April 30, 1968 H. K. PERRILL 3,380,268

PIN TUMBLER LOCK

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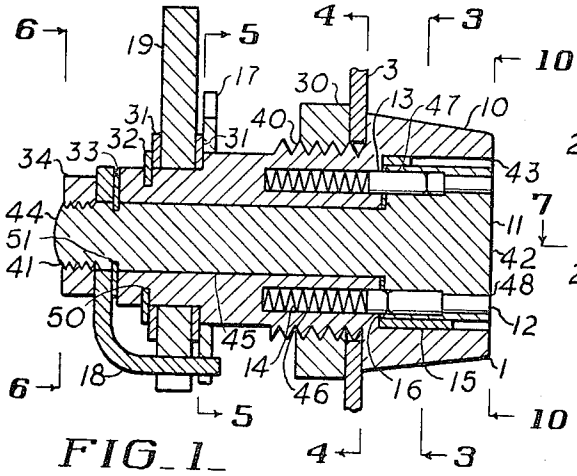


FIG_1_

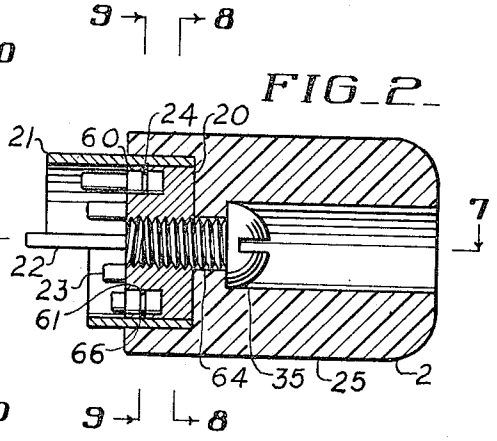


FIG_2_

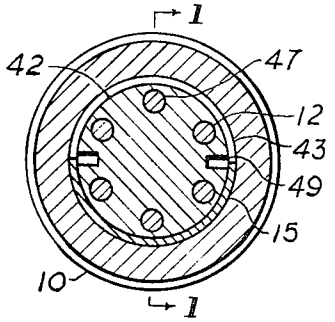


FIG_3_

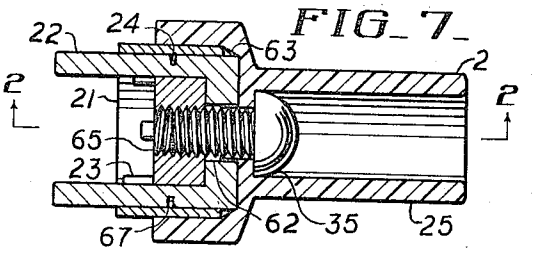


FIG_7_

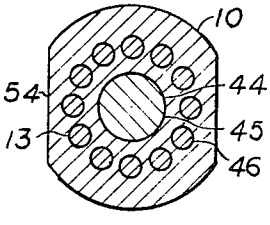


FIG_4_

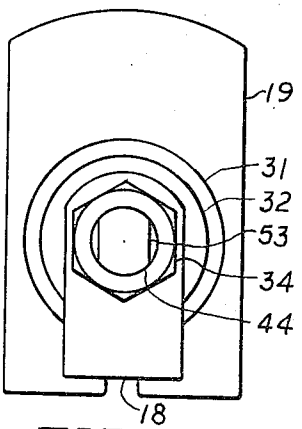


FIG_6_

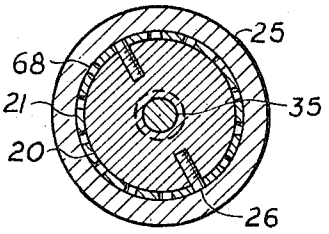


FIG_8_

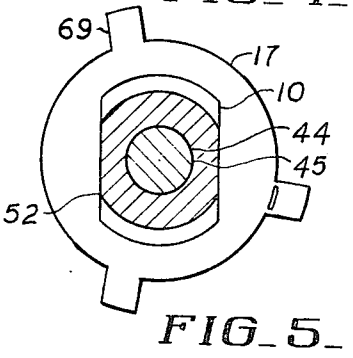


FIG_5_

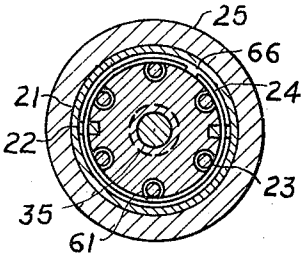


FIG_9_

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PIN TUMBLER LOCK

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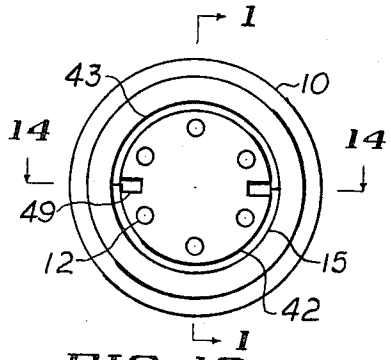


FIG_10_

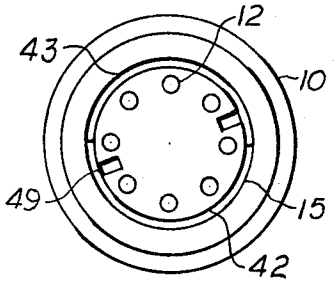


FIG_11_

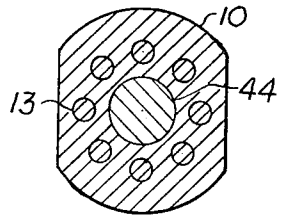


FIG_12_

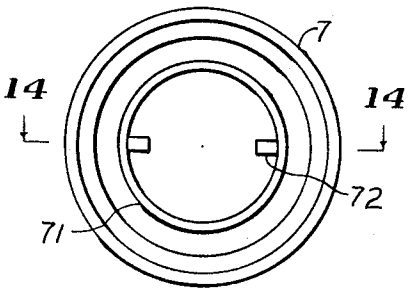


FIG_13_

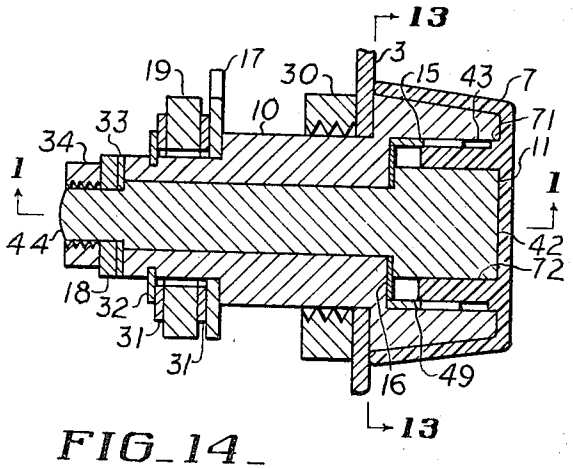


FIG_14_

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3,380,268

PIN TUMBLER LOCK

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10 Claims. (Cl. 70—363)

ABSTRACT OF THE DISCLOSURE

The device of the invention is an improved axial pin tumbler combination lock and key. In this type of lock there are circularly arranged pin tumblers in the body and in the rotatable barrel of the lock which are actuatable by a key having extending plungers or pins for actuating the tumblers in the lock for locking and unlocking. The improvements in the lock reside in the provision of a skirt on the key which engages in an annular groove in the barrel of the lock, these parts being configurated so that the key is operative in only one angular position. Further, a double set of bores alternately arranged is provided in the body of the lock with pin tumblers in the bores so related to the bores in the barrel that in both the lock and the unlocked positions of the lock itself, the pins in the barrel are in a position such that the combination of the lock is not exposed and not susceptible to picking.

The present invention relates to an improved axial pin tumbler cylindrical combination lock and its related key. The principal object of the invention is to provide a lock capable of being easily set to a greater number of permutations and combinations than any other lock of this type.

Another object of the invention is to provide users of the lock with individualized locks and keys distinct from those of other users.

Another object of the invention is to provide a key which can be either retained in the lock or removed at the user's option irrespective of the position of the lock.

Another object is to provide a lock of this axial pin tumbler type, which, when in the "open lock" position with the key removed, has the same degree of protection of pin tumbler combinations when probed, as it has in the "locked" position.

Another object of this invention is to provide a lock which can be locked in either the "open" or "closed" position when the key is removed from the lock.

Another object of the invention is to provide for quick and easy alignment of the key with the lock.

Another object of the invention is to provide a lock which can be fitted with a "weather cap" to provide a weather-proof and dust-proof lock.

Another object of this invention is to provide a small and compact lock that is rugged, strong and tamper proof.

In a preferred form of the invention as described herein, the foregoing objects are realized in particular ways, utilizing novel and unique constructions. As known in the art, pin tumbler locks are operated by a key having extending plungers of different lengths which are extended into the pin tumbler bores of the lock to position the pin tumblers therein for unlocking. Pin tumbler locks, as conventionally constructed, typically embody a cylindrical casing or body having it in a bore and a counterbore in which is positioned a rotating barrel having an enlarged end part in the counterbore at the end of the body. In the construction of the invention herein, this enlarged end part of the barrel is made smaller than the counterbore in the end of the body to leave an annular space. In the bottom of the space there is provided a guide ring, the

edge of which has an irregular contour. The key is provided with an extending skirt around the tumbler plungers. The skirt fits into the annular space in the lock. The end or edge part of the skirt has a reverse matching contour to mate with the contour of the guide ring. In this manner each lock has an individualized key so that each person's key is distinctive and, of course, is adaptable to operate with only its own particular lock. A further object of the invention is to realize this objective using this particular construction.

Tumbler locks conventionally have pairs of pin tumblers in the axial bores in the body and in the end of the barrel part, which bores are aligned in the locked position of the locks. In the unlocked position, the bores are, of course, out of alignment; in this position the lock is more susceptible to probing of the bores in this barrel for the purpose of determining the depth or length of the pins therein. In the herein invention, this deficiency is overcome by a particular and unique construction. This aspect of the invention is described in an exemplary embodiment thereof which is a six-pin or six-tumbler lock. However, instead of having six axial bores in the body of the lock, an additional pattern of six bores is provided having tumblers in the same sequence of lengths but with the pattern displaced 90° in the unlocking direction of the barrel. The additional bores alternate in position with the first six bores. In a pattern of six bores, they are spaced 90° apart. By means of this construction, when the lock is in unlocked position the additional pattern of pin tumblers in the body becomes aligned with the bores in the barrel so that in the unlocked position exactly the same configuration and position of plungers is presented as when the lock is in the locked position. Thus, the lock offers the same degree of protection against probing in the unlocked as in the locked position. The realization of this objective in this particular manner is another object of the invention.

It will be observed from the foregoing description that the construction is such that the use of the key is required to cause the lock to lock as well as to cause it to unlock, and the realization of this purpose in this particular way is one of the objects of the invention.

Referring to the accompanying drawings in which my invention is illustrated:

FIGURE 1 is a central vertical cross-section along the axis of the lock, along the plane **1—1** of FIGURE 14.

FIGURE 2 is a central vertical cross-section along the axis of the key, in the plane **2—2** of FIGURE 7.

FIGURES 1 and 2 show the lock and key in the relationship to each other that would exist immediately prior to the insertion of the key into the lock or immediately subsequent to the removal of the key from the lock, the lock being in the "closed" position.

FIGURE 3 is a cross-section of the lock, at right angles to the axis of the lock, in the plane **3—3** of FIGURE 1.

FIGURE 4 is a cross-section of the lock, at right angles to the axis of the lock, in the plane **4—4** of FIGURE 1.

FIGURE 5 is a cross-section of the lock, at right angles to the axis of the lock, in the plane **5—5** of FIGURE 1.

FIGURE 6 is a rear elevation of the lock, at the plane **6—6** of FIGURE 1.

FIGURE 7 is a horizontal cross-section along the axis of the key, in the plane **7—7** of FIGURE 2.

FIGURE 8 is a cross-section of the key, at right angles to the axis of the key, in the plane **8—8** of FIGURE 2.

FIGURE 9 is a cross-section of the key, at right angles to the axis of the key, in the plane **9—9** of FIGURE 2.

FIGURE 10 is a front elevation of the lock, at the plane **10—10** of FIGURE 1.

FIGURES 1 through 10 and 14 show details of a "six pin" version of the lock and key. FIGURES 11 and 12

show variations which would occur in an "eight pin" version of the lock.

FIGURE 11 is a front elevation of the "eight pin" version of the lock, at the plane 10—10 of FIGURE 1.

FIGURE 12 is a cross-section of the "eight pin" version at right angles to the axis of the lock, in the plane 4—4 of FIGURE 1.

FIGURE 13 is a rear elevation of the "weather cap," as it would appear from the plane 13—13 of FIGURE 14.

FIGURE 14 is a horizontal cross-section along the axis of the lock with the weather cap installed, in the plane 14—14 of FIGURE 13 and at right angles to the plane of FIGURE 1.

My invention contemplates two basically similar versions, with the majority of parts of each version being identical to those of the other. The "six pin" version is for uses where it is desirable or necessary to remove the key from the lock in either the "open" or "closed" position of the lock, so that the lock can remain in either condition for extended periods of time. The "eight pin" version is for uses where the lock normally remains in the "closed" position, and the key can be retained in the lock when it is in the "open" position. The differences in the two versions and their effect on the operation of the lock will be specifically brought out in the following description. Where the design and function of parts are identical, no version will be specified.

In the description of operation and in the drawings, the same parts are given the same numbers, whether for the "six pin" version or the "eight pin" version. The terms "six pin version" and "eight pin version" are used to designate variations in the features of the locks rather than to be restrictive as to the number of pins used.

The lock **1** consists essentially of a cylindrical lock body **10** containing a tumbler barrel **11** fitting in a bore and counterbore in body **10**. Tumbler pins **12** and **13** parallel to and concentric about the axis of the lock **1**, are contained in contiguous parallel bores **46** and **47** in the lock body **10** and the tumbler barrel **11**. Pins **12** are coaxial with and outward of pins **13**. When the key **2** is not in the lock, the tumbler pins **12** and **13** are forced towards the outer face of the tumbler barrel **11** by the force of the tumbler springs **14**. In this forward position, the body tumbler pins **13** lie across the shear plane between the lock body **10** and the tumbler barrel **11**, thereby making it impossible to rotate the tumbler barrel **11** in the lock body **10**. When the key **2** is inserted in the exposed end of the lock, the tumbler plunges **23** impinge on the out-faces of the barrel tumbler pins **12** and the tumbler pins **12** and **13** are forced into their respective bores. When the tumbler plungers **23** are correctly mated with the tumbler pins **12** and **13**, the contacting surfaces of the contiguous tumbler pins **12** and **13** lie on the shear plane of the tumbler barrel **11** and the lock body **10**, thereby making it possible to rotate the tumbler barrel **11** in the lock body **10**. The above brief description of the operation of the lock **1** and key **2** applies to all locks and keys of this basic type. The improvements covered by this invention, enhancing the utility and operation of this type of lock over the basic lock and existing locks, as well as features of construction of the component parts, are covered in the following paragraphs.

The lock body **10** is basically a cylindrical solid of revolution. The exposed outer portion of the lock body **10** is a truncated cone. The base of this cone is an annular plane at right angles to the axis of the lock body **11** extending out from the main cylindrical portion of the lock body **11** and providing a seat against the door panel **3** of the device upon which the lock is attached. To the rear of the truncated conical section of the body **10** is a stepped cylinder. The forward portion of the large diameter cylinder has threads **40** to receive a nut **30** which anchors the lock **1** to the door panel **3**. One or two body positioning flats **54** are milled on this threaded area, depending upon the shape of the mounting hole in the door panel **3**, to prevent rotation of the lock body **10**. See FIGURE 4. The rear portion of the cylindrical section of the body **10** is of reduced diameter. Limiting plate positioning flats **52** are milled on the reduced diameter portion and also at the extreme rear end of the large diameter to form a seat for the limiting plate **17** and prevent it from being rotated on the lock body **10**. See FIGURE 5. This smaller diameter cylindrical section of the lock body **10** forms the seat for the latch bar **19** and washers **31**. There is a spring fastener groove **50** turned in the lock body **10** immediately behind the latch bar seat area.

There are two bores drilled along the axis of the lock body **10**, a large diameter barrel cylinder counterbore **43** at the outer end of the lock body **10** and a smaller diameter barrel shaft bore **45** in the rear or inner end of the lock body **10**. The shear plane of the lock body **10** is formed by the inner radial annular face of the barrel cylinder bore **43**. Concentric with the forward portion of the barrel shaft bore **45** and located approximately midway between the barrel shaft diameter and barrel cylinder diameter are a number of equispaced body tumbler bores **46**. In the "eight pin" version of the lock (FIGURES 11–12) the number of these body tumbler bores **46** equals the number of barrel tumbler bores **47** in the tumbler barrel **11**. In the "six pin" version, FIGS. 3, 4 and 10, there are twice as many body tumbler bores **46**, one-half the angular distance apart, as there are barrel tumbler bores **47** in the tumbler barrel **11**. The function of this second set of intermediate body tumbler bores **46** is to contain a duplicate set of body tumbler pins **13** and tumbler springs **14**, for reasons which will be explained shortly.

The tumbler barrel **11** is made from magnetic permeable material. It consists of a large diameter tumbler barrel cylinder **42** at the outer end and an integral smaller diameter tumbler barrel shaft **44** at the rear. There is a threaded section **41** at the rear end of the tumbler barrel shaft **44**. Forward of this threaded section is a spring fastener groove **51**. The tumbler barrel shaft **44** has two dog positioning flats **53** milled in the threaded area to the rear of the spring fastener groove **51**. Concentric with the axis of the tumbler barrel **11** and approximately midway between the tumbler shaft diameter and the outer diameter of the tumbler barrel cylinder **42** are a number of equispaced barrel tumbler bores **47** which normally are aligned with the body tumbler bores **46**. The barrel tumbler inner bores **47** are the same diameter as the body tumbler bores **46**. The outer end parts of the barrel tumbler bores are smaller in diameter than the barrel tumbler inner bores **47**, as indicated at **48**, in order to form retaining seats for the barrel tumbler pins **12**. Milled in the periphery of the tumbler barrel cylinder **42**, diametrically opposite each other and parallel to the axis are two key guide tang slots **49**. In the "six pin" version, FIG. 10, these slots **49** are on the horizontal axial plane and midway, angularly, between adjacent tumbler pin bores when the tumbler is in the "closed" lock position. In the "eight pin" version, FIG. 11, these slots **49** are in an axial plane inclined to the horizontal but midway, angularly, between the adjacent tumbler pin bores. The function of the key guide tang slots **49** is to act as receptacles for the key guide tangs **22** of the key **2** and the weather cap tangs **72** of the weather cap. See FIGURES 13 and 14. A thin barrel closure plate **16** is permanently attached to the flat radial annular surface of the tumbler barrel cylinder **42**, forming an integral part of the tumbler barrel **11**. This plate **16** has holes of the same diameter drilled in it and located on the same centers as the barrel tumbler inner bores **47**. However, this barrel closure plate **16** does not contain any key guide tang slots. The function of this plate **16** is to seal the inner end of the key guide tang slots **49** to prevent probing of the two body tumbler pins **13** that otherwise would be open to the slots **49** in the "six pin" version only. The rear annular face of the barrel closure plate **16** and the radial annular surface at the rear of the barrel cyl-

inder bore 43 form the shear plane of the lock. There are two diametrically opposite radially drilled and tapped holes near the rear or inner end of the tumbler cylinder 42. These holes are to receive the guide ring indexing screws. (These holes in the tumbler barrel 11 are not shown in any of the figures, but are identical to and located in the same axial plane, when the lock 1 and the key 2 are in operating position, as the holes for the guide ring 21 and indexing screws 26 of the key body 20, shown in FIGURE 8.) In the "six pin" version, these screw holes are in an axial plane midway between the planes of the upper vertically located bore and one of the adjacent barrel tumbler bores 47. In the "eight pin" version, these guide ring indexing screw holes are in an axial plane at right angles to that of the key tang guide slots 49.

The various cylindrical body tumbler pins 13 which fit in the body tumbler bores 46 are of different lengths. The cylindrical barrel tumbler pins 12 have the same diameter at their rear sections as do the body tumbler pins 13. The barrel tumbler pins 12 fit in the barrel tumbler bores. The forward end of the barrel tumbler pins 12 are of smaller diameter than that of the rear section and fit into the barrel tumbler outer bores 48. The shoulder between the inner bores 47 and outer bores 48 and that on the barrel tumbler pins 12 retain the tumbler pins in the bores when the lock is asembled. The lengths of the rear sections of the barrel tumbler pins 12 vary inversely as the length of the mating body tumbler pins 13. The length of the reduced diameter section of the barrel tumbler pins 12 is the same for all pins. Consequently, the combined length of each pair of mated barrel tumbler pins 12 and body tumbler pins 13 is the same. This prevents probing of the tumbler from disclosing any information on pin lengths or combinations when the mated pins are aligned. Identical tumbler springs 14 are used to force the tumbler pins 12 and 13 towards the forward face of the tumbler barrel 11. In the "six pin" version, a duplicate set of body tumbler pins 13 and tumbler springs 14 are installed in alternate body tumbler bores 46 in the same sequence and permutation as are the original set of body tumbler pins 13; however, the pins in the duplicate set are displaced 90° from the original pins in the direction that the tumbler barrel 11 is turned when opening the lock. The barrel in the exemplary embodiment turns through 90° to unlock. The duplicate set of body tumbler pins 13 becomes a mated set with the barrel tumbler pins 12 when the tumbler barrel has been turned to the "open" lock position. If the key 2 is removed from the lock 1 in this position, the combination of the lock has the same amount of protection when probed, as in the "closed" lock position. This is true because in this "open" lock position, the tumbler barrel 11 is anchored to the lock body 10 by the duplicate set of body tumbler pins 13 when the key 2 is removed from the lock 1. The duplicate bores and pins in the body are aligned with the bores and pins in the barrel, so the geometrical pattern is the same as in the locked position of the lock. In the "eight pin" version, having an even (4 or 8) number of pairs of tumbler pins 12 and 13, it is also possible to lock the tumbler barrel 11 in the lock body 10 when the key 2 is removed from the lock 1 in the "open lock" position. However, this will result in unmatched pairs of tumbler pins 12 and 13 in the bores and probing of the tumbler pins will reveal differences in the lengths of the various pin pairs. The maximum number of mated pairs of body tumbler pins and barrel tumbler pins 12 are required in the "eight pin" version of the lock. If the same number of mated tumbler pins are supplied with the "six pin" version, the number of possible pin permutations is greatly increased.

The outside diameter of the tumbler barrel cylinder 42 is smaller than the inside diameter of the barrel cylinder counterbore 43. A barrel guide ring 15 fits over the periphery of the tumbler 11. Two guide ring indexing screws extend into the guide ring indexing screw holes in the guide ring 15 and impart the rotation of the tumbler barrel 11 to the guide ring 15. The relative angular position of the guide ring 15 on the tumbler barrel 11 is determined by the pair of diametrically opposite screw holes of the series of equiangularly spaced guide ring indexing screw holes in the ring 15, lined up with the guide ring indexing screws. The arrangement of screws and screw holes is the same as that shown at 26 and 68 in FIGURE 8 showing the securement of ring 21 in the key 2. The outer or forward edge of the barrel guide ring 15 can be of any one of an almost infinite number of different configurations or contours and is not restricted to the configuration shown in the drawings. The contour of the forward edge of the barrel guide ring 15 must be the reverse of that of the key guide ring 21, so that when the two rings are properly lined up angularly, these two guide rings 15 and 21 can intermesh forming a continuous cylinder. When in this intermeshed position the tumbler plungers 23 of the key 2 have entered the barrel tumbler outer bores 46 and pushed in the tumbler pins 12 and 13. If a key guide ring 21 of different edge contour is used or if the angular positions of the two guide rings are not aligned, the key cannot seat in the lock, and it will be impossible to open the lock. By varying the contours and dimensions of the mating edges of the guide rings and the relative angular locations of the guide ring indexing screw holes 68, it is possible to provide a myriad number of "individualized" locks and keys.

The latch bar 19 rotates about the axis of the lock 1 on the rear smaller diameter section of the lock body 10. The design of the latch bar 19 is determined by the latching provisions of the cabinet, etc. upon which the lock is installed. It is rotated by the tumbler barrel 11 through the use of the dog 18. A slot or holes in the latch bar 19 receives the tang of the dog 18, as shown. Washers 31 may be used on one or both sides of the latch bar 19. They act as spacers to locate the longitudinal position of the latch bar 19 and to act as chafing members between the latch bar 19 and the limiting plate 17.

The limiting plate 17 fits over the milled section at the rear of the larger cylindrical section of the lock body 10 and seats against the shoulder formed by the forward ends of the milled limiting plate positioning flats 52. See FIGS. 5 and 14. The tang of the dog 18 impinges on the dog stops 69 limiting the rotation of the dog 18 and the latch bar 19.

The dog 18 is a piece of metal bent through 90°. The horizontal tang is narrower than the vertical arm. The tang fits through the slot or hole in the latch bar 19 and extends beyond the limiting plate 17. The vertical arm has a hole punched through it which fits over the milled end of the tumbler barrel shaft 44.

The spring fastener 32 which fits into the spring fastener groove 50 on the lock body 10, holds the latch bar 19, washers 31 and the limiting plate 17 in place.

The spring fastener 33 which fits into the spring fastener groove 51 on the rear end of the tumbler shaft 44, holds the tumbler barrel 11 in the lock body 10.

The nut 34 which screws on the threads 41 at the end of the tumbler barrel shaft 44, holds the dog 18 on the tumbler barrer shaft 44.

The key body 20 contains the same number of plunger bores 60 as there are barrel tumbler outer bores 48 in the tumbler barrel cylinder 42. The centers of the plunger bores 60 are normally aligned with those of the barrel tumbler outer bores 48. There are two diametrically opposite key guide tang slots 62 milled in the periphery of the key body 20. These slots 62 are angular located so that they are aligned with those in the tumbler barrel cylinder 42 when the key body 20 is face to face with the tumbler barrel cylinder 42. There is a third key guide tang slot 62 milled across the rear face of the key body 20 and interconnecting the side key guide tang slots 62. A circumferential key body locking ring groove 66 is turned in the periphery of the key body 20 near the outside face of the key body 20. This groove 66 is deeper than the outside

walls of the plunger bores **60**. There are two radially drilled holes for the guide ring indexing screws **26** located near the rear face of the key body **20**. These holes are on the same axial plane as those in the tumbler barrel cylinder **42**, when the key body **20** and the tumbler barrel are face to face in the proper alignment. There is a drilled and tapped hole **65** on the axis of the key body **20**. The outside diameter of the key body **20** is the same as that of the tumbler barrel cylinder **42**.

The key guide ring **21** is similar in design to the tumbler barrel guide ring **15**, except that the contour of the outer edge of the ring must be the reverse of that of the tumbler barrel guide ring **15**. When these edges are intermeshed, the guide ring indexing screw holes **68** in both rings lie on the same axial planes. The angular position of the key guide ring **21** on the key body is determined by the same means as that of the tumbler barrel guide ring **15** on the tumbler barrel cylinder **42**.

The tumbler plungers **23** fit into the plunger bores **60** of the key body **20**. Each tumbler plunger **23** has a plunger locking ring groove **61** turned in its cylindrical surface. The longitudinal location of this groove **61** and its depth are such that when the tumbler plungers **23** are installed in the plunger bores **60**, the plunger locking ring grooves **61** coincide with the key body locking ring groove **66**. A smaller diameter portion of the tumbler plungers **23** extends outside the key body **20**. These extensions are of the same diameter as the smaller diameter of the barrel tumbler pins **12**. The length of these extensions are different for each pair of mated tumbled plungers **23** and barrel tumbler pins **12**, however, the combined lengths of the exposed part of the tubular pin **23** plus the overall length of the barrel tumbler pin **12** of each such mated pairs are identical and equal to the length between the face of the tumbler barrel cylinder **42** and its shear plane. The same number of different tumbler plungers are provided with each key as the number of different barrel tumbler pins **12** furnished with the lock **1**.

Two L-shaped magnetized metal key guide tangs **22** are contained in the key body slots **62**. A guide tang locking ring slot **67** is milled in the outer face of the key guide tang **22**. This locking ring slot **67** is so located and of such dimensions that it conicides with the key body locking ring groove **66** of the key body **20**. The plunger locking ring **24**, therefore, also locks the key guide tangs **22** into the key body **20**. The L-shaped rear section of the key guide tang **22** is deeper than the key tang slot **62** in the rear face of the key body **20**, therefore, the key guide tangs **22** extend past the inside face of the key body **20** and into the key handle tang slots **63** in the key handle **25**. This aligns the key body **20**, the key guide ring **21**, the key guide tangs **22** and the tumbler plungers **23** in the key handle **25**. This construction also transmits the turning torque from the key handle **25** to the parts of the key **2** in engagement with the lock **1**. The magnetized key guide tangs **22** are attracted to the magnetic permeable material of the tumbler barrel **11** and, therefore, holds the key **2** to the tumbler **11** when the key **2** is inserted in the lock **1**. However, this magnetic force does not prevent removal of the key **2** when desired whether the lock is in the "open" or "closed" positions. The key guide tangs **22** also act as guides when inserting the key **2** in the lock **1**, by entering the key guide tang slots **49** of the barrel tumbler cylinder **42**. The key guide tangs **22** also help to transmit the turning torque of the key **2** to the tumbler barrel **11**, thereby reducing the loads on the tumbler plungers **23**.

The plastic key handle **25** is essentially a cylindrical body. It has an internal bore at the hand grip end for installing the screw **35** used to assemble the component parts of the key **2**. The key handle **25** has two external wings to assist in gripping and turning the key **2**. There is a large diameter cylindrical cavity at the key body end of the key handle **25**. This cavity houses the key body **20** and its associated parts when the key is assembled. There are diametral key handle tang slots **63** molded into the inner face of the key body cavity. One of these slots **63** is so located that when used with the "six pin" version key body **20**, the wings of the key handle **25** will be vertical when the key guide tangs **22** are inserted in the key guide tang slots **49** of the tumbler barrel **11** in the "closed" lock position. The other key handle tang slot **63** is so located in the key handle **25** that it serves the same purpose for an "eight pin" version key body **20**. There is a short screw bore **64** connecting the handle bore and the key body cavity of the key handle **25**.

The plunger locking ring **24** is a piece of non-magnetic spring wire of slightly smaller diameter than the width of the key body locking ring groove **66**. It is formed into a circle with a diameter slightly smaller than that of the inside diameter of the key body locking ring groove **66**. It locks the tumbler plungers **23** and the key guide **22** tangs in the key body **20** when it is located in the key body locking ring groove **66**.

There are two guide ring indexing screws **26** to locate the angular position of the key guide ring **21** on the key body **20**. The design and function of these guide ring locking screws **26** which are identical with those used with the tumbler barrel cylinder **42** and the barrel guide ring **15**, have been described in preceding paragraphs.

The weather cap **7** is a plastic cover molded to the external exposed contours of the lock **1**. It can be attached to the lock **1** by the insertion of the weather cap tangs **72** into the key guide tang slots **49** of the tumbler barrel cylinder **42** and by the insertion of the weather cap ring **71** into the annular space between the forward part of the tumbler barrel cylinder **42** and the lock body **10**. It is held in place by the friction between the mating parts of the lock **1** and the weather cap **7**. It is designed to prevent the entry of freezing rain, snow and dirt into exposed openings in the lock. See FIGURES 13 and 14.

From the foregoing those skilled in the art will observe that the invention achieves all of the objects and advantages as set forth in the foregoing, as well as having many additional advantages that are apparent from the detailed description. Each key is individualized to each individual lock and it can be removed with the lock either in locked or unlocked position. The security offered by the lock, that is its lack of susceptibility to probing or picking, is the same in the unlocked position of the lock as it is in the locked position. The lock provides other detailed improved constructions described herein.

The foregoing is believed to clearly describe the invention, its operation and advantages. While I have shown a particular construction for the lock and key, I do not wish to be limited to the specific designs shown, it being understood that details and shapes may be altered and changed within the scope of the appended claims.

What is claimed is:

1. In a pin tumbler lock of the type having a cylindrical body, a coaxial cylindrical barrel having an enlarged end part rotatable within bores in the body, said barrel having a plurality of equally angularly spaced axial bores formed therein comunicating with the forward face of the barrel, the said body having a plurality of circularly arranged, angularly spaced axial bores alignable with corresponding bores in the barrel, pairs of pin tumblers in the alignable bores in the body and in the barrel, spring means in each bore of the body urging a pair of tumblers outwardly; the improvements comprising, the said body having a counterbore at the end of larger diameter than the enlarged end part of said barrel leaving an annular space between the inner walls of the counterbore and the outside of said enlarged end part of the barrel, a key for said lock, said key having plungers configurated to engage and depress said pin tumblers and having an extending skirt configurated to fit into the said annular space in the lock, said skirt having an outer edge portion extending longitudinally further than another outer edge portion, the interior of the annular space being configurated to

match said outer edge portions of said skirt so that the key can be operably inserted in only one position.

2. A lock structure as in claim 1 wherein said barrel has a pair of axially extending, peripheral slots angularly spaced from each other, said key having a pair of axially extending tangs configurated to fit into said axial slots in said barrel.

3. A lock structure as in claim 2 wherein said barrel is made of magnetically permeable material and said tangs are magnetized.

4. In a pin tumbler lock of the type having a cylindrical body, a coaxial cylindrical barrel having an enlarged end part rotatable within bores in the body, said barrel having a plurality of equally angularly spaced axial bores formed therein communicating with the forward face of the barrel, the said body having a plurality of circularly arranged, angularly spaced axial bores alignable with corresponding bores in the barrel, pairs of pin tumblers in the alignable bores in the body and in the barrel, spring means in each bore of the body urging a pair of tumblers outwardly; the improvements comprising, the said body having a counterbore at the end of large diameter than the enlarged end part of said barrel leaving an annular space between the inner walls of the counterbore and the outside of said enlarged end part of the barrel, a key for said lock, said key having plungers configurated to engage and depress said pin tumblers and having an extending skirt configurated to fit into the said annular space in the lock, a guide ring member fitting inthe bottom of said annular space in the lock, the outer edge of said guide ring having an irregular contour, the outer edge of said extending skirt on the key having a reverse matching contour adapted to mate with the contoured edge of the guide ring, whereby the key can operate only in a single position.

5. A lock structure as in claim 4 wherein said barrel has a pair of axially extending, peripheral slots angularly spaced from each other, said key having a pair of axially extending tangs configurated to fit into said axial slots in said barrel.

6. A structure as in claim 5 wherein said extending tangs comprise flat members lying in radial planes on the inside of said extending skirt member.

7. In a tumbler lock of the type having a cylindrical body, a cylindrical barrel having an enlarged forward end of larger diameter, said body having a coaxial bore and counterbore having sizes to rotatably receive therein the said barrel including the enlarged end part thereof, said barrel having circularly arranged angularly spaced axial

bores therein communicating with the forward face of the barrel, the said body having a plurality of circularly arranged angularly spaced axial bores therein positioned to be alignable with corresponding bores in the barrel, and there being twice as many bores in the body as in the barrel, a pair of pin tumblers positioned in alternate bores of said body aligned with the said bores in the barrel, the pin tumblers in the body and in the barrel being of varying axial lengths, the remaining bores in the said body having a set of pin tumblers therein corresponding to those in the said alternate bores varying in length in the same sequence, each of said corresponding pin tumblers in the body being angularly spaced from its duplicate pin tumbler in the body in the direction that the barrel is turned for opening the lock by an angular amount equal to the unlocking and locking movement of the barrel, spring means in each bore of the body urging the pin tumblers in the body outwardly, whereby when the lock is in unlocked position and the key is removed, the tumblers in the remaining bores of the body match up with the tumblers in the barrel so that the configuration of tumblers as between the body and the barrel is the same as when the lock is in locked position and the protection against picking is the same.

8. A construction as in claim 7 wherein the body has six alternate bores and six bores uniformly spaced between the alternate bores.

9. The structure as in claim 8 including a locking member movable by the barrel for locking through an angle of 90°, being equal to the spacing between duplicate pin tumblers in the body.

10. A construction as in claim 7 wherein said barrel has a pair of diametrically opposed slots and the said key has a pair of diametrically opposed tangs configurated to fit into the slots in the barrel.

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