Feb. 19, 1929. 1,702,430

J. A. FREMON

LOCK

Filed Dec. 5, 1922

Fig. 1.

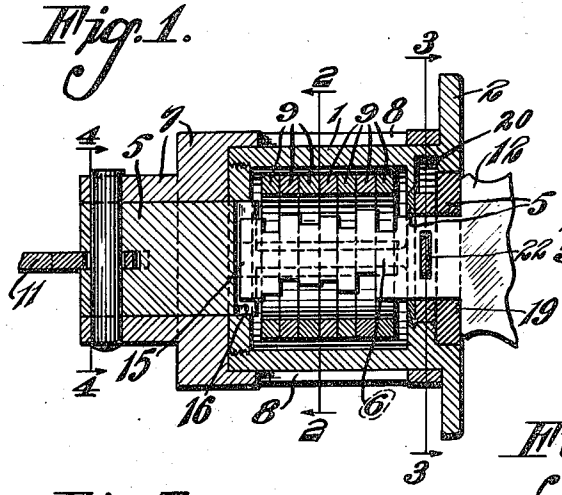


Fig. 2.

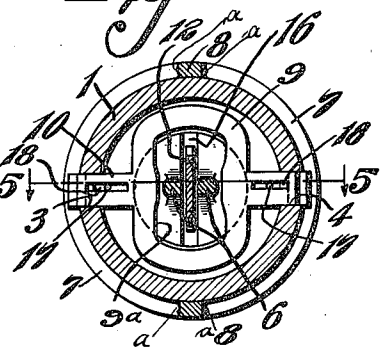


Fig. 3.

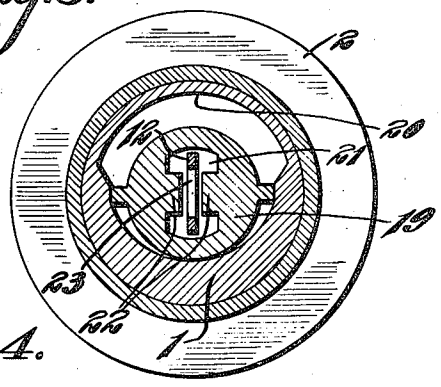


Fig. 5.

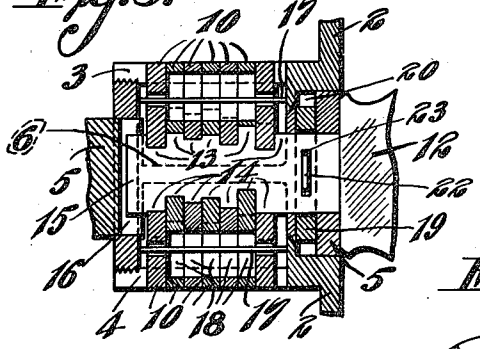


Fig. 4.

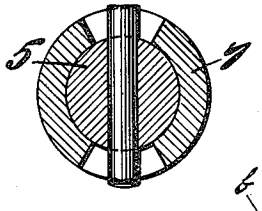


Fig. 7.

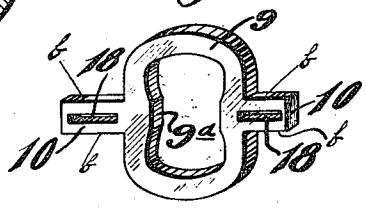


Fig. 6.

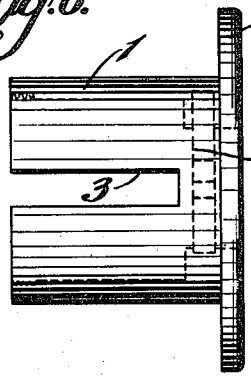


Fig. 8.



Fig. 9.



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UNITED STATES PATENT OFFICE.

JULES A. FREMON, OF LEEPER, MISSOURI.

LOCK.

Application filed December 5, 1922. Serial No. 605,083.

My invention relates to locks and consists in an improved tumbler lock in which the tumblers are moved into and out of locking position by the rotation of the key.

The objects of my invention are to eliminate wear of the key bits and the key engaging portions of the tumblers; to eliminate the use of springs by providing positive movement of the tumblers into and out of locking position; to secure greater security by providing each tumbler with two bit engaging faces, by providing frictional engagement between adjacent tumblers so that desirable movement of any one of them will tend to cause undesirable movement of the adjacent tumblers, by providing a tumbler holding member and by blocking the key opening when said member is moved out of tumbler holding position; to facilitate the rotation of the key and key operated lock members; and to facilitate assembly and replacement, changing or renewing of lock parts.

Other incidental objects will appear from the description of my lock and the illustration thereof in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section through the lock.

Figures 2, 3 and 4 are vertical transverse sections on lines 2—2, 3—3, and 4—4 of Figure 1, respectively.

Figure 5 is a horizontal longitudinal section taken substantially on line 5—5 of Figure 2 but showing the key and key rotatable parts turned ninety degrees from the position shown in Figure 2.

Figure 6 is a detail view of the lock cylinder.

Figure 7 is a detail view of one of the lock tumblers.

Figures 8 and 9 illustrate modified details referred to hereinafter.

The cylinder 1 forms the body of the lock and is the part which is immovably secured to the door or other element to which the lock is applied and includes a face plate 2. The main portion of the wall of cylinder 1 is provided with diametrically opposed slots 3 and 4 which extend from the rear of the cylinder to a point spaced from face plate 2. In cylinder 1 is a key-receiving member 5 cylindrical in shape at its forward and rear ends where it is journaled in cylinder 1 and consisting, between these cylindrical ends, of two parallel bars 6 spaced apart the thickness of a key. An element 7 is rotatably mounted upon cylinder 1 and is provided with a lost motion connection to member 5 here shown as a pin and slot engagement illustrated in Figure 4 whereby member 5 may rotate a short distance in either direction before moving element 7 with it. Intermediate the forward and rear ends of member 7 the latter is cut away throughout the most of its circumference, leaving two bars 8 of relatively small section extending lengthwise of the lock for approximately the same extent as bars 6 of member 5. Bars 8 are preferably corrugated as shown at *a* in Figure 2.

Positioned in cylinder 1 are a plurality of tumblers 9 one of which is detailed in Figure 7 and is shown as consisting of an oblong body portion provided with an oblong opening 9^a and with oppositely extending arms 10 which are preferably corrugated transversely at *b* on their upper and lower faces. The different tumblers vary from each other in the lengths of their respective arms 10 and it is the lengths of these arms which determine the heights of the bits of the key which operates the lock. The tumbler is supported by these arms upon the edges of slots 3 in cylinder 1 and the tumbler is in locking position whenever either one of its arms projects beyond the outer periphery of cylinder 1 so as to prevent rotation of bars 8 of member 7 and accordingly to prevent the rotation of member 5 and the lock bolt connection 11.

While the lengths of arms 10 will vary in different tumblers, the over-all distance from the outer end of one arm to the outer end of the opposite arm will always be the same and will equal the outside diameter of cylinder 1. Hence when the tumblers are moved transversely of the cylinder so as to align the outer ends of their arms with the outer periphery of the cylinder the bars 8 will be free to rotate a half revolution or more to throw the bolt. The tumblers are moved to this unlocking position by means of the proper key 12 which is provided with bits 13 corresponding in height inversely to the length of the tumbler arms 10 and adapted to engage one of the longer sides of the openings in tumblers 9 so as to push the latter into unlocking position as indicated in Figure 5. Opposite each bit 13 the key is provided with a cooperating bit 14 adapted to engage the other longer side of the opening in the tumbler and prevent too great a movement of the tumbler by the corresponding bit 13.

By referring to Figures 1 and 2 it will be seen that key 12 is inserted into the lock and through tumblers 9 by being positioned so that its width extends vertically and it will be freely received in the tumbler openings without contact taking place between its bits and the tumblers. Hence there will be no wear upon the edges of the bits due to the insertion or removal of the key nor will it be necessary to have the distance between the successive bits great enough to provide an inclined surface for tumblers to ride up as is customary in the usual spring pressed pin tumbler lock.

When the key is inserted in the lock its inner end 15 is seated in a groove 16 in member 5 and when the key is turned member 5 is also turned. It will be noted in Figure 2 that the key bits are aligned with bars 8. The lost motion device between member 5 and element 7 permits the key to rotate through a short arc before bars 8 are moved. This enables the key bits to contact with the sides of tumblers 9 and move the latter into unlocking position before bars 8 are rotated to tumbler arm engaging position.

After the lock has been unlocked and as the key is being returned to the withdrawal position indicated in Figures 1 and 2, the bars 6 of member 5 will engage the sides of the openings in tumblers 9 so as to align these sides, which operation will project one arm of each tumbler beyond the periphery of cylinder 1 and place the arm in position to engage one of bars 8 if the cylinder should be rotated by any but the proper key. In the event of such rotation and the engagement of arms 10 by bars 8, the difficulty of pushing one of the arms out of engagement with the bar by a picking tool will be enhanced by the corrugated surfaces so that the latter affords somewhat greater security against the picking of the lock.

It will be noted that both in locking and unlocking, opposite faces of each tumbler are engaged by the key so as to prevent any abnormal transverse movement of the tumbler. In both operations the tumbler is positively moved to the desired position and there is no reliance upon springs or gravity.

While the lock as above described would be very difficult to pick I have included two features which further preclude the picking of the lock and afford additional security. One of these features includes the placing of a bar 17 through all of the tumblers. The first and last tumblers are provided with a restricted opening to receive this bar whereby lateral movement of either of these end tumblers will move the corresponding end of the bar. The intermediate tumblers are provided with elongated openings 18 in their arms so that these tumblers do not interfere with the movement of the bar. The function of this bar is to provide frictional engagement between the tumblers so that movement of one of the tumblers alone will tend to move one or more of the other tumblers. A certain amount of friction is also provided by the contact of the faces of the tumblers with each other and the friction of this contact may be increased by providing one or more ribs or other interengaging surfaces upon the adjacent faces of the tumblers. I also contemplate the use of a spring in place of bar 17 which spring could take the form of a concavo-convex strip 24 shown in Figure 8 or a round wire 29 bent as shown in Figure 9.

The other security feature is best shown in Figures 3 and 5 and consists in a curtain 19 slidably positioned in member 5, having lateral projections extending into a groove 20 in cylinder 1 and provided with an opening 21 adapted to receive the key 12. Projections 22 on the sides of opening 21 are spaced from each other the thickness of the key so as to permit the insertion of the latter between them. When the key and member 5 are turned, curtain 19 is turned with them and the groove 20 in cylinder 1 has an irregular periphery which serves to cam curtain 19 across the axis of the lock, and so thrust projections 22 into a corresponding slot 23 in the key. If the length of projections 21 across the key is greater than or even approaches the over-all width of the key, it will be seen that if an attempt is made to turn member 5 by means of a tool in order to move bars 6 out of tumbler holding position it will be impossible to thereafter insert a picking tool in the key hole because the same will then be blocked by the transverse movement of the curtain.

Owing to the absence of delicate springs and because of the positive movement of the tumblers into locking and unlocking position, it is possible to apply oil or other lubricant to my lock without any resulting difficulties, thereby facilitating its operation. Oil is fatal to the ordinary tumbler lock and is usually advised against by the manufacturers.

Another advantage due to the absence of springs is the elimination of difficulties due to the breaking of a spring or the presence of an abnormally stiff spring.

One of the main advantages of my construction is the possibility of increasing the number of combination changes and of practically utilizing the theoretical number of changes. The number of changes may be greatly increased because there is no limit to the height of the key bits as there is in the ordinary pin tumbler lock in which the successive tumblers ride over the key bits as the key is inserted in the lock. In the ordinary pin tumbler lock inclined surfaces must be provided between each bit so as to raise the successive tumblers, whereas in my lock the key is inserted without contacting

with the tumblers and only the rotary movement of the key brings the bits into contact with the tumblers. This contact corresponds to the easy contact of the lever tumbler lock and retains the advantages of the latter. Theoretically, every two one-hundredths (.02) of an inch difference in the height of the bit in an ordinary pin tumbler lock makes possible a new combination but in actual manufacture it is found that the resistance to the longitudinal movement of the key, where the maximum lift is provided, is too great to be practical. Hence, while in a pin tumbler lock with five tumblers there is a theoretical possibility of approximately one hundred thousand (100,000) combinations, in actual practice this is reduced to about thirty thousand (30,000). With my lock, each variation of two one-hundredths of an inch for each bit may be utilized because of the absence of undue friction and as before referred to the total variation in bit height may be increased almost any reasonable amount and is not limited to approximately two-tenths of an inch because of the necessity of the tumblers riding over the bits. The absence of springs in my lock also reduces the friction between the bits and tumblers which reduces the likelihood of such wear on the contacting surfaces as will affect the security of the lock.

I claim:

1. In a lock, a cylinder, a rotatable member therein, key actuated tumblers non-rotatable adapted to be projected beyond the periphery of said cylinder to lock the lock, or to be withdrawn within the periphery of said cylinder to unlock the lock.

2. In a lock, non-rotating tumblers adapted to be positively moved to unlocking position by rotation of the proper key, and means for positively returning said tumblers to locking position when the key is rotated to withdrawal position.

3. In a lock, key-actuated means, non-rotating tumblers, each having opposing faces adapted to be engaged by rotation of the proper key or by said means to positively position the tumblers in unlocking or locking position, respectively.

4. In a lock, a rotatable member having a passage for the axial insertion of the key, a non-rotatable tumbler adapted to be engaged by the key only when the latter is rotated after insertion, and means adapted to positively move said tumbler to locking position upon continued rotation of the key.

5. In a lock, a non-rotatable tumbler having an oblong opening and provided with locking projections extending transversely of the major axis of said opening and rotatable means extending through said opening for moving said tumbler in the direction of said projections.

6. In a lock, a tumbler having an oblong opening and provided with locking projections extending transversely of the major axis of said opening and grooved transversely of their length.

7. In a lock, a rotatable cylinder having a longitudinal slot in its wall, a tumbler positioned transversely of said cylinder and having an arm resting upon an edge of said slot and adapted to be projected therethrough, said tumbler being provided with an oblong key-receiving opening, the major axis of which extends transversely of said arm and a longer side of which is adapted to be engaged by a key bit when the key is rotated in said opening.

8. In a lock, a rotatable cylinder having a longitudinal slot in its wall, a tumbler positioned transversely of said cylinder and having an arm resting upon an edge of said slot and adapted to be projected therethrough, said tumbler being provided with an oblong key-receiving opening, the major axis of which extends transversely of said arm and a longer side of which is adapted to be engaged by a key bit when the key is rotated in said opening, and a flat member extending through said opening and rotatable with the key but lying in a plane which traverses the width of the key, said member being adapted to engage a longer side of said tumbler opening to move the tumbler in the opposite direction with the movement produced by the key.

9. In a lock, a rotatable cylinder having diametrically opposite longitudinal slots in its wall, a tumbler positioned transversely of said cylinder and having oppositely extending arms positioned in said slots and adapted to be projected beyond the periphery of said cylinder, said tumbler being provided with an oblong key receiving opening, the major axis of which extends transversely of said arms and the longer sides of which are adapted to be engaged by key bits when the proper key is rotated in said opening.

10. In a lock, a plurality of tumblers, the first and last of which each have a restricted opening and the intermediate ones of which each have elongated openings, and a member extending through all of said openings to frictionally engage said tumblers.

11. In combination, in a tumbler lock, a cylinder having a slot in its wall, a tumbler positioned transversely of said cylinder and provided with an arm extending into said slot and projectable beyond the outer periphery of said cylinder, a member rotatably mounted in said cylinder and tumbler, an element rotatable with said member and adjacent the outer periphery of said cylinder, and a key adapted to enter said member and tumbler and when rotated to retract said tumbler arm within the periphery of said cylinder and to rotate said member and element.

12. In combination, in a tumbler lock, a cylinder having a slot in its wall, a member rotatably mounted in said cylinder, an element rotatable with said member and slidable over the outer periphery of said cylinder, tumblers in said cylinder having arms projectable through said slots to engage said element, said member being disposed in openings in said tumblers and adapted when rotated to project said tumbler arms beyond the periphery of said cylinder.

13. In combination, in a tumbler lock, a cylinder having a slot in its wall, a member rotatably mounted in said cylinder, an element rotatable with said member and slidable over the outer periphery of said cylinder, tumblers in said cylinder having arms projectable through said slots to engage said element, said member being disposed in openings in said tumblers and adapted when rotated to project said tumbler arms beyond the periphery of said cylinder, and a key insertable in said member and tumblers and adapted when rotated to rotate said member out of tumbler arm projecting position and to retract said arms from element engaging position.

14. In a tumbler lock, a cylinder, a key rotatable member within said cylinder, a rotatable element slidable over the outer periphery of said cylinder, a lost motion connection between said member and element, and tumblers projectable through said cylinder into the path of said element.

15. In a tumbler lock, a cylinder, a key rotatable member within said cylinder, a rotatable element slidable over the outer periphery of said cylinder, a lost motion connection between said member and element, and tumblers projectable by said member through said cylinder into the path of said element.

16. In a tumbler lock, a cylinder, a key rotatable member within said cylinder, a rotatable element slidable over the outer periphery of said cylinder, a lost motion connection between said member and element, tumblers projectable by said member through said cylinder into the path of said element, and a key for retracting said tumblers and moving said member out of tumbler projecting position or vice versa.

17. In a lock, a plurality of tumblers, a rotatable member having a bar adapted to project said tumblers into locking position and provided with a key hole longer than the width of said bar, and means operated when said member is rotated out of tumbler projecting position to close said opening.

18. In a lock, a cylinder, a rotatable member therein, non-rotatable tumblers having elements adapted to be projected beyond the periphery of said cylinder to lock the lock, and having elements engaged by rotation of the key for projecting or withdrawing said tumblers.

19. In a lock, a plurality of tumblers, two of which each have a restricted opening and others of which each have elongated openings, and a spring member extending through all of said openings to yieldingly engage the sides of the openings in said tumblers.

20. In a tumbler lock, a cylinder, a key-rotatable member within said cylinder, a rotatable element slidable over the outer periphery of said cylinder, a connection between said member and element, and tumblers projectable through said cylinder into the path of said element.

21. In a lock, a plurality of tumblers, a member which must move before said tumblers can be moved to unlocking position, said member having a key hole, and a curtain element adapted to partially close a substantial portion of said key hole when said member is moved as mentioned.

22. In a lock, a plurality of tumblers, a member for holding said tumblers in locking position and adapted to be rotated before said tumblers can be moved from said position, said member having an elongated passage for a member operating element such as a key and a curtain for partially closing said passage as soon as said member is rotated as mentioned.

23. In a cylinder lock, a rotatable lock-bolt-actuating member, a rotatable element controlling the movement of said member, non-rotatable tumblers surrounded by said element, said tumblers being key actuated to move into engagement with said element to lock the same against rotation.

24. In a lock, a rotatable bolt-actuating member, an element rotatable with said member, non-rotatable tumblers surrounded by said element and slidable into position for engaging said element to prevent rotation of the latter, said tumblers being slidable and said member being rotatable by a single key.

25. In a lock, a plurality of non-rotatable tumblers, a rotatable element surrounding said tumblers, a lock-actuating member controlled by said element, and positive means for moving said tumblers into and out of position for locking said element against rotation.

26. In a lock, a plurality of non-rotatable tumblers, a rotatable member for moving the lock-bolt, an element connected to said member and adapted to engage said tumblers when the latter are in locking position, said tumblers and element having roughened inter-engaging faces to frictionally resist slidable movement of said tumblers when engaged by said element.

In testimony whereof I hereunto affix my signature this 2nd day of December, 1922.

JULES A. FREMON.