Dec. 10, 1935. S. A. LISS 2,023,847

LOCK

Filed March 5, 1935 2 Sheets-Sheet 1

Fig. 1.

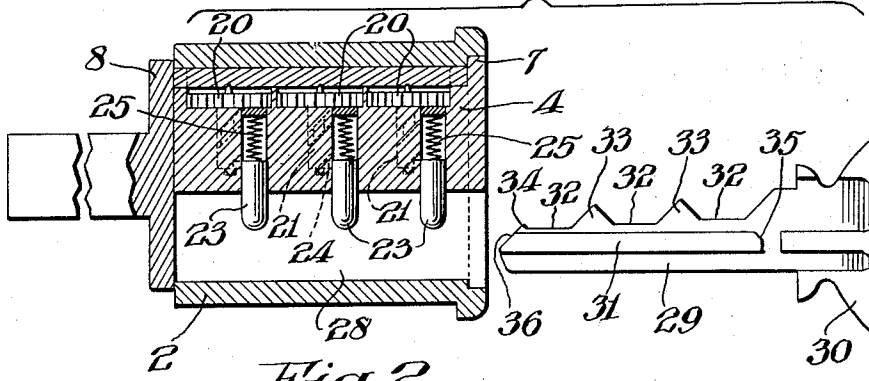


Fig. 7.

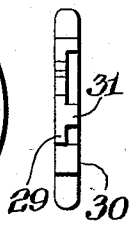


Fig. 2.

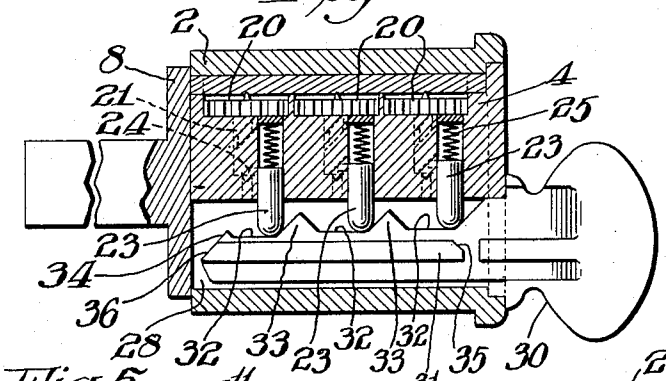


Fig. 8.

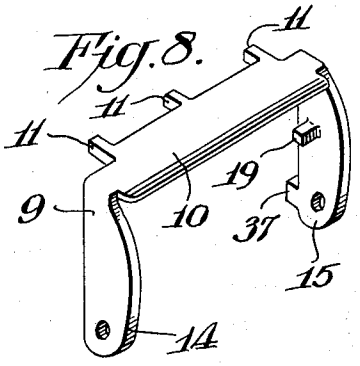


Fig. 5.

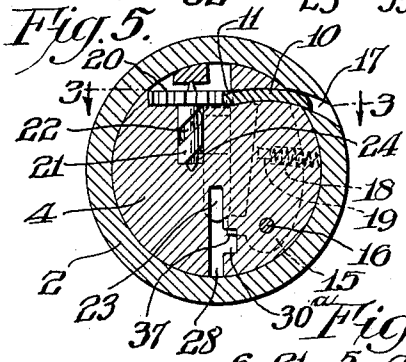


Fig. 6.

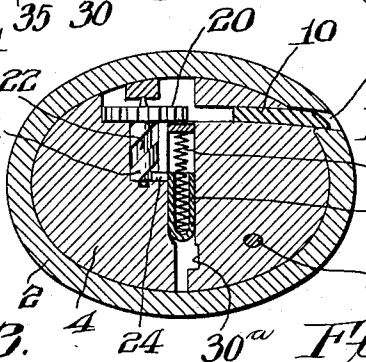


Fig. 3.

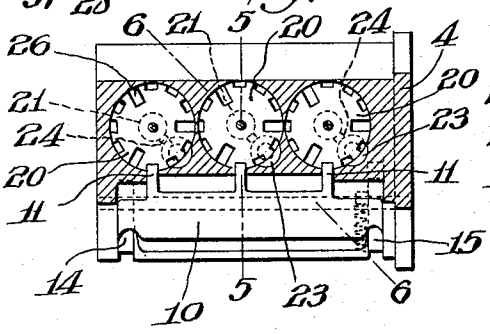
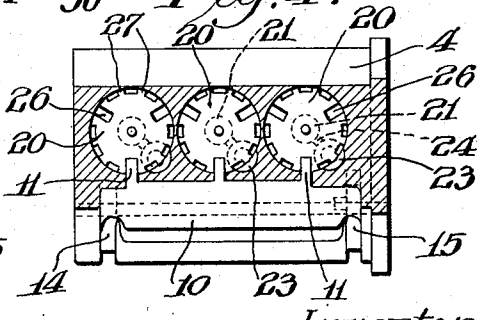


Fig. 4.



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LOCK

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Fig. 9.

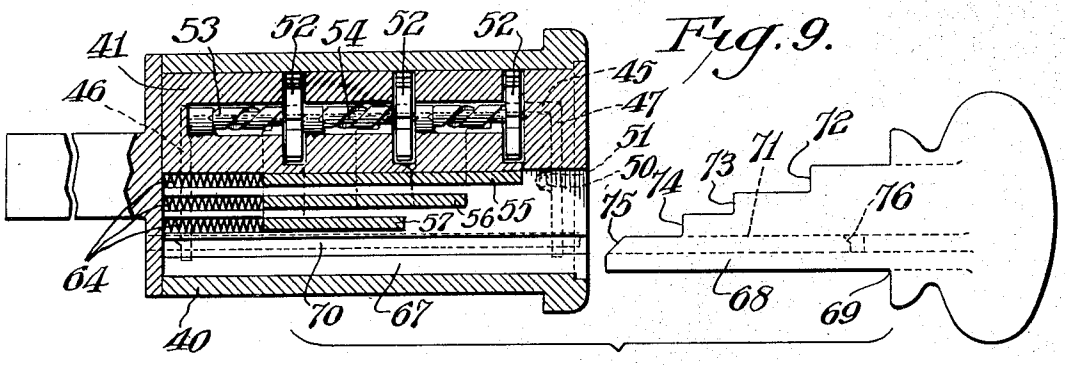


Fig. 10

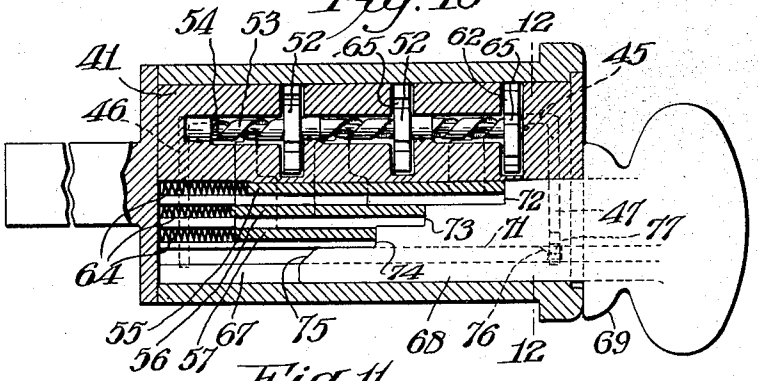


Fig. 14.

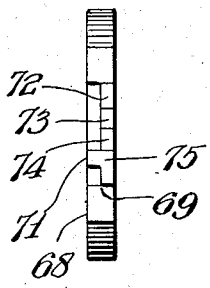


Fig. 11.

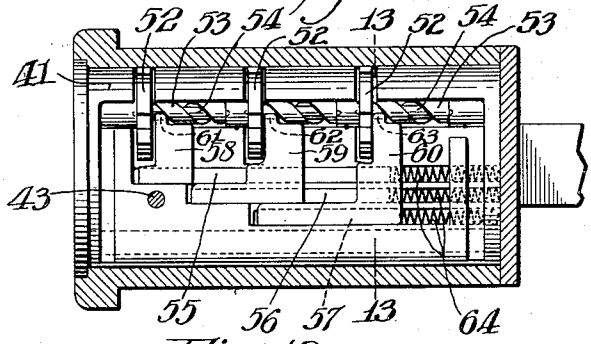


Fig. 15.

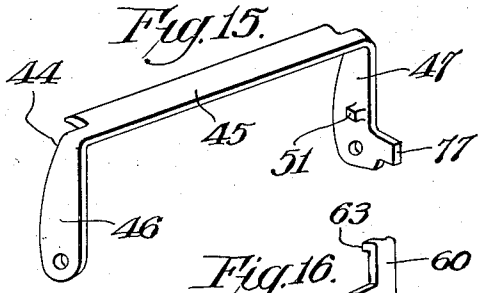


Fig. 16.

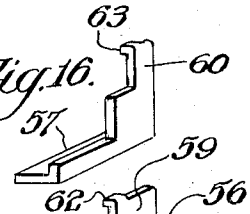


Fig. 12.

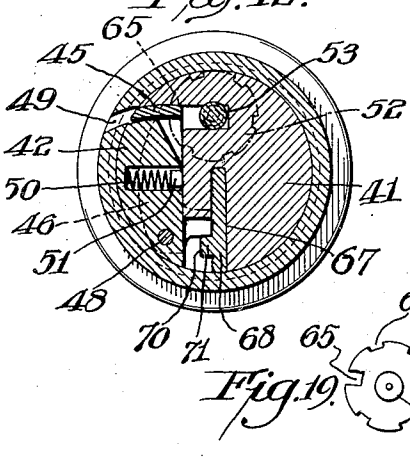


Fig. 13

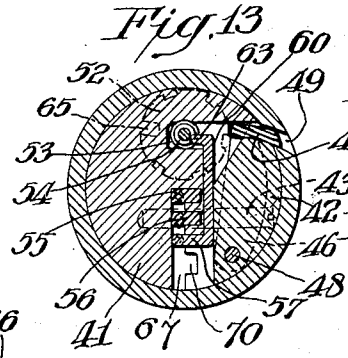


Fig. 17.

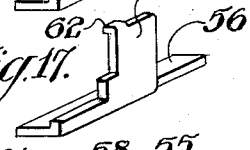


Fig. 18.

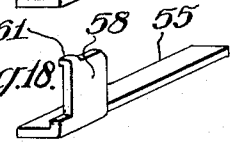
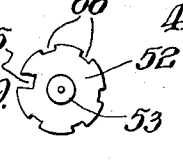


Fig. 19.



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Patented Dec. 10, 1935 2,023,847

UNITED STATES PATENT OFFICE

2,023,847

LOCK

Samuel A. Liss, Philadelphia, Pa., assignor of one-half to Helen B. Harvill, Haddonfield, N. J.

Application March 5, 1935, Serial No. 9,432

15 Claims. (Cl. 70—47)

This invention relates to improvements in cylinder locks, and the primary object thereof is to provide a lock of novel, inexpensive and advantageous construction which shall be non-pickable.

Another object is to provide a novel construction and arrangement of a number of secondary tumblers in association with a corresponding number of independently rotatable shafts for actuating the same, in combination with independently movable parts constructed to be actuated by the insertion of a key into the lock and related to the shafts to effect the turning thereof and the movement of the secondary tumblers to control the movement of the primary or locking tumbler.

Another object is to provide a novel construction and association of parts for supporting and actuating the secondary tumblers.

Another object is to provide a lock having its several parts constructed and related to one another in a novel manner whereby advantages are gained.

The invention consists of the elements and the combinations of them hereinafter described and claimed.

In the accompanying drawings, illustrating the invention,

Figure 1 is a longitudinal section of a lock and a key therefor constructed in accordance with my invention, the key being shown outside of the lock in line with the key opening therein.

Figure 2 is a view similar to Fig. 1, showing the key inserted into the lock.

Figure 3 is a horizontal section of the lock on line 3—3 of Fig. 5.

Figure 4 is a view similar to Fig. 3, showing the tumblers in a different position.

Figure 5 is a transverse section of the lock, on line 5—5 of Fig. 3.

Figure 6 is a transverse section of the lock on line 6—6 of Fig. 3.

Figure 7 is an end view of the key.

Figure 8 is a perspective view of the primary tumbler.

Figure 9 is a view similar to Fig. 1, showing a modified form of the invention.

Figure 10 is a view similar to Fig. 2.

Figure 11 is a longitudinal section of the lock shown in Fig. 1, as seen from the opposite side thereof and having a part of the cylinder removed.

Figure 12 is a transverse section of the modified form of the lock, on line 12—12 of Fig. 11.

Figure 13 is a transverse section, on line 13—13 of Fig. 11.

Figure 14 is an end view of the key shown in Figs. 9 and 10.

Figure 15 is a perspective view of the primary tumbler of the modified form.

Figures 16, 17 and 18 are perspective views of the key engaging and operating parts of the modified form of the lock.

Figure 19 is a view of one of the secondary tumblers of the modified form.

Referring first to Figs. 1 to 8, inclusive, of the drawings, 2 designates a lock casing and 4 a lock cylinder fitted to be rotated in a bore therein.

The outer or key receiving end of the cylinder 4 has an outwardly-extending, annular flange 7 formed thereon, and the inner end of the cylinder has a removable head 8 suitably secured thereto. The head 8 is constructed to engage the inner end of the casing 2 to prevent outward displacement of the cylinder 4, and the flange 7 is fitted to turn in a groove in the casing to prevent inward displacement of the cylinder.

The cylinder carries a primary tumbler 9 comprising a plate 10 provided with spaced, inwardly extending projections 11 and having end arms 14 and 15 which are fitted to be moved in slots or openings in the cylinder 4 near the respective ends thereof and which are pivoted to the cylinder by means of a pin or shaft 16 which extends through the same.

The primary tumbler 9 is mounted to move transversely of the cylinder 4 and the outer edge portion of its plate 10 rests normally within a longitudinal groove or slot 17 in the wall of the casing 2 and thus locks the cylinder against rotation relatively to the casing. The tumbler 9 is constantly urged inwardly to move its plate 10 from within the casing groove or slot 17 by a helical spring 18 which is housed within an opening in the cylinder and has its outer end bearing against the inner wall of the casing 2 and its inner end bearing against a projection 19 on the tumbler arm 15.

In the normal condition of the lock, when the key is removed therefrom, the spring 18 is prevented from moving the tumbler 9 inwardly from its locking position by one or more of a plurality of secondary tumblers 20. Any suitable number of these secondary tumblers may be employed in lieu of the three herein shown.

The tumblers 20 are secured to the outer ends of shafts 21 which are fitted to rotate in bores in the cylinder 4. The shafts 21 are arranged in parallel relation and extend transversely of the cylinder, and they are each provided with a spiral groove 22. Arranged adjacent to the shafts

21 in parallel relation thereto and corresponding in number therewith are key operated parts or pins 23 which are fitted to slide transversely of the cylinder 4 in suitable bores therein. The upper or inner end of each pin 23 is provided with a laterally-extending projection 24 which extends through a slot in the wall of the cylinder between the bores therein occupied by the pin 23 and its shaft 21 and into the spiral groove 22 of the shaft, the slot permitting longitudinal movement of the pin and preventing rotation thereof. The pins 23 are urged downwardly or outwardly by helical springs 25 which are seated in axial bores in the pins and bear against plugs in the ends of the bores in which the pins are slidably fitted. The pins 23 rest normally in the position shown in Fig. 1 with their projections 24 engaging the bottom walls of the slots in the cylinder walls through which they extend. When each pin 23 is moved longitudinally within its bore, its projection 24 engages the walls of the spiral groove 22 of its shaft 21 and rotates the same and thereby rotates the secondary tumbler 20 carried by the shaft.

The secondary tumblers 20 are each of wheel-like formation, their peripheries are interrupted by notches 26 and they are provided with spaced outwardly-extending projections 27, as clearly shown in Figs. 3 and 4. The notches 26 of the secondary tumblers 20 and the spaces between the projections 27 thereof are related to the projections 11 of the primary tumbler 9 to be capable of receiving the projections when they are in registry therewith.

The secondary tumblers 20 are provided to control the movement of the primary tumbler 9 by the spring 18 by permitting or preventing the movement of the primary tumbler plate 10 from within the casing slot 17, and the spring 18 can move the tumbler 9 sufficiently to cause its plate 10 to clear the casing slot 17 only when each of the three secondary tumblers 20 is turned to a position in which all of its notches 26 is in registry with its corresponding primary tumbler projection 11 to receive the same, as shown in Fig. 4.

In the normal condition of the lock, when the key is removed therefrom and the cylinder 4 is locked to the casing 2, the secondary tumblers 20 rest in positions in which at least one of the tumblers 20 does not have one of notches 26 in registry with its corresponding primary tumbler projection 11, and thus it will be understood that one or two or all of the secondary tumblers maintain the primary tumbler in the locked position shown in Figs. 3, 5 and 6.

The cylinder 4 has a key-way 28 formed therein and extending longitudinally thereof and having an open outer end for the reception of the bit 29 of a key 30. The key-way 28 has a longitudinally extending off-set portion 30*a* for receiving a longitudinal rib 31 on the key bit 29. The off-set portion 30 extends parallel to the axis of the cylinder 4 and the walls of the key-way 28 are constructed and related to the key bit 29 to prevent the key from being moved in any direction but parallel to the axis of the cylinder while the key is being projected into or being withdrawn from within the cylinder.

One edge of the key bit 29 is provided with tumbler-setting parts 32 which correspond in number with the pins 23. These parts extend parallel to the rib 31 and they are spaced different distances from the rib 31 and different distances longitudinally of the key bit in correspondence with the spacing of the pins 23 longitudinally of the cylinder 4 to receive the pins when the key is inserted into the cylinder.

The edge of the key bit 29 is provided with raised portions 33 between the parts 32 thereof and a raised portion 34 between the free end of the key bit 29 and the part 32 next adjacent thereto. These raised portions 33 and 34 have beveled or inclined sides, as shown, to permit them to move the pins 23 out of their path when the key is inserted into or withdrawn from within the cylinder.

The inner and outer end walls of the key rib 29 are provided with bevels 35 and 36, respectively, constructed and related to a projection 37 on the end arm 15 of the primary tumbler 9 to engage the projection and move the primary tumbler against the action of its spring 18 when the key is inserted into or withdrawn from within the cylinder for a purpose presently appearing.

When the key 30 is removed from the lock cylinder 4, the pins 23 and the secondary tumblers 20 are held in the normal or locking position shown in Figs. 1, 3, 5 and 6 by the springs 25, and the primary tumbler 9 is held in the normal or locking position against the action of its spring 18 by the secondary tumblers 20 which prevent the spring from moving the primary tumbler plate 10 from within the casing slot 17.

When the bit 29 of the key 30, shown in Figs. 1 and 2, is inserted into the key-way 28 and moved inwardly therein to the position shown in Fig. 2 it operates the lock to effect the unlocking or release of the cylinder 4 to permit the cylinder to be turned within the casing 2 by and with the key, as follows:

During the initial inward movement of the key, the bevel 36 on the outer or free end of the key rib 31 engages the projection 37 and moves the primary tumbler 9 outwardly a sufficient distance against the action of its spring 18 to free the secondary tumblers 20 from being engaged by the primary tumbler projections 11 and to move the projections 11 out from within any of the spaces between the secondary tumbler projections 27 within which they might be located.

During the continued inward movement of the key 30 the rib 31 engages the projection 37 and holds the primary tumbler in the position to which it was moved by the bevel 36, and the raised portions 33 and 34 of the key bit move the pins 23 against the action of their springs 25 and permit them to come to rest in contact with the end portions of the tumbler setting parts 32 of the key bit which are farthest from the key head, while the projections 24 on the pins 23, working in the spiral grooves 22 in the shafts 21 set the secondary tumblers 20 in positions in which each tumbler has one of its notches 26 in registry with its corresponding projection 11 on the primary tumbler 9 to receive the same. After the pins 23 come to rest in contact with the parts 32, as just described, and during the final inward movement of the key 30 to the position shown in Fig. 2, the parts 32 maintain the secondary tumblers 20 in position with a notch 26 of each tumbler in registry with its projection 11 on the primary tumbler 9 while the bevel 35 on the key rib 31 passes the projection 37 and permits the spring 18 to move the primary tumbler to move its projections 11 into the secondary tumbler notches 26 in registry therewith and to move its plate 10 from within the casing slot 17 to effect the unlocking of the cylinder 4.

After the cylinder 4 has been unlocked by the insertion of the key, as just described, and the cyl-

inder has been turned within the casing 2 to move the primary tumbler plate 10 out of registry with the casing slot 17, the primary tumbler projection 37 remains opposite to the bevel 35 on the outer end of the key rib 31 and thus prevents the withdrawal of the key from the slot 28 until the cylinder 4 is turned to a position in which the primary tumbler plate 10 is again in registry with the casing slot 17.

After the cylinder has been thus turned to bring the primary tumbler plate 10 again into registry with the casing slot 17, the key 30 may be withdrawn from within the cylinder slot 28, and, during the initial outward movement of the key, the bevel 35 on the key rib 31 engages the projection 37 and moves the primary tumbler outwardly against the action of its spring 18 to move the tumbler projections 11 from within the notches 26 to free the secondary tumblers 20 and return the primary tumbler plate 10 to its locking position within the casing slot 17. While the initial outward movement of the key just described is taking place, the tumbler setting parts 32 of the key bit move in contact with the pins 23 without causing them to change the positions of the secondary tumblers 20, and, after the primary tumbler plate 10 has been returned to its locking position in casing slot 17, the key rib 31 maintains it therein until, during the continued outward movement of the key, the pins 23 are operated by the raised portions 33 and 34 of the key bit 29 and all parts of the key bit contacting with the pins 23 have been withdrawn from engagement therewith and the pins 23 and secondary tumblers 20 are left in the positions shown in Figs. 1 and 3. After this has been done, the final outward movement of the key withdraws the rib 31 thereof from the primary tumbler projection 37 and permits the spring 18 to move the projections 11 of the primary tumbler 9 into contact with the secondary tumblers 20 which now hold the primary tumbler 9 in the locking position until the key 30 is again inserted into the cylinder to unlock the same.

In the normal positions of the secondary tumblers 20, as shown in Fig. 3, and in all other positions thereof, excepting the positions shown in Fig. 4, to which they are moved by the insertion of the key, all the notches 26 of one or more of the tumblers are out of registry with the adjacent projections 11 of the primary tumbler, so that if any attempt should be made to unlock the cylinder 4 by the aid of an instrument other than a properly formed key, one or more of the secondary tumblers 20 will prevent the primary tumbler from being moved to the unlocking position.

It will be understood that the positions of the tumbler setting parts or surfaces 32 with respect to the spaces between them and the secondary tumblers 20 determines whether the insertion of the key 30 will effect the unlocking of the cylinder 4, and that by changing the position of one or more of the parts or surfaces 32 and correspondingly changing a notch or notches 26 in the secondary tumbler or tumblers 20 so that the secondary tumblers will be properly operated by the key in accordance with the principle upon which the lock is operated, a large number of locks may be produced in which each one will require a key with surfaces or parts 32 spaced differently from the tumblers 20 of the others to effect the proper operation of the lock.

The purpose of providing each of the secondary tumblers 20 with three notches 26 to receive the projections 11 of the primary or locking tumbler 9 is that one notch of each tumbler 20 will serve for the proper operation of a lock by the ordinary key provided therefor, that another notch will serve for the proper operation of any lock of a number or group of locks by a master key having properly located parts 32 for its purpose, and that the remaining notch will serve for the proper opeation of any lock of any group of a number of groups of locks by a grand master key having properly located shoulders for its purpose.

Referring now to Figs. 9 to 19, inclusive, of the drawings and the modification of the invention therein illustrated, 40 designates a lock casing and 41 a lock cylinder fitted to be rotated in a bore therein similarly to the cylinder 4 hereinbefore referred to.

The cylinder 41 is provided with a removable block 42 which forms, in effect, a part of the body of the cylinder and which is provided for the purpose of assembling and disassembling the parts of the lock that are contained within openings in the cylinder. This block 42 is secured to the main body of the cylinder by a suitable screw 43.

The cylinder 41 carries a primary tumbler 44 comprising a plate 45 having end arms 46 and 47 which are arranged adjacent to the respective ends of the block 42 and which are pivoted to the cylinder by means of a pin or shaft 48 which extends through the cylinder block 42 and the arms.

This primary tumbler 44 is mounted to move transversely of the cylinder 41 and the outer edge portion of its plate 45 rests normally within a longitudinal groove or slot 49 in the wall of the casing 40 and thus locks the cylinder against rotation within the casing.

The tumbler 44 is constantly urged inwardly to move its plate 45 from within the casing groove or slot 49 by a helical spring 50 which is housed within an opening in the cylinder block 42 and has one end thereof bearing against the end wall of the opening and the other end thereof bearing against a projection 51 on the tumbler arm 47.

In the normal condition of the lock, when the key is removed therefrom, the spring 50 is prevented from moving the tumbler 44 inwardly from its locking position by one or more of a plurality of secondary tumblers 52 which are arranged to be engaged by the primary tumbler plate 45. Any suitable number of these secondary tumblers may be employed in lieu of the three herein shown.

The tumblers 52 are secured to the ends of independently rotatable shafts 53 which are fitted to suitable bearings in the cylinder. The shafts 53 are arranged in axial alinement and they extend longitudinally of the cylinder parallel to the axis thereof and they are each provided with a spiral groove 54.

Slidable longitudinally of the cylinder within grooves in the body thereof are key operated parts or plates 55, 56 and 57, one for each of the secondary tumblers 52. These plates 55, 56 and 57 are retained within their grooves by the removable block 42 of the cylinder and they are provided with arms 58, 59 and 60 which extend therefrom and have projections 61, 62 and 63, respectively, which extend into the spiral grooves 54 of the respective shafts 53 of the secondary tumblers 52; and the plates are urged toward the forward end of the cylinder 41 by helical springs 64 which are housed within the grooves in the cylinder within which the plates are fitted to slide. When the parts or plates 55, 56 and 57 are moved longitudinally within the cylinder 41 either by the springs 64 or against the action of

the springs by a key, as will presently appear, the operation of the projections 61, 62 and 63 within the grooves 54 of the shafts 53 will cause the respective secondary tumblers 52 carried by the shafts to be rotated.

The secondary tumblers 52 are each of wheel-like formation and the peripheries thereof are interrupted by deep notches 65 and shallow notches 66 constructed to receive the opposing edge portion of the primary tumbler plate 45.

The secondary tumblers 52 are provided to control the movement of the primary tumbler 44 by the spring 50 by permitting or preventing the movement of the primary tumbler plate 44 from within the casing slot 49, and the spring 50 can move the tumbler 44 sufficiently to cause its plate 45 to clear the casing slot 49 only when the secondary tumblers have been turned to positions wherein the deep notch 65 of each tumbler is in registry with the primary tumbler plate 45 to receive the same, as shown in Fig. 12.

In the normal condition of the lock, when the key is removed therefrom and the cylinder 41 is locked to the casing 40, the secondary tumblers 52 rest in positions in which at least one of the tumblers does not have its deep notch 65 in registry with the primary tumbler plate 45, and thus it will be understood that one or two or all of the secondary tumblers will maintain the primary tumbler in the locked position shown in Fig. 13.

The cylinder 41 has a key-way 67 formed therein and extending longitudinally thereof and having an open outer end for the reception of the bit 68 of a key 69. The key-way 67 has a longitudinally extending off-set portion 70 for receiving a longitudinal rib 71 on the key bit 68. The off-set portion 70 extends parallel to the axis of the cylinder 41 and the walls of the key-way 67 are constructed and related to the key bit 68 to prevent the key from being moved in any direction but parallel to the axis of the cylinder while the key is being projected into or being withdrawn from within the cylinder.

The key bit 68 is provided with stepped shoulders 72, 73 and 74 which are located progressively farther from the free end of the bit 68 and progressively farther from the key rib 71. These shoulders 72, 73 and 74 are arranged in alinement with the forward ends of the plates 55, 56 and 57, respectively, which extend into the key-way 67, and the shoulders are adapted to engage the plates and move them inwardly independently of each other when the key bit is inserted into the key-way.

The inner and outer end walls of the key rib 71 are provided with bevels 75 and 76, respectively, constructed and related to a projection 77 on the end arm 47 of the primary tumbler 44 to engage the projection and move the primary tumbler against the action of its spring 50 when the key is inserted into or withdrawn from within the cylinder.

When the key 69 is removed from the lock cylinder 41, the plates 55, 56 and 57, and therewith the secondary tumblers 52, are held in the normal or locking position shown in Figs. 9 and 13 by the springs 64, and the primary tumbler 44 is held in the normal or locking position against the action of its spring 50 by the secondary tumblers 52 which prevent the spring from moving the primary tumbler plate from within the casing slot 49.

When the bit 68 of the key 69, shown in Figs. 9 and 10, is inserted into the key-way 67 and moved inwardly therein to the position shown in Fig. 10 it operates the lock to effect the unlocking or release of the cylinder 41 to permit the cylinder to be turned within the casing 40 by and with the key, as follows:

During the initial inward movement of the key, the bevel 75 on the outer or free end of the key rib 68 engages the projection 77 and moves the primary tumbler 44 outwardly a sufficient distance against the action of its spring 50 to free the secondary tumblers 52 from being engaged by the primary tumbler plate 45 and to move the primary tumbler plate out from within any of the shallow notches 66 of the secondary tumblers within which they might be located.

During the continued inward movement of the key 69, the shoulders 72, 73 and 74 of the bit 68 thereof engage the plates 55, 56 and 57, respectively, and move them successively from the normal positions thereof shown in Figs. 9 and 11 to the positions shown in Fig. 10. Just before the key 69 reaches the end of its inward movement, the outer end of the key rib 71 passes the projection 77 of the primary tumbler, and, when the key reaches the end of its inward movement, the deep notches 65 of the secondary tumblers 52 have been turned into registry with the primary tumbler plate 45 and the spring 50 is now permitted to move such plate into the deep notches 65 and from within the casing slot 49 to effect the unlocking of the cylinder 41.

After the cylinder 41 has been unlocked by the insertion of the key 69 and turned by and with the key for the operation of the lock, the cylinder is locked by withdrawing the key therefrom. During the initial outward movement of the key the bevel 76 on the key rib 71 engages the projection 77 and moves the primary tumbler 44 outwardly to return the primary tumbler plate 45 to its locking position within the casing slot 49, and, during the continued outward movement of the key 69, the springs 64 are permitted to return the plates or parts 55, 56 and 57 to their normal positions for the return of the secondary tumblers 52 to normal positions wherein at least one of the deep notches 65 thereof is out of registry with the primary tumbler plate 45. The key rib 71 holds the primary tumbler plate 45 out of contact with the secondary tumblers 52 during the outward movement of the key, until the end of the rib escapes the projection 77 and permits the spring 50 to press the tumbler plate 45 into contact with the secondary tumblers which then hold the plate in the locking position until the key 69 is again inserted into the cylinder 41.

I claim:

1. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a rotatable shaft, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, a key operated part movable within the cylinder, and means operated by said part to rotate said shaft.

2. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a rotatable shaft having a spiral groove, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, and a key operated part movable within the cylinder and having a

projection extending into said groove to rotate the shaft when the part is moved.

3. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a rotatable secondary tumbler constructed and related to the primary tumbler to control the movement thereof, and key operated means to rotate the secondary tumbler, said means including a shaft extending transversely of the cylinder and rotatably mounted therein, and means cooperating with said shaft to rotate the secondary tumbler.

4. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a shaft extending transversely of the cylinder and rotatable therein, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, a key operated part movable within the cylinder, and means operated by said part to rotate said shaft.

5. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a shaft extending transversely of the cylinder and rotatable therein and having a spiral groove, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, and a key operated part movable within the cylinder and having a projection extending into said groove to rotate the shaft when the part is moved.

6. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable shafts, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, key operated parts movable within the cylinder, and means operated by said parts to rotate said shafts.

7. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable shafts having spiral grooves therein, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, and key operated parts movable within the cylinder and having projections extending into said grooves to rotate the shafts when the parts are moved.

8. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable parallel shafts extending transversely of the cylinder and rotatable therein, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, and key operated parts movable within the cylinder and having projections extending into said grooves to rotate the shafts when the parts are moved.

9. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable, parallel shafts extending transversely of the cylinder and rotatable therein and having spiral grooves, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, and key operated parts movable within the cylinder and having projections extending into said grooves to rotate the shafts when the parts are moved.

10. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and having spaced projections thereon and movable transversely of the axis of the cylinder into and from a position preventing rotation thereof, a plurality of independently rotatable, parallel shafts extending transversely of the cylinder and rotatable therein, secondary tumblers fixed to said shafts and constructed and related to the projections on the primary tumbler to control the movement thereof, key operated parts movable within the cylinder, and means operated by said parts to rotate said shafts.

11. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and having spaced projections thereon and movable transversely of the axis of the cylinder into and from a position preventing rotation thereof, a plurality of independently rotatable, parallel shafts extending transversely of the cylinder and rotatable therein and having spiral grooves, secondary tumblers fixed to said shafts and constructed and related to the projections on the primary tumbler to control the movement thereof, and key operated parts movable within the cylinder and having projections extending into said grooves to rotate the shafts when the parts are moved.

12. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a shaft extending longitudinally of the cylinder and rotatable therein, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, a key operated part movable longitudinally within the cylinder, and means operated by said part to rotate said shaft.

13. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a shaft extending longitudinally of the cylinder and rotatable therein and having a spiral groove, a secondary tumbler fixed to said shaft and constructed and related to the primary tumbler to control the movement thereof, and a key operated part movable longitudinally within the cylinder and having a projection extending into said groove to rotate the shaft when the part is moved.

14. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable shafts extending longitudinally of the cylinder and rotatable therein, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, key operated parts movable longitudi-

nally within the cylinder, and means operated by said parts to rotate said shafts.

15. In a lock, a casing, a cylinder rotatable therein, a primary tumbler within the cylinder and movable transversely of the axis thereof into and from a position preventing rotation of the cylinder, a plurality of independently rotatable shafts extending longitudinally of the cylinder and rotatable therein and having spiral grooves, secondary tumblers fixed to said shafts and constructed and related to the primary tumbler to control the movement thereof, and key operated parts movable longitudinally within the cylinder and having projections extending into said grooves to rotate the shafts when the parts are moved.

SAMUEL A. LISS.