

Cylinder lock

The invention relates to a cylinder lock including a number of locking discs arranged in succession and separated from each other by means of intermediate discs, all said discs being provided with a key opening in such a way that the shank of a key for the lock is insertable into a keyway formed jointly by the key openings, whereby the locking discs are turnable by means of combination surfaces on the key shank to a position in which a notch located in the periphery of each locking disc comes into line with notches in the other discs to form a channel into which a locking member of the lock can move to release the entire set of discs and allow the latter to turn with the key.

The "pitch" of a key as used in this specification means the mutual positioning of the combination surfaces, cut on the key shank, in the axial direction thereof, which combination surfaces, in cooperation with the locking discs of the lock, accomplish opening of the lock. To make it more difficult to "pick" the lock it is important that the pitch of the key cannot, at least not easily, be directly detected by inspection of the keyway by looking into the lock cylinder. By providing a simple mechanism for changing the pitch of the key, the number of available different arrangements of combination surfaces (and thus the number of possible different keys) can be increased remarkably.

One way of changing the pitch of a key, is to use locking discs and intermediate discs of different thickness in the same set of discs of the lock, the pitch of the key thereby being changed by changing the mutual positions of the discs of different thickness in the set of discs. A disadvantage of this solution is the necessity of having to make discs of different thickness which increases the number of items to be stored not

just by the manufacturer, but by locksmiths and other agents authorised to service the locks. Additionally, using discs of different thickness in a given series of discs contained in a cylinder lock is inconvenient  
5 with regard to automation of the assembling procedure.

One aim of the present invention is to provide a simple solution to the problem of modifying the pitch of the key of a lock so that the number of opening variations can be increased and, at the same time, making  
10 it more difficult to pick the lock. A further aim is to make the solution favourable with regard to production technology and to avoid making the construction of the lock more complicated.

What constitutes the invention in its broadest aspect  
15 is defined in the following claim 1.

By use of the invention there is no need to make and store a variety of different thicknesses of locking disc, since one type of locking disc can be used through-  
20 out a disc set, the pitch of a key being determined simply by the way in which the different locking discs are assembled in the set of discs incorporated in the lock.

Desirably each of said at least one locking discs is dimensioned and formed so that its periphery remains  
25 in the same position in the axial direction of the keyway formed in the set of discs regardless of which way round that locking disc has been placed in the set of discs. In one embodiment each of said at least one locking discs is provided with a recess in the central part thereof,  
30 so that the or each locking disc has a cup-like form. In principle a still greater change in the pitch of the key can be achieved when turning the locking discs about an axis in the plane of the discs, if the peripheral

surface of the locking disc is also provided with an annular recess. This peripheral annular recess is made on the opposite side of the said at least one locking disc to the central recess. The recess in the peripheral surface of the locking disc is most preferably less than half of the total thickness of an intermediate disc in the axial direction of the keyway of the set so that the said at least one locking disc, having been reversed in the sense of the invention, is not in contact with the or either of the adjacent locking discs. It is advisable to make a depression in the lock cylinder to receive the central region projecting beyond the annular recess in the outermost locking disc of the set of discs, so that the outermost locking disc of this kind can also be placed in the set of discs either way round without changing the position of the set of discs in the axial direction of the keyway with regard to the lock cylinder.

The invention will now be described in detail, by way of example, with reference to the accompanying drawings, in which

Figure 1 is an exploded view of the type of cylinder lock with rotary locking discs to which the invention is directed,

Figures 2a and 2b show, respectively, in front view and sectional side elevation, one embodiment of locking disc from a cylinder lock according to the invention,

Figures 3a and 3b show, respectively, in front view and sectional side elevation, another embodiment of locking disc from a cylinder lock according to the invention,

Figure 4 shows, in front view, an intermediate disc from a cylinder lock according to the invention, and

Figures 5-7 show the principles of changing the pitch of the key by utilizing the invention.

In Figure 1 the reference numeral 1 refers to a cylinder lock housing, enclosing a cylinder 2, a locking bar 3 and a set of discs comprising locking discs 4 and intermediate discs 5. Each locking disc includes a key opening 6 and is provided with a peripheral notch 7, the location of which notch on the periphery determines the angular rotation needed for each locking disc 4 to open the lock. The intermediate discs 5 also exhibit a peripheral notch 10 and a central opening 9 permitting passage of the key shank therethrough.

When the lock is locked, the locking bar 3 is held outwardly by at least one of the discs and prevents the cylinder 2 from being turned with respect to the cylinder housing 1. When the locking discs 4 are turned through varying amounts by the key 8 of the lock, their peripheral notches 7 underlie the position of a slot 11 in the cylinder 2. Since the peripheral notches 10 of the intermediate discs 5 also underlie the slot 11 a uniform channel is provided into which the locking bar 3 can move. In this way, the locking bar 3 releases the cylinder 2 and the entire set of discs 4, 5 to turn together so that force can be transmitted from the key as desired, for example to the bolt of a door. For this purpose, the end of the cylinder 2 can be formed in a suitable manner to permit the key-turning force to be coupled to a further movable part. For example, the end of the cylinder 2 can be provided with a slotted end to receive a force-transmission element 12, the attachment of which can be effected by means of elements 13.

According to the invention, at least some of the locking discs 4 of the lock are formed so that the surface 6a of the key opening 6 of the locking disc designed

to cooperate with the corresponding combination surface of the key(i.e. the surfaces 14a, 14b and 14c in Figures 5 to 7) is, in the axial direction of the set of discs, substantially shorter than the overall thickness A of the respective locking disc 4. The total thickness A (see Figures 2b and 3b) indicates the length of that part of the keyway represented by the respective locking disc, and is bisected by the median plane of the disc (not shown) which extends normal to the plane of the paper in Figures 2b and 3b. As the surface 6a represents just a part, in the axial direction of the locking disc, of the overall length of the locking disc in the whole set of discs, reversing a locking disc in the set of discs in the manner proposed in accordance with the invention, results in a shift or displacement of the required location of the corresponding combination surface of the key. This normally makes a key cut for one combination inoperable with the changed combination so that a new key has to be cut having a revised location for its combination surfaces corresponding to the repositioning, in the axial direction of the key shank, of the surface 6a of the reversed locking disc.

Changing the pitch of a key in accordance with the invention is illustrated in Figures 5-7, which are based on a use of the embodiment of locking disc shown in Figures 3a and 3b. In Figure 5 locking discs 4a, 4b and 4c are all mounted in the same way in the set of discs contained in the cylinder 2 of the lock. The combination surfaces 14a, 14b and 14c cut in the shank 8 of the key correspond to these locking discs. Figure 6 shows one possibility for changing the pitch of the key. In this case the locking discs 4a, 4b and 4c have all been reversed whereby their surfaces 6a have shifted axially by the same amount in the axial direction of the key shank 8. Because of these shifts, the positions of the respective combination surfaces of the key have

changed, so that neither the pitch of the key 8a of Figure 5 fits the lock of Figure 6 nor the pitch of the key 8b of Figure 6 fits the lock of Figure 5.

5 In Figure 7 only the locking discs 4b and 4c have been reversed with regard to the starting situation of Figure 5, whereby, again, a new pitch for the key 8c has been achieved, the corresponding lock of which cannot be opened with the keys 8a or 8b shown in Figures 5 and 6.

10 In practice, the locking discs 4 are designed so that their key opening 6 is provided with a central recess 15. In the embodiment shown in Figures 2a and 2b, the length and the position of the set of discs in the cylinder 2 remain completely unchanged irrespective of the  
15 way in which the locking discs of the set of discs are positioned. There is no need to make any changes in the construction of the lock when using locking discs according to Figures 2a and 2b, since all the elements of the lock can be standard components as is the case,  
20 for example, with the intermediate disc shown in Figure 4.

The peripheral surface of each locking disc can also be provided with an annular recess 16, as shown in Figure 3b, which recess decreases the thickness of  
25 the peripheral part of the locking disc. When the recess 16, in the axial direction, is less than half of the total thickness of an intermediate disc, and when the cylinder 2 is provided with a depression 17 accommodating the central region projecting beyond the recess 16 (see  
30 Figures 5, 6 and 7), all the locking discs in the set of discs, i.e. also the outermost ones, can be turned around without displacement of their peripheral parts in the axial direction of the cylinder 2.

In order to be turnable, the construction of the locking discs of the set of discs needs to be symmetric. As the peripheral notches 7 in the locking discs need to be formed in regions extending on both sides of the axis of symmetry (in Figures 2a and 3a the respective sectional chain line), the position of the peripheral notch 7 and thus the size of the cut for the corresponding combination surface of the key shank are changed as in a reflected image when the locking disc is turned around said axis of symmetry (which lies in the median plane) in accordance with the invention. Thus, for example, the so-called cut 0 becomes cut 5, cut 1 becomes cut 4 and cut 2 becomes cut 3 if the cuts vary from an uncut combination surface (= cut 0) to the complete 90° cut (= cut 5) in the key shank.

It is pointed out that the application of the invention does not depend on the form of the key opening 6 of the locking discs nor, consequently, on the form of the profile of the key shank either, and numerous other forms for the key opening 6 can be used. An essential thing is the fact that each locking disc can be turned by the key to a position opening the lock. On the other hand the key opening 6 need not necessarily include such a counter surface by means of which the locking disc can directly be returned to the datum position, but other solutions suitable for the purpose can be used as well, e.g. as is disclosed in U.S. Patent 4,351,172, according to which return of the locking discs is accomplished by means of a transmission member turning with the key and return bars.

It will be noted from Figures 5 to 7 that the periphery of each locking disc remains in the same position irrespective of which way round it is assembled in the set of discs.

The invention is not limited to the embodiments shown, since several modifications thereof are feasible within the scope of the following claims.



CLAIMS

1. A cylinder lock including a number of locking discs arranged in succession and separated from each other by means of intermediate discs, all said discs being provided with a key opening in such a way that the shank of  
5 a key for the lock is insertable into a keyway formed jointly by the key openings, whereby the locking discs are turnable by means of combination surfaces on the key shank to a position in which a notch located in the periphery of each locking disc comes into line with notches  
10 in the other discs to form a channel into which a locking member of the lock can move to release the entire set of discs and allow the latter to turn with the key, the peripheral notch of at least one locking disc being arranged so that said one locking disc is placeable in  
15 the set of discs selectively in either of two possible orientations substantially without change in the length of said set of discs, said at least one locking disc being formed so that that surface of the key opening of the said at least one locking disc which cooperates with a  
20 corresponding combination surface of the key shank, is substantially shorter, in the axial direction of the set, than the overall thickness of the said at least one locking disc also measured in the axial direction of the set, and is located asymmetrically with regard to the axial  
25 direction so that changing the orientation of said at least one locking disc in the set of discs causes the location of the corresponding combination surface of the key shank to be changed.

2. A cylinder lock according to claim 1, in which  
30 said at least one locking disc is dimensioned and formed so that the periphery thereof remains, in the axial direction of the keyway, in the same position in the set of discs regardless of the orientation of said at least one locking disc in the set of discs.



- 10 -

3. A cylinder lock according to claim 1 or 2, in which said at least one locking disc is provided with a central recess so that the said at least one locking disc has a cup-like form.

4. A cylinder lock according to claim 3, in which the peripheral surface of said at least one locking disc is provided with an annular recess located on the opposite side of said at least one locking disc from the central recess thereof.

5. A cylinder lock according to claim 4, in which said annular recess in the peripheral surface in the at least one locking disc is less than half of the total thickness of an intermediate disc in the disc set of the lock.

6. A cylinder lock according to claim 4 or 5, in which the cylinder element enclosing the set of discs includes a depression to accommodate the central region projecting beyond said annular recess.

7. A cylinder lock substantially as hereinbefore described with reference to Figure 1 of the accompanying drawings provided with at least one reversible locking disc of the kind shown in Figures 2a, 2b or Figures 3a, 3b, thereof.

8. A cylinder lock substantially as hereinbefore described with reference to Figure 5, 6 or 7 of the accompanying drawings.

---