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Reversible Keys for Profile Cylinders

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The present invention pertains to reversible keys for profile cylinders in accordance with the preamble of the main claim.

15 The invention further concerns a system of reversible keys and a system of assigned profile cylinders in accordance with the preamble of claim 5 as well as profile cylinders and reversible keys in accordance with the preamble of claim 8.

20 Fundamentally, the invention derives from a reversible key, which is also referred to as a flat key and which is used for locking an assigned profile cylinder.

25 Such a reversible key has notches of various cut depths on both its narrow edges, which serve to align the pin tumblers provided in a row in the profile cylinder so that the lock cylinder can be actuated.

30 With such a reversible key it is important to the invention that both narrow edges of the key shaft are provided with notches having a laterally reversed arrangement so that the reversible key can be inserted in the key channel of the lock core in the two possible insertion positions offset by 180 degrees with respect to each other, referred to in this application as key turning positions.

 Such reversible keys from the applicant are known, for example, from EP 1 503 010 A1.

Furthermore, from DE 199 39 734 A1 a reversible key is known, on which on both broad sides of the key shaft recesses are provided beginning from the key tip and extending a distance toward the key grip.

5 These recesses serve to align additional pin tumblers which are actuated via an angular face diverting mechanism when the reversible key is inserted.

10 These additional pin tumblers are located on the inner end of the lock cylinder and correspond in their design in principle to the usual pin tumblers consisting of core pins and cylinder pins as well as intermediate pins.

15 However, the shifting of the pin tumblers via the aforementioned inclined surface pairings is likely to enable actuation of the lock cylinder without catching only with the aid of additional lubricant.

Moreover, two variations are possible with such control pins, but no access authorizations in hierarchical order.

20 It is therefore the task of the present invention to develop the reversible key known from EP 1 503 010 A1 such that in addition to improved copy protection an increased number of variations is also possible in a hierarchical arrangement.

The invention solves this task with the characteristics of the main claim.

25 In addition to that, it is the task of the invention to create access authorizations in at least two predetermined hierarchical levels with the inventive reversible key in a system comprising such reversible keys and assigned profile cylinders.

30 The invention solves this task with the characteristics of claim 5.

35 A further subtask of the invention is based on specifying measures on the profile cylinder with which in addition to the pin tumblers, which are themselves known, a blocking or release of the lock cylinder is possible with an appropriately

designed reversible key.

The invention solves this subtask with the characteristics of claim 8.

5 The invention is distinguished in that on one and the same reversible key, in addition to the usual notches on the narrow edges and the bore holes possibly provided on the broadside of the key shaft for aligning any pin tumblers arranged laterally on each broad side, an additional contour cut is provided, which has the variation edges, which according to position,
10 distance from the key tip and geometric characteristics cannot be copied readily on conventional machines.

Consequently the inventive measures produce a reversible key which requires an additional tool for copying as well as an additional scan tool to apply the two variation edges
15 provided on a duplicate key.

Both variation edges must therefore be produced for a compatible duplicate key in accordance with the original dimensions with respect to their absolute position on the key and their relative position with respect to each other,
20 because otherwise it is to be assumed that the duplicate key, which was possibly produced without authorization, will not lock.

Moreover, the arrangement of two variation edges in each case on each of the two broad sides of the key enables a
25 plurality of variation options, because each of the two variation edges must be produced by itself with respect to its distance from the key tip, its geometric characteristics and its width, and nonetheless the relative positions of both variation edges with respect to each other is also to be
30 considered.

The invention therefore results in the advantage that an unauthorized copy of such a reversible key can only be produced with considerable effort, so the inventive reversible key actually provides considerably improved copy security than
35 the known systems.

The inventive reversible key therefore satisfies consumer interests for greater copy security, particularly also because

the variation edges should preferably stand perpendicularly on the broad sides of the key shaft.

5 The production of these geometric characteristics by itself requires a machining tool with its rotating axis perpendicular on the broad sides of the reversible key, such as a cylinder milling tool and a corresponding scanning device.

10 There it is advantageous that on both variation edges on each broad side, i.e. altogether four variation edges per reversible key, it is not apparent whether or not they are actually intended for the actuation of correspondingly assigned displaceable contact surfaces in the lock cylinder.

15 The presence of the - altogether - four variation edges cannot be overlooked during the subsequent production of an (unauthorized) key copy, so that for this reason the measures in accordance with the present invention already considerably complicate the production of unauthorized key copies.

20 In addition to that the two variation edges on each broad side of the reversible key must be arranged laterally reversed of each other with respect to the two possible key turning positions. This requirement implies an increased precision of fabrication.

25 Moreover, the measures in accordance with the present invention enable the use of such reversible keys and possibly assigned profile cylinders in addition to already existing master key systems, because although the inventive reversible key is in fact designed to lock subordinate profile cylinders, their reversible keys are not suited for locking superordinate profile cylinders.

30 Consequently the invention also creates the option to add possible improvements in copy security to master key systems with existing profile systems.

35 For certain application scenarios, reversible keys of even the lowest hierarchy according to EP 1 503 010 A1 could be made, while at least the reversible keys of the highest hierarchy must have the characteristics of the present invention.

Embodiments are conceivable in which the reversible keys of the middle hierarchy have on their broad sides either no variation edge or only one on each broad side.

5 The invention consequently also improves the possible number of variations within already existing master key systems, but particularly improves the copy security of reversible keys of the highest hierarchy.

10 In a practical embodiment, the two variation edges are formed on each broad side of the reversible key by two slots arranged one after another, of which the slot toward the tip of the key begins with a relatively large width.

A smaller slot then follows at the end of this first slot and continues a distance in the direction of the key grip.

15 At the end of the second slot the second variation edge is formed in this manner, while the variation edge of the first slot originates from the end this slot facing the key grip.

20 The variation edges can run crossways, aslant, perpendicular or even curved with respect to the longitudinal direction of the key shaft. They must only cross the longitudinal direction in some way so that when the reversible key is inserted in the profile cylinder a stop edge on the reversible key stands ready crossways to the direction of insertion.

25 Nearly any arrangement of the variation edges in the longitudinal section is possible.

One optimal stop variation results, for example, with variation edges which stand perpendicularly on the broad sides of the key shaft in the longitudinal section of the reversible key.

30 However, it is also possible to produce the variation edges with a truncated cone cutter, for example.

The variation edges would then stand at a corresponding angle on the broad sides of the reversible key.

There the geometry of the variation edges - seen in the

longitudinal section - should be a complementary match with the geometry of corresponding counterstops provided in the profile cylinder.

5 In order to achieve non-wearing interaction between the variation edges of the reversible key and the assigned counterstops in the lock cylinder over a long period of time as well, it is also proposed to provide a variation slider in the lock core of the profile cylinder, which is equipped with two stop extensions protruding into the key channel, of which
10 in each case one acts together with one of the two variation edges of the reversible key.

This is facilitated in that each of the two stop extensions extends into the key channel, both stop extensions are arranged one after another in the longitudinal direction
15 of the key channel and in the cross direction in each case at the height of the assigned variation edge of the inserted reversible key.

Since the variation slider is within a longitudinal recess of the lock core, it can be displaced by interaction between a variation edge and an assigned stop extension within the lock
20 core and thus be used for actuating additional tumbler elements.

The variation slider has a release recess for this purpose, in which with corresponding axial positioning the transverse extension of a locking bar can engage within the
25 longitudinal recess in the lock core so that the locking bar can be moved from its lock position to its release position.

These measures therefore favor long-term non-wearing interaction through a simple lock/release position without gear mechanism transfer elements between the variation slider
30 and transverse extension of the locking bar.

Exemplary embodiments are specified for this.

It is also particularly advantageous that both the stop geometry of the variation slider as well as the arrangement of
35 the variation edges are freely selectable in principle so that reversible keys of the present invention in supplementing existing systems can allow additional hierarchies to be

created and facilitate different security requirements just as well.

For this purpose it is proposed to situate the reversible keys in accordance with the present invention and the corresponding profile cylinders with their variation sliders as far up as possible for the respective hierarchy and/or security requirement, such as for a master key and important superordinate keys or even individual keys to doors with special security requirements.

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

These show in

Fig. 1: a first embodiment of the invention, first variation edge in the engagement;

Fig. 1a: a further embodiment of the invention, second variation edge in the engagement;

Fig. 2 a further embodiment in accordance with Fig. 1;

Fig. 2a a further embodiment in accordance with Fig. 1a;

Fig. 3 an embodiment for a reversible key of the highest hierarchy;

Fig. 4 an embodiment for a reversible key of a differing access authorization;

Fig. 5 an embodiment for a reversible key of lower hierarchy;

Fig. 6 an embodiment for a reversible key of the lowest hierarchy;

Fig. 7 to 9a interaction between a reversible key and an assigned profile cylinder;

Fig. 10a to 10d reversible key and lock cylinder, variation slider and locking bar;

Fig. 11a to 11d examples of a variation slider;

Fig. 12a

to 12b interaction between a stop extension and a variation edge;

Fig. 13a

5 to 13b interaction between a stop extension and a variation edge;

Fig. 14a

to 14e further details for a reversible key, variation slider, stop extensions

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

The figures show a reversible key 1.

15 19. It is a reversible key for an assigned profile cylinder

The reversible key 1 is designed as a flat key and can be inserted in the key channel 26 of the profile cylinder in two insertion positions offset by 180 degrees with respect to each other.

20 Notches 6 of various cut depths are provided in a laterally reversed arrangement on both narrow edges 4 of the reversible key 1.

25 The notches 6 have a laterally reversed arrangement with respect to the two possible key turning positions because it is a reversible key.

The notches 6 serve to align so-called pin tumblers, which are provided in the form of core pins, housing pins and possibly intermediate pins in the profile cylinder.

30 In addition to this on the broad sides 5 of the key shaft 2 there are recesses 8 provided which extend from the key tip 7 a distance in the direction of the key grip 3.

The recesses 8 are arranged on the opposite broad sides 5 of the key shaft such that they are laterally reversed with respect to the two possible key turning positions.

Here each of the two recesses 8 has at least two different variation edges 12,13 running in the cross direction 11 of the key shaft 2.

5 The two variation edges are independent of one another and accessible from the key tip 7.

This means that they are arranged in different transverse areas of the key shaft 2 with respect to the longitudinal direction 9 of the key shaft, which is described by the longitudinal course of the profile ribs 10.

10 The first variation edge 12 is thus located in a first transverse area 14 while the second variation edge 13 is arranged in the second transverse area 15.

Both transverse areas 14,15 have a longitudinal spacing 16 from each other in the longitudinal direction 9, so that each
15 variation edge 12,13 is able to cover another longitudinal area in the key channel 26 of the profile cylinder 19.

This will be discussed.

The arrangement of the two variation edges 12,13 in different transverse areas 14,15 means that they are also
20 accessible independently of one another.

The Figures 1 to 2a show various exemplary embodiments for this.

In the case of Figure 1, after a particular depth of insertion in the key channel, the first variation edge 12
25 encounters the first stop extension 28 assigned to it and displaces this upon further insertion in its direction of movement (see, for example, Fig. 13b), while the second stop extension 29 has no contact to the second variation edge 13.

Since both stop extensions 28,29 are located on one and
30 the same part in the lock core 25 of the profile cylinder 19, the gap between stop extension 28 and stop extension 29 is maintained on the entire path which this part moves on by means of the reversible key 1 during insertion.

Therefore individual control functions can be effected in

the profile cylinder 19 via the possible displacement path in each case; these will be discussed.

Figures 1a and 2a on the other hand show a missing first variation edge 12, whereas the second variation edge 13 serves
5 for acting upon the second stop extension 29.

Thus in these embodiments the first stop extension 28 passes unchecked to nowhere, while the second stop extension 29 is acted upon by the second variation edge 13 in the sense above.

10 In the embodiments 1 to 2a shown, the general direction of the variation edge 12,13 is shown transverse to the longitudinal direction 9 of the key shaft 2.

In the embodiment of Figure 1, the first variation edge 12 aslant to the longitudinal direction of the key.

15 In all embodiments, the second variation edge 13 runs perpendicular to the longitudinal direction and in addition to that in Figure 2 the first variation edge 12 does as well.

The geometric course of the variation edge 12,13 is thus freely selectable in principle without departing from the
20 basic idea of the invention.

Both recesses 8 are applied at the key tip and consequently weaken the cross-section of the key only in this relatively unsusceptible area.

25 The recess in a laterally reversed arrangement in each case is located on the back side and can be recognized by the dashed contour.

Moreover, the figures show embodiments, for which each recess 8 begins at the key tip 7 with a slot of constant width 17, to which a further slot of lesser width 17a connects in
30 the direction of the key grip 3. In this manner the variation edges 12,13 are formed in each case by the end area of each slot.

At the end area of each slot an edge area, is consequently formed which runs transversely to the longitudinal direction 9

of the key shaft 2 and which allows the particular variation edge 12 or 13 to be produced.

Purely of technical manufacturing advantage is a further development in which each recess 8 has a constant depth T over
5 its entire length 18.

The recesses 8 depicted can thus be produced using a correspondingly configured milling fixture.

In addition to that, Figures 3-6 show a system of altogether 4 reversible keys for a system of assigned profile
10 cylinders.

The individual key cross-sections of the reversible key in accordance with Figures 3-6 have an arrangement of profile ribs 10 prespecified by the manufacturer.

In this embodiment, the profile ribs 10 are formed in the
15 same manner with all reversible keys.

The individual reversible keys constitute a predetermined hierarchy of the sort where the reversible keys of the highest hierarchy 20 lock all profile cylinders, the reversible keys of the lower hierarchy 21 lock the profile cylinders corresponding to this hierarchy as well as subordinate profile cylinders, and the reversible keys of the lowest hierarchy 22 only lock the profile cylinders of the lowest hierarchy.

In this system at least the reversible keys of the highest hierarchy 20 have recesses 8, which form at least two
25 different variation edges 12,13 independent of one another and running transversely to the longitudinal direction 9 of the key shaft 2.

Both variation edges 12,13 are accessible independently of one another via the respective recess 8 beginning at the key
30 tip 7.

This means that each variation edge 12 is designed for actuation of a stop provided in the profile cylinder independently of the other variation edge 13 and vice versa.

Furthermore, both variation edges 12,13 of a broad side 5

are in a matching laterally reversed arrangement with the two variation edges 12,13 on the back side of the key shaft 2, which is not visible here, with respect to the two key turning positions.

5 It is thus important that at least the reversible keys of the highest hierarchy 20 be provided with the aforementioned characteristics for the two variation edges 12,13 in each case.

10 As a comparison of the Figures 3-6 shows, all reversible keys are provided with matching notches 6 in a laterally reversed arrangement on their narrow edges.

Thus all reversible keys lock the pin tumblers associated to the profile cylinders via their narrow edges.

15 In addition to this, the reversible keys of Figures 4 and 5 show lateral bore holes which serve to align corresponding pin tumblers arranged laterally in the profile cylinder; the reversible key according to Figure 4 operates a different pin tumbler than the reversible key according to Figure 5 due to the different axial position.

20 However, both lateral pin tumblers are actuated by a reversible key according to Figure 3.

This reversible key therefore aligns the pin tumblers via its narrow edges the same as the other reversible keys and also the lateral pin tumblers according to Figures 4 and 5.

25 Furthermore, the reversible keys of Figures 4,5 and 3 have a supplemental hierarchy.

The reversible key according to Figure 5 has a recess in the sense of the characteristics of claims 1 to 4 with the difference that only a single variation edge 12 is provided.

30 This variation edge can meet a correspondingly designed stop in the profile cylinder and displace it until the key stop is reached.

The superordinate keys 4 and 3 are likewise able to do so.

In additional, however, the key according to Figure 4,

which is superordinate to a key according to Figure 5, has a further variation edge 13, which is located at the end of the slot of lesser width 17a and, in a particular insertion position of the reversible key, activates a stop arranged
5 there in the profile cylinder.

This stop is not reached by the reversible key according to Figure 5, because prior to that the preceding first variation edge 12 becomes effective.

10 The second variation edge 13 which possibly takes effect after that should encounter a correspondingly arranged stop in the profile cylinder and displace it according to its geometric longitudinal geometry.

Such a key could therefore operate a special group of lock cylinders.

15 As a comparison of Figures 4 and 5 also shows, both keys have a first variation edge 12 and a second variation edge 13.

In the case of Figure 5, however, the wide slot toward the key tip 7 was extended as far in the direction of the key grip 3 as the slot of lesser width 17a on a key according to Figure
20 4 requires.

From this it is clear that the design of the two variation edges 12 and 13 is practically arbitrary as long as the spacing between the two variation edges is maintained along with the spacing of one of the variation edges from the depth
25 stop of the reversible key according to the requirement of the stop extensions 28, 29 provided in the profile cylinder 19; these will be discussed.

Moreover, Figure 3 shows the key of the highest ranking, e.g. the master key.

30 This reversible key also has two variation edges 12,13 of which the first variation edge 12 matches the variation edge 12 of the same designation in the subordinate keys of Figures 4 and 5.

The master key also exhibits the two lateral indentations
35 required to actuate the corresponding pin tumblers which are

provided on the profile cylinders for the reversible keys according to Figures 4 and 5.

Furthermore, the second variation edge 13 in the master key is displaced toward the back far enough that the associated stop extension in the profile cylinder cannot be reached by any of the keys according to Figures 4 and 5.

This means that the master key according to Figure 3 is in fact designed to lock the profile cylinders of the keys according to Figures 4 and 5, but not the other way around, because the master key always aligns the respective stop extension 28 in the profile cylinder 19 via the first variation edge 12. In order for it to be able to do this without hindrance in all profile cylinders 19 of the entire master key system, its second variation edge 13 extends so far in the direction of the key grip 3 that at least the greatest length used in this master key system is reached.

The Figures 7 to 9a show the interaction between the master key according to Figure 3 and an associated profile cylinder.

For reasons of clarity the so-called variation slider 27 (which is still to be discussed based on Figures 10 to 14) is omitted.

However, the variation slider is the subject of Figures 8, 8a.

The Figures 8, 8a. correspond to sectional views along the line VIII - VIII according to Figure 7.

Accordingly, Figures 9, 9a correspond to sectional views according to the line IX -IX in Figure 7.

The reversible key 1 is completely inserted in the key channel of the lock core 25.

The profile cylinder 19 has in its base area 23 pin tumblers 24 arranged in a single row, which consist of cylinder pins and core pins in a familiar manner.

These pin tumblers are aligned by the notches 6 of the

reversible key 1 located in the key channel so that they are located with their separating joint in the rotation plane of the lock core 25.

5 In this respect, reference is made to the state of the art.

Furthermore, one recognizes based on the Figures 8,8a that the recesses 8 have a constant depth T over the entire length 18.

10 The depth T of the recesses 8 is in each case less than half the thickness of the of the key shaft 2.

Since the recesses 8 are located in the area of the key tip 7, the stability of the reversible key 1 is limited only in an insignificant way for practical projects.

15 It is important that a variation slider 27 is provided in the lock core 25 of the profile cylinder 19, which has two stop extensions 28,29 in the longitudinal direction 9 of the key channel 26 one after the other and in the transverse direction 11 arranged at the height of one of the variation edges 12,13 of the inserted reversible key 1 which project
20 from one side into the key channel 26 and that the variation slider 27 can be axially shifted within a longitudinal recess 30 of the lock core 25.

This is described in more detail based on the figures 7-8a in conjunction with figures 10 to 14.

25 In this regard the figures show a lock core 25 at the inner end of which a longitudinal recess 30 is arranged, which faces the lock bit of the profile cylinder 19.

Within the longitudinal recess 30 there is an axially movable variation slider 27.

30 The variation slider 27 has an axial length which is shorter than the length of the longitudinal recess 30.

Therefore the variation slider 27 can be moved in the longitudinal recess 30 within the length difference.

The longitudinal recess is laterally tangential to the key

channel 26, as shown particularly in Figures 8,8a.

There two stop extensions 28,29 that are permanently attached to the variation slider 27 project into the key channel.

- 5 The stop extensions 28,29 are arranged in upper positions of the key channel 26 where the first and the second variation edges 12,13 of the reversible key pass by during insertion in the key channel 26.

- 10 If this is an access-authorized reversible key for this profile cylinder 19, one of the two variation edges 12,13 will meet the assigned stop extension 28,29 and in this manner displace the variation slider 27 toward the lock bit.

The extension path depends on the arrangement of the variation edges 12,13 concerned on the reversible key 1.

- 15 Because the variation slider 27 furthermore faces the insertion direction of the reversible key subject to the initial load of a spring 31, it always assumes the preferred position shown in Figure 10a as long as it is not actuated by an inserted reversible key.

- 20 In this initial position one of the two stop extensions 28,29 interact with the inserted reversible key.

- 25 If the reversible key corresponding to Figure 6 does not have the inventive recess 8, the variation slider 27 will be technically displaced without functioning and the respective profile cylinder 19 is not released.

If, on the other hand, it has a stop extension 28,29 set up for one of the two variation edges 12,13, the variation slider corresponding to Figure 10c will be shifted so that it can release a locking bar 33 corresponding to Figure 8,8a.

- 30 As Figures 8,8a and 11a to d in particular as well as 12a and c to g show, the longitudinal recess 30 in the lock core 25, which receives the variation slider 27, is crossed by a secantial recess 38 in the lock core 25 for this purpose.

The variation slider 27 has a release recess 32 at a

predetermined point which engages with the recess 38.

In this sense the release recess 32 is a secantially oriented extension of the recess 38, which likewise runs secantially in the lock core 25.

5 A transverse extension 34 of a locking bar 33 is run there.

The transverse extension 34 of the locking bar 33 can, given the corresponding alignment of the release recess 32, insert into the latter, so that the locking bar 33, which is
10 usually located in the cylinder surface 35 between the lock core 25 and the housing of the profile cylinder 19, can then be lifted out of a corresponding indentation 37 when the lock core 25 is turned.

Then the lock core 25 of the profile cylinder 19 can be
15 freely turned.

It can additionally be stated that the locking bar 33 can also be acted upon by a spring 36 towards the housing of the profile cylinder 19, which preferably is applied approximately in the center of the locking bar 33.

20 Additionally the Figures 7 and 9,9a show the interaction of the reversible key 1 as per Figure 7 with the complementary locking pins in Position IX - IX as per Figure 7.

The locking pins are intended to insert with their ends pointing to the key channel 26 in the corresponding
25 indentations of the reversible key 1.

If the reversible key 1 does not have these indentations in the right place corresponding to Figure 4-6, there is no access authorization for this profile cylinder 19.

Consequently, the locking pins 39 in their position as
30 shown in Figure 9, in which they are not inserted in a corresponding indentation in the reversible key 1, prevent the locking bar 33 from extending out of its indentation in the housing of the profile cylinder 19 via a common contact surface to a corresponding transverse extension 34a of the
35 locking bar 33, so that any turning of the lock core 25 is

precluded.

5 If however the reversible key 1 has the applicable indentation on its broad side 5, the locking pin can insert in this well and the locking bar 33 enables the turning of the lock core 25.

In accordance with the invention, these locking pins can be provided singly or multiply, in particular to provide variation for access authorizations as well.

10 In addition to this, Figures 8 to 9a show a special feature in particular.

The locking bar 33 sits in an indentation 37 of the housing of the profile cylinder 19.

15 The indentation is formed in such a way that with the longitudinal recess 30 of the variation slider 27 aligned in release position, i.e. if the transverse extension 34 can retract into the release recess 32, the locking bar 33 is lifted out of the indentation 37 when the lock core 25 is rotated so that the lock core 25 can be turned freely.

20 If in addition to that the reversible key 1 according, for example, to Figure 6 has no recess 8 on the key tip 7, this leads to a displacement of the variation slider 27 according to Figure 10b up to the back stop, which technically does not result in a release of the locking bar 33, because the release recess 32 is not congruent with the transverse extension 34.

25 Consequently, the lock core 25 cannot be turned.

The representations according to Figures 10c and/or 10d show possible release positions, in each case dependent on the position of the release recess 32, which is achieved with complete insertion of the reversible key 1.

30 In order that, for example, one and the same variation slider can be moved into release position by different keys with differently designed recesses 8, the release recess 32 in the variation slider 27 could, for example, be made accordingly long or a separate release recess 32 could be
35 provided in the variation slider 27 for both positions in

each case.

In addition to this, Figures 11a to d show diverse views of variously executed variation sliders 27.

5 The interaction of the stop extensions 28, 29 on reversible keys 1 with differently designed recesses 8 is depicted in the Figures 12a/b and 13a/b.

Figure 11a is a view of the variation slider 27 according to Figure 11c from below.

10 The stop extensions 28, 29 have different profile cross-sections such that only one of the stop extensions 28, 29 interacts in each case with one of the two variation edges 12, 13.

15 In this regard a comparison of Figure 11c and d shows that the spacing of the effective areas of the variation edges 12, 13 can be varied with the dimensions of the variation slider 27 unchanged.

This also applies for the respective profiles of the stop extensions 28, 29 as is apparent from Figure 11b.

20 It shows a truncated cone profile for the first stop extension 28 and on altogether rectangular profile for the second stop extension 29.

25 As a comparison of Figures 12 and 13 show here, the truncated cone-shaped stop extension 29 fits into a correspondingly shaped recess 8 of the reversible key 1, while the rectangular stop extension 28 only fits in the corresponding recess 8 of the reversible key 1, which is also designed to be rectangular.

Further embodiments for the arrangement and profiling of the stop extensions 28, 29 are found in Figures 14a to g.

30 The embodiments shown there bear the same reference numbers as the previously shown embodiments and make clear that both the functional lengths of the variation slider, the stop extensions and recesses as well as the position of the release recess 32 can vary in size and number.

For the embodiments shown in Figures 14a to g, the disclosures for the reference numbers shown there apply in a corresponding manner.

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Drawing reference list

	1	Reversible key
	2	Key shaft
10	3	Key grip
	4	Narrow edge
	5	Broad side
	6	Notch
	7	Key tip
15	8	Recess
	9	Longitudinal direction
	10	Profile rib
	11	Cross direction
	12	First variation edge
20	13	Second variation edge
	14	First transverse area
	15	Second transverse area
	16	Longitudinal spacing
	17	Width
25	17a	Smaller width
	18	Length
	19	Profile cylinder
	20	Reversible key of the highest hierarchy
	21	Reversible key of a lower hierarchy
30	22	Reversible key of the lowest hierarchy
	23	Base area
	24	Pin tumbler

	25	Lock core
	26	Key channel
	27	Variation slider
	28	First stop extension
5	29	Second stop extension
	30	Longitudinal recess in 25
	31	Spring for 27
	32	Release recess
	33	Locking bar
10	34	Transverse extension
	34a	Transverse extension
	35	Cylinder surface
	36	Spring for 33
	37	Indentation
15	38	Recess in 25
	39	Locking pin
	T	Depth

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Patent Claims

1. A reversible key (1) for profile cylinders (19), in which the reversible key (1) is provided on both its narrow edges (4) with notches (6) of various cut depths in a laterally reversed arrangement with respect to the two possible key turning positions and with which on both broad sides (5) of the key shaft (2) there are recesses (8) provided which begin at the key tip (7) and extend a distance toward the key grip (3), **characterized in that** each of the two recesses (8) forms at least two different variation edges (12,13) which are independent of one another and run transverse (11) to the longitudinal direction (9) of the key shaft (2), said variation edges both being accessible from the key tip (7) independently of one another via the respective recess (8), and in that both variation edges of the one broad side correspond in a laterally reversed manner with the two variation edges of the other broad side with respect to both key turning positions.
2. A reversible key (1) according to claim 1, **characterized in that** the variation edges (12,13) of each recess (8) extend in different transverse areas (14,15) of the key shaft (2) and have a longitudinal spacing (16) from one another in the longitudinal direction (9).
3. A reversible key (1) according to claim 1 or 2, **characterized in that** each recess (8) begins on the key tip (7) with a slot of constant width (17) to which a slot of lesser width (17a) connects and in that the variation edges (12,13) are formed at the end of each slot.
4. A reversible key (1) according to one of the claims 1 to 3, **characterized in that** each recess (8) has a constant

depth over its entire length (18).

5. A system of reversible keys (1) for a system of assigned profile cylinders (19) with an arrangement of profile ribs (10) prespecified by the manufacturer, said ribs forming individual key cross-sections, in which reversible keys (1) and profile cylinders (19) provide access authorizations in a predetermined hierarchy in such a way that the reversible keys of the highest hierarchy (20) lock all profile cylinders, the reversible keys of lower hierarchy (21) lock profile cylinders of their hierarchy or a subordinate hierarchy and reversible keys of the lowest hierarchy (22) lock only the profile cylinders of the lowest hierarchy, **characterized in that** in this system at least the reversible keys of the highest hierarchy (20) are provided with the characteristics of claims 1 to 4.
6. A system according to claim 5, **characterized in that** the reversible keys of lower hierarchy (21) are provided with recesses (8) which on each broad side have recesses with at most a single variation edge (12;13) according to one of the claims 1 to 4, which run transversely with respect to the longitudinal direction of the key shaft in each case and which are both in a laterally reversed arrangement toward each other with respect to both key turning positions.
7. A system according to claim 5 or 6, **characterized in that** the reversible key of the lowest hierarchy (22) has no recesses with the characteristics according to one of the claims 1 to 4 or 6.
8. A profile cylinder (19) and reversible key (1) according to one of the claims 1 to 7, in which the profile cylinder (19) is equipped in its base area (23) with pin tumblers (24) arranged in a single row, which are aligned by the notches (6) of the profile cylinder (1) inserted in the key channel (26), **characterized in that** a variation slider (27) is provided in the lock core (25) of the profile cylinder (19), which has two stop extensions (28,29) arranged one after the other in the longitudinal direction (9) of the key channel (26) in the transverse direction (11) at the height of one of the variation edges (12; 13)

of the inserted reversible key (1) in each case and which extend from one side into the key channel (26), and in that the lock core (25) has a longitudinal recess (30) within which the variation slider (27) can be displaced axially.

9. A profile cylinder (19) and reversible key (1) according to claim 8, **characterized in that** the variation slider (27) sits on the inner end of the lock core (25).

10. A profile cylinder (19) and reversible key (1) according to one of the claims 8 or 9, **characterized in that** the variation slider (27) can be displaced by a spring (31) in the direction of the outer end of the lock core (25) in a defined stop position.

11. A profile cylinder (19) and reversible key (1) according to one of the claims 8 to 10, **characterized in that** the longitudinal recess (30) in the lock core (25), which accommodates the variation slider (27), is crossed by a recess (38) running secantially in the lock core (25) and in that the variation slider (27) has a release recess (32) in at least one predetermined axial position at its position of intermeshing with the recess (38), whereby a transverse extension (34) of a locking bar (33) is guided in the secantial recess (38), and if the transverse extension (34) is not in the release recess (32), the cylinder surface (35) crosses between the lock core (25) and housing of the profile cylinder (19).

12. A profile cylinder (19) and reversible key (1) according to claim 11, **characterized in that** the locking bar (33) is acted upon by springs (36) in the direction of the housing of the profile cylinder (19).

13. A profile cylinder (19) and reversible key (1) according to claim 11 or 12, **characterized in that** the locking bar (33) sits in a recess (37) of the housing of the profile cylinder (19) formed in such a way that it slides out of the recess (37) of the housing of the profile cylinder (19) when the release recess (32) of the variation slider (27) is aligned in the release position and the lock core (25) is turned.

14. Profile cylinders (19) and reversible keys (1) according to one of the claims 8 to 13, **characterized in that** the profile cylinders (19) and reversible keys (1) are part of a master key system consisting of multiple profile cylinders and reversible keys (20,21,22) in a predetermined hierarchy of access authorizations.
15. A profile cylinder (19) and reversible key (1) according to one of the claims 8 to 13, **characterized in that** the profile cylinder (19) and reversible key (1) are part of a group of profile cylinders (19) and reversible keys (20,21,22) with different security requirements in which at least the profile cylinders (19) for higher security requirements are equipped with variation sliders (27).
16. Profile cylinders (19) and reversible keys (1) according to claim 15, **characterized in that** profile cylinders (19) of lesser security requirements are equipped without variation sliders.