Feb. 27, 1923. 1,446,760

A. E. MILLER

LOCK

Filed Dec. 7, 1920 2 sheets-sheet 1

Fig. 1.

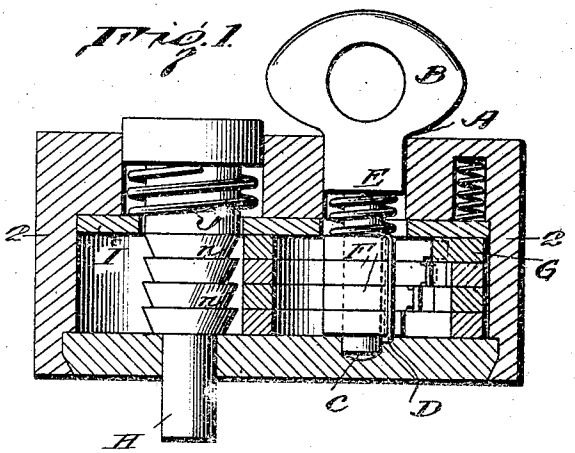
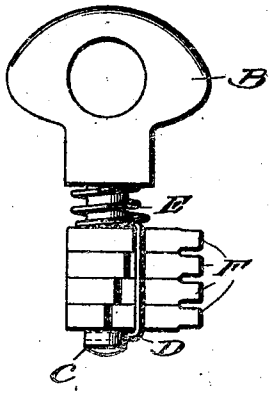


Fig. 3.



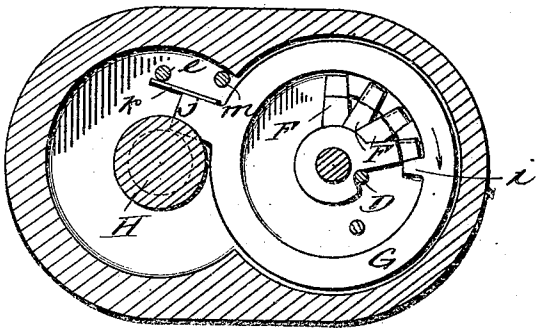


Fig. 2.

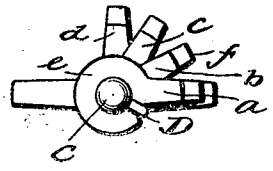


Fig. 4.

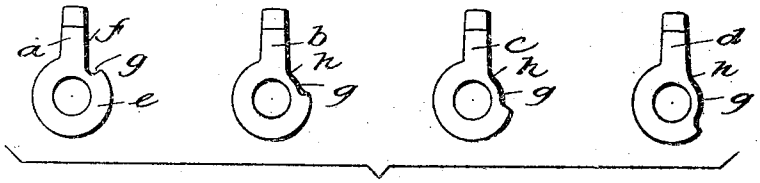


Fig. 5

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Fig. 5a



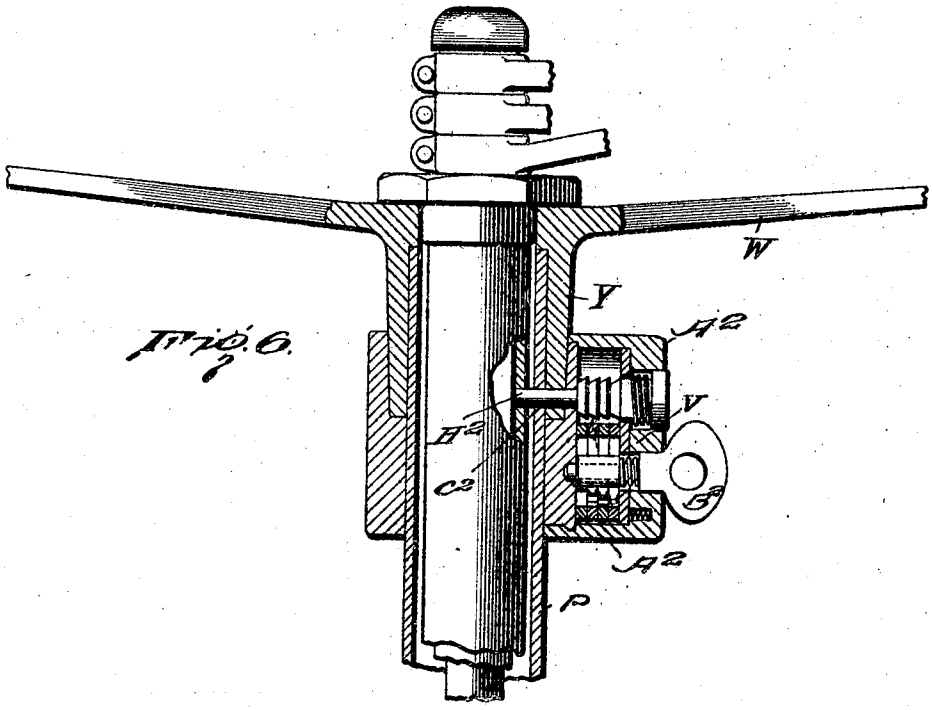


Fig. 6.

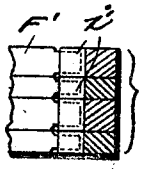


Fig. 7.

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Patented Feb. 27, 1923. 1,446,760

UNITED STATES PATENT OFFICE.

ARTHUR E. MILLER, OF SACRAMENTO, CALIFORNIA.

LOCK.

Application filed December 7, 1920. Serial No. 428,936.

To all whom it may concern:

Be it known that I, ARTHUR E. MILLER, a citizen of the United States, residing at Sacramento, in the county of Sacramento and State of California, have invented certain new and useful Improvements in Locks, of which the following is a specification.

My invention relates to certain new and useful improvements in locks, and it has particular reference to a lock which is designed to be operated by a key, said key carrying a plurality of pivotally-mounted bits which are designed to co-act with an equal number of rotating tumblers suitably mounted in the lock-case, and which tumblers are provided with means for engaging an appropriate locking-bolt whereby said bolt may be made to secure and release another part.

A leading object of the present invention is to devise a key-operated lock which is particularly designed for use in locking the steering mechanism of an automobile or for securing an automobile accessory, or other part against unlawful appropriation, and where the internal arrangement of the lock may be modified at pleasure, to substantially change the combination by which the lock can be opened.

With the above and other objects in view my invention consists of the parts and the constructions and arrangements and combinations of parts forming the improved lock, which I will hereinafter describe and claim.

In the accompanying drawings forming part of this specification, and in which similar reference characters indicate like parts in the several views,

Fig. 1 is a vertical sectional view of a lock embodying my invention.

Fig. 2 is a horizontal sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a detached view of the operating key provided with a series of pivoted bits.

Fig. 4 is an end view of the key showing the key partially turned to spread the bits into substantially fan shape.

Fig. 5 illustrates a series of the key bits detached.

Fig. 5ª shows diagrammatically the positions assumed by various bits when the key is turned in the lock.

Fig. 6 shows the application of my lock to the housing of the steering post of an automobile.

Fig. 7 is an edge view of several of the rotating tumblers assembled.

In carrying out my invention I provide the lock with a case of suitable design and which design will vary according to the particular use to which the lock is put, one of the face plates of said case being provided with a key-hole A′, for the insertion of the lock-operating key. This key forms an important portion of the present invention and its physical structure includes a head B, and a rigid stem or shank C, said stem or shank having fitted to it the bent end of a guide pin or rod, D, the major portion of which extends parallel with but is spaced from the side of the stem or shank, and has one end rigidly united to the head portion of the key, whereby the rod forms substantially an integral part of the key.

Surrounding the shank of the key is a spring E, and between this spring and the bent end of the aforesaid rod or pin is confined a series of bits or key tumblers F and which series may consist of any desired number. In the illustrated embodiment of my invention, Fig. 4, I show four of the aforesaid bits, *a*, *b*, *c*, *d*, and in Fig. 5, I illustrate these bits substantially diagrammatically, or detached from the shank of the key. In order that this part of my invention may be better understood, I will state that each of the aforesaid bits is provided with a hub-portion *e*, and a projecting finger, *f*; one edge of the said hub-portion is cut-away at *g* to form a peripheral recess which is concentric with the axis of the bit and which portion is designed to ride in contact with the pin or rod D, and to terminate in a radial abutment or shoulder *h*, adapted to contact with the side of the pin or rod D, to limit the rotation of the bit about its pivotal axis on the key-shank. In order that the bits, except the initial one, *a*, may have a varied axial movement, or may be moved to different distances around the shank of the key and to be spread out into substantially a fan-like formation, after the key has been inserted in the lock-case, the recesses in the edges of the hubs of the bits being made of different lengths, as shown in Fig. 5. Cooperating

with the aforesaid pivoted bits, which it will be understood are carried permanently by the key, is a like series of rings or rotating tumblers, G, which are appropriately mounted in the lock-casing, said tumblers being each provided with a radial lug, *i*, on its inner circumference and having an outwardly projecting radial lug *j*, on its outer circumference, the latter lug having secured to it a spring wire or plate, *k*, and the lock-casing being provided with a pair of pins or lugs *l*, and *m*, against the former of which the free end of the spring wire or plate is designed to contact to place the said wire or plate under tension when the ring to which it is connected is partially rotated, and the latter lug *m*, serving as an abutment or stop to limit the rotation of the tumbler by reason of the contact of its radial lug *i* therewith. It will be understood that there are as many of the aforesaid rings placed side by side, or one upon the other, and appropriately spaced apart to allow them to be independently rotated, as there are bits carried by the shank of the key, all of which bits except the initial one, *a*, which is stationary, being pivotally mounted, as before stated.

Appropriately mounted in the lock casing is the lock bolt, H. This bolt has its inner end adapted for engagement with the part to be secured, and if this part is the steering post of an automobile or like vehicle, the housing of the post or the post itself or a sleeve thereon will have an appropriate recess into which the inner end of the locking-bolt will be appropriately received, when the bolt is pushed inward or assumes its locked position. In furtherance of this part of my invention, and to control the locking bolt, H, said bolt has its stem or shank provided with a series of annular grooves, *n*, or it may be otherwise recessed for the reception of the radial lugs *i* on the outer circumference of the rotating tumblers or rings before mentioned.

Surrounding the shank of the locking-bolt is a loose washer I, and between this washer and the underside of the head of the bolt is a coiled spring J, which is held under compression when the bolt is in its locked position, but which spring expands to move the bolt longitudinally to withdraw its inner or locking end out of engagement with the steering post or other engaging part when the several tumblers have been moved so as to withdraw the radial lugs, *i*, from engagement with the recesses, *n*, in the shank of the locking bolt.

From this description it will be understood that the construction of the key is such that all of the bits may be assembled in alignment and in perfect register, as indicated in full lines in Fig. 4, to adapt the key for insertion within the key-hole of the lock-case. When the key is inserted, the bits are designed to be successively moved to variable distances until they assume substantially a fan-formation, as indicated in Figs. 2 and 4. The first of the bits is, as before explained, statonary,—the guide pin, D, engaging the notch of the bit and holding the bit so that it cannot revolve on the axis formed by the stem or shank of the key. The second bit, as the key is turned after it has been inserted in the lock, revolves on its axis, but the extent of movement of this bit is limited by the length of the recess to the right of the guide-pin, and which space varies in the several bits so as to allow these bits to rotate different distances. In Fig. 3 I show the top edge of the bits as being reduced in thickness and the purpose of this is to allow the bits which operate the shorter distance, or have the shorter recesses, to pass the projection or radial lugs, *i*, on the inner circumference of the rings or rotating tumblers, except that ring or tumbler with which a particular bit is designed to engage and actuate. In practice, I prefer to mount the bits on the stem of the key and to so place the pin or rod, D, that complete rotation of a bit around the stem is impossible, the several bits and of which there may be any desired number, being held frictionally together by the spring E, so that when they are lined up against the pin D from one side they will all be in line or register and in position for ready insertion in the key-hole of the lock-case. When the key has been inserted, as described, and is turned to the right, all the bits turn with the key until the bit having the greatest extent of rotation comes in contact with the lug, *i*, of the particular disk that it is to co-act with, and which has its lug arranged in the path of movement of said bit. This radial lug will, as will be understood by those skilled in the art, hold that particular bit yieldingly in contact with its co-acting tumbler, but the guide pin or rod, D, which is rigid with the key, is permitted to continue in rotation until it contacts with the radial shoulder formed in the cut-away edge of the engaged bit. In the meantime the other bits have come in contact with the radial lugs, *i*, of respective rings or tumblers G, the intention being that the bits shall be so selected and placed on the key that they will line up perfectly with the location of the various projections, *i*, on the different tumblers, as shown in Fig. 2. The bits having asumed the position shown in said Fig. 2, with one bit resting in contact with each of the radial lugs of the respective rings or rotating tumblers, and the guide rod resting against the shoulders, *h*, if the key is now rotated each bit thereof will be caused to forcibly press against and rotate one of the disks a certain distance; the rotation of these disks will result in the radial projections, *j*, on the outer circumference of

the tumblers being moved out of engagement with the recessed side of the locking bolt, H, thus releasing this bolt and allowing the spring J, to move the bolt longitudinally to withdraw its locking end out of engagement with the part to be secured. When the tumblers are being moved as described, the spring wire or plate, *k*, with which each radial lug, *j*, is supplied contacts with the pin *l*, before the lug is entirely withdrawn from its engagement with the locking bolt, and consequently it requires some axial pressure on the rings to entirely withdraw them from the bolt. When the pressure has been removed the spring wires or plates, *k*, re-act to return the rotating tumblers to normal position, where said tumblers may readily re-engage the locking bolt when the latter has been pressed inward, as will be understood. The pin *m* which is positioned adjacent the radial lugs *j*, prevents the tumblers from being displaced and permits them to be actuated only a distance sufficient to release the locking bolt. While I have shown the key as provided with four bits to co-act with an equal number of rotating tumblers or rings, I believe it will be found in practice that a less number of bits and rings will be sufficient for ordinary purposes, but the number of bits and rings which may be used is unimportant and may be varied without departing from the spirit of my invention.

To co-act with the particular type of locking bolt shown in Fig. 1, it is desirable to bevel the outer end of the lugs *j*, so that these lugs may more accurately fit the recessed seats they are to occupy in the bolt. The loose washer, I, which surmounts the rotating tumblers and through the center of which washer the stem of the locking bolt passes, is held down or inward by the spring, J, and which spring not only steadies the tumblers but lifts the locking bolt when the latter is released by the operating key.

By reference to Fig. 2, it will also be seen that when the key is inserted and turned in the lock case, the bits are spread fan-like, and are made to come into contact with their respective rotating tumblers, a condition not possible with a key having stationary bits, and as the radial lugs, *j*, are concealed within the lock casing and it is necessary to engage each of these lugs in order to actuate the entire complement of tumblers to effect the release of the locking bolt, I have, in effect, a combination key lock that cannot readily be picked. The variable length of the recesses in the hubs of the bits enables me to change the so-called combination by changing the order in which the bits are placed on the key-shank; for instance, a bit having the greatest length of recess may be placed next the one having the shortest recess; in any event the assemblage of the bits may be varied at pleasure and each change of location of the bits results in substantially a new combination. In each instance, however, the tumblers will be so arranged as to be properly actuated by the assembled bits. Thus a variety of combinations is possible with my described construction. In practice, a large number of bits will be manufactured and then numbered and paired so that the corresponding bits and tumblers can be readily assembled to form a most secure and efficient lock for almost any purpose, as the key and tumbler mechanism may be readily used with lock cases of different designs.

While the rotating tumblers may be of uniform thickness, I may also make them of different thicknesses, in which latter instance the corresponding key-bit will be of substantially like thickness which arrangement increases the difficulty of an unauthorized person in opening the lock. In other words, in making the tumblers, G′, and bits, F′, (Fig. 7) of varying thicknesses, the difference in thickness between certain of the tumblers and bits and others of the same series, would prevent the use of a false key having the right combination or arrangement of bits, but not the proper thickness of bits to correspond with the tumblers used. In such a case, the bits would not pass the radial projection *i′*, on the adjacent tumbler and the tumblers could not be operated to unlock the locking bolt.

In Fig. 6, I show my present lock as a means for securing the steering post of an automobile wherein the lock case A^2 is supposed to be supplied with the key-bit and tumbler mechanism hereinbefore described. In this instance (Fig. 6), the lock-case is formed of two parts so as to enclose the usual steering post housing, P, the parts of the lock case being united by one-way screws or other suitable fastenings so that the case may be retained on the housing just under the hub, Y, of the steering wheel, W. In the lock case is the bolt, H^2, whose inner end is designed to enter a recess, C^2, in the housing or in a sleeve thereon, and is operated by the tumblers, G^2, when the key, B^2 supplied with appropriate bits, F^2, is inserted and actuated substantially as before described.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:—

1. In a lock, the combination of a case, a series of rotatable tumblers therein, a locking bolt, and a key having a series of projections thereon independently rotatable about a common axis and adapted to successively engage the said tumblers.

2. In a lock, the combination of a case, a plurality of movable tumblers therein, a locking bolt adapted to be engaged by said

tumblers, and a key having a series of bits corresponding in number to the number of the tumblers, said bits being loosely mounted upon the key and adapted to be successively turned to engage the tumblers.

3. In a lock, the combination of a case, a series of movable tumblers mounted therein, a locking bolt, and a key having a series of bits adapted to be successively turned about a common center and to assume substantially a fan-like formation after insertion in the case, said bits adapted to engage and actuate corresponding tumblers.

4. A lock, having a bolt, a series of movable tumblers, and an actuating key having a series of bits corresponding to the tumblers and successively movable about a common axis when the key is turned, each of said bits being adapted to one of the tumblers, and said tumblers each having a part disposed in the range of action of its respective bit.

5. A lock having a bolt and a series of movable tumblers, in combination with a key having a series of bits axially mounted thereon and successively turnable relatively to each other and transversely of the key so that they assume a fan-like formation in the lock during the turning movement of the key, said tumblers having projections positioned in the path of rotation of the bits adapted to temporarily retard the independent rotation of the successive bits until each bit finally engages its corresponding tumbler.

6. In a lock, the combination with a case, a locking bolt and a series of rotating tumblers, of a key having a shank provided with a series of bits independently turnable relatively to each other and to said shank, one of the bits of said series being fixed to the key and each of said bits adapted to engage one of the tumblers and to have its individual turning motion restrained thereby until the full complement of bits is engaged by respective tumblers, said key adapted to actuate the series of tumblers in unison to release the locking bolt.

7. In a lock, the combination with a case, a locking bolt and a series of rotating tumblers, of a key having a shank provided with a series of bits independently turnable relatively to each other and to said shank, one of the bits of said series being fixed to the key and each of said bits adapted to engage one of the tumblers and to have its individual turning motion restrained thereby until the full complement of bits is engaged by respective tumblers, said key adapted to actuate the series of tumblers in unison to release the locking bolt, said tumblers having internal lugs to contact with the bits and having external lugs to releasably engage the locking bolt.

8. In a lock, the combination with a case, a locking bolt and a series of rotating tumblers, of a key having a shank provided with a series of bits independently turnable relatively to each other and to said shank, one of the bits of said series being fixed to the key and each of said bits adapted to engage one of the tumblers and to have its individual turning motion restrained thereby until the full complement of bits is engaged by respective tumblers, said key adapted to actuate the series of tumblers in unison to release the locking bolt, said tumblers having internal lugs to contact with the bits and having external lugs to releasably engage the locking bolt, a spring contact member fixed to said external lugs, a stop member on the lock case with which the spring members contact to retard the rotation of the tumblers, and a second stop-member to limit the rotation of the tumblers.

9. In a lock having a bolt and a series of rotating tumblers provided with internal lugs, a key having a shank provided with a series of independently turnable bits, one for each of the tumblers, and adapted to engage the lug thereof, said bits having recesses of variable length, and a guide pin fixed to the key adjacent the bits adapted to engage the latter to cause them to actuate the tumblers in unison to release the bolt.

10. In a lock having a bolt and a series of rotating tumblers provided with lugs, a key having a shank, a series of bits mounted side by side on the shank and movable transversely thereof one relatively to the other, said bits having means affording a variable degree of rotation thereof, and said lugs adapted to check the independent rotation of successive bits, and a part on the key to contact with the bits to actuate them and the series of tumblers in unison, to release said bolt.

11. In a lock having a bolt and a series of rotating tumblers, a key having a shank provided with a series of aligned bits independently transversely turnable about a common axis, said bits having hubs with recesses of variable length, and a member on the key for moving the bits of the series in unison and serving as a guide for aligning the bits, said recesses terminating in end shoulders for the engagement of said member.

12. In a lock, the combination with a case, a locking bolt and a series of rotating tumblers, of a key having a shank provided with a series of bits independently turnable relatively to each other and to said shank, one of the bits of said series being fixed to the key and each of said bits adapted to engage one of the tumblers and to have its individual turning motion restrained thereby until the full complement of bits is engaged by respective tumblers, said key adapted to actuate the series of tumblers in unison to release the locking bolt, and said tumblers and bits being of variable thicknesses.

13. In a lock, the combination with a case, a series of rotatable tumblers mounted therein, and a locking bolt, of a key having a series of bits adapted to be successively turned about a common center and to assume substantially a fan-like formaiton after insertion in the case, said bits adapted to engage and actuate corresponding tumblers, and said tumblers having peripheral lugs with beveled extremities, said bolt having a recessed side for the extremities of the lugs and having a longitudinal movement in the lock case.

14. An improved lock comprising a case having a keyhole; a locking bolt; a series of annular rotating tumblers assembled in said case, each of said tumblers having a lug on its inner and outer circumference; a key having a shank and a series of independently turnable bits thereon, one bit corresponding to each of the tumblers and each bit having a different length of axial movement about the key-shank, whereby the bits assume substantially a fan-formation in the lock case, and means on the key for aligning the several bits and for actuating the bits in unison to cause the tumblers to release the locking bolt, said bolt being spring-actuated and longitudinally movable in said case.

In testimony whereof I hereunto affix my signature.

ARTHUR E. MILLER.