

Profiled Lock Cylinder with Associated Key

5 The present invention pertains to a profiled lock cylinder with an associated key in accordance with the preamble of the main claim.

 Such a combination of profiled lock cylinder and associated key is known from DE 30 05 481 A1.

10 With this known combination, a key provided with recesses for the alignment of pin tumblers has a linear gear element of the toothed shaft type on the side in order to twist the blocking elements provided in addition to the spring-loaded pin tumblers in such a way that the turning block between the lock core and housing of the profiled lock cylinder is overridden.

15 However, this makes the insertion of additional blocking elements considerably more difficult, because the return springs needed for the blocking elements are designed as coil springs which can be installed mechanically between the blocking elements and the lock core only with extreme difficulty.

20 Furthermore, such return springs produce only limited restoring force due to their delicate construction, so that such a profiled lock cylinder, which is naturally also subject to wear as well as soiling, cannot always be operated in a functionally reliable manner.

25 Another problem of such profiled lock cylinders is the possibilities of overcoming them by unauthorized means by picking or striking technique, whereby in particular measures are also known to counteract attempts at manipulation by so-called striking technique (see DE 20 2004 017 531 U1, for example).

30 However, such a profiled lock cylinder is not necessarily also armed against attempts to pick it, as the profiled lock cylinder from DE 30 05 481 A1 cited initially.

 It is therefore the task of the present invention to constitute a generic combination of a profiled lock cylinder and associated key further in such a way that it offers reliable protection against both
35 picking attempts and striking technique and is simpler to manufacture.

 The invention solves this task with the characteristics of the

main claim.

The invention results in the advantage that the production of keys for overcoming the profiled lock cylinder in an unauthorized manner is made considerably more difficult.

5 An illegal key produced key must specifically have, in addition to the recesses on the key shaft for alignment of the spring-loaded pin tumblers, a linear gear element arranged at the correct position on the side, the toothing of which corresponds to the toothing of the blocking body, whereby it must be considered that the toothing would
10 need to be produced in the way that is prescribed by the gear wheel on the blocking body.

 This is practically impossible with conventional key copying methods, so that beyond the additional security the inventive profiled lock cylinder provides against picking and striking technique, it also
15 offers additional copy protection for the key.

 It is an important fact of the invention that the return spring is displaced via a displacement element separate from the blocking element, which is gear-coupled to the blocking element.

 In this way return springs can be used which are not tensioned by
20 the rotary motion of the blocking element but rather by direct linear application of force in the longitudinal direction.

 Therefore as soon as a key authorized for access is inserted, the coupled displacement element, which tensions the return spring in accordance with the invention, is able to follow a displacement path
25 deviating from the rotary motion of the blocking element, such as a linear displacement path in the longitudinal direction of the lock core, and tension an accordingly dimensioned compression spring on this displacement path.

 Therefore the decoupling of the movement of the blocking element
30 and the movement of the displacement element is of fundamental importance for the invention; they are connected with each other only via the shared gear coupling.

 In doing so the displacement element can be acted upon directly by the return spring in order to keep the frictional forces present as
35 low as possible at all times.

 The gear coupling preferably ensues in an entirely positive locking manner via a pairing of contact areas which are movable with

respect to each other, of which one is located on the blocking element and another on the displacement element in each case.

Without limitation of the invention hereto, in embodiments the positive locking pairings of contact areas can be formed by combinations of flat dog and sliding areas and/or additional toothed gears and toothed shafts.

In this regard reference is made to the embodiments.

If the displacement element can move linearly between two stop positions, the use of coil springs as a return springs is possible; due to their linear extension these can be integrated very simply in the lock core and even be dimensioned variably in wide ranges according to measurements and spring constant.

With the use of a additional gear wheel for actuating the displacement element, which then has the toothed shaft, it is additionally proposed to provide a rotation stop on the displacement element so that the spring-loaded toothed shaft cannot twist the blocking element beyond the blocking position.

For simple assembly of the blocking element in the lock core, it is also proposed to provide the entire blocking element with the gear wheel located on it for the linear gear element on the key and with the gear wheel or the dog (for example) for the gear coupling important to the invention on a - preferably single - shaft body - preferably one-piece - which is overhung in the lock core.

Here the direction of the shaft should run adjacent to the key channel and practically parallel to its main vertical direction.

This offers the advantage that the entire lock core equipped with the additional blocking element can simply be pushed into the housing of the profiled lock cylinder as before.

It is also proposed that the shaft of the blocking element should have an external diameter corresponding to the root diameter of the gear wheel provided for acting upon by the key.

This provides the advantage of simple manufacture and the greatest possible pitch circle diameter.

To achieve a blocking of the rotation movement of the lock core by an unauthorized key with this further development, a cut-out should be provided in the housing of the profiled lock cylinder where the bore hole for admitting the inserted object of the shaft penetrates

the wall of the lock core.

Then if a locking lug is provided on this end of the shaft, it only needs to be turned out of its blocking position by the inserted key which is authorized for access in order to release the rotating
5 movement of the lock core.

It is then advantageous if the shaft not exceed an angle of rotation of 180° .

The best possible blocking action is achieved with a 180° angle of rotation.

10 The cut-out in the housing of the profiled lock cylinder in this regard can then likewise be simply manufactured as an axial groove running parallel to the longitudinal direction of the lock core.

To facilitate the axial fixation of the blocking element in a simple way and yet enable twisting with little application of force,
15 it is proposed that the shaft be provided with a semi-spherical rounded end on its end bearing the gear wheel, which rests on the interior wall of the housing bore hole for the lock core with only a little play or no play.

This can be achieved by executing the bore hole which receives
20 the shaft of the blocking body as a step bore.

As a result the shaft is secured in the direction of the reducing diameter on one hand and by the semi-spherical rounded end in the other axial direction on the other hand.

Preferably the shaft is arranged between two pin tumblers in
25 order to have as much material cross-section as possible available for fitting of the bore hole for the shaft and gear coupling.

In addition to that if one applies the linear gear element on the key so that its first tooth space is located on the tip of the key - and corresponding to this the rotation position of the gear wheel
30 associated with the blocking position of the blocking element, the possibility is created of shaping the linear gear element without cutting with the displacement of as little material as possible.

Furthermore, the blocking element must then have a relatively large spacing from the insertion side of the profiled lock cylinder so
35 that it is also accessible only with great difficulty for any additional manipulation attempts.

The invention will be explained in more detail below based on exemplary embodiments.

These show in

- 5 Fig. 1 a sectional view of the profiled lock cylinder in blocking position
- Fig. 2 a sectional view of the profiled lock cylinder in release position
- Fig. 3 a gear coupling between a blocking element and displacement element
- 10 Fig. 4 a representation of the engagement between the blocking element and linear gear element on the key
- Fig. 5 a side view of the cylinder core with inserted key
- Fig. 6 an access-authorized key in a side view
- 15 Fig. 7 a cross section of the access-authorized key in the area of the first recess
- Fig. 8,9 a sectional view through the profiled lock cylinder with and without aligned tumblers as well as arrangement of the bore hole for receiving the displacement element
- Fig.10 another embodiment of a blocking body
- 20 Fig. 11 the embodiment according to Fig. 10 in conjunction with a corresponding displacement element
- Fig. 12 a cross section of the blocking body according to Fig. 10 in the area of the flat dog
- Fig. 13 an embodiment with two locking lugs and two recesses on the housing
- 25 Fig. 14 an blocking element according to Fig. 13 in detail

Insofar as nothing is stated otherwise, the following description always applies for all figures.

30 The figures show a profiled lock cylinder 1. Such a profiled lock cylinder has a housing 2, which has a circularly cylindrical profiled area and a bar-like area attached to it.

A rotatable lock core 3 sits in the circularly cylindrical profiled area, which has a key channel 4 for an access-authorized key 5 running in the longitudinal direction.

35 The key 5 with its key shaft 6 is inserted in the key channel 4 and has recesses 7 which are provided for aligning spring-loaded pin tumblers 8.

Such pin tumblers have a core pin 9 as well as a cylinder pin 10, which in each case are run together in a common bore hole and are

pushed by a tumbler spring 11 in the direction of the lock core 3.

As a result of the insertion of the key 5 the individual tumblers are aligned such that the separation interface 12, which is between the housing 2 and lock core 3 and the separation interface 13, which is between the core pin 9 and cylinder pin 10 for each pin tumbler 8, are aligned with one another.

Then the lock core 3 would be able to be turned without the additionally provided measure in accordance with the present invention.

Here, however, at least one additional blocking element 14 is provided, which is equipped with a toothing of the gear wheel type, which extends laterally into the key channel 4. This means that the blocking element 14, and/or its edging 17 of the gear wheel type can be displaced in rotation with the insertion of an access-authorized key.

In doing this the blocking element 14 should be twisted out of the blocking position 15, which is shown in Fig 1, such that the positive locking connection which is produced by the blocking element 14 between the lock core 3 and the housing 2 of the profiled lock cylinder 1 is removed.

To do this it is necessary to induce a rotation of the blocking element, which is directed against the force of the return spring 16, so that the block which prevents turning due to the blocking body 18 between the lock core 3 and housing 2 is removed.

A linear gear element 19 arranged in the key 5 serves this purpose; upon insertion of the key 5 in the key channel 4 it cogs with the gear wheel 17 of the blocking element 14 situated there.

One can envisage that the rotation of the blocking element 14 leads to a disengagement of the locking lug 28 arranged on the lower end of the blocking element 14 (see Fig. 2), so that the lock core 3 is then freely rotatable.

However, on the other hand the blocking element 14 is acted upon by the return spring 16. Here the return spring 16 is gear-coupled via a displacement element 23 separate from the blocking element 14, whereby it is important to the invention that the displacement element 23 be movable relative to the blocking element 14, preferably in a linear manner.

Only by movement of the displacement element 23 as a consequence of the rotational motion imposed upon the gear wheel 17 by the linear gear element 19 is the displacement element 23 brought into motion, tensioning the return spring 16, which for its part ensures that when
 5 the key 5 is withdrawn the blocking element 14 returns to its base position shown in Fig. 1.

The displacement element 23 is acted upon directly by the return spring 16 here.

In this regard it is recommended, corresponding in particular to
 10 Figures 3 and 10/11, to implement the gear coupling in a positive locking manner via a pairing of contact areas 20a, 20b which are movable relative to each other, of which in each case one is provided on the blocking element 14 and one on the displacement element 23.

In addition to this, both exemplary embodiments in Figures 3
 15 and/or 10/11 show displacement elements 23 which are linearly movable between two stop positions, so that in each case a coil spring is usable as a return spring 16.

As Figures 10/11 show, the gear coupling in this embodiment ensues, without limitation of the invention hereto, via a flat dog 21
 20 applied on the blocking element 14 and a sliding area 22 provided on the displacement element 23. The flat dog and sliding area are continuously in interlocking engagement with their allocated contact areas, because the return spring 16 is also under a certain initial load in the blocking position of the blocking element 14.

In the embodiment according to Fig. 1 the gear coupling is
 25 implemented via a toothed shaft 23a arranged on the displacement element 23 and a gear wheel 24 mounted on the blocking element 14.

It is clear that when the gear wheel 24 is rotated, the toothed
 30 shaft 23a, which is materially connected with the displacement element 23, ensures linear movement of the displacement elements 23.

In order to keep the friction between the respective contact areas as low as possible, suitable material pairings, such as steel/PTFE or suchlike can be selected.

Furthermore, Fig. 3 shows in particular that in the blocking
 35 position 15 of the additional blocking element 14 the gear wheel 24 encounters a rotation stop 25 which is provided on the displacement element 23.

This is only a step which a predetermined tooth of the gear wheel 24 comes upon as the displacement elements 23 approaches the rotating axis of the gear wheel 24, so that after that point further rotation of the gear wheel 24 is stopped.

5 Furthermore, the Figures show that the blocking element 14 is overhung in the lock core 3.

The shaft provided on the blocking element 14 is therefore located in a corresponding bore hole of the lock core 3 where it has a bearing zone 35 and is freely rotatable in it.

10 The bore hole 26 is arranged as a through hole parallel to the main center plane of the key channel 4 and sits laterally adjacent to it with a gap so that the gear wheel 17 of the blocking element 14 can extend into the key channel.

15 Figures 5 and 6 in particular show the arrangement of the blocking element 14 in the inner end area of the key core and/or of the key channel and of the linear gear element 19 corresponding to it only in the area of the key tip. As a consequence of the deep arrangement of the blocking element in the key channel this measure allows practically no tampering to overcome the system.

20 Furthermore it is proposed that the shaft of the blocking element 14 have an external diameter which corresponds to the root diameter of this gear wheel 17.

25 In this way it is ensured that the circle of engagement between this gear wheel 17 and the linear gear element 19 on the has as great a diameter as possible and the shaft as well.

Furthermore it is proposed that the bore hole 26 of the lock core should align with a cut-out 27 in the housing 2 of the profiled lock cylinder 1 in the rotation position which the lock core assumes in the key insertion position.

30 As Figures 1 and 2 show in particular, a locking lug 28 can then be provided on the lower end of the shaft, which is turned into the cut-out 27 of the housing in order to prevent the rotating motion of the lock core with unauthorized keys.

35 As a comparison of Figures 1 and 2 shows, the locking lug is formed here by a secantial bevel which in the release position corresponding to Fig. 2 lies completely the contour which circumscribes the lock core.

Free rotational movement is ensured in this way as soon as an access-authorized key has properly aligned the blocking element 14.

In doing so, as shown, the angle of rotation of the blocking element 14 can be up to 180° .

5 In this way the maximum depth of engagement possible for the locking lug 28 in the cut-out 27 of the housing 2 is ensured.

The manufacture of the cut-out 27 is facilitated if it is designed as an axial groove running parallel to the longitudinal direction of the lock core 3.

10 As a comparison of Figures 1 and 2 also particularly shows, such an axial groove can be provided on each of the two sides of the center plane of the bar-like area of the housing 2, in order to be able to manufacture a profiled lock cylinder equally suited for right or left striking of the door.

15 Furthermore, the Figures show that the blocking element 14 has a semi-spherical rounded end 29 on its end which supports the gear wheel 17, which is run on the interior wall 30 of the housing bore hole for the lock core 3 in a sliding manner but practically without play.

20 In addition to this, Figures 13 and 14 show a further development in which in the housing 2 of the profile cylinder two cut-outs 27, 27' are provided in each case, in which the shaft engages in each case with a locking lug 28, 28' of which one sits on the blocking element 14 on the end side in each case.

25 Furthermore, the bore hole 26 is executed as a step bore so that the shaft is run in the other direction of the narrowing area of the step bore.

The blocking element 14 is therefore run axially with any precision between the interior wall 30 of the housing 2 and the diameter step provided in the step bore.

30 In addition to this the Figures 6 and 7 show in particular that the linear gear element 19 is situated at the key tip.

Moreover, Fig. 6 shows that the linear gear element begins with a tooth base in which the gear wheel 17 then engages with a corresponding tooth tip so that from the first moment a positive
35 locking, error-free contact is ensured between the blocking element 14 and the key 5.

As Fig. 7 further shows, the linear gear element is worked into the material of the key without going beyond the maximum outer contour of the key.

5 If this linear gear element is made without cutting, i.e. by pressing, an additional reinforcement of the material at the key tip occurs here. This offers the additional advantage of an automatic reduction of the wear.

10 In addition to that Fig. 5 shows that the bore hole 26 is larger at its upper end than at its lower end where it opposes the cut-out 27.

The assembly of the blocking element 14 is therefore possible in a simple way by insertion from above.

15 Since in addition to that the blocking element 14 is guided with the spherical end 29 on the interior wall 30 of the housing 2, even with the most varied rotation positions the blocking element 14 cannot fall out of the position shown.

20 Figures 8 and 9 furthermore show the arrangement of the lengthwise boreholes in the lock core 3, which serve to accommodate the respective displacement elements 23 and associated return springs 16.

There are simple lengthwise bores, the inside diameter of which is adapted to the cross section of the respective displacement element and which lie laterally adjacent to the bore holes for the pin tumblers 8 shown.

Drawing reference list

- | | | |
|----|-----|-------------------------------|
| 5 | 1 | Profiled lock cylinder |
| | 2 | Housing |
| | 3 | Lock core |
| | 4 | Key channel |
| | 5 | Key |
| 10 | 6 | Key shaft |
| | 7 | Recess |
| | 8 | Pin tumbler |
| | 9 | Core pin |
| | 10 | Cylinder pin |
| 15 | 11 | Tumbler spring |
| | 12 | Separation interface for 2-3 |
| | 13 | Separation interface for 9-10 |
| | 14 | Blocking element |
| | 15 | Blocking position |
| 20 | 16 | Return spring |
| | 17 | Gear wheel |
| | 18 | Blocking body |
| | 19 | Linear gear element |
| | 20a | First contact area |
| 25 | 20b | Second contact area |
| | 21 | Flat dog |
| | 22 | Sliding area |
| | 23 | Displacement element |

	23a	Toothed shaft
	24	Gear wheel
	25	Rotation stop
	35	Shaft bearing zone
5	26	Bore hole
	27	Cut-out
	27'	Cut-out
	28	Locking lug
	28'	Locking lug
10	29	Spherical end
	30	Interior wall

Patent Claims

- 5 1. A profiled lock cylinder (1) and associated key (5) with recesses (7) on the key shaft (6) for the alignment of spring-loaded pin tumblers (8), in each case consisting of a core pin (9) and cylinder pin (10), which can be aligned by an associated key (5) with the separation interface between the core pin (9) and the

10 cylinder pin (10) in the separation interface (12) between the circularly cylindrical part of the housing (2) of the profiled lock cylinder (1) and its lock core (3) and with at least one supplemental blocking element (14) extending laterally with gear wheel type toothing into the key channel (4) of the key core, which has a blocking body (18) under load in the direction of its

15 blocking position (15) from a return spring (16) and bearing a gear wheel (17), which in the blocking position produces a positive locking connection between the lock core (3) and housing (2) of the profiled lock cylinder (1), whereby however the positive locking connection ceases with corresponding turning by a linear gear element (19) applied laterally on the key (5) and corresponding to the gear wheel (17) of the blocking element (14), characterized in that the return spring (16) can be

20 displaced from the blocking position (15) via a displacement blocking element (23) which is separate from the element (14) and movable relative to the blocking element (14) by means of a gear coupling which occurs by the cooperation between a toothed shaft (19) and a therewith coupled pinion (17) – preferably movable in a linear manner.

25
- 30 2. A profiled lock cylinder (1) according to claim 1, characterized in that the displacement element (23) is acted upon by the return spring (16).
- 35 3. A profiled lock cylinder (1) according to claim 1 or 2, characterized in that the gear coupling occurs in a positive locking manner via a pairing of contact areas (20a, 20b) which are movable with respect to each other, one provided on the blocking element (14) and the other on the displacement element (23).
- 40 4. A profiled lock cylinder (1) according to one of the claims 1 to 3, characterized in that the displacement element (23) between

two stop positions can be moved linearly and in that the return spring (16) is a coil spring.

5. A profiled lock cylinder (1) according to claim 3 or 4, characterized in that the gear coupling occurs via a flat dog (21) on the blocking element (14) and a sliding area (22) provided on the displacement element (23), in which the flat dog (21) and sliding area (22) are in positive locking mutual contact.
6. A profiled lock cylinder (1) according to claim 3 or 4, characterized in that the gear coupling occurs via a toothed shaft (23a) on the displacement element (23) and a gear wheel (24) on the blocking element (14), in which the toothed shaft (23a) and gear wheel (24) are in positive locking mutual contact.
7. A profiled lock cylinder (1) according to claim 6, characterized in that the gear wheel (24) in the blocking position (15) of the blocking element (14) runs up to a rotation stop (25) on the displacement element (23).
8. A profiled lock cylinder (1) according to one of the claims 1 to 7, characterized in that the blocking element (14) rests on a overhung shaft (35) in the lock core (3).
9. A profiled lock cylinder (1) according to claim 8, characterized in that the shaft has the root diameter of the gear wheel (17) as its external diameter.
10. A profiled lock cylinder (1) according to claim 8, characterized in that the shaft rests in a bore hole (26) of the lock core (3), which in the key insertion position of the lock core (3) is aligned with at least one cut-out (27, 27') in the housing (2) on the end side of the shaft, and that the shaft has a locking lug (28) extending into the cut-out (27, 27'), which in a rotation position of the lock core (3) corresponding to the key insertion position lies completely within the lock core (3) when the key (5) is fully inserted.
11. A profiled lock cylinder (1) according to claim 10, characterized in that the locking lug (28) forms a secantial bevel running within the outer contour of the lock core (3) when the key (5) is fully inserted.
12. A profiled lock cylinder (1) according to claim 10 or 11, characterized in that the shaft passes through an angle of rotation of up to 180°.

13. A profiled lock cylinder (1) according to claim 10 or 11, characterized in that the shaft passes through an angle of rotation of only about 60°.
- 5 14. A profiled lock cylinder (1) according to claim 10, characterized in that the cut-out (27) in the housing (2) of the profiled lock cylinder (1) is an axial groove running parallel to the longitudinal direction of the lock core (2).
- 10 15. A profiled lock cylinder (1) according to one of the claims 8 to 14, characterized in that the shaft is guided on its end bearing the gear wheel (17) with a semi-spherical round end (29) on the interior wall (30) of the housing bore for the lock core (3).
16. A profiled lock cylinder (1) according to one of the claims 8 to 15, characterized in that the shaft is rests in a step bore which is arranged between two pin tumblers (8).
- 15 17. A profiled lock cylinder (1) and associated key (5) according to one of the claims 1 to 16, characterized in that the blocking element (14) is placed in the end area of the key channel (4) and the linear gear element (19) on the key tip.
- 20 18. A profiled lock cylinder (1) according to one of the claims 1 to 17, characterized in that the linear gear element (19) is manufactured without cutting.