

REMOVABLE CORE CYLINDER LOCK

The present invention relates to a removable core cylinder lock, comprising a cylinder lock casing having an axially
5 extending cavity, a removable cylinder lock core which is axially insertable into said cavity, said lock core having an upper massive part with a row of holes for accommodating locking tumblers and a lower part defining a cylindrical bore
10 extending axially therethrough, a cylindrical, rotatable key plug located in said cylindrical bore and having a longitudinal key slot for receiving a key co-operating with said locking tumblers, a retainer member being transversely movable between a first position, in which it positively locks said lock core
15 in its axially inserted position, and a second position, in which said lock core may be retracted, said retainer member having a transversely extending locking lug engaging with said casing when said retainer member is in said first position.

Such a cylinder lock with a removable core is previously known
20 from US patent No. 4,328,690 and the corresponding re-issued patent No. RE.31910 (Medeco Security Locks Inc.). High security is obtained by way of the side or latch bar, being movable between a releasing position within a groove in the cylindrical
25 outer surface of the rotatable key plug and a locking position engaging a recess adjoining the cylindrical bore of the lock core. Normally, the side bar is situated in its locking position, whereby the rotatable key plug as well as the retainer member are prevented from moving. Only when all six locking
30 tumblers are elevated and twisted into specific elevational and rotational positions, will the locking tumblers be positioned with their end surfaces at the shear line defined by the outer cylindrical surface of the key plug and twisted into such rotational positions that the side bar is allowed to enter with its
35 projections into vertical grooves in the tumblers, so that the side bar may be urged into its releasing position and the key plug may be rotated by means of a proper operating key inserted into the key slot of the key plug. During such normal operation, the retainer member will be held in place in its first

position, where it positively locks the lock core axially in the cavity of the cylinder lock casing. The retainer member is formed as a ring or a sleeve, which encloses the rotatable key plug circumferentially all around, and is provided with a number of holes in registry with some of the holes accommodating the upper portions of the locking tumblers. The latter will be positioned partly in a hole in the lock core and partly in a corresponding hole in the retainer sleeve.

Moreover, the retainer sleeve constitutes a movable mid-section of the lower part of the lock core defining a cylindrical bore extending axially therethrough. It is provided with an axially extending recess at its inner, cylindrical surface, said recess being aligned with corresponding, axially or longitudinally extending recess portions in the inner cylindrical surface of the lower part of the lock core. When the removable cylinder lock core is to be taken out from the cylinder lock casing, one uses a special control key, by means of which the locking tumblers are elevated into positions with their end surfaces being located in a shear line between the retainer sleeve and the upper massive part of the lock core. Furthermore, to enable rotation of the retainer sleeve, all the six tumblers have to be twisted into positions allowing the side bar to be moved sideways into its groove in the outer surface of the rotatable key plug. Otherwise, the side bar will be retained in its locking position, where it engages with the axial recess of the retainer sleeve and prevents the key plug and the retainer sleeve from being rotated.

Although the prior art lock provides high security, there are some disadvantages involved in its structure. In particular, the cylindrical bore is axially divided by the retainer sleeve which forms a movable mid-section located between two stationary end sections of the lock core. Therefore, it is difficult to obtain a well-defined, exact guidance of the rotatable key plug and to maintain structural strength and wear resistance. Moreover, the retainer sleeve will only be held in place by a few (normally two) locking tumblers, which prevent rotation of

the retainer sleeve, during normal operation of the lock (turning of the key plug with a proper key). Furthermore, the division of the longitudinal recess for the side or latch bar into two end portions situated in the lower part of the lock core and a mid portion situated at the inside of the retainer sleeve may present problems of proper alignment, and such a divided longitudinal recess does not provide as good and exact a support for the side bar in its locking position as a longitudinal recess formed in a unitary wall portion.

Against this background, the primary object of the present invention is to provide an improved removable core cylinder lock of the general kind indicated in the opening paragraph, where the key plug is more exactly guided in the cylindrical bore in the lock core, and the retainer member is securely held in place, to prevent rotation thereof, by the locking tumblers during normal operation of the lock. At the same time, the structure should be sturdy and wear resistant, with relatively thick walls of the lock core and the retainer member, and the manufacture and assembly of the various parts should be simple and inexpensive. Furthermore, the lock should enable use in a lock system having a great number of variation possibilities for the control keys.

A secondary object of the invention is to achieve a structure, including a side bar, where the side bar is better and more accurately supported in its locking position at the inside of the lock core.

The primary object is achieved for a removable core cylinder lock of the present invention, wherein the lower part defining the cylinder bore of the cylinder lock core is partially cut away so as to form a chamber accommodating said transversely movable retainer member and leaving a continuous lower wall portion, which partially encloses the rotatable key plug and extends axially along substantially the whole length of said cylindrical bore, and wherein the retainer member has an axial length, which preferably corresponds to at least half of the

axial length of said row of holes in said upper massive part, and a limited circumferential extension which is substantially supplementary to said continuous lower wall so as to define said cylindrical bore. Compare claims 1, 2 and 3.

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Thus, the retainer member is not formed as a sleeve which encloses the key plug all around. Rather, the chamber accommodating the retaining member and the retaining member itself have a limited circumferential extension, such as about 180°.

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The remaining, continuous lower wall portion of the removable cylinder lock core is dimensioned so as to partially enclose the key plug and support the latter along substantially the whole length thereof.

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The axial length of the retainer member enables at least half of the tumblers in the row to lock the retainer member in its first position where it positively locks the lock core in the casing. Normally, three or four tumblers (of a total of six in the row) participate in this locking action.

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The various parts are easy to manufacture, and the total structure is sturdy and strong.

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Moreover, because of the number of tumblers participating in the locking engagement of the retainer member, typically three or four such tumblers, the number of variation possibilities for the control keys is relatively large.

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When the key plug includes a side bar, the latter may cooperate directly with the locking tumblers in the central row of holes in the key plug, or it may cooperate with separate side tumblers accommodated in associated cavities formed in the key plug at one or both sides of the key slot.

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In a preferred embodiment, the retainer member comprises a base portion, which is formed substantially as a part-cylindrical shell with external and internal cylindrical surfaces, and a

radially outwardly projecting portion constituting the locking lug. Compare claims 4 and 5.

In principle, the retainer member may be displaceable by a
5 translatory motion sideways between first and second positions. However, preferably, the retainer member is rotatable between the first and second positions, an upper convex cylindrical surface being in sliding contact with a concave cylindrical
10 surface at the upper, massive part of the lock core. Compare claim 6. Then, the retainer member may be moved into its second position, in which the lock core may be retracted, by means of a control key cooperating with tumbler portions partially situated in holes in the retainer member.

15 Further advantageous features are stated in claims 7 through 14.

The invention will be explained more fully below with reference
20 to the accompanying drawings illustrating a preferred embodiment.

Figure 1 shows in perspective view a cylinder lock casing and a removable cylinder lock core to be inserted into the casing;

25 Figure 2 illustrates, likewise in a perspective view, the basic parts of the removable cylinder lock core shown in figure 1, these parts being separated from one another for increased clarity;

30 Figure 3 is a side view of the core body shown in figures 1 and 2;

Figure 4 is an opposite side view of the core body;

35 Figure 5 is a cross-sectional view taken along line V-V in figure 3;

Figure 6 is a cross-sectional view taken along line VI-VI in figure 4;

Figure 7 is a perspective view of the retainer member shown from the other side in figure 2;

Figures 8 and 9 are end views of the lock core, illustrating the movement of the retainer member into its second, releasing position;

Figures 10 and 11 are corresponding end views illustrating the normal operation of the cylinder lock.

In figure 1, there is shown a conventional cylinder lock casing 10 having an axially extending cavity 11 for receiving a removable cylinder lock core 20 with a rotatable key plug 60 and a key 99. The casing 10 is intended to be permanently mounted in a door (not shown) or some other object to be locked in relation to a frame or some other stationary structure. Alternatively, the casing 10 may constitute a padlock or some other locking device. The removable cylinder lock core 20 is axially insertable into the cavity 11 of the casing 10 and is retained in the casing by means of a retainer member 40 to be described further below. Upon insertion of the lock core 20 into the casing 10, the rear end of the key plug 60 cooperates, e.g. by way of an axially projecting member (not shown), with a secondary locking mechanism of any kind.

In the illustrated embodiment, the cavity 11 has a cross-sectional shape substantially like an "8" corresponding to the cross-sectional shape of the lock core 20, so that the latter fits slideably in the cavity 11. The inside bore defining the cavity 11 has a recessed portion 14 (indicated by dashed lines in figure 1) with which a transversely extending locking lug 50 of the retainer member engages so as to retain the lock core 20 in its inserted position.

In the exploded view of figure 2, the various parts of the removable cylinder lock core 20 are readily apparent.

5 The core body 21 (compare also figures 3, 4, 5 and 6) comprises an upper, massive part 22 and a lower part 23 defining a cylindrical bore 24 extending axially therethrough. In the central vertical plane of the upper part 22, there is a row 25 of six holes 25a, 25b, 25c, 25d, 25e and 25f for accommodating upper portions 26 of locking tumblers, which are biased in a conventional manner by associated helical springs 27. The
10 rotatable key plug 60 has a corresponding row of holes 65a, 65b, 65c, 65d, 65e and 65f which are in registry with the corresponding holes 25a-25f in a locking condition. Lower portions 66 of the locking tumblers are located in the holes
15 65a through 65f. The retainer member 40, which is somewhat shorter in its axial length, has a corresponding row 55 of four holes 55c, 55d, 55e and 55f, likewise in registry with the corresponding holes in the rows 25 and 65.

20 In the rotatable key plug 60 there is also a row 67 of side tumblers, e.g. such side tumblers, located in corresponding cavities inside the key plug 60 so as to be elevationally movable in a vertical plane B in parallel and slightly displaced sideways in relation to the vertical plane A through the
25 key slot 68 and the row 65 of holes for the tumblers. As is known per se, the side tumblers are specifically elevated by a proper key 99 and cooperate with a side bar 80, which is located in a longitudinal groove 69 in the cylindrical outer surface of the rotatable key plug 60. In its locking position,
30 the side bar 80 projects transversely outwardly and engages with a corresponding longitudinal recess 29 in the lower part 23 of the lock core 20. When all side tumblers 67 are properly elevated, the side bar 80 can be forced sideways into the groove 69 while letting projections 81 be fitted into corresponding recesses 70 in the lateral surface of each side
35 tumbler 67. Such an operation of a side bar between a locking position and a releasing position is previously known per se, e.g. from WO 94/01643 (Widén).

In accordance with the present invention, the retainer member 40 has a special structure permitting the associated core body 21 to include a continuous lower wall portion 23a, which extends axially along the whole length of the cylindrical bore 24. Along an axial length, which corresponds to the axial length of the retainer member 40, the lower part 23 of the core body 21 is partially cut away, as appears from figures 2, 3, 4 and 6, so as to form a chamber 30 accommodating the retainer member 40. The cut-away portion extends from the rear end of the core body 21 and has a circumferential extension of about 180° and is upwardly extended into the upper massive part 22 of the core body 21. Here, the accommodating chamber 30 is defined by a concave cylindrical surface 31, which adjoins an axially limited recess 39 dimensioned to receive the radially projecting locking lug 50 of the retainer member.

At one side (to the left in figure 6) of the continuous bottom wall portion 23a, the wall portion extends upwardly to form a longitudinal edge surface 32 located vertically above the central axis C of the cylindrical bore 24. The longitudinal edge surface 32 constitutes an abutment surface, which defines a first position of the retainer member locking the lock core 20 in its axially inserted position.

At the other side (to the right in figure 6), the continuous lower wall portion 23a has a longitudinal edge surface 33 with separated teeth portions 34 approximately at the level of the central axis C. Compare fig. 3. The edge surface 33 constitutes abutment surface portions defining a second position of the retainer member, in which the projecting lug 50 is totally accommodated in the upper recess 32 so as to enable axial retraction of the lock core 20 as a unit.

The retainer member 40 comprises a base portion 41, which is formed substantially as a part-cylindrical shell with external and internal cylindrical surfaces 42 and 43, respectively, the locking lug 50 projecting radially outwardly from the base portion 41.

At one side (to the left in figure 7), the part-cylindrical base portion 41 has a substantially straight longitudinal edge 44, which abuts the longitudinal edge 32 in the first position of the retainer member 40. At the other side (to the right in figure 7), the part-cylindrical base portion 41 has a longitudinal edge 45 with downwardly projecting fingers 46 fitting between the teeth 34 at the longitudinal edge 33. When the retainer member is located in its second position, the edge portions 45 abut the surface portions 33.

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The upper, external cylindrical surface 42 corresponds to the curvature of the concave cylindrical surface 31 in the upper, massive part 22 of the core body 21. Therefore, the retainer member is rotatable between its first and second positions while keeping a sliding contact between the cylindrical surfaces 42 and 31. Moreover, throughout such a rotational movement, the inner cylindrical surface 43 of the retainer member will define a wall portion of the cylindrical bore 24 as a supplement to the inside surface of the continuous lower wall portion 23a of the core body 21.

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The circumferential dimensions of the continuous wall portion 23a and the base portion 41 of the retainer member 40 are such that the retainer member 40 can be rotated between its first and second positions through such an angle that the locking lug 50 is moved from a first locking position (compare figure 8) into a second, releasing position (compare figure 9) where it is totally accommodated in the recess 39.

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In the illustrated embodiment, as appears from figure 7, the projecting lug 50 is formed like a wing, and it has large opposite surface portions 50a, 50b (compare figure 2) which may contact corresponding surface portions of the recess 39 in the core body 21 and of the recess 14 in the casing 10, respectively, when the retainer member 40 is rotated into its first, locking position. During the rotary motion, the fingers 46 and the teeth 34 overlap each other circumferentially.

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The recess 29 (or separate recess portions) for engaging the side bar 80 is formed entirely in the inside surface of the continuous lower wall portion 23a. This is made possible by the fact that the wall portion 23a extends axially along substantially the whole length of the cylindrical bore 24 in the region corresponding to the normal position of the outwardly projecting side bar 80. In the illustrated example, the side bar 80 is normally located at the same level as the central axis C and, therefore, the continuous lower wall portion 23a as a whole is inclined in relation to a transversal plane D, which is perpendicular to the vertical plane A through the central axis C (defining the cylindrical bore 24) and the row 25 of holes in the upper massive part 22 of the core body 21.

The operation of the lock will appear from figures 8 through 11. By using a control key, the side tumblers 67 and the tumbler pin portions 66 and 26 are raised to such positions that the upper ends of the lower tumbler pin portions 66 are all located in the shear line between the cylindrical surfaces 31 and 42, whereby the key plug 60 together with the retainer member 40 may be rotated into the position shown in figure 9. Then, the locking lug 50 is accommodated in the recess 39, so that the lock core 20 can be retracted axially as a unit from the casing 10 (provided that all tumblers are properly aligned).

Figures 10 and 11 illustrate the normal operation of the lock by means of an operating key. Then, the lower tumbler pin portions 66 are raised only to the shear line corresponding to the inner surface 43 of the retainer member 40. Thus, the retainer member will be maintained in its first position, where it positively locks the lock core 20 in its axially inserted position. The upper locking tumbler pin portions 26, which extend through the holes 25c, 25d, 25e and 25f as well as the holes 55c, 55d, 55e and 55f (figure 2), prevent the retainer member from rotation. Thus, only the key plug 60 can be rotated by means of a proper operating key.

The removable cylinder lock described above may be modified by those skilled in the art within the scope of the appended claims.

5 In the illustrated embodiment, the accommodating chamber 30 is cut out from one axial end of the lock core 20. This will facilitate the machining of the chamber walls and the mounting of the retainer member 40. However, alternatively, the accommo-
10 dating chamber may be confined to a mid-section of the lock core 20. It is advantageous that the retainer member 40 has a substantial axial length, preferably about half of the axial length of the cylindrical bore 24, or even more. Then, many holes (normally three or four) can be provided in the retainer member in a row, whereby the latter is securely and accurately
15 held in position by the tumblers.

The locking lug of the retainer member 40 may alternatively be shaped as a tangential (and possibly slightly radial as well) projection, especially in case the motion of the retainer
20 member is not strictly rotational, but at least partly transla- tory.

The recess 29 for engaging the side bar does not necessarily have to be longitudinal and continuous. Instead, it may be
25 constituted by a number of separate recess portions in a row. Also, naturally, there may be two side bars in the key plug and corresponding recesses in the continuous lower wall portion.



CLAIMS

1. Removable core cylinder lock, comprising
- 5 - a cylinder lock casing (10) having an axially extending cavity (11),
- a removable cylinder lock core (20) which is axially insertable into said cavity, said lock core having an upper
- 10 massive part (22) with a row (25) of holes for accommodating locking tumblers (26, 66) and a lower part (23) defining a cylindrical bore (24) extending axially there-through,
- 15 - a cylindrical, rotatable key plug (60) located in said cylindrical bore (24) and having a longitudinal key slot (68) for receiving a key (99) co-operating with said locking tumblers (26, 66), and
- 20 - a retainer member (40) being transversely movable between a first position, in which it positively locks said lock core (20) in its axially inserted position, and a second position, in which said lock core may be retracted, said
- 25 retainer member having a transversely extending locking lug (50) engaging with said casing (10) when said retainer member is in said first position,

c h a r a c t e r i z e d i n t h a t

- 30 - said lower part (23) defining the cylinder bore (24) of the cylinder lock core (20) is partially cut away so as to form an axially extending chamber (30) accommodating said transversely movable retainer member (40) and leaving a
- 35 continuous lower wall portion (23a), which partially encloses the rotatable key plug and extends axially along substantially the whole length of said cylindrical bore (24); and





- said retainer member has a limited circumferential extension, which is substantially supplementary to said continuous lower wall portion so as to define said cylindrical bore (24).

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2. Removable core cylinder lock as defined in claim 1, characterized in that said retainer member is axially elongated.

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3. Removable core cylinder lock as defined in claim 2, characterized in that said retainer member has an axial length, which corresponds to at least half of the axial length of said row (25) of holes in said upper massive part.

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4. Removable core cylinder lock as defined in any one of claims 1-3, characterized in that said accommodating chamber (30) is upwardly extended into said upper massive part (22) of the cylinder lock core (20).

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5. Removable core cylinder lock as defined in claim 4, characterized in that said retainer member comprises a base portion (41), which is formed substantially as a part-cylindrical shell with external and internal cylindrical surfaces (42, 43), and a radially outwardly projecting portion constituting said locking lug (50).

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6. Removable core cylinder lock as defined in claim 5, characterized in that said accommodating chamber (30) is upwardly defined by a concave cylindrical surface (31) and in that the retainer member (40) has a corresponding upper convex cylindrical surface (42), said retainer member being rotatable between said first and second positions with a sliding contact between said concave and convex surfaces.

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7. Removable core cylinder lock as defined in any one of claims 4-6, characterized in that said radially projecting locking lug (50) is formed as wing, which is





5 received in a recess (39) in said upper massive part (22) when the retainer member (40) is moved into said second position and which is projected transversely outwardly into engagement with said casing (10) when the retainer member is moved into said first position.

10 8. Removable core cylinder lock as defined in claim 7, characterized in that said wing-formed locking lug (50) comprises large opposite surface portions (50a, 50b) which make contact with corresponding surface portions of the upper massive part (22) of the lock core (29) and the casing (10), respectively, when the retainer member (40) is located in said first position.

15 9. Removable core cylinder lock as defined in any one of claims 6-8, characterized in that the circumferential dimension of said base portion (41) is less than the circumferential dimension of said accommodating chamber (30) and in that said base portion (41) and said lower wall portion (23a) have longitudinal abutment surface portions (32, 33) defining said first and second positions of the retainer member.

25 10. Removable core cylinder lock as defined in claim 9, characterized in that said abutment surface portions are formed on circumferentially overlapping but longitudinally displaced edge portions (45, 46, 33, 34) of said retainer member (40) and said lower wall portion (23a), respectively.

30 11. Removable core cylinder lock as defined in any one of claims 1-10, said key plug having a side bar (80), said side bar being movable between a releasing position within a groove (69) in the cylindrical outer surface of the rotatable key plug and a locking position engaging a recess (29) adjoining said cylindrical bore (24) of the lock core, characterized in that said recess (29) for engaging said side

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bar is formed entirely in the inside surface of said continuous lower wall portion (23a).

5 12. Removable core cylinder lock as defined in claim 11, characterized in that said continuous lower wall portion (23a) of the lower part (23) of said lock core (20) has a circumferential extension of about 180°.

10 13. Removable core cylinder lock as defined in claim 12, characterized in that said continuous lower wall portion (23a) is inclined in relation to a transversal plane (D), which is perpendicular to a plane (A) through said row of locking tumblers (26) in said massive part (22) of the lock core (20), said recess (29) for engaging said side bar (80)
15 being located substantially at the same level as the rotational axis (C) of said rotatable key plug (60).

20 14. Removable core cylinder lock as defined in any one of claims 1-13, characterized in that said accommodating chamber (30) is cut out from one axial end of the lock core (20).

