

[54] PIN-TUMBLER LOCK CYLINDER

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[58] Field of Search . 70/358, 364 A, 373, 375, 380,
70/401, 411, 419, 420, 421, 379 R

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[57]

ABSTRACT

A lock cylinder is formed having a plurality of projections extending from the periphery of its body in radial directions and having a plurality of pin bores spaced apart by a predetermined distance. The pin bores extend to a keyway in a rotatable barrel housed in the body. Tumbler pins, driver pins and springs are inserted in a desired number of selected pin bores, whereby the lock cylinder is adapted for a vast number of different locking combinations. The rear end of the barrel incorporated in the lock cylinder extends outward from the body of the lock cylinder. Within the keyway, at the extension thereof, there is provided a slidable locking plate which is usually urged by a spring into engagement with a latch portion formed in the body to prevent the rotation of the barrel. The locking plate thus serves as a pick-proof means and is freed from locking engagement when a key is inserted into the keyway and acts as an actuating member for the locking mechanism when the barrel is rotated.

2 Claims, 9 Drawing Figures

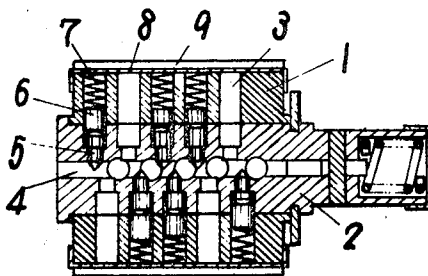


Fig. 1

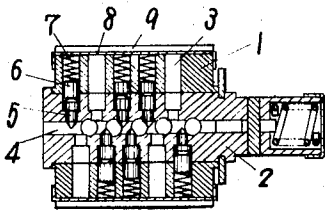


Fig. 2

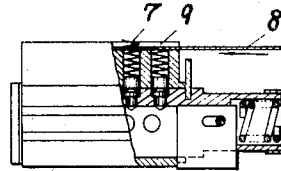


Fig. 3

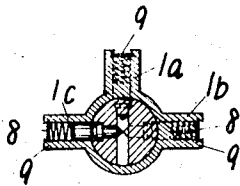


Fig. 4

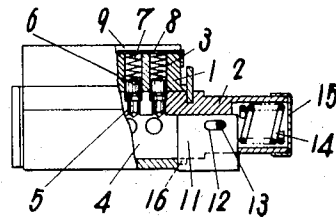


Fig. 5

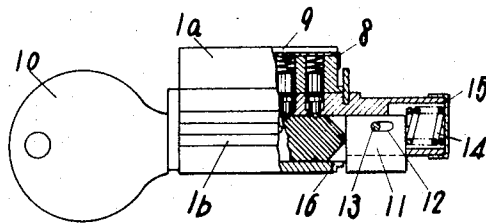


Fig. 6

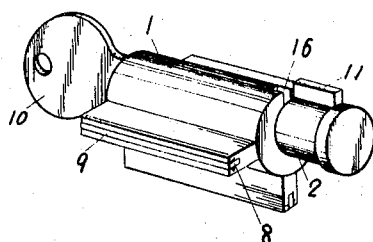


Fig. 7

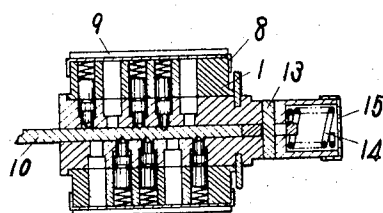


Fig. 8

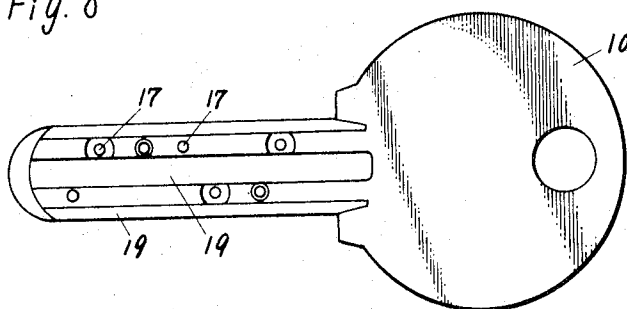
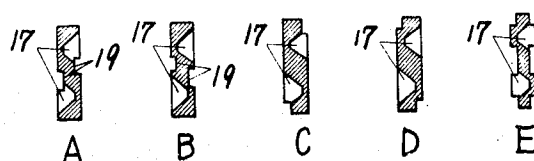


Fig. 9



PIN-TUMBLER LOCK CYLINDER

BACKGROUND OF THE INVENTION

Pick proof locks and locks having different locking combinations are known from U.S. Pat. Nos. 3,045,468 and 3,111,834. However none of the conventional devices have the combined advantages of the device of the present invention as described below.

SUMMARY OF THE INVENTION

The present invention relates to a pin-tumbler lock cylinder, more particularly to a pin-tumbler lock cylinder adapted for different locking combinations by inserting pins and springs in selected pin bores and having at the rear end of its barrel a locking plate serving as pick-proof means and an actuating member for the locking mechanism.

An object of this invention is to provide a lock cylinder including a body having on its periphery a plurality of projections each of which is formed with pin bores spaced apart by a uniform distance and communicating with a key-way extending through an inner barrel, a desired number of selected pin bores receiving pins therein so as to provide an increased number of different locking combinations.

Another object of the present invention is to form uniform pin bores spaced apart at a given uniform interval for ease of working, which bores are formed in a plurality of projections on the periphery of the body of a lock cylinder and extend from the upper face of the projections to a key-way through a barrel in the body.

Another object of the present invention is to provide a structure wherein tumbler pins, driver pins and springs can be inserted in place with ease.

Another object of the present invention is to provide a pick-proof lock which can be operated by a key inserted in the keyway.

Another object of this invention is to provide a lock having a pick-proof means which serves as an actuator for the locking mechanism when the barrel is rotated.

Still another object of this invention is to provide a master keying system by forming a plurality of additional grooves in the key and longitudinally thereof in conformity with the keyway.

DETAILED DESCRIPTION

The body of the lock cylinder of this invention is formed on its circumferential face with radial projections extending upward and downward or leftward and rightward or upward, leftward, and rightward or upward, downward, leftward and rightward at angles of 180° or 90° with respect to each other. With this construction, pin bores are easier to form in the projections than in the cylindrical body used in conventional structures. The projections thus formed make it convenient to insert pins and the like in the bores and retain the same in place. Moreover, the projections make it easier to fix the cylinder to the locking mechanism. Thus, two, three, four or more of projections are provided depending upon the number of different locking combinations desired. The projection has a width suitable for forming pin bores and its length is suitably determined in accordance with the number of the different locking combinations. The upper face of the projection is formed with a dovetail groove for receiving a holding plate which retains the pins and springs within the pin bores.

The opposite ends of the holding plate are bent and secured to the opposite ends of the projection. The pin bores may be formed in each projection at an equal interval and with the same diameter. In the case where the bores in one projection differ in interval and diameter from those in another projection, a greater number of different locking combinations will be obtained. Assuming that the total number of bores formed in the respective projections is A and the number of the pin bores receiving therein pins or the like is B , the number of different locking combinations will be $M=A \cdot C_B$. If $A=16$ and $B=8$, for example, the number of different locking combinations will be 12,870. It will be apparent that the number of the combinations will be further increased if the pin bores differ in interval and distance from projection to projection.

Since the projections are independent of one another, it is easy to insert the tumbler pins, driver pins and springs into the pin bores. After they are placed in the bores, the holding plate is inserted progressively from one end thereof into the dovetail groove to cover the upper end of the projection while depressing the springs one after another, whereby they are placed and held in position. In the case where the different locking combinations are provided with differing lengths of the bores as heretofore practiced, it has been necessary to block the upper ends of the bores with filling members one by one. However the present invention does not require such a troublesome procedure. With the conventional structure wherein a plurality of rows of pins are formed in the periphery of the body, it has been necessary to cover the pins in the pin bores with one cylindrical cover at the same time, whereas the present invention does not involve such a difficult procedure.

At the rear end of an extension of the barrel, there is provided a locking plate which is slidable within the keyway and which is usually urged by a spring into resilient engagement with a latch portion formed in the body to prevent the rotation of the barrel. A pin secured to the barrel is received in a slot formed in the locking plate, the locking plate thus being slidably movable within the range of the slot. When a key is inserted into the keyway, the front end of the key pushes the locking plate against the resilient force of the spring to release the locking plate from the body, permitting the barrel to rotate. Accordingly, even if a usual picking attempt is made by inserting an article other than the key into the keyway to shift the projecting pins, the barrel will be held in place against rotation unless the locking plate is moved. Thus the present structure includes an effective pick-proof mechanism. Furthermore, the locking plate which projects in a radial direction at the rear end of the extension of the barrel comes into engagement, for example, with a retractor or hub included in an unillustrated locking mechanism when the barrel is rotated and drives the same to unlatch the locking mechanism. In this way, the locking plate serves as an actuator for unlocking the locking mechanism. For this reason, unlike conventional structure, there is no need to provide a separate actuating member at the rear end of the barrel, thus making it possible to provide a simple mechanism which is serviceable both as pick-proof means and as an actuator.

With reference to drawings illustrating an embodiment, the construction of the present device will be described in greater detail.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in longitudinal section showing a lock cylinder including a plurality of rows of pins;

FIG. 2 is a view in section showing the principal part of the lock cylinder, the view illustrating a procedure to insert tumbler pins, driver pins and springs in place and hold the same by a holding plate which is thereafter caulked;

FIG. 3 is a view in cross section;

FIG. 4 is a view showing the principal part in section as the locking plate is in engagement with the body of the lock cylinder;

FIG. 5 is a view showing the principal part in section as a key is inserted in the keyway;

FIG. 6 is a perspective view of the lock cylinder with the key inserted therein;

FIG. 7 is a view in longitudinal section;

FIG. 8 is a plan view showing an example of the key; and

FIG. 9 is a view in cross section showing keys including a master key.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, there is shown a body 1 including a barrel 2 rotatably housed in the body 1. Pin bores 3 extend through the body 1 and barrel 2 and communicate with a keyway 4. Tumbler pins 5, driver pins 6 and springs 7 are inserted in the pin bores 3. A holding plate 8 for retaining these pins and springs in position in pressing contact with the springs 7 is secured in place, conveniently by caulking. The body 1 is provided on its periphery with a plurality of projections 1a, 1b, extending in radial directions. The pins and springs are accommodated in the projections as described above in alignment with a key to be inserted in the body. Each of the projections 1a, 1b, is formed in its upper face with a dovetail groove 9. The holding plate 8 is inserted into the groove 9 in sliding contact with the bottom of the groove and retained therein against upward displacement. The holding plate 8 is bent at its opposite ends and caulked to the projection. A key 10 has recesses in a corresponding relation to the pin bores.

To form the bores 3, the barrel 2 is held stationary to the body 1 and bores of the same size are formed in one projection 1a at a given interval longitudinally of the body. After this, the same procedure is repeated on another projection 1b. Thus the projections are bored one after another separately. A desired number of the pin bores 3 individually accommodate tumbler pins 5, driver pins 6 and springs 7, which are retained against jumping out by the holding plate 8 slidably inserted into the dovetail groove 9 while depressing the upper ends of the springs. The holding plate 8 is then bent and caulked to the opposite end of the projection. As a result, the holding plate 8 remains engaged in the dovetail 9, assuring that the pins and the like are retained in position.

In the keyway 4 at the end of rear extension of the barrel 2, there is provided a locking plate 11 which is slidably supported in the keyway 4 on a pin 13 extending into a slot 12 in the locking plate 11. The locking plate projects from the barrel 2 in a radial direction. A spring 14 is secured at one end to a cover 15 and is in pressing contact with the locking plate 11 at the other

end. The locking plate 11 is usually urged by the spring 14 into engagement with a latch 16 formed at the end of the body 1. Accordingly, unless the locking plate 11 is pushed out of engagement by the key 10 inserted into the keyway 4, the barrel 2 is prevented from rotation (see FIG. 4). Thus even when the tumbler pins are moved by a wire or the like, for instance, in an upward direction to permit the bored portion of the barrel to rotate, the barrel 2 is still held against rotation by the locking plate 11 to prevent picking, assuring improved safety.

FIG. 5 shows the state wherein the key 10 is inserted in the keyway 4 to make the barrel rotatable. More specifically, the locking plate 11 is pushed by the front end of the key 10 to a retracted position defined by the slot 12 against the action of the spring 14, rendering the barrel 2 rotatable. In this state, the rotation of the barrel 2 causes the locking plate 11 to rotate. Since the locking plate 11 projects outward in a radial direction, the projected portion will be associated with a locking mechanism such as a boxlike or cylindrical lock, particularly with a hub thereof. This enables the locking plate 11 to act as an actuating member for unlocking. When the barrel 2 is returned to the original position and the key 10 is pulled out, the locking plate 11 is urged into engagement with the latch portion 16 again under the action of the spring 14 to bring the lock cylinder to the locking state.

To sum up, the lock cylinder of this invention has a body which serves as a pin cylinder and which is provided with a plurality of projections extending in radial directions, with pin bores extending from the projections through the barrel. Each of the projections accommodates a plurality of tumbler pins, driver pins and springs which are retained in position by a holding plate. Because of such construction, the present device is easy to manufacture in working and assemblage. In addition the device is very convenient and useful in that the locking plate assures improved safety and serves as an actuating member for driving the hub of a locking mechanism.

As shown in FIG. 8, the key 10 to be used in accordance with this invention has recesses 17 corresponding to the pin bores of the projections and in conformity with the pins accommodated in the projections. The recesses 17 formed in the key 10 have varying depths respectively such that the abutting portions of the tumbler pins and driver pins of differing lengths can be brought into alignment with the shear line between the body 1 and the barrel 2. The keys 10 shown in FIGS. 8 and 9 are formed with grooves 18 as well as the recesses 17. FIG. 9 shows keys having different sections, A, B, C and D respectively with the grooves 18 differing from each other in shape. A master keying system will be obtained with a key having a section E including all of these four sections. In accordance with the present invention, therefore, the master keying system provides a number of different locking combinations in addition to those obtained by inserting pins in a selected number of the pin bores.

What I claim is:

1. A pin-tumbler lock cylinder including a barrel rotatably disposed in a body of said cylinder, pin bores extending through the body and the barrel to a keyway and tumbler pins, driver pins and springs inserted in said pin bores such that different locking combinations are provided depending upon whether or not said pin

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and springs are accommodated in a particular pin bore, said lock cylinder comprising a locking plate disposed at the end of a rearward extension of the barrel and rotatably supported in the keyway, said locking plate being slidable within a range defined by a slot formed in said locking plate when a key is inserted in the keyway, said locking plate being mechanically urged into engagement with a latch portion formed in the body.

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2. The pin-tumbler lock cylinder as set forth in claim 1 wherein when said locking plate is disengageable from the latch portion of the body by a key insertable into the keyway, the locking plate is rotated along with the barrel by the rotation of the key to come into contact with a locking mechanism and act as an actuating member for an unlocking operation.

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