June 29, 1926.

1,590,232

J. A. FREMON

TUMBLER LOCK

Filed August 15, 1921 2 Sheets-Sheet 1

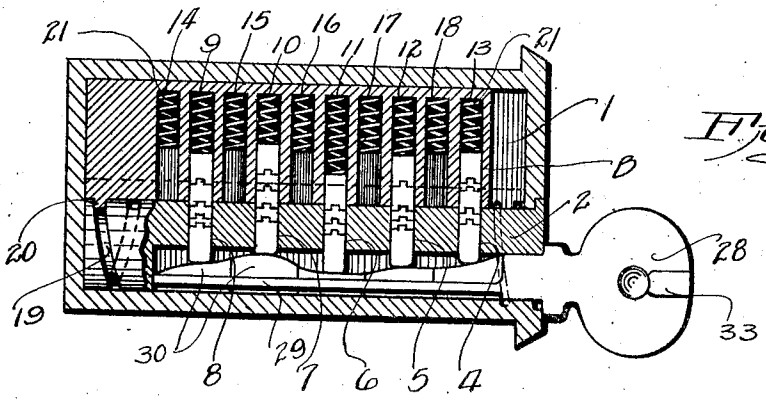


Fig. 1.

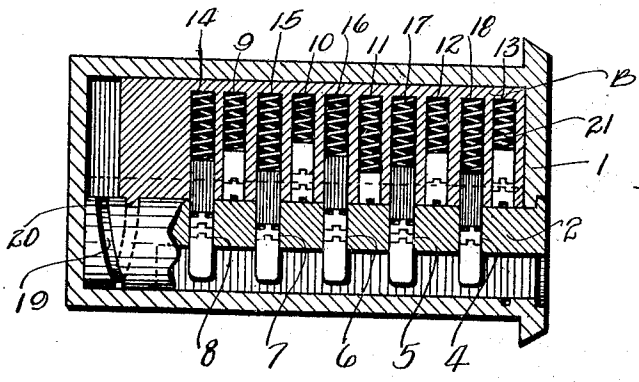


Fig. 2.

Fig. 3.

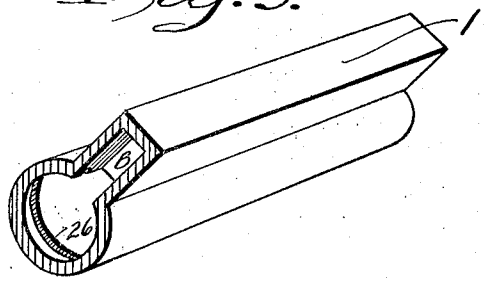
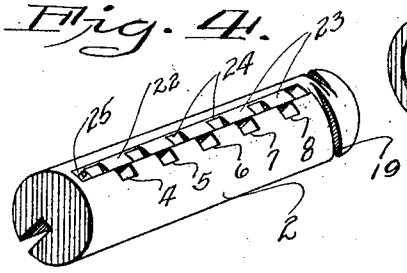


Fig. 4.



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Fig. 7.

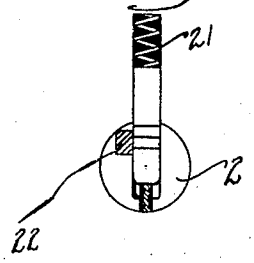


Fig. 8.

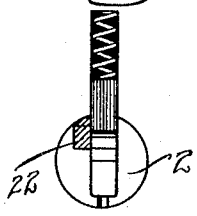


Fig. 9.

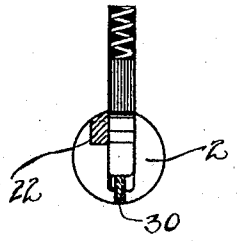


Fig. 10.

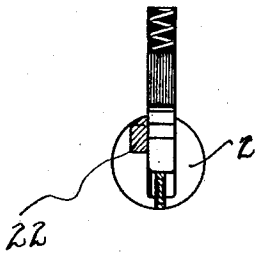


Fig. 11.

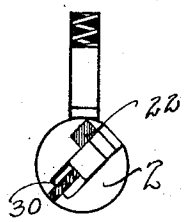


Fig. 12.

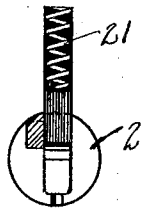


Fig. 13.

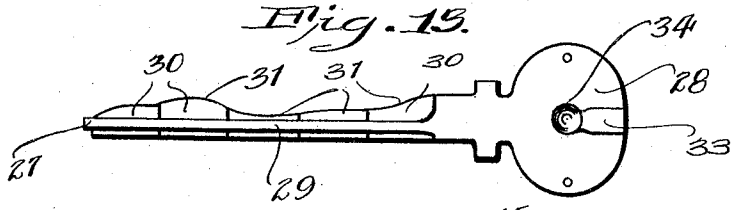


Fig. 14.

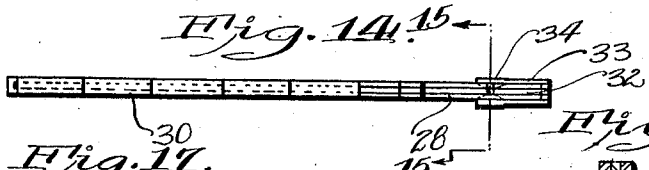


Fig. 15.

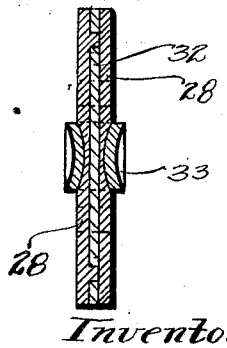


Fig. 16.

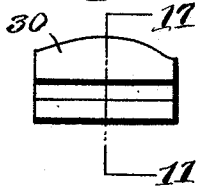


Fig. 17.

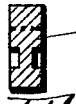


Fig. 5.

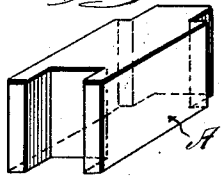
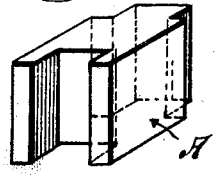


Fig. 6.



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Patented June 29, 1926. 1,590,232

UNITED STATES PATENT OFFICE.

JULES A. FREMON, OF LEEPER, MISSOURI.

TUMBLER LOCK.

Application filed August 15, 1921. Serial No. 492,373.

My invention relates to pin tumbler locks of the type in which a key cylinder is rotated in a case and in which both the cylinder and the case have tumbler recesses and tumbler elements slidable therein and in which the operation of the lock depends upon the positioning of the tumbler segments in the respective recesses.

In some types of this kind of lock, the lock may be operated to lock by any one of a number of keys and it may then be unlocked only by the same key that was used to lock it or a duplicate thereof, but all pin tumbler locks of this type heretofore invented afford but slight security against picking or against the use of unauthorized keys.

The main object of my invention is to provide a lock of the type last mentioned which, having been operated to lock by any one of a number of keys, can only be unlocked by the same or an identical key, and which cannot be picked by any method or in any manner now known or used.

A further object of my invention is to provide a lock possessing my improvements of such construction that when it is fitted to a door or other fixture, it presents the same appearance as a conventional pin tumbler lock, and one that is operated from unlocked to locked position, or vice versa, by turning the key cylinder a complete revolution in the same manner as a conventional pin tumbler lock is operated.

A still further object of my invention is to provide a key for such a lock consisting of removable sections or bits whereby the possessor of the lock may at will render keys previously used inoperative.

These and other detailed objects of my invention are secured by the construction shown in the accompanying drawings which illustrate a selected embodiment of my invention and in which.

Figure 1 is a longitudinal vertical section through as much of my lock as is necessary to illustrate its construction and operation and showing the cylinder in unlocked position.

Figure 2 is a similar section showing the cylinder in locked position.

Figure 3 is an isometric view of the lock case.

Figure 4 is a similar view of the key cylinder withdrawn from the case as shown in Figure 3.

Figures 5 and 6 are isometric views of two of the lock tumbler segments showing their interengagement construction.

Figures 7, 8, and 9, are transverse sections through a single tumbler, largely diagrammatic, showing various operative positions of a given tumbler and referred to more specifically hereinafter.

Figure 10 is a similar section illustrating an inoperative attempt to rotate the cylinder by means of an improper key.

Figures 11 and 12 are similar to Figures 7 and 8, respectively, but show the lock operated with a different key.

Figures 13, 14, and 15 are detailed views of my improved key and are referred to hereinafter, and

Figures 16 and 17 are, respectively, an elevation and cross section through a single key bit.

The case 1 is of the form shown in Figure 3 and is provided with a cylindrical opening in which is journaled the key cylinder 2 which is rotated by the key detailed in Figure 13.

The key cylinder 2 is provided with a series of tumbler recesses 4, 5, 6, 7, and 8, all of which are positioned in the same radial plane of the cylinder.

A block B is slidably contained in case 1 and is provided with a similar series of tumbler recesses, 9, 10, 11, 12, and 13, each aligned with one of the cylinder recesses when the block is in the left hand position shown in Figure 1. Intermediate block tumbler recesses 9 to 13, are locking pin recesses 14, 15, 16, 17, and 18. All of the block recesses mentioned are in the same longitudinal plane.

Key cylinder 2 is provided with a helical cam groove 19 and block B is provided with a cooperating groove engaging element 20. The pitch of groove 19 equals the distance between two successive block recesses and it is obvious that when key 3 and cylinder 2 are rotated in a clockwise direction, groove 19 will cam block B to the front of the case from the position shown in Figure 1 to the position shown in Figure 2.

Each cylinder recess contains a plurality of tumbler segments A, preferably of the form shown in Figures 5 and 6, in which the ends of the segments are stepped or offset so that each segment has transverse engagement with each adjacent segment and at

the same time contacts with the recess wall throughout the entire length of the segment.

In order to render my lock operative, it is essential that each of these segments be held against rotation on its axis and to secure this, I have constructed the tumbler segments of square stock and made all of the recesses in the cylinder and block square to receive the squared tumblers.

Each of the block recesses contains a tumbler adapted to cooperate with the segmental tumbler in the cylinder. The block tumblers in recesses 9 to 13 have stepped lower ends corresponding to the stepped upper ends of the cylinder tumblers and are adapted to be engaged thereby.

The block tumblers or locking pins in recesses 14 to 18 have smooth lower ends. To more clearly distinguish between these two sets of tumblers, I have indicated the smooth-end block locking tumblers by shading, while the stepped end block tumblers are merely outlined. Each of the block tumblers is provided with a coil spring 21 which presses downwardly on the tumbler in the usual manner.

Along the lefthand side of the cylinder recesses the cylinder is cut away to provide a channel adapted to receive a bar 22 which has alternate rectangular sections 23 and cam sections 24. The bevel on each cam 24 slightly exceeds the depth of the step on the tumbler segments.

Bar 22 has a pin 25 which projects into a helical groove 26 in case 1 whereby rotation of the cylinder from unlocked to locked position will shift slide 22 so that cam sections 24 are moved out of alignment with recesses, 4, 5, 6, 7, and 8. Thus when the cylinder is in the locked position, as shown in Figures 2, 8, 9, 10 and 12, the elements extending into both cylinder 2 and block B are supported laterally throughout their length and any tendency to rotate vertically in their recesses under pressure is resisted more effectively than would be the case if the cam surfaces opposed the locking segments, especially after wear of the adjacent corners has taken place.

The key which operates my lock consists preferably of a U-shaped frame 27, the ends of the legs of which form the finger grip portions 28 and the remainder of the frame consists of relatively small spaced tracks 29 adapted to receive between them a plurality of bits 30. Each bit 30 has a tumbler engaging surface 31 which may vary in the different bits, but the variations should be in units of the length of the tumbler segments. The last bit to enter the cylinder has an integral extension 32 which serves as a filler located between the grip portions 28 of frame 27. A spring 33 is slipped over the end of the assembled key and its bent ends extend into suitable holes 34 in portions 28. Integral projections 35 on portions 28 extend into recesses in extension 32 and these with spring 33 serve to hold the key elements together.

Operation: Referring to Figure 1, the key has been inserted in the cylinder and the different bits have raised their respective tumblers, as indicated.

A key with bits of the heights indicated will raise the several tumblers so that one cylinder segment has been pushed into block recess 9, two cylinder segments have been pushed into block recess 10; in block recess 11 only the block pin tumbler is present, and block recesses 12 and 13 have, respectively, received one and two key tumbler segments.

It will be noted that because of the stepped ends of the tumbler segments, one of the latter in each block recess numbered 9, 10, 11, 12, and 13, projects partially into the aligned cylinder recess. The forward end of each cam 24, however, is low enough to pass under the downwardly projecting end of the block contained tumbler and as the key and cylinder are rotated, the cam raises the tumbler until the latter rides upon the normal surface of the cylinder.

When the cylinder has been rotated 360 degrees and block B has been moved longitudinally, as before described, and key 3 is withdrawn, the cylinder tumbler segments drop to their lowermost positions and the locking pins in block recesses 14, 15, 16, 17, and 18, follow the cylinder tumbler segments and project into the cylinder recesses thereby locking the cylinder in position. To unlock, it is necessary to insert the same or an identical key. If any one bit of the unlocking key is too low, it will not raise the locking pin entirely out of the cylinder recess and of course the cylinder can not be rotated. If the key bit is too high, instead of just raising the block locking tumbler to the edge of the cylinder, it will raise, in addition, one of the key tumbler segments, as indicated in Figure 6. As no cams similar to 24 are provided on the righthand side of the cylinder recesses, it will be impossible to rotate the cylinder in a right-hand direction except when the bottom of the block tumbler is flush with the end of its recess and consequently the cylinder will remain locked until the proper height of bit has been provided.

From the foregoing explanation of operation of the lock, it will be apparent that by varying the height of the several key bits, so that in the operation of locking there will be left in each block recess, 9 to 14, either the block tumbler alone or, in addition thereto, one or more segments of the cylinder tumblers, it is possible to effect a great number of changes in the depth of projection of the locking tumblers into the cylinder re-

cesses when the lock is locked and the key withdrawn. It will also be apparent that whatever formation of the key bits may be used in the operation of locking, that formation must be exactly duplicated in order to unlock the lock. It will be noted that I have shown the tumbler segments as varying in length which greatly increases the possible variations of the lock and the difficulty of picking it.

While all of the details described by me comprise my complete improved lock, it is to be noted that one or more of them may be used with older lock constructions to the betterment of the latter and that some of these features may be omitted from my lock without destroying its operativeness and I contemplate all such and other uses of my invention as fall within the scope of the following claims.

I claim:

1. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder confined in said case and having a lesser number of tumbler recesses therein and adapted to assume cooperative relation with all of said case recesses, and means for automatically shifting said cylinder in said case when the lock is operated.

2. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder confined in said case and having one half as many tumbler recesses therein adapted to assume cooperative relation with all of said case recesses and means for automatically changing the relations of said case and cylinder recesses when the lock is operated.

3. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein, a key cylinder having a plurality of tumbler recesses therein aligned with every alternate one of said case recesses and means for automatically aligning said cylinder recesses with the intermediate case recesses when the lock is operated.

4. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder having a plurality of tumbler recesses therein radially aligned with every alternate one of said case recesses and means automatically aligning said cylinder recesses with the intermediate case recesses when the lock is operated.

5. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder having a plurality of tumbler recesses therein radially aligned with every alternate one of said case recesses, said cylinder and case recesses being adapted for relative longitudinal movement to radially align said cylinder recesses with the intermediate case recesses and means automatically providing relative longitudinal movement of said cylinder and case when said cylinder is rotated.

6. In a pin tumbler lock, a tumbler containing block having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder having a plurality of tumbler recesses therein radially aligned with every alternate one of said block recesses, and means controlled by rotation of said cylinder for moving said block longitudinally to radially align its intermediate recesses with the cylinder recesses.

7. In a pin tumbler lock, a tumbler containing block, a plurality of tumbler recesses therein in a single radial plane, a key cylinder, a plurality of tumbler recesses therein radially aligned with every alternate one of said block recesses, a helical cam groove in said cylinder, and a groove engaging element in said block.

8. In a pin tumbler lock, a tumbler containing block slidable longitudinally, a key cylinder rotatable relative to said block, a plurality of tumbler recesses in said block positioned in a single radial plane, a locking pin in every alternate one of said recesses, a plurality of tumbler recesses in said cylinder numbering half as many as said block recesses and spaced twice as far apart, a control tumbler in each of said recesses, key actuated means for rotating said cylinder, and means for automatically moving said block longitudinally of said cylinder when said cylinder is rotated.

9. In a pin tumbler lock, a case, a key cylinder rotatably mounted therein, a tumbler containing block slidable in said case, a plurality of tumbler recesses in said block positioned in a single radial plane, a plurality of tumbler recesses in said cylinder spaced twice as far apart as said block recesses, means for moving said block longitudinally of said case when the cylinder is rotated so that at the ends of its rotary movement each of said cylinder recesses will be aligned with different ones of said block recesses.

10. In a pin tumbler lock, a case having two tumbler recesses, a cylinder having a tumbler recess adapted to align with one of said case recesses at the beginning of a locking movement and to align with the other of said case recesses at the end of a locking movement, a tumbler in said first-mentioned case recess consisting of a plurality of separable segments each having stepped bottoms, a tumbler in said second mentioned case recess having a smooth bottom, and a tumbler in said cylinder recess, consisting of a plurality of separable segments having stepped tops, adapted to engage transversely with said stepped case tumbler.

11. In a pin tumbler lock, a case having two tumbler recesses, a cylinder having a

tumbler recess adapted to align with one of said case recesses at the beginning of a locking movement and to align with the other of said case recesses at the end of a locking movement, a tumbler in said first-mentioned case recess consisting of a plurality of separable segments, a tumbler in said second-mentioned case recess consisting of a single element, and a tumbler in said cylinder recess consisting of a plurality of separable segments.

12. In a pin tumbler lock, a key cylinder having a tumbler recess, a pin tumbler in said recess, the wall of said recess being cut-away in part to permit transverse movement of said tumbler therefrom, and means for blocking the cutaway portion of the recess wall when the cylinder is in locked position.

13. In a pin tumbler lock, a key cylinder having a tumbler recess, a pin tumbler in said recess, the wall of said recess being cut-away in part to permit transverse movement of said tumbler therefrom, and means actuated automatically by rotation of the cylinder for blocking the cut-away portion of the recess wall when the cylinder is in locked position.

14. In a pin tumbler lock, a key cylinder having a tumbler recess therein, and a plurality of tumbler segments arranged end to end in said recesses, the ends of said tumblers being correspondingly stepped.

15. In a pin tumbler lock, a tumbler case having a recess therein, a tumbler in said recess having a step on its bottom, a key cylinder having a tumbler recess therein, a tumbler in said cylinder recess having a stepped top fitting the stepped bottom of said case tumbler.

16. In a pin tumbler lock, a tumbler case having a recess therein, a tumbler in said recess having a step on its bottom, a key cylinder having a tumbler recess therein, and a tumbler in said cylinder recess having a stepped top fitting the stepped bottom of said case tumbler, said cylinder having a cam surafce adjacent to its recess adapted, when rotated in a given direction, to raise said case tumbler the height of the tumbler step.

17. In a pin tumbler lock, a tumbler case having a recess therein, a tumbler in said recess having a step on its bottom, a key cylder having a tumbler recess therein, and a tumbler in said cylinder recess having a stepped top fitting the stepped bottom of said case tumbler, said cylinder having a cam surface adjacent to its recess on the side of the latter opposite to the direction in which the cylinder is turned to lock, the rise of said cam being equal to the depth of said case tumbler step.

18. In a pin tumbler lock, a case having two tumbler recesses arranged longitudinally thereof, a cylinder having a tumbler recess adapted to align with one of said case recesses at the beginning of a locking movement and to automatically align with the other of said case recesses at the end of a locking movement.

19. In a pin tumbler lock, a case having two tumbler recesses arranged longitudinally thereof, a cylinder having a tumbler recess adapted to align with one of said case recesses at the beginning of a locking movement and to align with the other of said case recesses at the end of a locking movement, tumbler segments in said cylinder recess different members of which segments are adapted to be projected into said first mentioned case recess by a different key bits, and means for preventing turning of said cylinder from the latter mentioned case recess except by the use of a key bit of the same height as used to turn said cylinder to locking position.

20. In a pin tumbler lock, a case having two tumbler recesses, a cylinder having a tumbler recess adapted to align with one of said case recesses at the beginning of a locking movement and to align with the other of said case recesses at the end of a locking movement, a tumbler in said first-mentioned case recess having a stepped bottom, a tumbler in said second-mentioned case recess having a smooth bottom, and a tumbler in said cylinder recess having a stepped top adapted to engage transversely with said stepped case tumbler.

21. In a pin tumbler lock, a key cylinder having a tumbler recess therein, a pin tumbler formed of separable segments in said recess, a cam element adjacent said recess for raising one of said segments when said cylinder is being turned to locking position, and means for shifting said element from adjacent said recess after functioning of said element as described.

22. In a pin tumbler lock, a key cylinder, a tumbler recess therein, a pin tumbler in said recess, the wall of said recess being cut away in part to permit transverse movement of said tumbler therefrom, and means for temporarily blocking the cut away portion of the recess wall.

23. In a pin tumbler lock, a key cylinder having a tumbler recess therein, a pin tumbler in said recess, a bar slidable longitudinally in said cylinder alongside of said recess and provided with a portion rectangular in cross section and with an adjacent portion beveled transversely of the cylinder, each of said portions being adapted to align with said recess during a portion of the slidable movement of said bar.

24. In a pin tumbler lock, a case, a key cylinder having a tumbler recess therein, a pin tumbler in said recess, a bar slidable longitudinally in said cylinder alongside of said recess, and provided with a portion rectangular in cross section and with an ad-

jacent portion beveled transversely of the cylinder, each of said portions being adapted to align with said recesses, a pin on said bar, and a helical groove in said case receiving said pin.

25. In a pin tumbler lock, a pin tumbler comprising segments overlapping each other lengthwise and separable from each other lengthwise.

26. In a pin tumbler lock, a pin tumbler comprising segments which have their opposed ends tongued and grooved to overlap each other longitudinally of the lock key hole and are separable from each other lengthwise.

27. In a pin tumbler lock, a rotatable cylinder, and a pin tumbler comprising segments which are tongued and grooved in the direction of rotation of the cylinder, and means for separating said segments lengthwise automatically by rotation of said cylinder.

28. In a pin tumbler lock, a tumbler case having a plurality of tumbler recesses therein in a single longitudinal plane, a key cylinder having a plurality of tumbler recesses therein aligned with every alternate one of said case recesses, said cylinder being shiftable along said case recesses to align said cylinder recesses with the intermediate case recesses.

In testimony whereof I hereunto affix my signature this 5th day of August, 1921.

JULES A. FREMON.