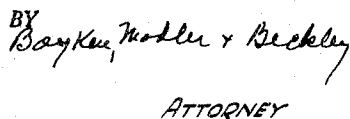


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CYLINDER LOCK

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My invention relates to locks and particularly to locks of the type in which a cylinder body contains a cylinder plug rotatable therein when a plurality of tumblers contained in passages and recesses in the plug and body are in appropriate shearing alignment. The tumblers are put into aligned position by a notched key insertable into a keyhole communicating with the passages in the cylinder plug, the key being rotatable with the plug. In a commercial lock there may be a number of notches on the key and the notches may be of various depths but because of physical limitations, such as manufacturing and wear tolerances and strength requirements among other considerations, it is not possible by any practical means to get the maximum theoretical number of different combinations to operate well in practice. This becomes important in lock installations wherein it is desired to have a master key or master keys for a large number of locks. While it is theoretically possible to combine an extraordinarily large number of locks for control by a single master key, it is practically not possible to do so even by extraordinarily fine design and manufacture.

It is therefore an object of my invention to provide a lock cylinder affording a larger number of effective combinations than usual without drastically modifying a standard lock cylinder.

Another object of my invention is to provide a lock cylinder which for the most part is interchangeable with a standard lock cylinder, for example of the type shown in Schlage Patent No. 2,293,856.

A still further object of my invention is to provide a lock cylinder having an additional variable factor for increasing substantially the number of combinations possible.

A still further object of my invention is to provide an improved pin tumbler lock cylinder.

Other objects, together with the foregoing, are attained in the embodiment of the invention described in the accompanying description and illustrated in the accompanying drawings in which

Fig. 1 is a cross section through a lock cylinder constructed in accordance with my invention and showing a key in position therein.

Fig. 2 is a view comparable to Fig. 1 but with the key withdrawn from the mechanism.

Fig. 3 is a cross section, the plane of which is indicated by the line 3—3 of Fig. 1.

Fig. 4 is an interior end elevation of the lock cylinder structure, a portion of the device being broken away to reduce the size of the figure.

Fig. 5 is a fragmentary detail in cross section, the plane of section being indicated by the line 5—5 of Fig. 4.

Fig. 6 is a cross section similar to Fig. 3, but showing an ineffective key in the lock.

Fig. 7 is a view similar to Fig. 3, but showing a key and cylinder plug partly rotated.

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Fig. 8 is a bottom elevation of a modified form of lock cylinder constructed in accordance with my invention, certain parts being omitted.

Fig. 9 is a cross section, the plane of which is indicated by the line 9—9 of Fig. 8.

Fig. 10 is a view similar to Fig. 6, but showing a modified form of device.

Fig. 11 is a cross section comparable to Fig. 6, but showing a further modified form of lock cylinder construction.

Fig. 12 is a view comparable to Fig. 6, but showing a still further modified form of lock cylinder construction.

Fig. 13 is a view comparable to Fig. 6, but showing an additional modified form of lock cylinder.

In the preferred form of construction, successfully applied in practice, there is provided a cylinder body 6 usually fabricated of metal and having one portion 7, substantially circular cylindrical in external cross section and having another extended portion 8 like a tongue. The body 6 is normally provided with a circular cylindrical bore 9 extending therethrough concentric with a longitudinal axis 11. The bore when formed is open on both ends and between its ends communicates with a plurality of equally spaced parallel tumbler recesses 12 arranged in the tongue 8 at selected intervals apart and with their own axes preferably intersecting and perpendicular to the axis 11 in the usual way.

In the normal installation the cylinder body 6 is fixed in a door lock unit. Designed to rotate relative to the cylinder body is a cylinder plug 16 circular cylindrical in cross section and free turning within the cylinder body about the same axis 11 as a center. The cylinder plug is kept in position axially at one end by an enlarged collar 17 thereon. For the same purpose, at the other end it is provided with threads 18 engaged by a rim flanged retainer 19. A disc 21 fits against the end of the cylinder plug 16 and is held by the flange on the retainer 19. An actuating spindle bar 22 projects from the disc 21 through the retainer 19 and is made to rotate in unison with the cylinder plug 16 by an eccentrically located locking pin 23 (Figs. 4, 5) lodged in a notch 24 in the disc 21. The pin 23 also is effective to keep the retainer 19 from unscrewing inasmuch as the pin also engages in a notch 26 in the retainer flange. A spring 27 disposed in the pin bore 28 in the plug 16 urges the parts into appropriate position.

The cylinder plug 16 is pierced by a keyhole 31, usually of irregular cross section as shown in Fig. 3, having its bottom portion or radially outermost portion terminating mostly on one side of a radial line. The keyhole 31 is uniform throughout the length of the cylinder plug and is intersected by a plurality of tumbler passages 33 spaced apart at suitable axial intervals along the plug. In one rotated position of the plug with respect to the body the passages 33 are in registry with the recesses 12. Adapted to operate in the tumbler passages and recesses are tumblers 34 and 36. These are made up in appropriate lengths to act as the combining devices.

When no key is in the hole, as shown in Fig. 2, springs 37 urge the tumblers into position with the ends of the tumblers abutting the side wall of the keyhole 31. The tumblers are arranged so that their abutting faces are not in registry with the contacting surfaces of the cylinder plug in the cylinder body. The plug cannot then rotate within the body and spindle bar 22 is locked. Upon the introduction of a proper key 38, however, a different situation arises. The key in cross section is similar to the keyhole 31 and extends into the cylinder plug 16 for substantially its entire length. Along one

of its edges 39 the key is provided with a number of indentations 41. These are of a suitable spacing and depth so that when the key is in position, as shown in Fig. 1, the abutting surfaces or shear planes of the tumblers 34 coincide with the contacting surfaces of the body and plug. Rotation of the key 38 is then possible and produces a corresponding rotation of the cylinder plug in the cylinder body.

Since the number of combinations possible as a practical matter with the number and depth of practical indentations on the key 38 is too limited for some installations, I provide a means for affording additional combinations.

This is accomplished by forming the cylinder plug 16 with one or more peripheral grooves 46 extending entirely around the cylinder plug and intersecting the keyhole 31. The grooves are interspersed with the tumbler passages 33 being disposed substantially halfway between such passages. In one instance, several of the grooves 46 also intersect the bore 28 in which the pin 23 reciprocates. To avoid interference of parts in this location, the pin 23 has a square reduced portion 47 so that the pin is freely slidable without interfering with the grooves 46.

In accordance with my invention, I provide or dispose in one or more of the grooves 46 one or more rings 48. These are sometimes termed ward rings. Each is preferably constituted of an approximately annular metal structure having a gap 49 in its periphery to leave a pair of opposing ends 51 and 52 defining a pair of opposed shoulders. These are spaced apart substantially the width of the adjacent portion of the keyhole 31. The key 38 can then pass into the keyhole without in anywise in its axial movement interfering with the ring or rings 48. Each ring 48 is provided with a pair of lugs 53 and 54 designed to seat in registering channels 56 and 57 extending longitudinally or axially of the cylinder body 6 and intersecting the bore 9 thereof. The lugs are preferably distant from the end faces of the ring, as in Fig. 3, but for manufacturing and other reasons can be at the end faces of the ring as in Fig. 10.

Because of the lug construction, a ring 48 once positioned in one of the grooves 46 and having its lugs 53 and 54 engaged in the channels 56 and 57 of the cylinder body is not rotatable with respect to the cylinder body. A normal key in the keyhole 31 is therefore not rotatable, since the sides of the key abut either the face 51 or the face 52 depending upon the direction in which the key is attempted to be rotated. Even though the indentations 41 of the key appropriately actuate the combination set up in the tumblers 34, the key still cannot be rotated because the non-rotatable ring 48 interferes.

In order to permit some keys to actuate the lock, it is provided, in accordance with the invention, that an appropriate key having the proper indentations 41 also have one or more notches 61 on the edge 62 opposite the edge 39. A notch 61, for example, is cut in the edge 62 of the key in the same axial location as a particular ring 48, as shown in Fig. 1. If more than one ring 48 is positioned in the several grooves 46, then other notches like the notch 61 are correspondingly placed in the edge 62 of the key.

The notch 61 is of a location and size to clear the block constituted by the faces 51 and 52 of the ring 48 anchored by its lugs 53 and 54 in the cylinder body. When a key having a notch 61 therein is inserted in the lock it operates in the normal manner. Another key having the same combination introduced into the lock will not operate unless the key also has a notch 61 therein. In this fashion it is possible to increase very markedly the number of combinations which can be obtained from a substantially standard lock.

For manufacturing and other reasons, it is possible to vary the construction as shown in Figs. 8 and 9,

The lock body 78 is generally similar to the body 6, but is provided with appropriately positioned cross cuts 79 into one or more of which an individual sector 81 of metal or other slightly springy material can be inserted. Each sector has a pair of tabs 82 and 83 projecting therefrom to provide points 84 and 86 adapted to spring over corners 87 and 88 on the lock body 78 when the sector is positioned. The sector is in effect snapped into place and is primarily retained by the points 84 and 86 although it can be forcibly sprung out of position for changing the lock combination. When one or more sectors 81 are in place, they function just as the rings 48 operate.

The rings 48 need not be in a single piece since assembly and manufacture may be facilitated by making the ring in several parts, as shown in Fig. 11. While the parts otherwise are the same, the ring is made up of two parts 91 and 92, both of which act about like a complete ring, but only one of which need be used if the lock is arranged for unlocking rotation in only one direction.

A further variation is shown in Fig. 12 in which the lock body 93 is drilled and tapped at appropriate locations to receive one or a pair of special blocking screws 94 and 96 arranged at either side of the keyhole 97. The screws 94 and 96 or either of them serve to prevent rotation of a key in the keyhole 97 unless the key has an appropriate notch cut therein.

In some cases wherein extra strength and stability are required, the ring is made, as shown in Fig. 13, to fit a lock body 101 provided with a number of longitudinal channels 102 into which fit tabs 103 projecting appropriately from each of a pair of half rings 104 and 106. The half rings, or one of them in a proper case, serve to block turning of an improper or false key in the keyhole 107, although they pass a key having a suitable notch therein.

I claim:

1. A cylinder lock comprising a cylinder body and a cylinder plug rotatable therein, said body and plug being provided with registering tumbler recesses and passages respectively for receiving tumblers therein, said plug being provided with a keyhole slot opening outwardly of one side thereof for receiving a key axially therein and said recesses and passages being axially spaced apart for registration of said tumblers with longitudinally spaced indentations on such key, said plug being provided with a plurality of circumferentially extending slots axially spaced apart between said recesses and passages, a ward ring in at least one of said slots and held therein by its inherent resiliency, said ring being split and having a pair of spaced opposed ends on opposite sides of said keyhole slot, a radially outwardly projecting lug on said ring and a radially inwardly opening recess in said cylinder body opening radially inwardly of said bore receiving said lug therein to prevent rotation of said ring relative to said body.

2. A cylinder lock comprising a cylinder body and a cylinder plug rotatable therein, said body and plug being provided with registering tumbler recesses and passages respectively for receiving tumblers therein, said plug being provided with a keyhole slot opening outwardly of one side thereof for receiving a key axially therein and said recesses and passages being axially spaced apart for registration of said tumblers with longitudinally spaced indentations on such key, said plug being provided with a plurality of circumferentially extending slots axially spaced apart between said recesses and passages, a ward ring in at least one of said slots and held therein by its inherent resiliency, said ring being split and having a pair of spaced opposed ends on opposite sides of said keyhole slot, a radially outwardly projecting lug on said ring and an axially extending channel in said cylinder body opening radially inward-

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ly of said bore receiving said lug therein to prevent rotation of said ring relative to said body said channel extending to one end of said body to permit insertion of said plug axially into said bore from said one end with said lug extending outwardly from said plug. 5

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