

SPECIFICATION

Cylinder lock mechanism

- 5 This invention relates to a cylinder lock mechanism of the kind comprising a fixed cylinder housing which houses a turnable cylinder in which there is a plurality of tumbler discs turnable by means of the key of the lock
- 10 mechanism, and a locking bar which locks the cylinder to the cylinder housing, but which, when the tumbler discs are in a certain releasing position, is able to move radially inwards into a groove jointly formed by peripheral
- 15 recesses in the tumbler discs, whereby the locking of the cylinder is released and the cylinder is able to turn.

- A conventional cylinder lock has a certain key combination which is determined once
- 20 and for all and which cannot be changed without disconnecting the lock from its mounting and disassembling it. In certain cases, however, it would be advantageous to be able to change the combination of a series
- 25 of locks. Such a situation can arise when, for instance, due to changes in personnel, an unauthorised person holds a key which will actuate the locks. Until now the only solution in such a situation has been to change the
- 30 complete lock mechanism in each lock, which in a large series of locks becomes rather expensive.

- The present invention aims to provide a lock mechanism of the kind referred to in
- 35 which the key combination can be changed in an easy way without disassembling the lock mechanism.

- According to the invention, a lock mechanism of the kind referred to is characterised in
- 40 that in the lock mechanism there is at least one composite tumbler disc which includes first and second parts, the angular position of which relative to each other is adjustable and of which the first part is provided with a force
- 45 transmitting surface which is able to receive turning force from the key and which is so dimensioned within a certain adjustment sector that it is unable to cause any substantial influence on the locking bar of the lock mechanism, while the second part of the composite
- 50 tumbler disc has within said adjustment sector a support surface preventing radial movement of the locking bar and a peripheral recess allowing radial movement of the locking bar, and in that between said parts of the composite
- 55 tumbler disc there is a clutch device by means of which said parts can be set in different predetermined functionally fixed positions relative to each other.

- 60 In the ensuing description and claims, a cylinder lock mechanism will be regarded as having an "outer end", which is the end into which a key is introduced into the mechanism, and an "inner end", which is the end
- 65 opposite to the outer end. Logically corre-

sponding terms are used with respect to parts of the lock mechanism.

- The combination of a lock mechanism in accordance with the invention can be changed
- 70 by changing the position of the parts of the composite tumbler disc relative to each other, and this is best carried out by means of a special setting key. The number of key combinations which can be set by means of a
- 75 setting operation of this kind equals the number of fixed setting positions of the parts of the composite tumbler discs raised to a power equalling the number of composite tumbler discs in the lock mechanism in question.
- 80 It is recommended that the composite tumbler disc should be so formed that it is able to rotate freely relative to the cylinder. In this way the advantage is obtained that changing of the relative position of the parts of the
- 85 composite tumbler disc is practically impossible to carry out in any other way than using a proper tool and the proper method developed for this purpose, and this contributes to the security of the lock mechanism. The security
- 90 can be further improved by giving an annular configuration to said second part of the composite tumbler disc and providing it with such a large central opening that the key of the lock mechanism is unable, in any position, to
- 95 transmit any substantial torque to the second part of the composite tumbler disc.

- The number of clutch positions between the parts of the composite tumbler disc can be freely chosen up to a certain maximum, but in
- 100 practice the best thing is to arrange as many clutch positions as there are different combination positions for the tumbler discs within the scope of the combination system of the lock mechanism. If the combination steps of
- 105 the locking system are so small that it is difficult to arrange clutch positions that close to each other, it is feasible to provide a clutch position only at the position of every second combination step. However, in this case the
- 110 number of lock combinations obtainable by means of a composite tumbler disc is reduced.

- In a conventional rotary disc tumbler lock mechanism there is in the lock mechanism
- 115 cylinder an axially somewhat flexible set of discs which is composed of tumbler discs with somewhat axially flexible spacer discs between them. In a lock mechanism in accordance with the invention, this axial flexibility
- 120 of the disc set can be used for obtaining the clutch effect of the composition tumbler disc. The entire disc set thereby functions as a clutch spring.

- It is recommended in a lock mechanism in
- 125 accordance with the invention that outwardly of the composite tumbler disc there is at least one tumbler disc which rotates with the key of the lock mechanism. The advantage is then obtained that, when the lock mechanism is in
- 130 its releasing position, which is the only posi-

tion in which said second part of the composite tumbler disc is locked against rotation so that the relative angular position of the two parts of the composite tumbler disc can be changed, the tumbler disc which is outwardly of the composite tumbler disc has been turned so much that it partly covers the keyway. Manipulation of the composite tumbler disc in any way other than with the proper tool is then extremely difficult.

The relative angular position of the two parts of the composite tumbler disc is changed by means of a setting key fitting into the lock mechanism, which key at the position of the composite tumbler disc or discs has a combination surface, the position of which can be changed when the setting key is in the lock mechanism so that the parts of the composite tumbler disc are moved into another relative position determined by the setting key. In practice this operation is preferably carried out in the following way:—

The setting key is first set to zero position and is pushed into the lock mechanism. The setting key is then set to a position corresponding to the combination of the lock mechanism and is turned until it has brought the lock mechanism to its releasing position and turned the cylinder somewhat, that is, so much that the locking bar locks the turning movement of all the tumbler discs. In this position the setting key is set to another combination position and is turned back in the opposite direction until the lock mechanism has again reached its initial position, that is, the position of insertion and withdrawal of the key. The setting key has to be brought back into said zero position before it is removed from the lock mechanism.

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

Figure 1 is an exploded perspective view of a lock mechanism in accordance with the invention,

Figure 2 is a view in the axial direction of the lock mechanism, of the inner part of a composite tumbler disc of the lock mechanism of *Fig. 1*,

Figure 3 is a view in the axial direction of the lock mechanism, of the outer part of the composite tumbler disc of the lock mechanism of *Fig. 1*,

Figure 4 is a partly sectioned side view of a setting key for changing the combination of the lock mechanism of *Fig. 1*, and

Figure 5 is an end view of the setting key of *Fig. 4*.

The lock mechanism shown in *Fig. 1* comprises a cylinder housing 1, a cylinder 2, a locking bar 3 and a retainer ring 7 for the cylinder, the numeral 6 designating the key of the lock mechanism. In the cylinder 2 there is a disc set including tumbler discs 4 and between them spacer discs 5. The spacer

discs 5 are made of thin metallic sheet and are so formed that they are somewhat flexible in the axial direction. There is a slot 8 in the cylinder 2 for the locking bar 3, into which

the locking bar can move, in a radial direction, guided by said slot. When the locking bar 3 is partly in the slot 8 and partly in a groove made in the interior surface of cylinder housing 1, the cylinder 2 is locked against

turning. Normally, the peripheral edges of the tumbler discs 4 keep the locking bar 3 in this locking position. However, in each tumbler disc 4 there is a peripheral recess 9 and by turning the key 6 in the lock mechanism,

tumbler discs 4 are brought to a position in which their peripheral recesses 9 jointly form a groove at the position of the locking bar 3. The locking bar 3 is able to move radially

inwards into the groove formed by the recesses 9 so that it is disengaged from the grip of the cylinder housing 1 and the cylinder 2 is

free to turn. When the cylinder 2 has turned through a small angle, which may take part, for instance, because a small axial protrusion

on the innermost tumbler disc transmits torque to the side surface of a small axial recess 11 in the inner end of the cylinder 2, the guiding slot 8 for the locking bar 3 and the locking bar are moved away from the

locking groove in the interior surface of the cylinder housing, and the locking bar takes a position between the unbroken interior cylindrical surface of cylinder housing 1 and the bottom of the peripheral recesses 9 in tumbler

discs 4, in which position it locks the turning movement of all the tumbler discs with respect to the cylinder 2 so that a considerable torque can be transmitted from the key through the tumbler discs and the locking bar

3 to the cylinder 2. In the lock mechanism shown in *Fig. 1*, there is a composite tumbler disc 4a, which is the second tumbler disc from the outer end of the lock mechanism.

There is only one such composite tumbler disc in the lock mechanism shown, but it is possible to use more than one such composite tumbler disc.

In the lock mechanism shown in *Fig. 1*, the freedom of turning of the tumbler discs 4 with respect to the cylinder 2 is unlimited. However, the invention can also be applied to a

conventional rotary disc tumbler cylinder lock mechanism, wherein the turning of the tumbler discs is limited, for instance, as shown in

Fig. 1 of U.S. Patent 3,623,345. However, it is preferred that the turning movement of the composite tumbler disc 4a with respect to the cylinder 2 should not be limited in any way.

The design of the composite tumbler disc 4a is shown in detail in *Figs. 2* and *3* of which *Fig. 2* shows the inner, first part 12 of the composite tumbler disc, that is, the part to which the turning force of the key 6 is transmitted, and *Fig. 3* shows the outer, second part 14 of the composite tumbler disc, that is,

the part which guides the locking bar 3 of the lock mechanism in the same way as the other, conventional tumbler discs 4. The linear edge 13 of the central opening of first part 12 of the composite tumbler disc transmits the torque of the key from the key to the composite tumbler disc. A corresponding torque transmission also takes part in the other tumbler discs 4. In Fig. 2, a sector *a* is shown which corresponds to that sector of the tumbler disc which in normal use of the lock can move under the locking bar 3. Since the first part 12 of the composite tumbler disc 4*a* within the area of the sector *a* is provided with a radial recess, this part of the composite tumbler disc cannot influence the locking bar 3. On the other hand, the second part 14 of the composite tumbler disc, which corresponds to the peripheral portion of a normal tumbler disc, guides the locking bar 3 with its peripheral edge in the same way as the other tumbler discs. To this end, the second part 14 has a peripheral recess 9 and it may also be provided with some so-called false recesses 15 which are so shallow that they do not have any essential influence on the position of the locking bar 3. False recesses 15 may be provided in any of the tumbler discs and their object is only to make the picking of the lock mechanism more difficult. The central opening 16 of the part 14 of the composite tumbler disc 4*a* is circular, in the embodiment shown, and of so large a diameter that the key of the lock mechanism, or a corresponding element, is unable to transmit torque to the part 14, naturally with exception of torque possibly transmitted by means of friction. The parts 12 and 14 of the composite tumbler disc are connected to each other by means of a small plug 17 in the part 12 and corresponding recesses or borings 18 in the part 14. Since the disc set in the cylinder 2 has a certain axial flexibility and is subject to a certain axial compression load, a suitable axial compression force is obtained acting on the parts 12 and 14 of the composite tumbler disc, which force keeps the plug 17 in that boring or recess 18 in which it has been set. The angular position of the parts 12 and 14 with respect to each other can nevertheless, be changed if the connection between these parts is subject to such a large torque that plug 17 moves to another boring or recess 18. There are as many borings or recesses 18 as there are different turning positions in the combination system of the lock mechanism, that is, six in the shown embodiment.

The thickness of a composite tumbler disc 4*a* can be chosen so that it directly fits into the axial pitch of the combination surfaces of the key. Since the composite tumbler disc is composed of two parts, the most convenient solution in practice is that the thickness of a composite tumbler disc equals the total thickness of two ordinary tumbler discs and one

spacer disc. Other solutions can be chosen instead.

Figs. 4 and 5 show an embodiment of a setting key. The setting key comprises two parts, a body portion 19 and a setting member 20. The body portion 19 is in principle a normal key, the combination of which corresponds to the combination determined by the ordinary tumbler discs of the lock mechanism. By means of the setting member 20, the combination value of the composite tumbler disc 4*a* can be changed. When the lock mechanism is in such a position that the locking bar 3 locks the turning movement of all the tumbler discs 4, the setting member 20 of the setting key is turned, so that its semi-cylindrical end portion 20*a* which moves in an annular recess 21 made in the body portion, engages both ends of the linear edge 13 of the central opening of the inner part 12 of the composite tumbler disc 4*a* and forces said inner part to turn relative to the outer part 14 of the composite tumbler disc. In order to make this possible there should be in the body portion of the setting key a milling cut 22 or a corresponding recess which covers the whole setting area. If, outwardly of the composite tumbler disc 4*a*, there is a tumbler disc 4 turning together with the key, there should also be a milling cut or the like in the setting member of the setting key, which compared to the milling cut 22 is at the opposite side of the setting key.

At the other end of the setting key there is a flexible pin 23 which is flexible in the axial direction of the setting key and keeps the body portion and the setting member of the setting key in a certain axial position relative to each other. By moving the longer flexible end of flexible pin 23 to one of a number of grooves 24 made in the outer end of the setting member and corresponding to the different setting positions, a desired change of the combination value of the composite tumbler disc is carried out. The grooves 24 correspond to the combination steps of the lock mechanism.

CLAIMS

1. A cylinder lock mechanism comprising a fixed cylinder housing which houses a turnable cylinder in which there is a plurality of tumbler discs turnable by means of the key of the lock mechanism, and a locking bar which locks the cylinder to the cylinder housing, but which, when the tumbler discs are in a certain releasing position, is able to move radially inwards into a groove jointly formed by peripheral recesses in the tumbler discs, whereby the locking of the cylinder is released and the cylinder is able to turn, characterised in that in the lock mechanism there is at least one composite tumbler disc which includes first and second parts, the angular position of which relative to each other is adjustable, and



the part which guides the locking bar 3 of the lock mechanism in the same way as the other, conventional tumbler discs 4. The linear edge 13 of the central opening of first part 12 of the composite tumbler disc transmits the torque of the key from the key to the composite tumbler disc. A corresponding torque transmission also takes part in the other tumbler discs 4. In Fig. 2, a sector *a* is shown which corresponds to that sector of the tumbler disc which in normal use of the lock can move under the locking bar 3. Since the first part 12 of the composite tumbler disc 4*a* within the area of the sector *a* is provided with a radial recess, this part of the composite tumbler disc cannot influence the locking bar 3. On the other hand, the second part 14 of the composite tumbler disc, which corresponds to the peripheral portion of a normal tumbler disc, guides the locking bar 3 with its peripheral edge in the same way as the other tumbler discs. To this end, the second part 14 has a peripheral recess 9 and it may also be provided with some so-called false recesses 15 which are so shallow that they do not have any essential influence on the position of the locking bar 3. False recesses 15 may be provided in any of the tumbler discs and their object is only to make the picking of the lock mechanism more difficult. The central opening 16 of the part 14 of the composite tumbler disc 4*a* is circular, in the embodiment shown, and of so large a diameter that the key of the lock mechanism, or a corresponding element, is unable to transmit torque to the part 14, naturally with exception of torque possibly transmitted by means of friction. The parts 12 and 14 of the composite tumbler disc are connected to each other by means of a small plug 17 in the part 12 and corresponding recesses or borings 18 in the part 14. Since the disc set in the cylinder 2 has a certain axial flexibility and is subject to a certain axial compression load, a suitable axial compression force is obtained acting on the parts 12 and 14 of the composite tumbler disc, which force keeps the plug 17 in that boring or recess 18 in which it has been set. The angular position of the parts 12 and 14 with respect to each other can nevertheless be changed if the connection between these parts is subject to such a large torque that plug 17 moves to another boring or recess 18. There are as many borings or recesses 18 as there are different turning positions in the combination system of the lock mechanism, that is, six in the shown embodiment.

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of which the first part is provided with a force transmitting surface which is able to receive turning force from the key and which is so dimensioned with a certain adjustment sector that it is unable to have any substantial influence on the locking bar of the lock mechanism, while the second part of the composite tumbler disc has within said adjustment sector a support surface preventing radial movement of the locking bar and a peripheral recess allowing radial movement of the locking bar and a peripheral recess allowing radial movement of the locking bar, and in that between said parts of the composite tumbler disc there is a clutch device by means of which said parts can be set in different predetermined functionally fixed positions relative to each other.

2. A lock mechanism according to claim 1, in which said composite tumbler disc is able to rotate freely with respect to the cylinder.

3. A lock mechanism according to claim 1 or 2, in which said second part of the composite tumbler disc is annular and provided with such a large central opening that the key of the lock mechanism is unable in any position to transmit any substantial turning force to said second part of the composite tumbler disc.

4. A lock mechanism according to any of the preceding claims, in which the two parts of the composite tumbler disc have as many clutch positions relative to each other as there are different combination positions for a tumbler disc in the combination system of the lock mechanism.

5. A lock mechanism according to any of the preceding claims, in which the two parts of the composite tumbler disc are pressed together flexibly by means of an axial force acting on the discs in the cylinder.

6. A lock mechanism according to any of the preceding claims, in which outwardly of the composite tumbler disc there is at least one tumbler disc which rotates together with the key.

7. A cylinder lock mechanism constructed and arranged substantially as herein described with reference to Figs. 1 to 3 of the accompanying drawings.

8. A method of changing the key combination of a lock mechanism according to any of the preceding claims employing a setting key which has a combination surface, the position of which is changeable when the setting key is in the lock mechanism so that the parts of the composite tumbler disc can be moved to another position relative to each other determined by the setting key, which method comprises the steps of inserting the setting key into the lock mechanism in a certain zero position, setting the setting key to a position corresponding to the lock combination, bringing the lock mechanism to its re-

leasing position and turning the cylinder with the setting key, setting the setting key to another combination position, returning the lock mechanism to its locking position, re-setting the setting key to said zero position and removing the setting key from the lock mechanism.

9. A setting key for changing the key combination of a lock mechanism according to any of claims 1 to 7 by the method claimed in claim 8.

10. A setting key according to claim 9, constructed and arranged substantially as herein described with reference to Figs. 4 and 5 of the accompanying drawings.

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