

Flat key for cylinder lock and cylinder lock

The invention relates to a flat key for a cylinder lock with an encoded surface, which extends along the longitudinal extension of the flat key, wherein, for encoding, control points, which are connected by a control groove, are provided at sensing positions on the surface, and wherein encoding features to be read in the cylinder lock are provided at the control points.

Flat keys of this kind with control grooves extending along the longitudinal extension are known from the state of the art. It is in particular known to use the position of the control groove as an encoding feature, wherein control slides with reading elements for engaging the control groove are provided in the cylinder lock. As soon as all control slides of the cylinder lock are moved into the designated position by the control groove on the flat key, the cylinder lock locks.

However, in practice, these flat keys and associated cylinder locks suffer from a number of shortcomings. For example, the number of possible variations is limited by the use of discrete encoding features, e. g. the position of the control groove at the respective sensing position. Also, the shape of the control groove and, thus, of the encoding features at the sensing positions can be easily copied by means of modern electronic recording methods.

Thus, the object of the invention is to solve these and other problems of conventional flat keys and associated cylinder locks.

According to the invention, the object is solved by a flat key according to claim 1 and a cylinder lock according to claim 14.

The invention provides that, at a first control point, the encoding feature forms an angle with the central longitudinal plane of the flat key which is different from that of the encoding feature at a second control point. It may be provided that the encoding features comprise surfaces or projections whose angles to the central longitudinal plane of the flat key can be determined. Choosing certain angles of these encoding features leads to further possibilities for variation for encoding the key. In addition, it offers the advantage according to the invention that the angle of the encoding feature cannot be inferred from a simple photo of the key. This makes unauthorized copying of the key more difficult.

Further, the invention may provide that the control groove has a torsion section at least between the first control point and the second control point. Such a torsion section of the control groove is advantageous in that the free cross section of the control groove is not constant, e. g. rectangular, but rotates along the longitudinal direction of the flat key. In a cylinder lock which is not associated with the flat key, this causes control slides to get

caught in the modified cross section of the control groove and prevents the insertion of the key into the keyway. In addition, the torsion section is advantageous in that the torsion of the control groove cannot be directly inferred from a simple photo of the flat side of the key.

5 The invention may further provide that the control groove has a cross section in the torsion section which is rotated by an angle in the range of -45° to $+45^{\circ}$, preferably -30° to $+30^{\circ}$, relative to the cross section of the control groove outside the torsion section. This ensures that also structurally very small control slides have enough material to ensure blocking of an unauthorized key in the keyway of the cylinder lock.

10 The invention may further provide that the angle of the encoding feature to the central longitudinal plane of the flat key changes in the torsion section along the longitudinal extension from a first angle value in the area of the first control point to a second angle value in the area of the second control point. Preferably, the change may be linear. However, it may also be provided that the angle of the encoding feature to the central
15 longitudinal plane of the flat key in the torsion section changes abruptly, e. g. in a stepwise manner. This ensures that the control slides are smoothly guided in the control groove, without blocking due to dirt or production-related inaccuracies.

In particular, the invention may provide that the first angle value is in the range of -45° to 0° , preferably in the range of -30° to 0° , and that the second angle value is in the range of
20 0° to 45° , preferably in the range of 0° to 30° , measured with respect to the central longitudinal plane. In turn, these angle values allow a particularly robust detection of unauthorized key/lock combinations.

The invention may provide that at least one further control groove with control points is provided on the encoded surface next to the control groove, whose encoding features
25 form substantially the same angle with the central longitudinal plane of the flat key at all control points. This means that this further control groove has no torsion section. The use of rotated and unrotated control grooves at the same control point allows numerous additional variations to the key.

In particular, the invention may provide that the rotated and unrotated control grooves
30 have different depths and/or widths.

Particularly preferably, the invention may provide that the encoding feature is configured as a groove bottom of the control groove. The use of the groove bottom as encoding feature is advantageous in that it can be easily sensed by a conventional spring-loaded control slide, since also conventional control slides are typically configured to sense the
35 groove bottom.

The control slides of an associated cylinder lock have to have correspondingly designed sensing elements in order to be able to follow the rotating groove bottom of the control groove upon inserting the key in the keyway along the longitudinal extension up until the designated control point without blocking.

5 The invention may provide that the lateral surfaces of the control grooves always form a substantially right angle with the groove bottom of the control grooves. This results in a rectangular cross section shape of the control groove, which is comparatively easy to produce in practice. However, the invention may also provide that the encoding feature is configured as a material ridge, which extends along the longitudinal extension of the flat
10 key in the control groove. The use of a material ridge offers an alternative to the use of the groove bottom, which is more complex in production, but requires the use of special sensing elements with a correspondingly designed clearance so that an additional possibility for variation is provided.

According to the invention, the material ridge may be arranged substantially centrally in
15 the control groove. The material ridge may have a width corresponding substantially to a third of the width of the control groove, for example. This ensures that the material ridge may be sensed safely and that the material ridge and the remaining lateral areas of the control groove are protected from dirt.

The invention may further provide that the material ridge protrudes beyond the cross
20 section of the key profile. The projection of the material ridge may be comparatively small, e. g. $1/10$ to $1/3$ of the width of the control groove, to prevent the material ridge from being subjected to excess loads and from breaking or bending when handling the flat key.

The invention may provide that the lateral surfaces of the material ridge form a
25 substantially right angle with the groove bottom of the control grooves.

This in turn results in the advantage of a simpler production, especially since only a suitably shaped milling tool needs to be rotated relative to the central longitudinal plane of the flat key when manufacturing the flat key. The encoded surface may be a flat side of the flat key. Alternatively, the encoded surface may also be a narrow side of the flat key.

30 Finally, combinations are possible, in which one encoded surface is provided on the flat side and another one on the narrow side of the flat key.

The invention further relates to a cylinder lock for a flat key according to the invention. Such a cylinder lock comprises a keyway with at least one side and sensing positions provided along the longitudinal extension of the keyway, wherein at least one control slide
35 is provided at each sensing position and wherein each control slide comprises at least

one reading element for reading an encoding feature of a control groove at a control point of the flat key.

Normally, the keyway is part of a cylinder core, which is rotatably arranged in a cylinder housing. In the locked state, the control slides prevent the cylinder core from rotating in the cylinder housing. It may also be provided that the control slides cooperate with one or more locking elements, which counteract a rotation of the cylinder core in the cylinder housing. Upon inserting an authorized key, the control slides are slid into a release position by bringing their reading elements into engagement with encoding features on the flat key, which are arranged at different positions. In the release position, the control slides or the locking elements actuated by the control slides allow the cylinder core to rotate in the cylinder housing.

In the cylinder lock according to the invention, at least one control slide is provided, which comprises a first reading element and a second reading element, wherein the first reading element forms an angle with the central longitudinal plane of the keyway which differs from that of the second reading element. Thus, one and the same control slide comprises two different reading elements.

This enables the control slide to engage differently shaped encoding features at different sensing positions of the flat key. In contrast, conventional control slides with only one single reading element would, upon inserting the key, be blocked by encoding features of the control groove which are not configured for the single reading element.

The invention may provide that the first reading element is designed as a first reading surface and that the second reading element designed as a second reading surface on a sensing cam of the control slide. This allows the control slide to engage a first surface and a second surface of the control groove and to sense corresponding encoding features.

It may in particular be provided that the first reading surface and the second reading surface are designed as end surfaces of the sensing cam for engaging the groove bottom of the control groove of the flat key. This allows a flat key, which has a control groove with a torsion section, to be sensed. In such a torsion section, the groove bottom of the control groove forms a different angle with the central longitudinal plane of the flat key at least at two control points of the flat key. Thus, the first reading surface of the control slide may engage the groove bottom at the first control point and the second reading surface of the control slide may engage the groove bottom at the second control point. This ensures that the control slide can follow the changing orientation of the groove bottom of the control groove along the longitudinal extension of the flat key.

However, the invention may also provide that the first reading surface and the second reading surface are configured as lateral surfaces of a sensing groove of the sensing cam for engaging a material ridge of the control groove of the flat key. In this case, a material ridge is provided in the control groove and the control slide is guided along the material ridge in the control groove. In a torsion section, the material ridge may change its angle to the central longitudinal plane of the flat key so that, at a first control point, the material ridge has a different inclination relative to the central longitudinal plane of the flat key than at a second control point.

As the first reading surface and the second reading surface of the control slide form different angles with the central longitudinal plane of the keyway, the control slide may also follow the control groove in the torsion section; conventional control slides, in contrast, would block.

The invention may further provide at least one further control slide, which comprises a first reading element, but no second reading element. Such known control slides may be combined with the control slides configured according to the invention, in order to create an additional number of possibilities for variation.

The invention may further provide that the first reading surface extends substantially parallel to the central longitudinal plane of the keyway. The second reading surface may form an angle in the range of -45° to $+45^{\circ}$, preferably in the range of -30° to $+30^{\circ}$, but for example also in the range of -15° to $+15^{\circ}$, to the central longitudinal plane.

The invention may provide that the cylinder lock comprises a cylinder core, in which cut-outs with a preferably circular cross section are provided parallel to the central longitudinal plane and at a distance to it at the sensing positions, wherein the control slides are movably mounted in the cut-outs. The control slides can be mounted in the cut-outs without being pretensioned so that, upon inserting the flat key, they may be actively curve-guided into a release position by positively engaging the control grooves of the flat key.

The invention further relates to a system comprising at least one key according to the invention and at least one cylinder lock according to the invention.

Further features according to the invention will become apparent from the figures, the description of the exemplary embodiments, and the claims.

In the following, the invention is explained in more detail on the basis of non-exclusive exemplary embodiments.

Fig. 1 shows a side view of an embodiment of a flat key according to the invention;

Fig. 2 shows a detail of the flat key of Fig. 1;

Figs. 3a-3b show sectional views of the flat key of Fig. 2;

Figs. 4a-4b show sectional views of an alternative embodiment of a flat key according to the invention;

Fig. 5 shows an exploded view of a system comprising a flat key according to the invention and a cylinder core of a cylinder lock according to the invention;

5 Figs. 6a-6b show sectional views of an embodiment of a cylinder lock according to the invention;

Figs. 7a-7b show sectional views of a system comprising a flat key according to the invention and a control slide according to the invention of a cylinder lock according to the invention;

10 Figs. 8a-8c show sectional views of another system comprising a flat key according to the invention and a control slide according to the invention of a cylinder lock according to the invention.

Fig. 1 shows a side view of an embodiment of a flat key 1 according to the invention. The flat key 1 comprises an encoded surface 2 extending along its longitudinal extension. In the present exemplary embodiment, a first control groove 6 and a second control groove 9 are provided on the encoded surface 2.

Fig. 2 shows a detail of the flat key 1 of Fig. 1. Multiple sensing positions 5, which are indicated by letters A-F, are provided along the longitudinal extension of the flat key 1. At each sensing position 5, dedicated control points 3, 3', 3" are provided in the control grooves 6, 9 and connected by the respective control groove 6, 9. The control groove 6, 9 serves to guide control slides in the cylinder lock to the respective control points 3, 3', 3", for example.

At the control points 3, 3', 3", encoding features are provided, which are sensed by correspondingly configured sensing elements of the control slides in the cylinder lock. In the present exemplary embodiment, the encoding feature is configured as the groove bottom 7 of the control groove 6, 9, respectively.

The second control groove 9 is a conventional control groove, whose encoding features substantially form the same angle with the central longitudinal plane 8 of the key at all control points 3.

30 However, the first control groove 6 has different encoding features at the control points 3, 3', 3". Between a first control point 3' and a second control point 3", a torsion section 11 is provided, in which the control groove 6 changes its orientation relative to the central longitudinal plane of the key. Thus, the encoding feature, at a first control point 3', forms an angle with the central longitudinal plane of the key which differs from that of the encoding feature at the second control point 3".

In the torsion section 11, the cross section of the control groove 6 is rotated by an angle in the range of -45° to $+45^\circ$, preferably -30° to $+30^\circ$, relative to the cross section of the control groove 6 outside the torsion section 11. The angle of the encoding feature to the central longitudinal plane 8 in the torsion section 11 changes along the longitudinal extension in a linear manner from a first angle value in the area of the first control point 3' to a second angle value in the area of the second control point 3".

Figs. 3a-3b show sectional views of the flat key of Fig. 2 at the positions of the different control points 3, 3' and 3".

Fig. 3a shows the sectional view X-X. The flat key 1 has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7, which extends substantially parallel to the central longitudinal plane of the key 8. The lateral surfaces 10 of the control grooves 6, 9, respectively, form a right angle with the groove bottom 7.

Fig. 3b shows the sectional view Y-Y. The flat key 1 has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7. In the second control groove 9, the groove bottom 7 extends substantially parallel to the central longitudinal plane 8 of the key. However, the groove bottom 7 in the first control groove 6 is inclined relative to the central longitudinal plane 8 by an angle of about $\alpha = 30^\circ$. Again, the lateral surfaces 10 of the control grooves 6, 9, respectively, form a right angle with the groove bottom 7.

Fig. 3c shows the sectional view Z-Z. The flat key 1 has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7. In the second control groove 9, the groove bottom 7 extends substantially parallel to the central longitudinal plane 8 of the key. However, the groove bottom 7 in the first control groove 6 is inclined relative to the central longitudinal plane 8 by an angle of about $\alpha = -30^\circ$. Again, the lateral surfaces 10 of the control grooves 6, 9, respectively, form a right angle with the groove bottom 7.

Figs. 4a-4b show sectional views of an alternative embodiment of a flat key 1 according to the invention. The sectional views are taken at the positions of the different control points 3, 3', 3"; in this case, however, the encoding features of the flat key 1 are configured differently from those in the exemplary embodiment according to Fig. 1.

Fig. 4a shows the sectional view X-X. The flat key 1 has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7, which extends substantially parallel to the central longitudinal plane 8 of the key. The lateral surfaces 10 of the control grooves 6, 9, respectively, form a right angle with the groove bottom 7.

Fig. 4b shows the sectional view Y-Y. The flat key 1, again, has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7. In the second control groove 9, the groove bottom 7 extends substantially parallel to the central longitudinal plane 8 of the key.

However, the groove bottom 7 in the first control groove 6 is inclined relative to the central longitudinal plane 8 by an angle of about $\alpha = 30^\circ$. Furthermore, in this embodiment, a material ridge 4 is provided in the first control groove 6, which extends from the groove bottom 7 towards the outer surface of the flat key 1. Again, the lateral surfaces 10 of the control grooves 6, 9, respectively, form a right angle with the groove bottom 7.

Thus, the control point 3 in the second control groove 9 differs from the control point 3" in the first control groove 6 in that the groove bottom forms a different angle with the central longitudinal plane 8 and in that a material ridge 4, which is also inclined relative to the central longitudinal plane 8, is provided in the control point 3".

In the shown exemplary embodiment, the lateral surfaces 16 of the material ridge 4 form an angle of about 75° with the central longitudinal plane 8 and a substantially right angle with the groove bottom 7. The material ridge 4 is arranged approximately centrally in the control groove 6 and has a width corresponding to about a quarter to about a third of the width of the control groove 6. In this exemplary embodiment, the material ridge 4 is also approximately flush with the encoded surface 2 of the flat key 1. However, exemplary embodiments of the invention are provided in which the material ridge 4 protrudes beyond the encoded surface 2 of the flat key 1.

Fig. 4c shows the sectional view Z-Z. The flat key 1 has a first control groove 6 and a second control groove 9 on its encoded surface 2. Both control grooves have a groove bottom 7. In the second control groove 9, the groove bottom 7 extends substantially parallel to the central longitudinal plane 8 of the key. However, the groove bottom 7 in the first control groove 6 is inclined relative to the central longitudinal plane 8 by an angle of about $\alpha = -30^\circ$. Again, a material ridge 4 is provided in the first control groove 6, which extends from the groove bottom 7 towards the outer surface of the flat key 1. Again, the lateral surfaces 16 of the material ridge 4 form an angle of about 75° with the central longitudinal plane 8. The lateral surfaces 16 of the material ridge 4 form a substantially right angle with the groove bottom 7.

Between the shown sections Y-Y and Z-Z, the control groove 6 rotates in a substantially linear manner so that also in this embodiment a torsion section 11 is formed. Control slides of a cylinder lock which are not configured to follow the control groove 6 and the

material ridge 4 in the torsion section thus get caught upon inserting the flat key 1 into the keyway.

Fig. 5 shows an exploded view of a system comprising a flat key 1 according to the invention with a first control groove 6 and a second control groove 9 as well as a first
 5 cylinder lock according to the invention.

In the cylinder core, control slides 13 for reading the control grooves of the flat key 1 are arranged. To this end, the control slides are provided with reading elements, which protrude into the keyway 12 of the cylinder core. The remaining parts of the cylinder lock, in particular the cylinder housing, are not shown in this figure for the sake of clarity.

10 Fig. 6a shows a sectional view transversal to the keyway 12 of an embodiment of a cylinder lock according to the invention. Two control slides 13, 13' are shown, which each have sensing cams 17 protruding into the keyway 12. The cylinder lock has a central longitudinal plane 15. The control slides 13, 13' are movably mounted in cut-outs with a circular cross section, substantially parallel and at a distance to the central longitudinal
 15 plane 15.

Fig. 6b shows a view of a cylinder lock according to the invention from above, wherein the keyway 12 and the central longitudinal plane 15 are shown again. It can be discerned that cut-outs with a circular cross section are provided at the sensing positions 5 with the reference letters A-F, in which control slides 13 are movably mounted.

20 In this exemplary embodiment of the cylinder lock, the control slides 13, 13' are mounted in the cut-outs without being pretensioned so that, upon inserting the flat key 1 into the keyway 12, they engage the control grooves 6, 9 in a positive manner and are thus actively curve-guided into a release position. However, embodiments of the invention are provided, in which the control slides 13, 13' are guided in a spring-loaded manner.

25 Figs. 7a-7c show sectional views of a system comprising a flat key 1 according to the invention and a control slide 13, 13' according to the invention of a cylinder lock according to the invention.

Fig. 7a schematically shows a sectional view of a system similar to the one shown in Fig. 6b, along the section line X-X transversal to the central longitudinal plane 15. For reasons
 30 of clarity, only the flat key 1 and one control slide 13 are shown. The control slide 13 comprises a sensing cam 17, which protrudes into the keyway 12. At the tip of the sensing cam 17, a reading surface 14 is provided, which serves as a reading element for reading the corresponding encoding feature of a control groove 6 on the flat key 1. The reading surface 14 of this control slide is configured to read the groove bottom 7 of the
 35 control groove 6 of the flat key 1 and is arranged substantially parallel to the central longitudinal plane 15.

Fig. 7b schematically shows a sectional view of a system similar to the one shown in Fig. 6b, along the section line Y-Y transversal to the central longitudinal plane 15. For reasons of clarity, only the flat key 1 and one control slide 13' are shown. Again, the control slide 13' comprises a sensing cam 17, which protrudes into the keyway 12. In this case, however, two reading surfaces 14, 14', which serve as reading elements for reading an encoding feature of the control groove 6 on the flat key 1, are provided at the tip of the sensing cam 17. The reading surface 14 of this control slide forms an angle with the central longitudinal plane 15 which differs from that of the reading surface 14'. In particular, the reading surface 14' is inclined relative to the central longitudinal plane 15 by an angle $\alpha = 30^\circ$, which corresponds to the angle by which the groove bottom 7 of the control groove 6 on the key 1 is inclined relative to the central longitudinal plane 15.

This allows the control slide 13' to engage the groove bottom 7 of the control groove 6 in this position and to be guided along a torsion section 11 of the control groove 6, in which the control groove 6 rotates.

Fig. 7c schematically shows a sectional view of this system along the section line Z-Z transversal to the central longitudinal plane 15. Again, the control slide 13' comprises a sensing cam 17, which protrudes into the keyway 12. Again, two reading surfaces 14, 14', which serve as reading elements for reading an encoding feature of the control groove 6 on the flat key 1, are provided at the tip of the sensing cam 17.

The reading surface 14 of this control slide forms an angle with the central longitudinal plane 15 which differs from that of the reading surface 14'. The reading surface 14' is inclined relative to the central longitudinal plane 15 by an angle $\alpha = -30^\circ$, which corresponds to the angle by which the groove bottom 7 of the control groove 6 on the key 1 is inclined relative to the central longitudinal plane 15. This allows the control slide 13' to engage the groove bottom 7 of the control groove 6 in this position and to be guided along a torsion section 11 of the control groove 6, in which the control groove 6 rotates.

This embodiment of the sensing cams 17 with two reading surfaces, which are arranged at an angle to one another, allows the control slide 13', upon inserting the flat key, to follow a torsionally rotated control groove 6 without the control slide 13' being blocked or pressed out of the control groove 6.

Figs. 8a-8c show sectional views of another system comprising a flat key 1 according to the invention and a control slide 13, 13' according to the invention of a cylinder lock according to the invention.

Fig. 8a schematically shows a sectional view of a system similar to the one shown in Fig. 6b, along the section line X-X transversal to the central longitudinal plane 15. This figure

corresponds to Figure 7a. The control slide 13 comprises a sensing cam 17, which protrudes into the keyway 12.

A reading surface 14, which serves as a reading element for reading the corresponding encoding feature of a control groove 6 on the flat key 1, is provided at the tip of the sensing cam 17. The reading surface 14 of this control slide is configured to read the groove bottom 7 of the control groove 6 of the flat key 1 and is arranged substantially parallel to the central longitudinal plane 15.

Fig. 8b schematically shows a sectional view of a system similar to the one shown in Fig. 6b, along the section line Y-Y transversal to the central longitudinal plane 15. For reasons of clarity, only the flat key 1 and one control slide 13' are shown. Again, the control slide 13' comprises a sensing cam 17, which protrudes into the keyway 12.

In this case, however, a sensing groove 18, which has two reading surfaces 14, 14' as lateral surfaces, is provided at the tip of the sensing cam 17.

These lateral surfaces serve as reading elements for reading an encoding feature of the control groove 6 on the flat key 1. In this exemplary embodiment, the encoding feature is configured as a material ridge 4 extending in the control groove 6. The sensing groove 18 is configured in such a way that it may receive the material ridge 4 so that the control slide 13' is guided along the control groove 6.

The reading surface 14 forms an angle with the central longitudinal plane 15 which differs from that of the reading surface 14'. In particular, the reading surface 14' is inclined relative to the central longitudinal plane 15 by an angle $\alpha = 30^\circ$, which corresponds to the angle by which the material ridge 4 of the control groove 6 on the key 1 is inclined relative to the central longitudinal plane 15. This allows the control slide 13' to engage the lateral surface 16 of the material ridge in this position and to be guided along a torsion section 11 of the control groove 6, in which the control groove 6 rotates together with the material ridge 4.

Fig. 8c schematically shows a sectional view of this system along the section line Z-Z transversal to the central longitudinal plane 15. Again, the control slide 13' comprises a sensing cam 17, which protrudes into the keyway 12.

Again, a sensing groove 18 with two reading surfaces 14, 14', which serve as reading elements for reading an encoding feature of the control groove 6 on the flat key 1, is provided at the tip of the sensing cam 17. The cross section of the sensing groove 18 is substantially trapezoidal, wherein the reading surface 14 forms an angle with the central longitudinal plane 15, which differs from that of the reading surface 14'. The reading surface 14' is inclined relative to the central longitudinal plane 15 by an angle $\alpha = -30^\circ$, which corresponds to the angle by which the material ridge 4 of the control groove 6 on

the key 1 is inclined relative to the central longitudinal plane 15. This allows the control slide 13' to engage the lateral surface 16 of the material ridge 7 of the control groove 6 in this position and to be guided along a torsion section 11 of the control groove 6, in which the control groove 6 rotates.

- 5 This embodiment of the sensing cams 17 with a trapezoidal sensing groove 18 with two reading surfaces 14, 14', which are arranged at an angle to one another, allows the control slide 13', upon inserting the flat key 1, to follow a torsionally rotated control groove 6 with a material ridge 4 located therein without the control slide 13' being blocked or pressed out of the control groove 6.

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Reference list

	1	Flat key
	2	Encoded surface
15	3, 3', 3"	Control point
	4	Material ridge
	5	Sensing position
	6	Control groove
	7	Groove bottom
20	8	Central longitudinal plane of the key
	9	Control groove
	10	Lateral surface of the control groove
	11	Torsion section
	12	Keyway
25	13	Control slide
	14	Reading surface
	15	Central longitudinal plane of the cylinder lock
	16	Lateral surface of the material ridge
	17	Sensing cam
30	18	Sensing groove

Claims

1. A flat key (1) for a cylinder lock, comprising
at least one encoded surface (2), which extends along the longitudinal extension of the
5 flat key (1), wherein,
for encoding, control points (3, 3', 3''), which are connected by a control groove (6), are
provided at sensing positions (5) on the surface (2), and wherein encoding features to be
read in the cylinder lock are provided at the control points (3, 3', 3''),
characterized in that
10 the encoding feature, at a first control point (3'), forms an angle with the central
longitudinal plane (8) of the flat key (1) which differs from that of the encoding feature at a
second control point (3'').
2. The flat key according to claim 1, characterized in that the control groove (6) has a
15 torsion section (11) at least between the first control point (3') and the second control
point (3'').
3. The flat key according to claim 2, characterized in that the control groove (6) has a
cross section in the torsion section (11), which is rotated by an angle in the range of -45°
20 to +45°, preferably -30° to +30°, relative to the cross section of the control groove (6)
outside the torsion section (11).
4. The flat key according to one of claims 2 or 3, characterized in that the angle of
the encoding feature to the central longitudinal plane (8) changes in the torsion section
25 (11) along the longitudinal extension in a preferably linear manner from a first angle value
in the area of the first control point (3') to a second angle value in the area of the second
control point (3'').
5. The flat key according to claim 4, characterized in that the first angle value is in
30 the range of -45° to 0°, preferably in the range of -30° to 0°, and in that the second angle
value is in the range of 0° to 45°, preferably in the range of 0° to 30°, measured with
respect to the central longitudinal plane (8).
6. The flat key according to one of claims 1 to 5, characterized in that at least one
35 further control groove (9) with control points (3) is provided on the encoded surface (2)

next to the control groove (6) and its encoding features form substantially the same angle with the central longitudinal plane (8) of the flat key (1) at all control points (3).

7. The flat key according to one of claims 1 to 6, characterized in that the control
5 grooves (6, 9) have different depths and/or different widths.

8. The flat key according to one of claims 1 to 7, characterized in that the encoding feature is configured as groove bottom (7) of the control groove (6).

9. The flat key according to claim 8, characterized in that the lateral surfaces (10) of
10 the control grooves (6, 9) always form a substantially right angle with the groove bottom (7) of the control grooves (6, 9).

10. The flat key according to one of claims 1 to 7, characterized in that the encoding
15 feature is configured as a material ridge (4), which extends in the control groove (6) along the longitudinal extension of the flat key.

11. The flat key according to claim 10, characterized in that the material ridge (4) is
20 arranged substantially centrally in the control groove (6) and has a width, which substantially corresponds to a third of the width of the control groove (6), for example.

12. The flat key according to one of claims 10 or 11, characterized in that the material ridge (4) extends beyond the cross section of the key profile.

13. The flat key according to one of claims 10 to 12, characterized in that the lateral
25 surfaces (16) of the material ridge (4) always form a substantially right angle with the groove bottom (7) of the control grooves (6).

14. A cylinder lock for a flat key (1) according to one of claims 1 to 13, comprising
30 a keyway (12) with at least one side and sensing positions (5) provided along the longitudinal extension of the keyway (12),
wherein at least one control slide (13) is provided at each sensing position (5),
wherein each control slide (13) comprises at least one reading element for reading an
encoding feature of a control groove (6, 9) at a control point (3, 3', 3'') of the flat key (1).
35 characterized in that

at least one control slide (13) is provided, which comprises a first reading element and a second reading element, wherein the first reading element forms an angle with the central longitudinal plane (15) of the keyway (12) which differs from that of the second reading element.

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15. The cylinder lock according to claim 14, characterized in that the first reading element is configured as a first reading surface (14) and in that the second reading element is configured as a second reading surface (14') on a sensing cam (17) of the control slide (13).

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16. The cylinder lock according to claim 15, characterized in that the first reading surface (14) and the second reading surface (14') are configured as end surfaces of the sensing cam (17) for engaging the groove bottom (7) of the control groove (6, 6', 6'') of the flat key (1).

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17. The cylinder lock according to claim 15, characterized in that the first reading surface (14) and the second reading surface (14') are configured as lateral surfaces of a sensing groove (18) of the sensing cam (17) for engaging a material ridge (16) of the control groove (6, 6', 6'') of the flat key (1).

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18. The cylinder lock according to one of claims 14 to 17, characterized in that at least one further control slide (13) is provided, which comprises a first reading element, but no second reading element.

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19. The cylinder lock according to one of claims 15 to 18, characterized in that the first reading surface (14) extends substantially parallel to the central longitudinal plane (15).

20. The cylinder lock according to one of claims 15 to 19, characterized in that the second reading surface (14') forms an angle in the range of -45° to $+45^\circ$, preferably in the range of -30° to $+30^\circ$, with the central longitudinal plane (15).

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21. The cylinder lock according to one of claims 13 to 20, characterized in that the cylinder lock comprises a cylinder core, in which cut-outs with preferably circular cross section are provided parallel to the central longitudinal plane (15) and at a distance to it at the sensing positions (5), wherein the control slides (13, 13') are movably mounted in the cut-outs.

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22. The cylinder lock according to claim 21, characterized in that the control slides (13, 13') are mounted in the cut-outs without being pretensioned so that, upon inserting the flat key (1), they may be actively curve-guided into a release position by positively
5 engaging the control grooves (6, 9) of the flat key (1).

23. A system comprising a key according to one of claims 1 to 13 and a cylinder lock according to one of claims 14 to 22.