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3,455,128

TUMBLER CONSTRUCTION AND LOCK USING THE SAME

Filed Jan. 3, 1966

2 Sheets-Sheet 1

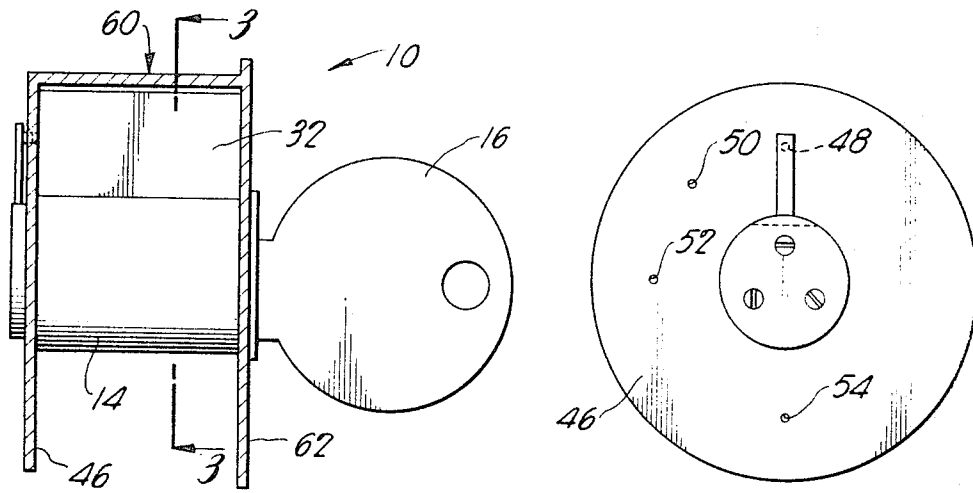


FIG. 1

FIG. 2

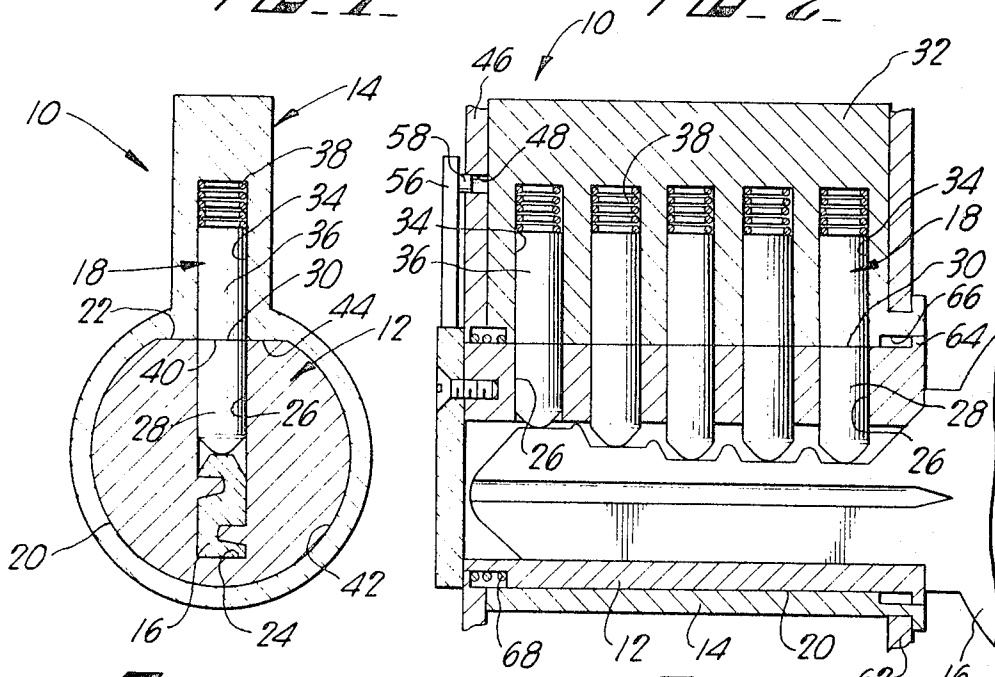


FIG. 3

FIG. 4

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2 Sheets-Sheet 2

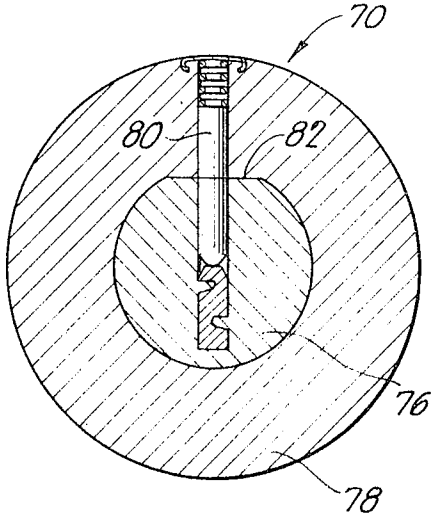


FIG. 5

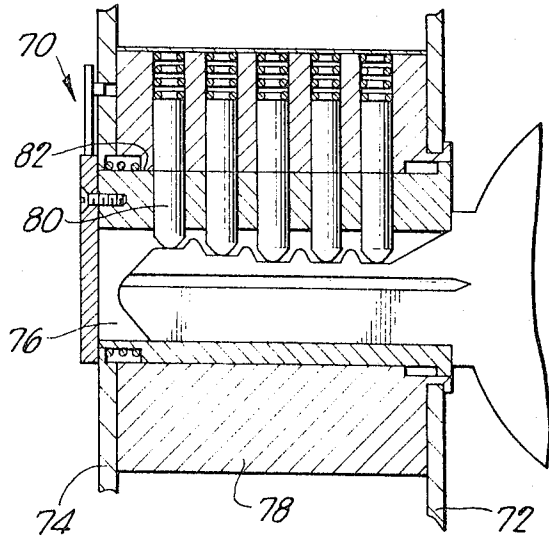


FIG. 6

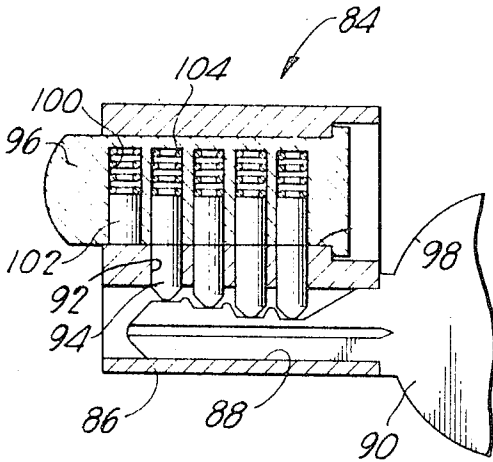


FIG. 7

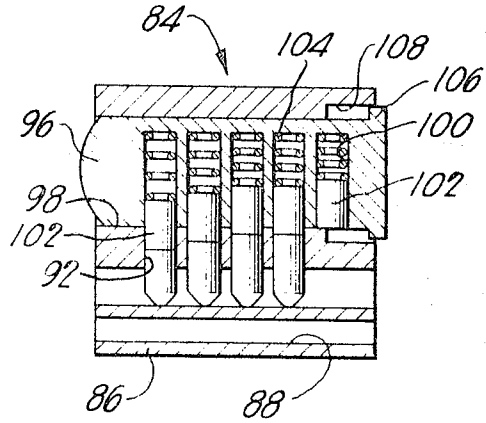


FIG. 8

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**TUMBLER CONSTRUCTION AND LOCK USING THE SAME**

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 U.S. Cl. 70-361

8 Claims

**ABSTRACT OF THE DISCLOSURE**

A tumbler construction and lock using the same comprising a lock housing having a bore therein and a lock barrel positioned within the bore. The bore and the barrel have mating planar surfaces which prevent rotation of the barrel within the housing. A plurality of tumbler bores are positioned in the barrel and the housing. A tumbler is positioned in each of the tumbler bores. Each of the tumblers in the housing and each of the tumblers in the barrel have ends which comprise planar surfaces which are positioned coplanar with the planar surfaces of the barrel and the housing when the lock is in an unlocked condition. In the unlocked condition the barrel is axially movable within the housing to release the entire barrel-housing structure so that it may be rotated within a supporting frame.

This invention is directed to a tumbler construction for locks, and particularly to a tumbler construction which provides greater safety and more sensitivity to tumbler type locks, and is directed to a lock employing this tumbler construction.

Key operated locks with radial tumblers are well known. Such locks have a key slot and the upper side of the key is provided with lands of various heights which are related to the length of the tumbler in the lock barrel. When a key is inserted, these tumblers substantially align with the outer surface of the barrel, and thrust associated tumblers in the adjacent housing to a position where their ends substantially lie in line with the outer surface of the barrel. These prior locks have been arranged so that when the tumblers are aligned, the barrel is rotatable within the housing. Such rotation necessitates forming the tumblers so that they are chamfered or rounded at the moving joint between the barrel and the housing. Such chamfering or rounding reduces the sensitivity of the lock, for keys having slight variations in them will still cause adequate alignment for barrel rotation. Thus, such locks are not fully secure.

Accordingly, it is an object of this invention to provide a tumbler construction having a planar end positioned at right angles to the axis of the tumbler so that a sharp dividing point between the barrel in which the tumbler is mounted and the housing is delineated to thus produce a lock which is highly sensitive to key configuration and which renders the lock more difficult to actuate by other means.

It is a further object of this invention to provide a lock structure which employs such tumblers, which lock structure includes a tumbler carrying barrel which is axially movable with respect to the housing as compared to the rotatability of the barrel in conventional tumbler locks.

It is still a further object of this invention to provide an improved lock tumbler, and a lock barrel and housing

structure for use with the tumbler which provides the accurate key control and which eliminates operation by key which is not of the correct configuration.

Other objects and advantages of this invention will become apparent from a study of the following portion of this specification, the claims, and the attached drawings in which:

FIG. 1 is a side elevational view of a lock and key in accordance with this invention;

FIG. 2 is a rear end elevational view thereof;

FIG. 3 is an enlarged section taken generally along the line 3-3 of FIG. 1.

FIG. 4 is an enlarged longitudinal elevational section taken through the lock of FIG. 1;

FIG. 5 is a transverse section through another embodiment of the lock illustrating the principle of this invention;

FIG. 6 is a longitudinal section through the lock of FIG. 5;

FIG. 7 is a longitudinal section through a further embodiment of the lock of this invention, showing the lock in a first position; and

FIG. 8 is a section similar to FIG. 7, showing the lock in a second position.

As an aid to understanding this invention, it can be stated in essentially summary form that it is directed to a tumbler construction and lock embodying the tumbler construction. The tumblers are moved toward the unlocking position by means of a key and moved toward the locking position by means of a spring. This motion determines the axial position of each tumbler. A barrel is movable within a housing, with tumblers in each portion. The tumblers are divided into barrel sections and housing sections. The inter-face between the sections of the tumblers, which inter-face must separate for unlocking, is planar on each of the tumblers. The planes of these interfaces are at right angles to the axial dimension of the tumblers. In view of the fact that such planar faces are not compatible with an external surface of the tumbler barrel of cylindrical configuration so that the barrel may rotate in the housing, the barrel is restrained from such rotation and is permitted to move axially when the tumbler inter-faces are aligned with the inter-face between the barrel and the housing. In another embodiment, these key operated tumblers are in the relatively stationary portion of the lock while the spring return tumblers are in the moving portion of the lock. In this embodiment, an extra tumbler in the moving portion permits the lock to be locked in either of two positions.

This invention will be understood in greater detail by reference to the following portion of the specification. Referring now to the drawings and, more particularly, to FIGS. 1 through 4 thereof, the preferred embodiment of the tumbler construction and the lock embodying the tumbler construction is identified at 10. The lock 10 comprises barrel 12, housing 14, key 16 and tumblers 18.

Barrel 12 is cylindrical throughout most of its exterior surface 20 and has a planar exterior surface 22 on one side. Housing 14 has similar surfaces so that barrel 12, in the absence of any other restraint, is axially movable in but non-rotatable with respect to housing 14. Barrel 12 has key slot 24 therein, which key slot is of conventional irregular configuration so as to accept a key only having the proper milled longitudinal grooves therein.

A plurality of tumbler bores 26 are positioned in barrel 12. The tumbler bores 26 are preferably cylindrical and

extend downward at right angles to planar surface 22 to intersect with key slot 24. The tumbler bores 26 are positioned in such a manner that tumblers 28, positioned within bores 26, enter into the key slot to be actuated by the various lands on key 16. The barrel tumblers 28 are of such length that when they rest with their bottom ends upon the lands of an appropriately shaped key, their top ends 30 lie very close to being co-planar with the planar surface 22. Preferably, the ends 30 are exactly co-planar with respect to planar surface 22, but a few thousandths of an inch variation is permissible. It is critical in this invention that the top ends 30 lie very close to being co-planar with respect to planar surface 22.

Housing 14 has a tumbler receiving extension 32 which has housing tumbler bores 34 therein. The number of tumbler bores 34, in the embodiments of FIGS. 1 through 6, is equal in number to the tumbler bores 26. Furthermore, the bores are aligned so that they may be virtually exactly positioned in line with each other when the barrel 12 is in the locked position with respect to housing 14. Housing tumblers 36 are positioned within the tumbler bores 34. Springs 38 are positioned in the blind upper end of bores 34 above tumblers 36 so as to urge the tumblers downwardly as is shown in these figures. Tumblers 36 have a substantially planar lower end 40 which is adapted to be forced by springs 38 in contact with top ends 30. It is thus seen that when the bores 26 and 34 are aligned and the key 16 is withdrawn, spring 38 moves both sets of tumblers downward. In such position, the tumblers 36 lie across the dividing line defined by planar surface 22 so that barrel 12 cannot be moved with respect to housing 14. Furthermore, since the surfaces 30 and 40 are planar, the tumblers must be moved exactly to the planar surface 22 before the barrel 12 can be moved with respect to housing 14.

The tumblers 28 and 36 are preferably of cylindrical configuration and their mating ends are planar in a direction at right angles to the direction of motion, and in the cylindrical configuration this direction of motion is axial. There is no chamfering or rounding of the mating tumbler ends, which chamfering or rounding is necessary in locks where the barrel rotates with respect to the housing. Such chamfering or rounding causes lack of precise definition for each tumbler at the point where it will permit movement. However, in the case of the present tumblers, they must be moved exactly to position to permit motion.

Barrel 12 is axially movable within housing 14. Housing 14 has a bore 42 in which the barrel 12 is fitted. The upper side of bore 42 has a planar surface 44 which corresponds to surface 22 and lies closely thereagainst. These planar surfaces, which are chords, prevent rotation of barrel 12 within housing 14. Housing 14 is carried by lock plate 46 which has dock holes 48, 50, 52 and 54. Furthermore, barrel 12 carries lock arm 56 which is secured thereto so as to move therewith. Lock arm 56 carries lock plunger 58 which is engagable in any one of the lock holes 48, 50, 52 or 54 in lock plate 46.

Lock plate 46 is a part of a frame 60 which includes a front plate 62 in addition to the lock plate 46. Frame 60 is securable in one of the members to be locked with respect to each other. Housing 14 is rotatably mounted in frame 60, but is restrained by engagement of lock plunger 58 in one of the holes in the lock plate. Furthermore, barrel 12 is axially movable with respect to housing 14. Lip 64 in recess 66 permits such leftward motion of barrel 12, as is seen in FIG. 4. Furthermore, this lip-recess combination prevents a thin shim from being inserted between surfaces 22 and 44 to prevent tampering with the tumblers. Spring 68 is a compression spring acting to urge barrel 12 to the right, to the position shown. In this position the entire structure is locked. Upon insertion of the key to line up the tumblers as shown, the entire barrel 12 can be pressed to the left, which is the natural direction upon key insertion. When it is moved to the left, lock plunger 58 moves out of the lock hole 48 so that

the entire barrel 12-housing 14 structure can be rotated within frame 60. When it is rotated, structure coupled to the rotating structure causes the latching or unlatching action. When the lock plunger 58 is in line with any of the lock holes 48, 50, 52 or 54, the barrel 12 is moved to the right by means of spring 68 and the key can be withdrawn. The key cannot be withdrawn unless the lock plunger 58 is in one of the lock holes, for otherwise the barrel 12 cannot move to the right to realign the tumbler bores.

Lock 70, shown in FIGS. 5 and 6, another embodiment of the lock of this invention employing the tumbler construction of this invention, is quite similar to lock 10. It illustrates the principles of the invention. Lock 70 includes frame 72 which has a lock plate 74 having one or more lock holes therein. Barrel 76 and housing 78 are non-rotatable with respect to each other but are rotatable within frame 72. In fact, the entire structure is virtually identical except for the fact that housing 78 has a cylindrical exterior, rather than the cylindrical housing 14 with extension 32 of the embodiment of FIGS. 1 through 4. Again, barrel 76 is axially slidable in housing 78 when tumblers 80 have their ends aligned at planar inter-face 82 between the barrel and housing. Again, the tumblers 80 are preferably cylindrical in form and have co-joining ends which are planar, without chamfers or rounding and at right angles to the axis which is at right angles to the inter-face 82. By this tumbler construction, the tumblers must be moved to a position with their co-joining faces exactly upon the planar inter-face line to permit relative motion between the barrel 76 and housing 78. Thus, lock 70 has the same components as lock 10, with a different configuration of the housing. Such cylindrical configuration is desirable for it is seen that rotation of the housing is the act which unlatches the structure attached to lock 70. With a cylindrical external configuration, less torque can be applied thereto in a tampering effort on the lock 70.

The third embodiment of the lock is shown in FIGS. 7 and 8 and is identified as lock 84. The lock 84 comprises a housing 86 which is fixed to one of the elements which is intended to be locked with respect to another. Housing 86 contains key slot 88 into which key 90 is adapted to be inserted. Housing 86 contains tumbler bores 92 in which housing tumblers 94 are placed. In the illustrated configuration, there are four tumbler bores 92 with a housing tumbler 94 in each bore.

Lock plunger 96 is of preferably cylindrical configuration except for a planar inter-face 98 at the surface at which bores 92 intersect. Lock plunger 96 has a plurality of tumbler bores 100 therein. In the illustrated embodiment there are five tumbler bores 100 therein. In more general terms, there are more tumbler bores 100 than there are tumbler bores 92. While one more tumbler bore 100 is illustrated, it is practical in specialized circumstances to have two or even more tumbler bores 100 than tumbler bores 92. A plunger tumbler 102 is positioned in each of the bores 100. Compression spring 104 is positioned in the bottom of each tumbler bore 100 so as to urge the tumbler 102 downward, as is shown in the figures.

The tumblers 94 and 102, similar to the earlier tumblers, are preferably cylindrical and have a planar co-joining face which is at right angles to the cylindrical axis. There is no chamfering or rounding of the co-joined tumbler ends. Thus, the key 90 must precisely move the tumblers to the position wherein their co-joined interface is exactly in line with planar inter-face 98 in order for plunger 96 to be moved with respect to barrel 86. When the tumblers are so aligned, the plunger 96 is movable with the inter-face 98 in sliding relationship. It is movable to the leftward position illustrated in FIG. 7 wherein the nose of the plunger 96 may enter into a hole in associated member to thus lock the associated member with respect to the one in which housing 86 is secured.

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The key 90 may be removed in this position so that the four rightmost tumblers 102 move across the planar inter-face 98 to lock plunger 96 in its position. Furthermore, as is illustrated in FIG. 8, plunger 96 may be secured in the unlocked, rightward position. In this position, the four leftmost tumblers 102 lie across the inter-face 98. As is illustrated in the previous lock, lip 106 acting in conjunction with recess 108 prevents access to the planar inter-face 98 to prevent thin material from being inserted therein to tamper with tumbler operation. Furthermore, if desired, a spring may be located with respect to plunger 96 to move it to the position shown in FIG. 8 while a stop may be conventionally located to prohibit further rightward motion.

While the dictionary definition of "lock" means the physical securement of two mechanical members, it is clear that in modern technology it also includes the control of various elements such as electric switches. Thus, the term lock as used here means the ability to prevent actuation or a mechanical, electrical, or other kind of signal or device, or to prevent the cessation of its actuation. It is believed that the term "lock" has developed a much more broad meaning in present day usage in today's world, and thus it is specified that the term with respect to this invention shall not merely be limited to the mere mechanical securement of two members with respect to each other but to the broader generic term as used today.

This invention having been described in its preferred embodiments, it is clear that it is susceptible to numerous modifications and embodiments within the ability of those skilled in the art without the exercise of the inventive faculty.

I claim:

1. A lock comprising, in combination:

- a lock barrel and a lock housing lockable with respect to each other, said lock barrel being mounted within said lock housing, said lock housing being rotatably mounted within a frame, said lock barrel having a planar surface along one side thereof, said lock barrel further having a key slot therein adapted to accept a key, said lock housing having a planar surface, said planar surface of said lock housing being in contact with said planar surface of said lock barrel to define means to rotate said lock housing with said lock barrel relative to said frame;
- a plurality of tumbler bores in said lock barrel, said tumbler bores intersecting said key slot;
- a plurality of first tumblers, one of said first tumblers being positioned in each of said tumbler bores in said lock barrel, one end of each of said first tumblers being rounded and adapted to be contacted by said key, the other end of each of said first tumblers comprising a planar surface, said first tumblers having lengths such that said planar ends thereof are positioned coplanar with said planar surfaces of said lock barrel and said lock housing when said lock is in an unlocked condition by insertion of a proper key in said key slot;
- a plurality of tumbler bores in said lock housing; and
- a plurality of second tumblers, one of said second tumblers being positioned in each of said tumbler bores in said lock housing, one end of each of said second tumblers comprising a planar surface adapted to be in substantially planar contact with said planar ends of said first tumblers, said second tumblers being positioned so that said planar ends thereof are positioned coplanar with said planar surfaces of said lock barrel and said lock housing when said lock is in said unlocked condition, said lock barrel being axially movable with respect to said lock housing when said lock is in said unlocked condition.

2. The lock of claim 1 wherein each of said first and second tumblers has an axis, and wherein said planar ends of said first and second tumblers are positioned at right angles to the axis thereof, and wherein said planar surfaces of said lock barrel and said lock housing are

slideable with respect to each other from a locked to an unlocked position.

3. The lock of claim 2 further comprising:

- an arm attached to said lock barrel and extending therefrom in a direction which is at right angles to the direction of slideable motion between said lock barrel and said lock housing;
- a plunger connected to said arm at right angles thereto; and
- at least one lock hole in said frame, said plunger adapted to be positionable within said lock hole to prevent rotation of said lock barrel and said lock housing with respect to said frame when said lock is in said locked condition, said barrel being slideable with respect to said housing to remove said plunger from said lock hole when said planar ends of said first and second tumblers are coplanar with said planar surfaces of said lock barrel and said lock housing.

4. The lock of claim 3 further comprising:

- a spring mounted to urge said lock barrel with respect to said lock housing to a position wherein said tumbler bores in said lock barrel are aligned with said tumbler bores in said lock housing.

5. The lock of claim 3 wherein said frame includes a plurality of lock holes, said plunger adapted to be positionable within any of said lock holes to prevent rotation of said lock barrel and said lock housing with respect to said frame from any of a plurality of locked position corresponding to the locations of said lock holes.

6. A lock comprising, in combination:

- a housing and a plunger, said plunger being mounted within said housing, said housing being rotatably mounted within a frame, said housing having a key slot therein adapted to receive a key, said housing further having a planar surface along one side thereof, said plunger having a planar surface along one side thereof, the planar surfaces of said housing and said plunger being in contact with each other to define means to rotate said housing with said plunger relative to said frame;
- a plurality of tumbler bores in said housing, said tumbler bores intersecting said key slot, said tumbler bores intersecting said planar surface of said housing;
- a plurality of first tumblers, one of said first tumblers being positioned in each of said tumbler bores in said housing, one end of each of said first tumblers adapted to be contacted by said key, the other end of each of said first tumblers comprising a planar surface, said first tumblers having lengths such that said planar ends thereof lie coplanar with said planar surfaces of said housing and said plunger when a proper key is positioned in said key slot;
- a plurality of tumbler bores in said plunger, said tumbler bores intersecting said planar surface of said plunger, said tumbler bores in said plunger being alignable with said tumbler bores in said lock housing; and
- a plurality of second tumblers, one of said second tumblers being positioned in each of said tumbler bores in said plunger, one end of each of said second tumblers comprising a planar surface adapted to be in substantially planar contact with said planar ends of said first tumblers so that in the absence of a proper key in said key slot said tumblers in said plunger are positioned across said planar surfaces of said housing and said plunger so as to prevent motion of said plunger with respect to said housing along said planar surface.

7. The lock of claim 6 wherein said plunger is slideable with respect to said housing along said planar surfaces when said planar ends of said first and second tumblers are coplanar with said planar surfaces and wherein there are more tumbler bores and second tumblers in said plunger than there are tumbler bores and first tumblers

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in said housing so that said plunger may be locked in more than one position.

8. The lock of claim 6 wherein each of said first and second tumblers and said tumbler bores have an axis and wherein said planar ends of said first and second tumblers are at right angles to said axis.

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