

The invention relates to a key and rotary lock cylinder according to the preamble to the independent Patent Claim 1, a key for a rotary lock cylinder with an additional tumbler as well as a rotary lock cylinder for a key which has a control element in the shank.

A key and rotary lock cylinder of this type are known in the state of the art from DE-A-35 17 660. In the narrow sides of the shank and when at rest, the key comprises projecting and movable members with which it is possible to arrange corresponding tumblers of the lock cylinder. Similar keys have become known from DE-A-34 24 307.

Keys of this type have the advantage that by virtue of the control element disposed in the shank they can scarcely be copied without authorisation and thus the locking installations equipped with such keys offer a higher level of security. Those keys of this type which have become known so far and which are also referred to as "mechanical keys" do still however have various drawbacks, so that in spite of the very high level of security against being copied, these keys have as yet not found very wide acceptance, particularly as a reversible key.

For example, US-A-4 667 495 disclosed a further key which comprises in the shank a pin adapted for limited displacement for coordinating the additional tumbler. When the shank is inserted into the key channel, the pin encounters a ramp disposed in the rotor, which ramp radially displaces the pin and so coordinates it with the additional tumbler. So that the ramp is able to arrive at the pin when the shank is inserted, it is necessary to have on the shank grooves or other recesses which, in the case of a flat key, limit the surface area available for control ports. In practice, therefore, the pin must be disposed as closely as possible to the front end of the shank. The loosely displaceable pin mostly has one end projecting from the shank so that the key can hook on here.

A key of this type has likewise become known from EP-A-202 949. The additional tumbler is in this case likewise arranged for limited displacement in the key shank so that there are also difficulties with this above-mentioned construction.

The invention is based on the problem of providing a key and a rotary lock cylinder of the aforementioned type which offers a greater degree of security against manipulation. The problem is resolved by the invention in accordance with Claim 1, the key being the object of Claim 6 and the rotary lock cylinder being the object of Claim 11.

Examples of embodiment of the invention are explained in greater detail with reference to the accompanying drawings in which:

Fig. 1 shows a cross-section through a rotary lock cylinder according to the invention,

Fig. 2 shows a cross-section through a rotary lock cylinder according to the invention, with a key inserted,

Fig. 3 shows the same as Fig. 2 but after the rotor has been rotated through about 45°,

Fig. 4 shows a cross-section through a key according to the invention, taken on the line IV-IV in Fig. 5,

Fig. 5 is a partial view of a key according to the invention shown partly in section,

Fig. 6a and 6b are views of a locking element,

Fig. 7 is a partial view of a rotor and of a locking element according to Figs. 6a and 6b,

Fig. 8 is a partial view of a key according to the invention, in an advantageous alternative embodiment,

Fig. 9a shows partly in cross-section a portion of a key in accordance with a third alternative embodiment,

Fig. 9b shows a cross-section taken on the line IXb-IXb in Fig. 9a,

Figs. 10a to 10e show cross-sections through a rotary lock cylinder according to the invention, in an advantageous alternative embodiment.

The rotary lock cylinder shown in Fig. 1 has in conventional manner a rotor 3 with a key channel 4, a stator 2 and a steel sleeve 5. Although not shown here, conventional pin tumblers are coordinated with a reversible key adapted for insertion into the key channel 4, whereupon the rotor 3 can be turned to actuate the lock, not shown here. For coordinating these conventional tumblers, the associated key 16 according to Fig. 5 has bores 35 on the broad sides and narrow sides. However, the key may also be a toothed key, in which case then the rotary lock cylinder is of course constructed accordingly.

The rotary lock cylinder comprises a further tumbler 10 which is coordinated by the control element 19 shown in Fig. 4. This additional control element 19 has, mounted in a radial bore 8 of the rotor 3, a core pin 13 and a housing pin 12 mounted in a bore 9 in the stator 2 as well as a coil spring 11 biased on the sleeve 5. In the arrangement shown in Fig. 1, the housing pin 12 extends beyond the shear line 14 and thus locks the rotor 3. At

the same time, the rotor 3 is locked by the usual other pin tumblers not shown here.

As Fig. 1 shows, into each symmetrical bore 15 of the stator 2 there is inserted a locking pin 6, said locking pins 6 likewise being braced against the sleeve 5, their front ends extending beyond the shear line 14. Such a locking pin is shown in greater detail in Figs. 6a and 6b. In addition, Fig. 7 shows how the narrower inner end 24 of the locking pin 6 engages an encircling groove 7 in the rotor 3. The locking pin 6 can therefore move only slightly in a radial direction since it has one end bearing on the sleeve 5 and the other on the rotor 3.

The control element 19 shown in Figs. 4 and 5 is inserted into a continuous bore 18, this latter extending crosswise to the longitudinal direction of the shank 17 and parallel with the broad sides 36 of the key 16. The control element 19 comprises two bolts 20 between which there is a thrust spring 27 which has a substantially higher spring force than the spring 11 of the additional tumbler 10. The end faces 23 of the bolts 20 are flush with the narrow sides 30 of the shank 17 and are prevented from emerging from the bore 18 by sleeves 21 inserted into the bore 18. The sleeves 21 are for example fixed rigidly in the bores 18 by a press fit. The spring 19 presses the bolts 20 on radially projecting abutments 37 against respective sleeves 21 rigid in the bore 18. When there is exerted on the bolts 20 in the direction of the arrows 38 a force which is greater than the spring force of the spring 27, the bolts 20 can be moved individually or jointly inwardly. This movement is limited by sleeves 22 which are fitted against each outer end of the bolts 20.

The manner in which the control element 19 operates will be described in greater detail hereinafter with reference to Figs. 2 and 3. To release the rotor 3 so that it can

rotate, the key shank 16 is inserted into the key channel 4 in the usual way. When this happens, the usual tumblers are coordinated in known manner. The additional pin tumbler 10 is coordinated by the control element 19 as shown in Fig. 2. The core pin 13 bears on the end face 23 of the bolt 20 and is lifted radially to the height required to release the rotor 3. Since, as mentioned, the spring 27 is substantially stronger than the spring 11 of the pin tumbler, the bolt 20 of the control element 19 is not moved to any substantial degree while the tumbler 10 is being coordinated.

Since, now all tumblers are coordinated, the rotor 3 can be turned in a clockwise or anti-clockwise direction by the inserted key 16. As can be seen, the outer end of the core pin 13 engages the encircling groove 7 of the rotor 3.

After a rotation of about 45° , in other words still before the bolts of an associated lock is actuated, a bolt 20 of the control element 19 encounters a locking bolt 6. If the rotor 3 is rotated farther on in the same direction, then the bolt 20 is moved inwards by a wedge surface 39 of the locking bolt 6 against the restoring force of the spring 27. Since the bolt 20 is able readily to yield inwardly, the rotor 3 can be rotated farther in the same direction of rotation beyond the locking bolt 6 and the bolt of the lock can be actuated. In the case of a key without a control element 19, the rotor 3 can also be rotated only as far as one of the locking bolts 6 when the additional tumbler 10 is coordinated, since the core pin 13 is not able to yield inwardly and therefore rests against the corresponding locking bolt 6.

In the case of the advantageous embodiment of key according to the invention which is shown in Fig. 8, a control element 25 is constituted by a spring-loaded arm

31 the free end of which is able to yield inwardly into a recess 32 in the key shank 28. Here, too, the key can be a reversible key or a toothed key. In the case of a reversible key, two such control elements 25 are disposed symmetrically. The spring-loaded arm 31 is so constructed that for coordinating the additional tumbler 10, it is able to lift the core pin 13 against the force of the spring 11 radially outwardly to the required height.

In the case of the embodiment shown in Figs. 9a and 9b, a control element 26 is constituted by a spring-loaded web 33 which covers a trough-like recess 34. The two ends of the spring-loaded web 33 are engaged on corresponding recesses in or are soldered to the shank 29. Here, too, the web 33 is so constructed that it is able to lift the core pin 13 to the necessary height to release the rotor 3, although when a locking bolt 6 is passed over, the core pin 13 can yield inwardly.

Figs. 10a to 10e show a rotary lock cylinder 50 which can be operated by a key 16 as described above. This rotary lock cylinder differs from the rotary lock cylinder 1 in that in the radial plane of the additional tumbler 10 there are two further tumblers 40 each of which comprises in a radial bore 43 of the stator a bolt 41 of chrome nickel steel which is pressed against the rotor by a thrust spring 42 which is preferably substantially stiffer than the spring 11. These further tumblers 40 monitor the control element 19, 25 or 29 in order to prevent manual interference. The mode of action of the further tumblers 40 will be explained hereinafter with reference to Figs. 10a to 10c.

In the arrangement shown in Fig. 10a, the above-described key 16 is inserted into the key channel 4. The additional tumbler 10 and the conventional tumblers not shown here are coordinated so that the rotor can be rotated into the

position shown in Fig. 10b and finally into that shown in Fig. 10c. In the rotated position shown in Fig. 10c, the core pin 13 is pressed radially inwardly against a pin 20 of the control element 19 by the bolt 41 of the additional tumbler 40. The spring 27 is stiffer than the spring 42 of the additional tumbler 40 so that the rotor can be turned beyond this position and the lock finally opened.

In the arrangement shown in Fig. 10d, an unauthorised key 51 is inserted into the key channel and it is assumed that it can serve to coordinate the usual tumblers and also the additional tumbler 10. It is likewise assumed that the core pin 31 can be moved radially inwardly into a depression 53 in the key 51 in order to overcome the locking pin 6. When the tube reaches the rotated position in which the bore 43 and the bore 44 are aligned, the bolt 41 is moved inwardly by the spring 42 and engages the bore 44 in the tube which is thus locked and cannot be further rotated in order to open the lock. Fig. 10e shows the arrangement in which the bolt 41 has passed beyond the shear line 14 and prevents further rotation of the rotor. Here, the unauthorised key 51 is likewise locked and can no longer be withdrawn from the rotary lock cylinder.

Patent Claims



1. A key and rotary lock cylinder for a security lock with at least one control element (19, 25, 26) disposed in the shank (17) of the key (16) for coordinating an additional tumbler arrangement (10) of the rotary lock cylinder, comprising a core pin (13), the rotary lock cylinder having a stator (2) and a rotor (3) and the control element (19, 25, 26) being capable of inwards displacement against a restoring force crosswise to the longitudinal direction of the shank (17), whereby the restoring force is greater than that of the additional tumbler arrangement (10), characterised in that in the direction of rotation of the rotor (3) and at a distance from the additional tumbler arrangement (10), there is in the stator (2) at least one locking element (6) which exceeds the shear line (14) between the stator (2) and the rotor (3) and which in a specific rotated position of the rotor (3) deflects the control element (19, 25, 26) with the core pin (13) of the additional tumbler arrangement (10) inwardly in the shank (17) against the said restoring force, whereby the rotor (3) has an encircling groove (7) engaged by the locking element (6).
2. A key and a rotary lock cylinder according to Claim 1, characterised in that the locking element (6) is inserted into a radial bore (15) in the stator (2).
3. A key and rotary lock cylinder according to Claim 1 or 2, characterised in that the locking element (6) is a bolt.
4. A key and rotary lock cylinder according to one of Claims 1 to 3, characterised in that two locking elements (6) are provided before and after the additional tumbler arrangement (10).



5. A key and rotary lock cylinder according to Claim 4, characterised in that the locking elements (6) are in the direction of rotation each offset by about 45° in respect of the additional tumbler arrangement (10).
6. A key for a rotary lock cylinder with an additional tumbler arrangement whereby in the shank (27-29) there is a control element (19, 25, 26) which is inwardly displaceable against a restoring force crosswise to the longitudinal direction of the shank, characterised in that in the position of rest, the control element (19, 25, 26) has its outer surface flush with the shank (27).
7. A key according to Claim 6, characterised in that the control element (19) comprises two bolts (20) the end faces (23) of which are each flush with an outer surface (30) of the shank (27) whereby the outer surfaces (30) are provided on the narrow sides of the key shank (27).
8. A key according to Claim 6, characterised in that the control element (25) has a spring-action tongue (31) which is able to move aside inwardly into a recess (32) in the key shank (28).
9. A key according to Claim 6, characterised in that the control element (26) has a spring-action web (33) adapted to be deflected inwardly into a recess (34) in the shank (29).
10. A key according to Claim 6, characterised in that the key is a flat or reversible key and in that two control elements (19, 25, 26) are disposed in the key shank in an appropriately symmetrical arrangement.



11. A rotary lock cylinder for a key which has in the shank (17) a control element (19, 25, 26) which is inwardly displaceable against a restoring force crosswise to the longitudinal direction of the shank (17), with a stator (2) and a rotor (3), characterised in that there is in the stator (2) a locking element (6) which exceeds the shear line (14) and in that following this locking element (6) there is a stator (2) in the direction of rotation of the rotor (3) and in the same radial plane a further tumbler (40) which corresponds to an additional tumbler arrangement (10) disposed upstream of the locking element (6), the rotor (3) having an encircling groove (7) engaged by the locking element (6).
12. A rotary lock cylinder according to Claim 11, characterised in that a housing pin (41) of the further tumbler arrangement (40) is subjected to a thrust spring (42) which is substantially harder than the corresponding spring (11) of the additional tumbler arrangement (10).
13. A rotary lock cylinder according to Claim 11 or 12, characterised in that in the same radial plane of and following the additional tumbler arrangement (10) there is in each case a locking element (6) and a further tumbler arrangement (40).

Five sheets of drawings