Dec. 2, 1958 N. A. WELCH 2,862,380

CYLINDER LOCK

Original Filed Jan. 25, 1952

Fig. 1.

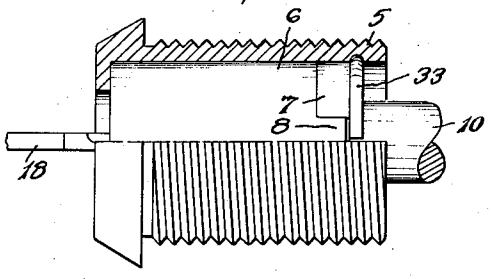


Fig. 2.

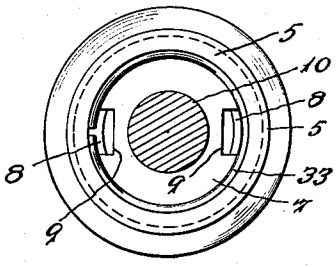


Fig. 3.

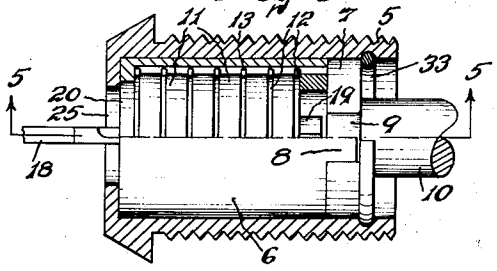


Fig. 4.

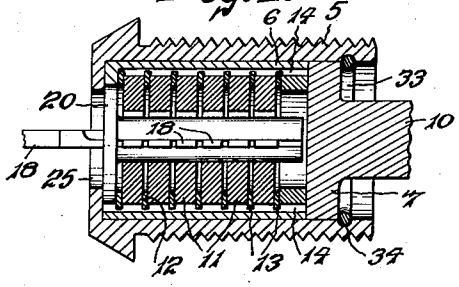


Fig. 5.

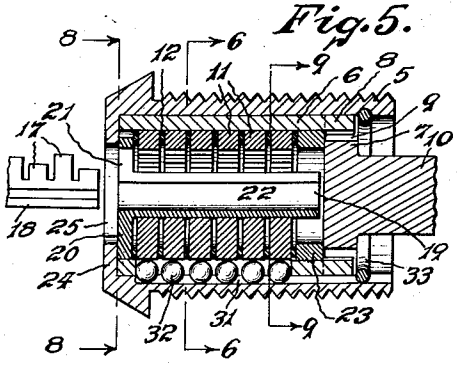


Fig. 6.

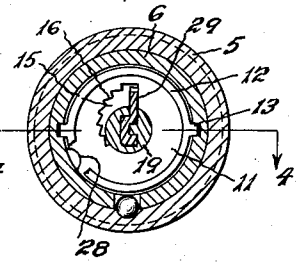


Fig. 10.

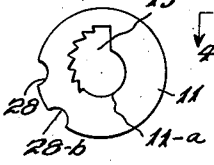


Fig. 7.

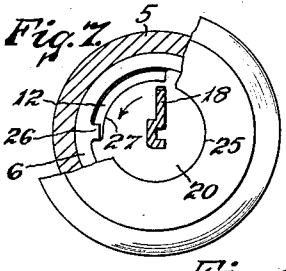


Fig. 8.

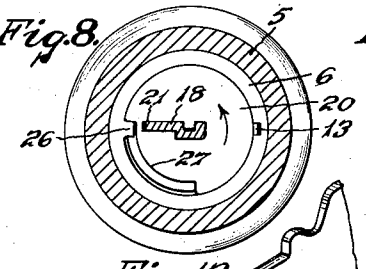


Fig. 9.

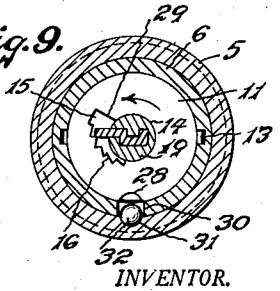


Fig. 11.

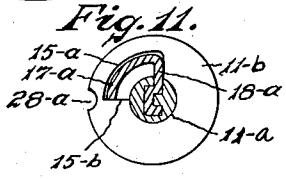
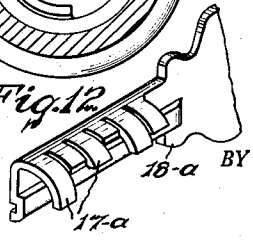


Fig. 12.



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CYLINDER LOCK

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Substitute for abandoned application Serial No. 268,203, January 25, 1952. This application June 28, 1957, Serial No. 669,409

14 Claims. (Cl. 70—366)

This application relates to a cylinder lock and is substituted for my prior application, Serial No. 268,203, filed January 25, 1952, now abandoned.

It is an object of the present invention to provide a cylinder lock of the rotary disc tumbler type having an operating member which is rotated directly through a key-controlled member and in which the disc tumblers function only to prevent unauthorized operation of the lock.

A further object of this invention is the provision of a novel construction for such cylinder locks wherein the possibility of picking the lock is greatly reduced.

A still further object of this invention is the provision of novel means for preventing a person who may be attempting to pick the lock from "feeling" when the tumblers are brought into registering position.

Further objects and advantages of this invention will be more clearly understood from the following description and from the accompanying drawings in which:

Fig. 1 is a plan view of a cylinder lock embodying my invention and showing a portion of the outer shell in central horizontal section.

Fig. 2 is a rear view of said lock.

Fig. 3 is a plan view showing the outer shell and a portion of the lock mechanism in central horizontal section.

Fig. 4 is a sectional plan view of said lock on line 4—4 of Fig. 6, but showing the center member and key in elevation.

Fig. 5 is a sectional side view of said lock on line 5—5 of Fig. 3.

Fig. 6 is a sectional end view on line 6—6 of Fig. 5.

Fig. 7 is a front view of the said lock, partly in section on line 8—8 of Fig. 5, showing the mechanism in a locked position.

Fig. 8 is a sectional front view on line 8—8 of Fig. 5, illustrating the operation of said mechanism.

Fig. 9 is a sectional end view on line 9—9 of Fig. 5 illustrating the mechanism in unlocked position.

Fig. 10 is a front view of one of the tumblers as modified for use with a master key.

Fig. 11 is an end view of a further modified form of tumbler and key.

Fig. 12 is a perspective view of the key shown in Fig. 11.

In the embodiment of the present invention which is shown in the drawings, my improved lock comprises an outer casing 5 in which there is rotatably mounted an inner sleeve 6. An operating member 7 is also rotatable in said casing and is connected to the said inner sleeve by means of prongs 8 which extend from the sleeve into notches 9—9 in said operating member. A suitable shaft 10 projects from the operating member 7 for connecting it to a conventional latch or any other device which is to be operated by my improved lock.

A series of disc tumblers 11 are rotatably contained within the inner sleeve and longitudinally spaced therein by means of spring washers 12 having ears 13—13 which

fit into longitudinal slots 14—14 in the inner shell 6 and separate the said tumblers so that they will not be rotated by frictional contact with each other during the operation of the lock. In addition, the said washers frictionally engage the tumblers to retain them in properly aligned position.

Each of the tumblers 11 has an axial hole 11–*a* therein which communicates with an opening 15 having an edge portion that is provided with a series of circularly and radially spaced teeth 16 which includes one tooth that is engaged by the respective one of the operating projections 17 on a suitable key 18 which is receivable within a center member 19 that rotatably extends through all of the holes 11–*a* in the said series of tumblers.

The center member 19 has a flange 20 which is also rotatable within the inner sleeve 6 and has a key opening 21 therein which extends into a longitudinal slot 22 in the said center member that receives and positions the key 18 so that each of the projections 17 will extend outwardly from the said member into the opening 15 of its respective tumbler and in position to engage the corresponding one of the teeth 16.

In the embodiment shown, a spacer ring 23 is provided between the innermost tumbler and the operating member 7. The flange 20 of the center member is disposed between the first of the washers 12 and the front wall 24 of the casing 5, which wall has an axial opening 25 therein of a smaller diameter than the flange 20 and through which the key slot in the center member is accessible; the rotation of said center member being limited by means of a projection 26 which extends inwardly from the inner sleeve into a peripheral notch 27 in the edge of the said flange. The opposite ends of said notch provide spaced abutments which allow independent rotation of the center member for a distance of 90° before one of said abutments engages the projection 26 and thereby rotates the sleeve 6 with the said center member.

Each of the tumblers 11 is provided in its outer periphery with a longitudinal notch 28 that is located in a predetermined position with respect to the tooth of the series 16 that is engaged by the respective projection 17 of the key, and each of the openings 15 in the tumblers has a side wall 29 which is engageable by the side of the key to align all of the tumblers in their normal position wherein all of the openings 15 will be in alignment and the notches 28 will be out of alignment.

The inner sleeve 6 has an elongated longitudinal slot 30 therein and the outer casing 5 is provided in the inner wall thereof with an elongated longitudinal groove 31 which registers with the said slot 30 when the sleeve is in its normal position. A plurality of tumbler locking balls 32, which includes one ball for each of the tumblers 11, is contained within the slot 30 and normally located in the groove 31 as clearly shown in Fig. 9 of the drawings.

The entire assembly of the lock mechanism is rotatably secured within the outer casing by means of a split locking ring 33 which fits within an annular groove 34 in the inner wall of the said casing.

The lock is in its normal or locked condition when the mechanism is in position as shown in Figs. 5 to 7. When in this condition, and it is desired to unlock the mechanism, the operation of my improved lock is as follows:

The key 18 is first inserted into the center member 19 and moved into the position shown in Fig. 4, wherein each of the projections 17 of said key will be in register with its respective tumbler 11, and the key is then rotated with the center member 19 in a counterclockwise direction. This rotation of the key will cause each projection 17 of the key to engage the tooth 16 of its respective tumbler which is spaced from the axis thereof in accordance with the length of the particular projection 17 so that, during

the 90° rotation of the key which is permitted by the notch 27, each of the tumblers will have been rotated for different distances corresponding to the normal distance between the particular tooth in each tumbler and the respective projection of the key which is engageable therewith.

When the key and the center member have been rotated for the 90° and are in the position shown in Fig. 8, the notches 28 in all of said tumblers will be aligned and in register with the slot 30 and the locking balls 32 which are contained therein. When all of the notches 28 are so aligned, further rotation of the key will cause rotation of the inner sleeve 6 with the center member 19 and the consequent rotation of the operating member 7 and the operation of whatever device may be connected to the shaft 10.

It will be noted that when all of the notches 28 are in alignment with the balls 32, the said balls will move into the notches 28 and permit the inner sleeve to rotate but, if a wrong key has been used or attempt has been made to pick the lock and any of the notches 28 are out of alignment with its respective ball 32, the said ball will not be permitted to leave the groove 31 and it will then prevent rotation of the inner sleeve 6 and thereby retain the lock in its locked position. It will be also noted that, unless all of the tumblers are positioned with a proper key so that all of the notches 28 will be in alignment with the balls 32, the lock mechanism cannot be operated to its unlocked position since any one of the said balls will prevent rotation of the inner sleeve 6.

When the lock is in its normal position, the groove 31 is preferably located at the bottom of the lock so that the balls 32 will be gravitationally retained in said groove and out of engagement with the tumblers 11. This further prevents any attempt to pick the lock by "feeling" the movement of the balls 32 into the notches 28, as each of said notches is brought into alignment, since the said balls 32 will remain in the groove 31 until all of the tumblers are aligned and the balls are permitted to move into the said notches and thereby leave the groove 31 and permit rotation of the inner sleeve.

It will be further noted that the balls 32 merely lock the inner sleeve to the outer casing, so as to prevent the rotation of the said sleeve when the notches in the tumblers are not aligned, and that the said balls do not connect the tumblers with the inner sleeve for rotation therewith since such a connection is provided by abutment between the end of the notch 27 and the projection 26 so that the operating member 7 is rotated by the key directly through the center member 19 and the inner sleeve 6 and not through the tumblers.

In the modified form illustrated in Figs. 11 and 12, the tumblers 11–*b* are provided with a sectorial opening 15–*a* which communicates with the axial hole 11–*a*. The key 18–*a* provided for this lock has a flat shank portion that is received in the slot in the center member 19, but instead of being bitted as the key 18, said shank is provided with a plurality of arcuate projections 17–*a* of different lengths which project from the upper edge of the flat shank portion and are each adapted to engage the side 15–*b* of the hole 15–*a* in its respective tumbler for rotating said tumbler for a distance corresponding to the length of the particular projection and thereby align all of the notches 28–*a*; the said notches being at different distances from the sides 15–*b* of the openings in accordance with the lengths of the said projections 17–*a*.

As shown in Fig. 10, the lock may be modified to be operable with a master key by providing the tumblers 11 with master notches 28–*b* that are aligned with the slot 30 and the balls 32 when an appropriate master key is used instead of the regular key.

I claim:

1. A lock comprising a casing, an inner shell adapted to rotate within said casing, means normally locking said inner shell to the casing including a tumbler rotatable within said inner shell and a locking member retained in locking position by said tumbler; said tumbler having a notch therein alignable with and adapted to receive said locking member to permit rotation of the inner shell, a rotatable key receiving member extending through said tumbler, and means on said key receiving member engageable with the inner shell, after the notch in said tumbler is aligned with said locking member, for rotating said shell.

2. A lock comprising a casing, an inner shell adapted to rotate within said casing, means normally locking said inner shell to the casing including a series of tumblers rotatable within said inner shell and locking members retained in locking position by said tumblers; each of said tumblers having a notch therein alignable with and adapted to receive its respective locking member to permit rotation of the inner shell relatively to the casing, a key receiving member extending through said tumblers and rotatable relatively to said tumblers and said inner shell, means in said tumblers engageable by a key in said key receiving member during rotation thereof relatively to said inner shell for aligning the notches in said tumblers with their respective locking members, and an abutment on said key receiving member engageable with a cooperating abutment on said shell, after the notches in said tumblers are aligned with their respective locking members, for rotating the shell.

3. A lock comprising a casing, an inner shell adapted to rotate within said casing, means normally locking said inner shell to the casing including a plurality of tumblers rotatable in said inner shell and locking members retained in locking position by said tumblers; each of said tumblers having a notch therein alignable with and adapted to receive its respective locking member whereby rotation of said inner shell relatively to the casing is permitted, a key receiving member extending coaxially through said openings in said tumblers and rotatable relatively thereto and to said inner shell; the said key receiving member having a key slot extending longitudinally therethrough, means in said tumblers adapted to be engaged by a key in said key receiving member during rotation thereof relatively to said inner shell for aligning the notches in said tumblers with said locking members, a flange on said key receiving member, and cooperating abutment means on said flange and said inner shell, engageable after the tumblers have been aligned, for rotating said inner shell.

4. A lock comprising a casing, an inner shell adapted to rotate within said casing, means normally locking said inner shell to the casing including a series of tumblers rotatable within said inner shell and locking members retained in locking position by said tumblers, each of said tumblers having a notch therein alignable with and adapted to receive its respective locking member whereby rotation of said inner shell relatively to the casing is permitted, key receiving means extending coaxially through said tumblers; each of said tumblers having a sectorial opening therethrough with substantially straight side portions; the adjacent side portions of said tumblers all normally lying in the same plane and adapted to be engaged by a key.

5. A lock comprising a casing, an inner shell adapted to rotate within said casing, means normally locking said inner shell to the casing including a series of tumblers rotatable within said inner shell and locking means retained in locking position by said tumblers; said tumblers being adapted to receive said locking means to permit rotation of said inner shell, a key receiving member extending through said tumblers and rotatable relatively to said tumblers and said inner shell; said key receiving member being adapted to receive a key which, upon rotation with said key receiving member, is adapted to move said tumblers to permit release of said locking means, and cooperating means on said key receiving

member and said shell, engageable after the tumblers are moved to unlocking position, for rotating said shell.

6. A lock comprising a casing, an inner shell rotatably mounted in said casing, means normally locking said inner shell to the casing including a plurality of tumblers rotatable within said inner shell, a key receiving member extending through said tumblers and rotatable relatively to said tumblers and said inner shell, said key receiving member being adapted to receive a key for moving said tumblers to unlocking position, and cooperating means on said key receiving member and said inner shell for rotating the shell after the tumblers have been moved to unlocking position.

7. A lock comprising a casing, an inner shell rotatable in said casing, a plurality of tumblers rotatable within said inner shell, a plurality of balls each associated with one of said tumblers and independently locking the inner shell to the casing to prevent rotation of the inner shell, the said tumblers normally retaining said balls in locking position and each having a notch therein to permit movement of its respective ball to unlocking position for releasing the inner shell from the casing, a center member rotatable relatively to said tumblers and having a slot therein to receive and position a key relatively to the tumblers, key-operated means in said tumblers for aligning the notches with their respective balls, a lost motion connection between said center member and the inner shell for permitting independent rotation of the center member while the notches in the tumblers are being aligned with the balls and causing rotation of the inner shell by the center member when the notches are in alignment with the balls, and latch-operating means connected to said inner shell.

8. A lock comprising a casing, an inner shell rotatable in said casing, a plurality of balls normally locking said inner shell to the casing to prevent rotation of the shell, a series of tumblers rotatable within said inner shell and adapted to retain the balls in locking position, notches in said tumblers alignable to permit movement of the balls to unlocking position to thereby release the said inner shell, key operated means in said tumblers for aligning said notches with respect to the balls, a center member coaxial with said tumblers and having a slot therein to receive a key and operatively position it relatively to the tumblers, a flange on said center member having a notch in the periphery thereof to provide spaced abutments, an abutment projecting from said inner shell into the notch and engageable by said abutments for causing rotation of the inner shell by the center member, and an operating member connected to said inner shell.

9. A lock comprising a casing, an inner shell rotatable in said casing, the said casing having a groove in the inner wall thereof, the said inner shell having a slot extending through a wall portion thereof and normally in register with the said groove, a plurality of balls contained within the said slot and normally extending into the groove to thereby lock the inner shell to the outer casing to prevent rotation of the inner shell, a series of disc-type tumblers coaxial with and rotatable within the inner shell and each associated with one of the balls to retain the ball within the groove and having a notch therein to receive said ball, a center member coaxial with the tumblers and having a slot therein to receive a key and position it relatively to the tumblers, key-operated means in said tumblers for aligning the notches therein with their respective balls to permit the balls to leave the said groove, the said center member being rotatable by the key, a lost motion connection between said center member and shell for permitting alignment of the notches with their respective balls and then causing rotation of said inner shell, and connecting means secured to the said inner shell for operating a separate member.

10. A lock comprising a casing, an inner shell rotatable within said casing, the said casing having a longitudinal

groove in the inner wall thereof, the said shell having a longitudinal slot extending through its wall and normally in alignment with the said groove, a plurality of balls contained within said slot and resting in said groove to thereby lock the inner shell against rotation relatively to the casing, a plurality of disc-shaped tumblers coaxial with and rotatable within the shell, each of said tumblers having a notch in the periphery thereof, a center member coaxial with and rotatable relatively to said tumblers, the said center member having a longitudinal slot therein to receive a key and operatively position it relatively to the tumblers, the said center member being rotatable by the key, key-operated means in said tumblers for aligning the notches thereof with their respective balls, a flange on said center member having a notch in the periphery thereof providing spaced abutments, a projection on said inner shell extending into said notch and engageable by one of said abutments when all of the notches in the tumblers are in alignment with the balls, and latch-operating means connected to said inner shell.

11. A lock comprising a casing, an inner shell rotatable in said casing, the said casing having a lonigtudinal groove in the inner wall thereof and the said inner shell having a longitudinal slot extending through its wall and normally in register with the said groove, a plurality of separate locking members contained within said slot and disposed within the groove to thereby lock the shell to the said casing, a plurality of tumblers rotatable within said inner shell and each adapted to retain one of said locking members in locking position, each of said tumblers having a notch in the periphery thereof to receive its respective locking member and permit said locking member to move out of the said groove, a center member extending through and rotatable relatively to said tumblers, the said center member having a longitudinal slot to receive and position a key relatively to said tumblers, key-operated means in said tumblers for aligning said notches with their respective locking members, a latch-operating member connected to said shell, and a lost motion connection between said center member and shell whereby, when all of the said notches are aligned with their respective locking members, the said operating member may be rotated by the key through the said center member and shell and independently of the tumblers.

12. A lock comprising a casing, an inner shell rotatable within said casing, said casing having a longitudinal groove in the inner wall thereof, the said inner shell having a longitudinal slot in its wall normally in register with the said groove, a plurality of balls contained within said groove and disposed in said slot, a series of tumbler discs rotatable within said inner shell and each associated with one of said balls for retaining the ball within the groove and thereby locking the inner shell against rotation relatively to the casing, each of said discs having a notch in the periphery thereof to receive its respective ball and permit it to leave said groove, a center member extending longitudinally through said tumblers and rotatable relatively thereto, the said center member having a longitudinal slot therein to receive and operatively position a key with respect to said tumblers, an annular flange upon said center member having a notch in the periphery thereof providing spaced abutments, a projection on said shell extending between said abutments, key-operable means in said tumblers for aligning the said notches with their respective balls to thereby permit rotation of the inner shell by the key through the said center member and abutments, an operating member rotatable within said casing and secured to the shell, and an extension on said operating member for connecting said lock to a separate member.

13. A lock as set forth in claim 12 wherein the said groove and slot are normally disposed at the bottom of the lock whereby the balls are gravitationally retained within the groove and are prevented from moving into

their respective notches until all of said notches have been aligned and the inner shell is rotated.

14. A lock as set forth in claim 12 wherein the tumblers are provided with separate notches alignable with their respective locking members by a master key.

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