April 30, 1940. B. C. SMITH 2,199,165

PIN-TUMBLER LOCK

Original Filed April 22, 1937

FIG. 1.

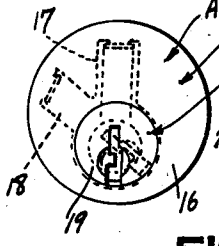


FIG. 2.

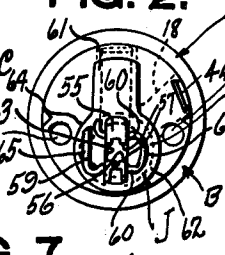


FIG. 3.

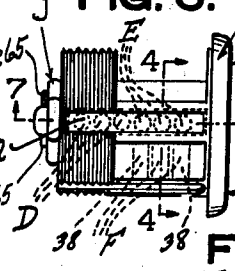


FIG. 4.

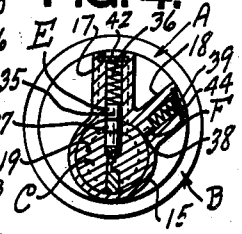


FIG. 7.

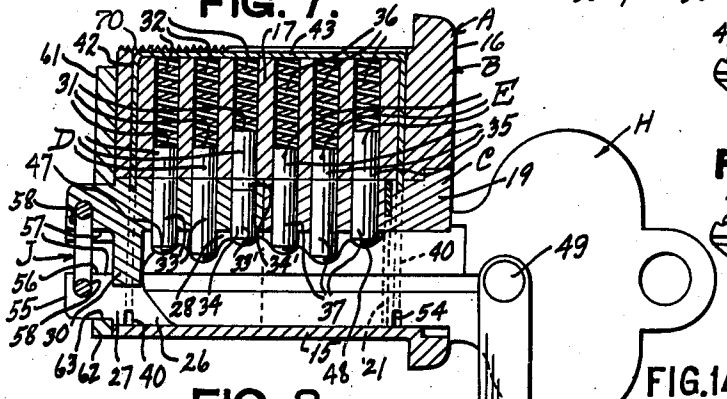


FIG. 5.

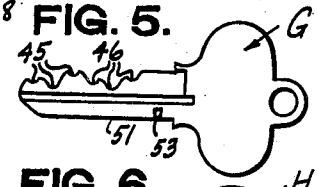


FIG. 6.

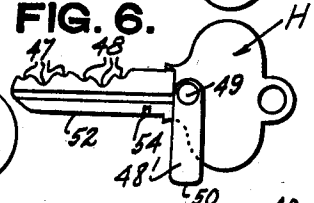


FIG. 14.

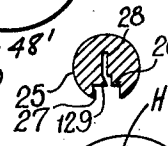


FIG. 10.

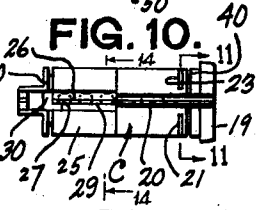


FIG. 8.

FIG. 11.

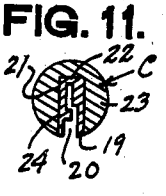


FIG. 9.

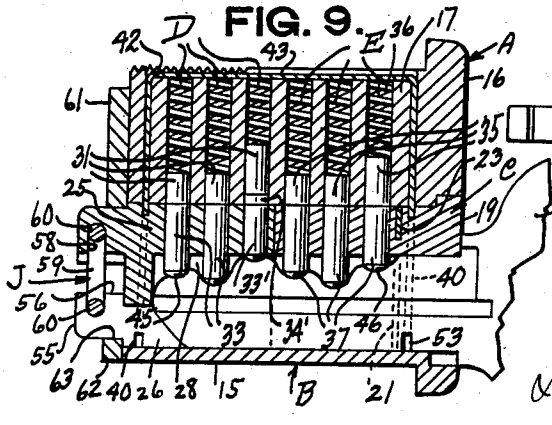


FIG. 13.

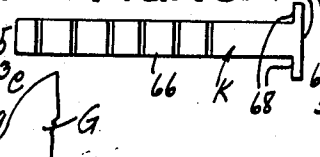
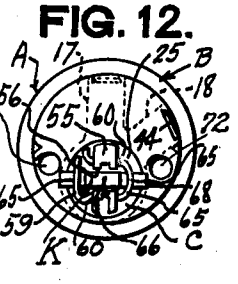


FIG. 12.



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Attorneys

Patented Apr. 30, 1940 2,199,165

UNITED STATES PATENT OFFICE

2,199,165

PIN-TUMBLER LOCK

Bernard C. Smith, Brooklyn, N. Y.

Continuation of application Serial No. 138,439, April 22, 1937. This application March 14, 1939, Serial No. 261,809

6 Claims. (Cl. 70—341)

This invention relates to improvements in locking mechanisms, and more particularly to pin-tumbler locking mechanisms. The present application is a continuation of my application for patent, Serial Number 138,439, filed April 22, 1937.

Heretofore, pin-tumbler locks have been regarded as being substantially invulnerable, but with the development of various unauthorized methods of opening locks by trickery, such as "sense of touch", "sense of hearing", "drop on shackle", "tap system", "spurious keys", "picking", etc., all commonly known to experts and very easily applied, the conventional pin-tumbler locking principle can no longer be considered safe and secure. For example, in "picking" a lock of the pin-tumbler principle, the intruder will insert a "tension tool" into the keyway so as to exert a tension or leverage on the plug upon the application of pressure with one hand and permitting the other hand to apply a "picking tool" for aligning the pins so that the first hand with the "tension tool" may revolve the cylinder plug for opening the lock.

The primary object of the present invention is to provide a pin-tumbler locking mechanism so constructed that it cannot be operated by trickery, either by "picking" or any other secret baffling system of unauthorized manipulation and which is therefore definitely pick-proof.

A further object is to provide an improved pin-tumbler locking mechanism having a sectional locking plug so constructed as to foil any attempt to apply tension or leverage to the plug by means of a "tension tool".

A still further object of the invention is the provision of baffling means for preventing joining of the sectional locking plug by drilling.

Another object is to provide an improved pin-tumbler lock including a sectional locking plug having a normal locking position and an emergency locking position.

Still another object is to provide an improved rotary locking plug construction for use in conjunction with either a rim or a mortise lock.

Another object of the invention is to provide an improved sectional cylinder locking plug including a rear plug section having a keyway channel of abnormal width along its base and a baffling wall or ward at the end of the keyway channel.

Another object of the invention is to provide a pin-tumbler lock mechanism including a sectional locking plug normally rotatable by the use of either of two types of keys, one type of key being termed the "guest" or "maid's" key, and the other type of key being termed the "master" or "emergency lock-out" key.

Another object of the invention is to provide a pin-tumbler lock mechanism including a sectional locking plug including a front plug cylinder section independently rotatable to and from a normal and an emergency lock-out position by means of the aforesaid "emergency lock-out" key and to the exclusion of the holder of the "guest" key at the will of the holder of the "emergency lock-out" key.

Other objects and advantages of the invention will be apparent from the following detailed description, taken in connection with the accompanying drawing, forming a part of this specification and in which drawing:

Figure 1 is a view in front elevation of the outer face of the improved lock and showing the rotary plug thereof by means of full and dash lines in its "normal" and its "emergency lock-out" positions respectively.

Fig. 2 is a view in rear elevation of the improved lock and showing a mortise type of cam element removably secured to the rotary plug.

Fig. 3 is a top plan view of the improved lock.

Fig. 4 is a vertical sectional view taken on the line 4—4 of Fig. 3.

Figs. 5 and 6 are views in side elevation of the "guest" and "emergency lock-out" types of keys respectively.

Fig. 7 is a longitudinal vertical sectional view taken on the line 7—7 of Fig. 3 and showing the relation of parts upon a full insertion of the "emergency lock-out" key.

Fig. 8 is a view similar to Fig. 7 but showing the relation of parts upon a partial insertion of the "emergency lock-out" key.

Fig. 9 is a view similar to Fig. 7 but showing the relation of parts upon insertion of the "guest" key.

Fig. 10 is a bottom plan view of a sectional rotary plug forming a part of the present invention.

Fig. 11 is a vertical sectional view taken on the line 11—11 of Fig. 10 and showing a baffling washer mounted in the plug.

Fig. 12 is a view similar to Fig. 2 but showing a rim type of connecting element removably secured to the rotary plug.

Fig. 13 is a view in side elevation of the rim type of connecting element.

Fig. 14 is a section on the line 14—14 of Fig. 10.

In the drawing, which shows only a preferred form of pin-tumbler lock with its "guest" and "emergency lock-out" keys, as well as preferred

and modified forms of motion transmitting elements for detachable connection to the rotary plug, the letter A may generally designate the improved lock consisting of a frame, housing or casing B carrying a sectional rotary plug C, pin-tumbler locking means D for locking the rear section of the plug C, pin-tumbler locking means E for locking the front section of the plug C in a normal position, and pin tumbler locking means F for locking the front section of the plug C in an abnormal or "emergency" position. The "guest" key and the "emergency lock-out" key may be designated G and H respectively while the mortise and rim types of motion transmitting elements for transmitting the rotary motion of the plug C may be designated J and K respectively.

The casing B may include a hollow cylinder 15 having the usual front or outer face 16 and provided with a radial rib 17 preferably extending vertically upwardly from the cylinder 15 and a second radial rib 18 preferably extending angularly upwardly from the cylinder.

In the cylinder 15 is the key receiving barrel or rotary plug C which includes a front section 19 having a longitudinal slot or keyway 20 of conventional cross-sectional area, and provided with an intra-circumferential slot 21 having a substantially U-shaped base 22 in closely spaced adjacent relation to the keyway. The purpose of the slot 21 is to accommodate a disk-like baffling washer 23 provided with a U-shaped notch 24 and so proportioned that the washer may be slid into the slot 21 about the keyway 20 before the plug is mounted in the casing. Preferably, the washer is formed of steel or other suitable material sufficiently hardened to successfully resist penetration by a drill or the like. At the inner end of the cylinder 15 is a rear plug section 25 in end to end axially aligning relation to the front section 19 and having a longitudinal slot or keyway 26 adapted to angularly align with the keyway 20 of the front section. However, the keyway 26 preferably differs from the conventional cross-sectional area of the keyway 20 in that the keyway 26 at its base portion 27 is abnormally wide as shown in Figures 10 and 14, and communicates with the upper portion 28 through the restricted slot 29. At the inner end of the rear plug section the upper portion 28 of the keyway terminates in a wall or ward 30 below which extends the widened base portion 27 of the keyway. The widened portion 27 extends throughout the length of the rear key receiving barrel or plug section 25 extending to the longitudinally extending shoulder 129.

Referring to the pin tumbler locking means D for locking the rear plug section, the same may include a row of drivers 31, preferably three in number, mounted in openings of conventional cylindrical formation at the inner end of the radial rib 17 and urged as by springs 32 into contact with the ends of a similar row of pins or pin-tumblers 33—33′ mounted in radial openings in the rear plug section, upon proper angular alignment of the rear plug section in the casing. Preferably one of the pins 33′ is composed of a master pin section 34 and a master disk section 34′.

For locking the front plug section in a normal position, and in which position the keyway 26 is secured in alignment with the keyway 20 in its locked position, pin-tumbler locking means E is provided. The latter may include a row of drivers 35, preferably three in number, mounted in openings of conventional cylindrical formation at the outer end of the radial rib 17 and urged as by springs 36 into contact with the ends of a similar row of pins 37 mounted in radial openings in the front plug section, upon proper angular alignment of the front plug section within the casing.

The arrangement of the pin tumbler locking means D and E preferably is such that the rows of drivers 31 and 35 form a continuous line or series of drivers along the radial rib 17 while the rows of pins 33 and 37 form an interrupted line or series of pins along the rotary sectional plug C whereby a continuous keyway is formed which provides access to the locking means D and E when the front and rear plug sections are in their normal locked position.

Mounted in suitable cylindrical openings in the angularly disposed radial rib 18 and adapted to co-act with the pins 37 (which are common to each of the locking means E and F), upon predetermined angular rotation of the front plug section is a corresponding angularly disposed row of drivers 38 provided with suitable springs 39 and forming, in conjunction with the pins 37, the pin tumbler locking means F for locking the front plug section in the "emergency lock-out" position, and in which position the keyway 20 is secured in angular disalignment with the locked position of the keyway 26 so that access to the pin-tumbler locking means D through the keyway 20 and into the keyway 26 is prevented.

The front and rear plug sections may each include a circumferential slot 40 accommodating the opposite ends 41 of a U-shaped retainer 42 swedged or pressed into the casing B so that the intermediate portion 43 see Fig. 8, will retain the springs 32 and 36 within the rib 17. The other rib 18 may be provided with a suitable slide 44 for retaining the springs 39.

As shown, in Figures 7–9, the length of each of the pins 33—33′ of locking means D equals the length of its correspondingly positioned pin 37 common to each of the locking means E and F.

The "guest" key G is provided along its upper edge with a series of six pin-positioning notches, the first three notches 45 inwardly of the free end of the keyblade being adapted to raise the two whole pins 33 and the master pin section 34 of the broken pin 33′ so that their upper ends are brought into unlocking alignment along the cylindrical surface of the rear plug section. The other three notches 46 are adapted to raise the pins 37 so that their upper ends are brought into similar unlocking alignment along the cylindrical surface of the front plug section. While the pins 33—33′ of the locking means D preferably correspond each to a similarly located pin 37 common to each of the locking means E and F, it will be noted that in order to raise the master pin section 34 so that its upper end is flush with the surface of the plug, one notch of the series of notches 45 in the upper edge of the "guest" key will be positioned at a greater height than the similarly located notch of the series of notches 46, the difference in height being equal to the height or thickness of the master disk section 34′ as shown in Fig. 9. This differentiation between the first series of notches 45 and the second series of notches 46 of the "guest" key is sufficient to prevent unlocking of the front plug section upon a partial insertion of the "guest" key in the keyway to a position in which the series of notches 45 at the free end of the key would co-act each

with one of the pins 37 common to each of the locking means E and F.

The "emergency lock-out" key H is provided along its upper edge with a series of six pin-positioning notches, the first three notches 47 inwardly of the free end of the key-blade being adapted to raise the pins 33—33' so that their upper ends are brought into unlocking alignment along the cylindrical surface of the rear plug section, while the other three notches 48 serve to raise the pins 37 to an unlocked position. It will therefore be seen that, with the pins 33—33' of the locking means D each corresponding to a similarly located pin of the series of pins 37 of the locking means E, there need be no differentiation between the series of notches 47 and the series of notches 48 of the "emergency lock-out" key. Thus, as shown in Figure 7, the "emergency lock-out" key H may be fully inserted in the keyways 20 and 26 of both plug sections and will, through the respective co-action of the notches 47 with the pins 33—33' and the notches 48 with the pins 37, unlock both the locking means D and E and free the entire plug for rotation by the keyblade. In addition, as shown in Fig. 8, the "emergency lock-out" key may be partially inserted in the keyway so that, through the co-action of the notches 47 with the pins 37, the locking means E or the locking means F, depending on the angular position of the front plug section, will be released so that the front plug section may be turned by the keyblade independently of the rear plug section. In order to facilitate accurate cooperation of the notches 47 with the pins 37 when the "emergency lock-out" key H is utilized in its partially inserted position, a flat strip 48' provided at one end with a pivot 49 affixed to the handle end of the key, may be swung in a plane parallel to the keyblade so that its free end 50 is positioned along one side of the keyblade to form an abutment for limiting insertion of the keyblade beyond a predetermined portion of the keyway. This abutment will contact the outer end or face of the cylinder plug.

In the back or lower edges 51—52 of the keys G and H respectively, there may be provided suitable niches 53—54 so that the retainer 42 will not obstruct the complete rotation of the plug.

At the rear end of the main body portion of the plug C, and preferably integral therewith is a rib-like connecting end portion 55 which may be provided with a bifurcating slot 56 defined by opposite side walls 57 each provided with a transverse notch 58 adapted to slidably receive a resilient loop-shaped retainer 59 at opposite sides 60 thereof. This retainer 59 may be employed for connecting to the plug either the mortise type of motion transmitting element J or the rim type of motion transmitting element K. The element J may include a cam or roll-back portion 61 at one end and an attaching portion 62 at the other end which may be provided with a slot 63 adapted to accommodate the rib-like end portion 55 of the rear plug section. The attaching portion 62 may include a pair of side portions 64 at opposite sides of the slot and which portions are adapted to abut the end of the main body portion of the plug C upon interlocking of the rib-like end portion 55 with the attaching portion 62 of the element J at the slot 63.

The loop-shaped retainer 59 may then be slidably inserted in the transverse notches 58 so that the opposite ends 65 thereof will bear each upon one of the side portions 64 whereby to hold the element J in its interlocking position.

As for the rim type of motion transmitting element K, it may include an elongated spindle portion 66 having at one end 67 a pair of laterally extending side portions 68. The elements J and K may be employed interchangeably with the plug C. When the element K is utilized, the spindle end 66 is first inserted in the loop-shaped retainer 59 so that the retainer is positioned inwardly adjacent the side portions 68. The end 67 is then positioned in alignment with but laterally of the bifurcating slot 56 so that upon alignment of the loop-shaped retainer encircling the spindle with the transverse notches 58, the end 67 may be slid into the bifurcating slot 56 and at the same time the retainer 59 will slide into the notches 58. By this procedure, the element K will be interlockingly secured to the plug C with its side portions 68 held in abutting relation to the end of the main body portion of the rear plug section by the opposite ends 65 of the retainer 59, as shown in Fig. 12.

When the mortise type of motion transmitting element J is used, then the threaded portion 70 of the casing B will cooperate with a threaded portion in the door or other structure to be equipped with this lock to secure the casing B in place. On the other hand, when the rim type of motion transmitting element K is being used, then the casing B is secured in place to the door or structure with which the lock A is to be equipped by screws cooperating with the openings 71 and 72 respectively.

Obviously, the lock A may be utilized in a variety of situations, although particularly well adapted for use in hotels. As an example, a "guest" type of key G may be supplied to the hotel guest and the hotel manager may retain the "emergency lock-out" key H so that when the plug C is in its normal position, the locking means D and E may be released by either the guest or the manager whereby to gain access to the room. If the guest should fail to pay his or her hotel bill, the manager may utilize the key H to lock out the guest, so as to force the guest to apply to the manager for entrance to the room. This may be accomplished by swinging the abutment strip 48' to a position alongside the keyblade, so as to unlock the locking means E through the use of only that portion of the keyblade including the bits or notches 47. The front plug section may thus be rotated to its angular position as shown by dash lines in Fig. 1, and upon withdrawal of the keyblade, the locking means F will function. The guest, upon his or her return, will find that the "guest" key G is blocked from full insertion in the lock, and, because of the differentiation between the ends of the keys G and H, he or she will find that the plug may not be turned, and will call upon the manager to open the door, probably thinking the lock has become jammed. The manager may then tactfully request payment of the hotel bill and then proceed to open the door through the use of the key H, which of course may first be utilized in its partially inserted position to unlock the locking means F so that the keyways of the front and rear plug sections may be brought into alignment, and subsequently in its fully inserted position to unlock the locking means D and E, for rotation of the entire plug C to retract the bolt. If desired, the manager may hide the abutment strip 48' so as not to disclose to the guest that a special "emergency lock-out" key has been used.

If an intruder should attempt to "pick" the lock in its normally locked position, he would find

it impossible to apply the necessary tension to the rear plug section in order to release the locking means D, as the only access to the rear plug section is through the keyway through which the "picking tool" must be inserted. Due to the widened base portion of the keyway of the rear plug section and the ward 30 at the end of the upper portion of the keyway, the use of any instrument or instruments other than a properly bitted key of correct length for unlocking the locking means D and E will invariably prove to be unsuccessful. For example, it has been actually demonstrated that some of the so-called "pick-proof" locks, such as those embodying independently rotatable front and rear plug sections each having a keyway one alignable with the other, and wherein the keyway of the rear or inner plug section includes a narrow slot communicating with the tumbler openings and an enlarged slot of greater width than that of the corresponding portion of the keyway of the front or outer plug section, can be effectively picked by the modification and use of a readily obtainable key blank and a picking tool. In modifying the key blank, the top or working edge of the blank is removed except for the forward or innermost end of the blank, whereby to leave an inverted V-shaped last rise forming a picking bit. The entire or substantially all of the lower or back marginal edge of the modified blank may then be used as a tension tool, with the last rise or end bit extending upwardly into the narrow portion of the keyway in the rear plug section, so as to join the front and rear sections for rotation in unison. The last rise of the modified key blank may then be reciprocated beneath the innermost pin so as to properly align the latter under tension for a break relative to the casing, the remaining pins being properly aligned by the use of a conventional picking tool disposed in the keyway above the lower or back edge of the modified blank and outwardly of the last rise thereon.

The present invention has not only the widened portion 27 of the keyway groove which prevents cooperation of a conventional tension tool with the rear plug section 25 due to the resulting lost motion between the tension tool and rear plug section, but also the wall or ward 30 which makes it impossible for a modified key blank tensioning-picking tool to operate the innermost pin as by reciprocation of the end bit or last rise of the modified blank past the bottom end of the pin. Obviously, the modified key blank tensioning-picking tool just described, may be readily shaped to pass over an obstacle such as a ward were it disposed only at the inner end portion of the widened base of the keyway in the rear plug section, but where the ward is disposed in the narrow portion of the keyway adjacent the innermost tumbler, the same cannot be picked while under tension. It will be seen that when the locking plug is in its "emergency lock-out" position, an added barrier confronts the unauthorized intruder, in that the keyways of the front and rear plug sections are disaligned so that the locking means D may not be reached through the usual keyway.

Any attempt to connect the front and rear plug sections by drilling a hole through the outer plug section and into the inner plug section with the idea of pinning the two sections together, will be frustated by the hardened baffling washer 23 closely positioned about the keyhole and formed of drill-resisting material.

Obviously the lock A may be employed solely in conjunction with a key H of the "emergency lock-out" type, where the user desires merely to utilize the added protection against unauthorized intruders which is afforded by the lock in its "emergency lock-out" position, without sharing the use of the lock with another party through the provision of a "guest" key.

Various changes may be made to the shape, size and arrangement of parts, without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. In a cylinder lock, a plug including a pair of axially aligning cylinder sections disposed in end to end relation one in front of the other, said cylinder sections each having a keyway one normally in alignment with the other, a casing for the plug, means carried by the casing for locking the front and rear cylinder sections when the keyways are in alignment with each other, additional means carried by the casing for locking the front cylinder section when the keyway of said section is in an annular position relative to the keyway in the rear cylinder section, key-operated means for releasing the front and rear cylinder sections when the keyways thereof are in alignment and for releasing the front cylinder section when the keyways are in disalignment, said key-operated means being so constructed as to permit the use of a proper key to disengage the front and rear cylinder section locking means simultaneously upon normal insertion into said keyways of said proper key, and to disengage said front cylinder section locking means upon a partial insertion of the same key.

2. In a cylinder lock, a plug including a pair of axially aligning cylinder sections disposed in end to end relation one in front of the other, said cylinder sections each having a keyway one normally in alignment with the other, a casing for the plug, means carried by the casing for locking the front and rear cylinder sections when the keyways are in alignment with each other, additional means carried by the casing for locking the front cylinder section when the keyway of said section is in an angular position relative to the keyway in the rear cylinder section, key-operated means for releasing the front and rear cylinder sections when the keyways thereof are in alignment and for releasing the front cylinder section when the keyways are in disalignment, said key-operated means being so constructed as to permit the use of a proper key to disengage the front and rear cylinder section locking means simultaneously upon normal insertion into said keyways of said proper key, and to disengage said front cylinder section locking means upon a partial insertion of the same key, said key-operated means including a tumbler element for releasing the rear cylinder section and comprising a master pin section and a master disc section.

3. In a lock of the character described, a casing including an outer face and having a cylindrical opening extending into the casing from the outer face, said casing being provided with a row of driver-containing chambers extending inwardly of the outer face, a plug rotatable in the cylindrical opening of the casing and having an inwardly extending row of pin-containing openings corresponding to the row of driver-containing chambers, said plug having a keyway including a marginal zone communicating with the row of openings and adapted to receive the inner end portions of the pins carried in said row of openings, a ward closing the inner end of the mar-

ginal zone, said ward being disposed from the innermost pin a distance less than the distance between adjacent pins, the remainder of the keyway communicating with the marginal zone and extending beyond said ward.

4. In a lock of the character described, a casing including an outer face and having a cylindrical opening extending into the casing from the outer face, said casing being provided with a row of driver-containing chambers extending inwardly of the outer face, a plug including a pair of cylindrical sections positioned in end to end relation in the opening one inwardly of the other, said plug having an inwardly extending row of pin-containing openings corresponding to the row of driver-containing chambers, at least one of said openings being provided in each section, said sections each having a keyway one alignable with the other, the keyways of the inner and outer sections each including a marginal space, said marginal spaces upon alignment of the keyways forming a zone communicating with the row of openings and adapted to receive the inner end portions of the pins carried in said row of openings, a ward closing the inner end of the zone, said ward being disposed from the innermost pin a distance less than the distance between adjacent pins, the remainder of the keyway of the inner section being of a width greater than the width of the corresponding portion of the keyway of the outer section and extending beyond said ward.

5. In a pin tumbler lock construction, a casing having an outer face and provided with a cylindrical opening extending into the casing from the outer face, a cylindrical plug in the opening, pin tumbler locking means normally positioned partly in the casing and partly in the plug at its inner end portion for locking the plug, said plug being provided with a longitudinal keyhole extending inwardly of the plug from its outer end portion and permitting the insertion of a proper key for releasing said locking means, and the outer end portion of the plug being provided with an intra-circumferential slot about the keyhole, a penetration-resistant washer corresponding to and mounted in the slot, said outer end portion being provided with an annular groove outwardly of said slot, and means carried by the casing extending into said annular groove, said means permitting rotation of said outer end portion and preventing axial movement thereof.

6. In a pin tumbler lock, a casing, a key receiving barrel rotatable within said casing, said casing and barrel having alignable bores, pin tumblers each slidably mounted in a set of alignable bores, and each including a driver and a pin, a spring mounted in the casing portion of each alignable bore and engaging the outer end of the driver of each alignable bore, said barrel having a key opening with a longitudinally extending shoulder extending into such opening to receive the key receiving faces of the pins in locked position, a rib extending from the rear end of said barrel and having a bifurcating slot, notches in the portions of said rib on opposite sides of said slot, a yieldable retainer cooperating with said notches to anchor either the spindle of a rim type lock or the cam disk of a mortise type lock said casing having internally threaded screw receiving openings and an external thread, the internally threaded screw receiving openings being adapted to receive screws for anchoring the casing when used as a rim type lock and the external thread being adapted to anchor the casing when used as a mortise type lock.

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