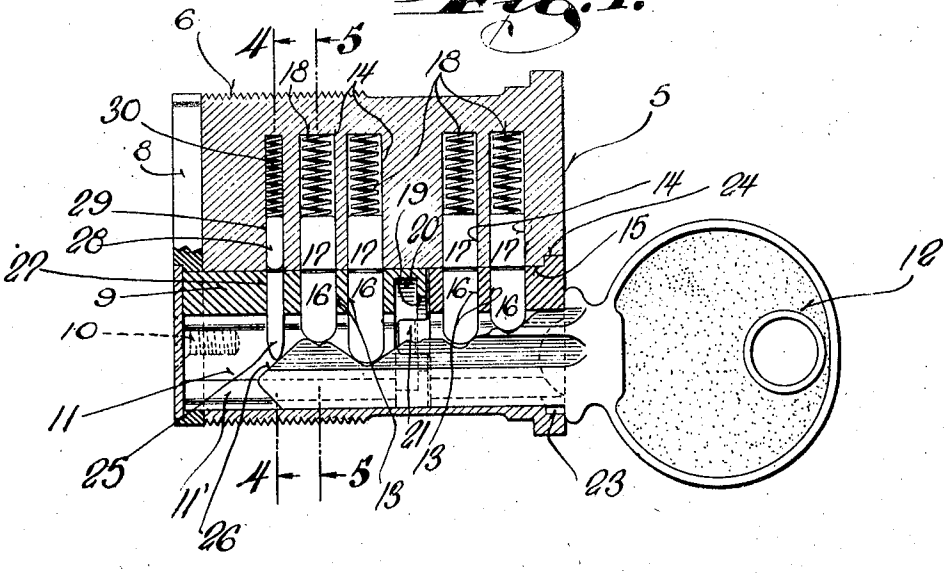


Fig. 2.

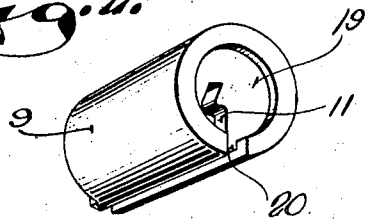


Fig. 3.

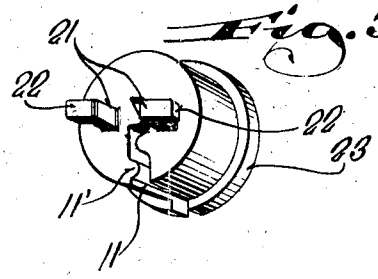


Fig. 4.

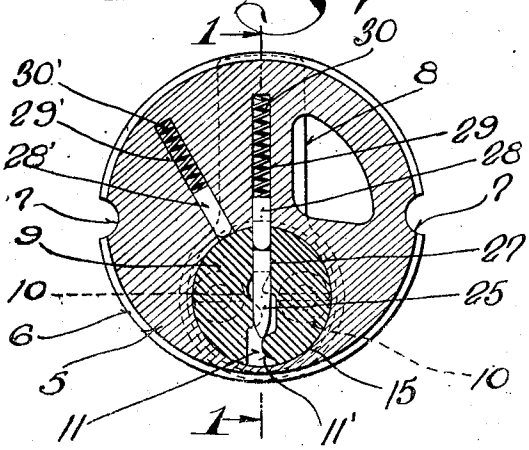
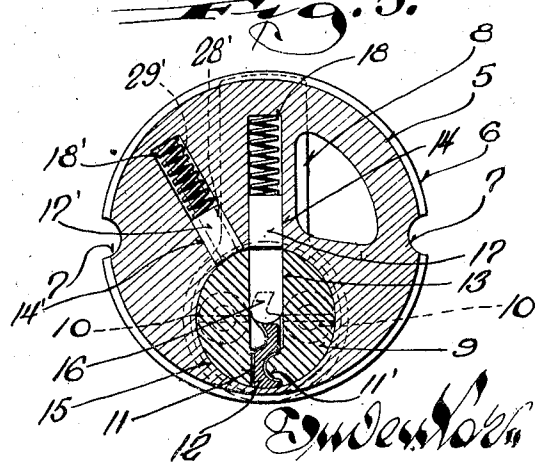


Fig. 5.



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Patented Apr. 22, 1930 1,755,847

UNITED STATES PATENT OFFICE

ARTHUR C. STEVENS, OF MILWAUKEE, WISCONSIN, ASSIGNOR OF ONE-THIRD TO PHILLIP W. GROSS AND ONE-THIRD TO IRA MILTON JONES, BOTH OF MILWAUKEE, WISCONSIN

LOCK

Application filed March 25, 1925. Serial No. 18,263.

Until recent years, cylinder type locks have been the symbol of security, but lately the manner of picking this type of lock has become almost general knowledge. Therefore, this invention contemplates as a primary object the provision of means for preventing the picking of cylinder or similar type locks.

A further object of this invention resides in the provision of a lock cylinder having safe-guards against picking which will not materially increase its cost of production and which in nowise increases its cost of installation or requires revision of the lock proper or other parts with which the cylinder is associated.

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 hereindisclosed invention may be made as come within the scope of the claims.

In the accompanying drawing, I have illustrated one complete example 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 sectional view through a lock cylinder, the key, tumblers, pins or drivers and pin or driver springs being in elevation and said view being taken through Figure 4 on the plane of the line 1—1;

Figure 2 is a perspective view of the inner section of the improved plug;

Figure 3 is a perspective view of the outer section of my improved plug;

Figure 4 is a view taken transversely through the cylinder on the plane of the line 4—4 of Figure 1, and

Figure 5 is a view similar to Figure 4 taken through Figure 1 on the plane of the line 5—5;

Referring now more particularly to the accompanying drawing, the numeral 5 designates the barrel or shell of a lock cylinder which is adapted to be secured in a door frame, not shown, in a suitable manner, as by screwing its threaded inner end 6 into the casing or box of the lock, not shown, with which it is used, the barrel being held against retrograde movement by set-screws, not shown, engaging slots 7 in the barrel sides. As is customary, the lock proper, not shown, is actuated from a cam or tail piece 8 secured to the inner end of a plug 9 by fastenings 10.

The plug 9 may be of the special construction later described and is provided with a longitudinal key-way or slot 11 of irregular shape in transverse section to conform with the irregularities of a key 12 adapted to be inserted therein. The portion of the plug directly above the key-way slot is provided with a plurality of spaced, longitudinally aligned, radial apertures 13, the inner ends of which terminate in the key-way and the outer ends of which are adapted to register with bores 14 in the barrel or shell and radiating from the axis of the bore 15 in which the plug is rotatably mounted. Tumblers 16 of different lengths are positioned in the openings 13 of the plug and cooperate with pins or drivers 17 mounted in the barrel or shell bores 14. The lower ends of the tumblers are preferably slightly rounded and normally rest on the lowermost ridge or bead 11′ of the key-way with the pins or drivers extended into the openings 13 and yieldably held in engagement with their respective tumblers when the plug is in neutral position with the openings and bores in register by expansile springs 18.

The upper or active edge of the key is provided with "hills" and "dales" so arranged that when inserted in the plug key-way, the tumblers are raised the proper distance against the springs 18 to position the line of break between the tumblers and drivers in register with the periphery of the plug. The key, when properly cut, thus positions the pins or drivers to permit the free rotation of the plug and the consequent opening of the lock proper, not shown, by the cam or tail piece 8.

Heretofore, it has been a comparatively easy task to open locks of this character with-

out a key, this being accomplished by placing a picking tool such as a thin but stiff wire in the key-way and applying a rotational strain on the plug at the same time rapidly vibrating the picking tool. The vibrating of the tumblers while a rotational stress is applied to the plug results in the catching of the pins or drivers in their bores after they have been freed of the plug so that when all of the pins or drivers have been so caught, the plug may be freely rotated to open the lock, not shown, connected therewith through the cam or tail piece 8.

In order to render the unauthorized actuation of the lock cylinder difficult, if not impossible, the plug 9 may be formed in sections, as best depicted in Figures 1, 2 and 3. The sections of the plug are secured against longitudinal separation, as later described, but are free to rotate independently except when the key 12 is in place so that in the event a picking method such as previously described is employed only the pins or drivers engaging the outer section of the plug will be disengaged. Consequently, only the first or outer plug section is freed to rotate, the inner plug section remaining locked against rotation by the inner pins or drivers engaged in the openings 13 of the section, inasmuch as the rotational stress placed on the plug in the picking operation was not applied to the inner section.

The sections of the improved plug are connected by the interlocking construction illustrated in Figures 2 and 3, the outer end of the inner section being counter-bored, as at 19, and the wall of the counter-bore being back bored to form an annular groove or channel 20. A pair of spaced lugs or projections 21 are formed on the inner end of the outer plug section on opposite sides of the key-way and the ends of the projections are extended laterally in opposite directions to provide ears 22, adapted to track in the channel 20 to prevent longitudinal movement between the sections, but permit their independent free rotational movement on a common axis. The sections of the plug are connected by inserting one ear 22 in the channel 19 opposite the key-way and placing the other ear 22 in the key-way in register with the channel when the sections are rotated with respect to each other to disalign the ears and the key-way. The assembled plug is then positioned in the shell or barrel bore 15 and secured therein against longitudinal movement by the cam 8 at its rear and a flange 23 on the outer end of the outer section and which fits in a counter-bore 24 in the barrel outer face. The plug being confined in the bore 15, movement apart of the sections thereof in the event the ears 22 align with the key-way is prevented as the plug sections must be moved transversely after the key-way and ears 22 are in register to effect the separation of the sections.

In addition to the safe-guard against picking which is offered by the novel two section plug previously described, I provide an additional safe-guard in the form of a tumbler 25 of reduced diameter and adapted to be actuated by the extreme inner end 26 of the key. The tumbler 25 works in an opening 27 of the plug and its inner end is pointed for the reasons later described. The tumbler 25 cooperates with a pin or driver 28 mounted in a bore 29 in the barrel or shell in line with the bores 14, the pin or driver 28 being yieldably urged into the opening 27 when in register with the bore 29 by an expansile spring 30.

The tumbler 25 being of reduced diameter and pointed at its lower end affords added protection against picking, as the picking tool or other member, which of necessity must be thin, cannot lift the tumbler to move its pin 28 into the bore 29, but instead the picking tool slides off to one side thereof. This difficulty is further increased by the location of the tumbler 25 at the extreme inner end of the key-way.

In addition to the safe-guards against picking previously described, additional means are provided, the form of two additional pins or drivers 17′ and 28′ mounted in bores 14′ and 29′, respectively.

The bores 14 and 29 are arranged in a longitudinal line and intersect the axis of the plug, and the bores 14′ and 29′, while intersecting the axis of the plug, are disposed out of line with the bores 14 and 29, being positioned to the side thereof the plug is rotated toward its unlocking movement. The bore 29′ is in transverse alignment with the bore 29 so that a rotation of the plug to open the lock controlled from the cam 8 registers the opening 27 therewith after the plug has partially rotated toward lock opening position, and with the tumbler 25 held in proper position by the key, the continued rotation of the plug is unrestricted.

The bore 14′ is in transverse alignment with the innermost bore 14, and in longitudinal alignment with the bore 29′. With the key in place the innermost tumbler 16 and the tumbler 25 prevent the pins or drivers 17′ and 28′ from entering the innermost opening 13 and the opening 27, and thus the plug is free to rotate. The pins or drivers 17′ and 28′ are yieldably urged outwardly of their bores by springs 18′ and 30′, respectively, the strength of which are greater than the other springs.

In the opening of the lock, the key is inserted in the manner illustrated in Figure 1, as a result of which the tumblers all move their respective pins or drivers into the barrel or shell with the line of break between the tumblers and pins or drivers in register with the wall of the bore 23, so that the plug may be freely rotated by the key to rotate the cam or tail piece 8 and actuate the lock, not

shown, controlled therefrom. As the plug is rotated to open the lock, the innermost opening 13 and the opening 27 simultaneously register with the bores 14′ and 29′, respectively, the pins or drivers 17′ and 28′ being held inoperable by the tumblers which are held with their upper ends in line with the plug periphery, and the plug is free to rotate.

However, assume that, in the event the plug is of the one-piece type and a picking tool of the vibrating or any other type has been actuated to successfully align the tops of the tumblers with the periphery of the plug to permit the rotation of the plug, as soon as the bores 14′ and 29′ align with the innermost opening 13 and opening 27, the pins or drivers 17′ and 28′ engage therein, firmly locking the plug against further rotation.

With the plug thus locked by the pins or drivers 28′ or 17′, their release by a picking tool whether of the vibrating or any other type is rendered exceedingly difficult if not impossible by reason of the fact that the tumblers 16 outwardly of the one in the opening in which the auxiliary pin or driver is engaged cannot be vibrated as their outer ends are engaged against the solid wall of the barrel or shell bore 15. In this event, the only manner in which the plug can be released and rotated is by drilling through the pins or drivers, which results in the destruction of the cylinder and requires its replacement with a new one.

As illustrated the inner small sharp tumbler 25 preferably works on the inner end of the key and the spring of its pin or driver 28 is of added strength. If desired, the auxiliary pins or drivers 14′ and 27′ may be eliminated by reason of the fact that it is practically impossible to vibrate the tumbler 25 with any type of picking tool by reason of its pointed end, its small diameter and the comparatively heavy spring for its pin or driver. Further, the provision of the sectional plug renders it difficult to pick as it is customary to insert a tool in the outer end of the plug to apply the rotating stress as the tumblers are vibrated, which results in the releasing of only the pins or drivers cooperating with the first plug section. This is especially true as I have found it impractical to provide a means insertable in the key-way a distance sufficient to connect the plug sections, as to do so reduces the vibrating space necessary to effect the picking of the cylinder. Furthermore, any means extended through the key-way to effect the picking of the cylinder will have to be of such reduced thickness as to render it impossible to stand the strain necessary to rotate the plug in the event the pins or drivers are moved to inactive position.

As stated, the auxiliary pins or drivers 14′ and 27′ may be eliminated, but they constitute an additional, positive safe-guard and may be used either singly or jointly and may be arranged in a common, longitudinal plane or offset with respect to each other, as illustrated and may be utilized either with a sectional plug or a one-piece plug.

From the foregoing description, taken in connection with the accompanying drawing, it will be readily apparent to those skilled in the art to which an invention of this character appertains, that I provide a novel and simple means for rendering a lock cylinder safe against unauthorized opening and one which may be added to locks now in use or to locks at the time of their manufacture.

What I claim as my invention is:

1. A lock of class described, comprising a shell, a slotted plug rotatable therein and provided with a plurality of tumbler sockets, tumblers movable in the sockets, drivers mounted in the shell and adapted to pass into the tumbler sockets when the plug is in a neutral position, said drivers being removed from the plug by the insertion of a key in the slot thereof, and one of said tumblers being of a smaller diameter than the others and having its end portion pointed for engagement with the extreme end portion of a key.

2. A device of the character described, comprising a shell, a slotted, sectional plug rotatable in the shell, cooperating means carried by the sections for permitting the rotation of one plug section with respect to the other and preventing the longitudinal movement of one section with respect to the other, drivers mounted in the shell, means normally tending to urge the drivers into openings in the plug sections when the sections are rotated to register their openings with the drivers, and tumblers in the plug openings and operable upon the insertion of a proper key in the plug slot to connect the sections for joint rotation and free the drivers of the plug to permit its rotation as a unit.

3. A lock of the class described, comprising a shell, a sectional, slotted plug rotatable therein, means for locking both sections against relative movement, and a second means for locking one of the sections against unlawful rotation.

4. A lock of the class described, comprising a shell, a sectional, slotted plug rotatable therein, key releasable means for locking both sections against movement, and auxiliary means engageable with one plug section upon its unauthorized rotation a predetermined distance to lock the same against continued rotation.

5. A lock of the class described, comprising a shell, a sectional, slotted plug mounted therein and rotatable by the insertion of a key within the slot, locking elements for preventing the rotation of both sections other than by the use of a key, and means arranged in alignment with the locking elements for

preventing the rotation of one section during the unauthorized movement of the other section.

6. A device of the character described, comprising a shell, a plug rotatable therein and consisting of two sections adapted to be operatively connected by a key, tumblers mounted in sockets formed in the plug sections, drivers carried by the shell and adapted to pass into the tumbler sockets when the plug sections are in a neutral position, the insertion of a properly fitted key in the plug connecting the sections and moving the drivers free of the tumbler sockets to permit the rotation of the plug sections as a unit, and means operable upon the unlawful rotation of one plug section a predetermined distance to lock the same against continued rotation.

7. A device of the character described, comprising a shell, a plug rotatable therein and consisting of two sections adapted to be operatively connected by a key, tumblers mounted in sockets formed in the plug sections, and drivers carried by the shell and adapted to pass into the tumbler sockets when the plug sections are in a neutral position, the insertion of a properly fitted key in the plug connecting the sections and moving the drivers free of the tumbler sockets to permit the rotation of the plug sections as a unit, the innermost tumbler of the inner plug section being of a smaller diameter than the others and having its inner end portion pointed.

8. A device of the character described, comprising a shell, a plug rotatable therein and consisting of two sections adapted to be operatively connected by a key, tumblers mounted in sockets formed in the plug sections, drivers carried by the shell and adapted to pass into the tumbler sockets when the plug sections are in a neutral position, the insertion of a properly fitted key in the plug connecting the sections and moving the drivers free of the tumbler sockets to permit the rotation of the plug sections as a unit, the inner-most tumbler of the inner plug sections being of a smaller diameter than the others and having its inner end portion pointed, and means operable upon the unlawful rotation of one plug section a predetermined distance to lock the same against continued rotation.

9. A device of the character described, comprising a shell, a plug rotatable therein and provided with a key slot, a plurality of locking elements operatively accessible from points spaced longitudinally in the slot, means for breaking the continuity of said slot between certain of said points on unauthorized rotation of said plug, and means automatically operable to prevent rotation of the plug to restore continuity of the slot.

10. A device of the character described, comprising a shell, a plug rotable therein and provided with a key slot, a plurality of locking elements operatively accessible from said slot, means for distorting the slot on unauthorized rotation of the plug, and means operable by unauthorized rotation of the plug to lock the plug in slot distorted position in the shell.

11. A device of the character described, comprising a shell, a plug rotatable therein and provided with a key slot, a plurality of locking elements operatively accessible from points spaced longitudinally in the slot, means for breaking the continuity of said slot between certain of said points upon unauthorized rotation of the plug, and means automatically operable upon a predetermined degree of unauthorized rotation of said plug to lock said plug against further movement in any direction.

12. A device of the character described, comprising a shell, a plug rotatable therein and provided with a plurality of tumbler sockets, tumblers mounted in said sockets, drivers mounted in the shell and adapted to pass into the tumbler sockets when the plug is in a neutral position, said drivers being removed from the plug by the insertion of a key therein to permit rotation of the plug, the innermost tumbler being of a smaller diameter than the others and of a smaller diameter than the thickness of a key, the inner end portion of said smaller diameter tumbler being pointed and disposed for contact with the extreme inner end of a key.

In testimony whereof I affix my signature.

ARTHUR C. STEVENS.