

Locking System Comprising a Cylinder Lock and a Flat Key

The invention relates to a locking system comprising a cylinder lock and a flat key for locking the cylinder lock.

Locking systems comprising a cylinder lock and a flat key for locking the cylinder lock are known from the prior art. Such systems comprise cylinder locks with a keyway for receiving a flat key and core pins that can be moved into the keyway. In particular, it is known to form the core pins of the cylinder lock in such a way that they have a scanning extension at their end pointing towards the keyway, the scanning extension extending from a base body of the core pin towards the keyway. Further, it is known to form the scanning extensions in such a way that they are narrower than the base body of the core pin and, in particular, are aligned with the longitudinal direction of the keyway.

Suitable flat keys comprise an encoded lateral surface running along their longitudinal extension and having control points arranged along the longitudinal extension, wherein an incision milling, also running in the longitudinal direction, is provided at at least one control point.

When the flat key is inserted into the keyway, the scanning extension of the core pin is pushed or pulled positively into the incision milling in such a way that the core pin releases the dividing plane between the cylinder housing and the cylinder core, and the key locks the lock. In addition to the depth of the incision milling, it is also known to vary the position of the incision milling transversely to the longitudinal extension of the keyway. This allows for scanning extensions to be provided offset to the left or right of the central longitudinal plane of the keyway, providing a further possibility for variation.

However, there is a need for further variations of such locking systems. It is important that the additional coding on the key is difficult to recognise, especially on the broad side of the key, i.e. the side of the key that has the greater extension, since this can be photographed and copied particularly easily.

It is therefore one of the objects of the invention to provide a locking system that offers increased possibilities for variation of the conventional locking systems and increased functional safety compared to conventional locking systems.

According to the invention, this and other objects are solved by a locking system according to claim 1.

A locking system according to the invention comprises a cylinder lock and at least one flat key for locking the cylinder lock. The cylinder comprises a cylindrical core rotatably mounted in a housing and comprising a keyway and core pins that can be moved into the keyway. At least one core pin has a scanning extension at its end pointing towards the keyway, the scanning extension extending towards the keyway. The flat key has at least one encoded lateral surface running along the longitudinal extension of the flat key and having control points arranged along the longitudinal extension. At least one incision milling is provided at at least one control point, which is designed to receive the scanning extension when the flat key is inserted into the keyway.

According to the invention, the flat key has a recess designed to receive a projection of the core pin when the flat key is inserted into the keyway. According to the invention, the features of the locking system are designed in such a way that, when the flat key is pulled out of the keyway, the projection is completely removed from the recess.

According to the invention, it may be provided that the recess is arranged offset along the transverse extension of the flat key relative to the incision milling. The recess may be designed to receive, in particular positively receive, the projection of the core pin, wherein the projection extends from the base body of the core pin towards the keyway.

According to the invention, the incision milling of the flat key and the scanning extension of the corresponding core pin may be designed in such a way that, when the flat key is pulled out of the keyway, the projection is completely removed from the recess.

According to the invention, it may be provided for this purpose that the incision milling has a guide surface, which interacts with a control surface on the scanning extension of the core pin in such a way that, when the flat key is pulled out, the projection is completely moved out of the keyway.

Further, the projection may be designed in such a way that it abuts onto a stop of the flat key when the flat key is pulled out, if the projection is not completely moved out of the recess.

The longitudinal extension of the incision milling, that is its extension in the longitudinal direction of the flat key, may be greater than the longitudinal extension of the scanning extension, that is its extension in the longitudinal direction of the keyway.

The shape of the scanning extension may correspond to the shape of the guide surface of the incision milling at least in the region of a control surface, so that the scanning extension can be guided along the guide surface. For example, the scanning extension may have a slightly curved or rounded shape in the region of a control surface.

The shape of the projection may substantially correspond to the shape of the recess, so that, in the position where the scanning extension engages entirely in the recess, the projection positively engages in the recess.

The base body of the core pin may preferably be cylindrical, while the scanning extension can substantially be of any shape. Optionally, the core pin not only has the scanning extension for engaging in an incision milling, but also a projection on the base body of the core pin, which is, however, set back from the scanning extension.

A special recess may be provided on the key, offset from the incision milling, for positively receiving the projection. In order to lock the lock, both the scanning extension and the projection of the core pin must fit precisely into the incision milling and into this special recess respectively, so that the core pin is correctly displaced and releases the dividing plane of the cylinder lock.

When the key is pulled out, the scanning extension is lifted out of the incision milling. In order to prevent blocking, it may be provided that the incision milling has a circular arc-shaped cross section - this often occurs by itself during the production of the incision milling by the milling cutter.

The scanning extension of the core pin may extend beyond the projection by at least that distance by which the projection extends relative to the base body of the core pin. As a result, when the key is pulled out, the core pin is lifted a sufficient distance to ensure that the projection can leave the recess completely.

As a result, it is not necessary to also provide the recess with a circular arc-shaped cross section in order to achieve a lifting out of the projection - the recess may therefore also be provided with a right-angled stop. The matching shapes of the incision milling, the scanning

extension and the projection on the core pin ensure that, when the key is pulled out, the projection is lifted out of the recess via this stop and thus cannot block.

Optionally, it may be provided that the base body of the core pin is substantially cylindrical, wherein the scanning extension is narrower than the diameter of the base body and extends substantially in the axial direction of the base body therefrom. This allows the scanning extension to scan a narrow incision milling on the key. It may also be provided that the scanning extensions of different core pins are offset from each other in order to scan incision millings that are offset relative to a central longitudinal plane of the key.

The scanning extension may in particular have a substantially rectangular cross section and be oriented in the longitudinal direction of the keyway. Preferably, the scanning extension may have lateral surfaces extending in the axial direction from the base body. In this case, the scanning extension may substantially have the shape of a rectangular ridge extending from a cylindrical base body in its axial direction.

The projection may be arranged immediately adjacent to the scanning extension in the transverse direction of the keyway. The transverse direction of the keyway defines a direction oriented substantially at right angles to the longitudinal extension of the keyway. In this case, the projection is therefore located immediately adjacent to the scanning extension at the tip of the base body of the core pin.

However, a groove may also be provided between the scanning extension and the projection. The width of the groove may preferably be greater than or equal to the thickness of the scanning extension. The thickness defines the extension of the scanning extension in the transverse direction of the keyway.

Optionally, it may be provided that the core pin is pushed into the keyway by a spring force, for example via a spiral spring arranged in the cylinder housing.

However, a ferromagnetic element may also be provided in the core pin, preferably in the scanning extension. In this case, the core pin may be pulled towards the keyway by a magnetic element in the key. Alternatively, a magnetic element may of course be arranged in the core pin and a ferromagnetic element in the key.

Optionally, it may be provided that the scanning extension tapers towards the keyway. In particular, it may be provided that the scanning extension has the shape of a semicircle, a

flattened isosceles triangle or an isosceles trapezium. The scanning extension may have a flattened tip and leg surfaces extending towards the tip.

As a result, when the key is pulled out, the scanning extension can slide without interference along an accordingly shaped incision milling having the shape of a circular section of a flattened triangle or a trapezium and therefore does not block the pulling movement of the key.

For this purpose, the scanning extension may have its own control surface, which is preferably located on the part of the scanning extension that is closest to the keyway. The control surface may have an outer curve that corresponds to the inner curve of the incision milling.

The projection according to the invention, which is preferably arranged next to the scanning extension, may have an engagement surface. The engagement surface of the projection may be shaped to engage in the recess of the key. The engagement surface may be arranged substantially parallel to the control surface at the tip of the scanning extension and preferably form a right angle with the lateral surface of the scanning extension.

Further, it may be provided that the projection of the core pin has a retaining surface extending obliquely to the keyway and the stop has a corresponding side wall extending obliquely to the longitudinal extension of the flat key.

The retaining surface and the side wall may be designed in such a way that the retaining surface abuts onto the side wall when the flat key is pulled out, if the projection is not completely removed from the recess. The retaining surface and the side wall may be undercut in such a way that the core pin is not movable in its axial direction in the inserted state of the flat key.

The retaining surface may form an angle greater than 0° , preferably 5° to 30° , more preferably 15° , with the lateral surface of the scanning extension and an angle smaller than 90° , preferably 60° to 85° , more preferably 75° , with the engagement surface.

A chamfer may be arranged between the retaining surface and the engagement surface in order to facilitate the insertion of the key. The retaining surface may form an undercut when viewed in the axial direction of the base body. Together with a similarly undercut edge of the recess on the key, this ensures that the core pin is guided along the retaining surface when the key is inserted and pulled out, and is not movable in the recess when the key is inserted. This provides another safety feature. In particular, this undercut has the advantage that it can only be detected on the key with great effort and prevents the insertion of a key without an undercut.

A flat key for a locking system of this type comprises at least one encoded lateral surface running along the longitudinal extension of the flat key and having control points arranged along the longitudinal extension. At least one incision milling is provided at at least one control point. The incision milling may have a first depth substantially normal to the lateral surface. A recess with a second depth substantially normal to the lateral surface may be provided at this control point of the flat key, wherein the incision milling and the recess are arranged offset from each other, in particular next to each other, transversely to the longitudinal extension of the flat key. Optionally, the second depth is at most half the size of the first depth.

Therefore, such a key not only has an incision milling with a defined depth for coding purposes at a control point, but also a recess arranged offset from the incision milling in the transverse direction of the key. This provides several possibilities for variation at this control point.

Furthermore, the recess may be shallower than the incision milling, and at most half as deep. The core pin, which positively engages in the incision milling and the recess to lock the lock, must leave the incision milling completely when the key is pulled out. Since the incision milling is at least twice as deep as the recess, the core pin inevitably leaves the recess when it is completely removed from the incision milling. Since the core pin is thereby completely lifted out of the recess via the incision milling, the recess may be provided with a steep edge or another form of stop on which unauthorised keys would get stuck.

The lateral surface may be a narrow side of the flat key. However, the lateral surface may also be a broad side of the flat key.

The incision milling may be narrower than the lateral surface. In particular, it may have an extension transverse to the longitudinal extension of the flat key of preferably one third of the extension of the lateral surface. Two or more incision millings may be provided transversely to the longitudinal extension of the flat key.

The incision milling may be curved and preferably substantially circular arc-shaped, as well as form an internal circular arc-shaped guide surface. This embodiment allows the core pin to be guided as smoothly as possible along the guide surface when the key is inserted and pulled out.

The recess does not have to be curved or circular arc-shaped, but may have a base that is substantially parallel to the lateral surface. This allows for a particularly good positive engagement of an authorised core pin in the recess. A stop may preferably be formed between

the lateral surface and the recess, so that an unauthorised core pin blocks against the key when the latter is removed. The lateral surface may also merge into the recess via a stop.

The stop may have a side wall arranged at an angle of 60° to 90° , preferably 75° to 90° , more preferably 90° , to the lateral surface. Provided that the angle is less than 90° , this has the advantage according to the invention that an undercut is formed so that a core pin formed with a suitably matching undercut is no longer movable in the axial direction in the inserted state.

Optionally, at least one ferromagnetic element may be provided on the flat key at at least one control point for applying an attractive force on at least one core pin of the cylinder lock. For this purpose, a magnetic element may be provided in the core pin. Alternatively, a magnetic element may be provided at the control point in the key and a ferromagnetic element in the core pin. This eliminates the need for a spring element, such as a spiral spring, for biasing the core pin. Additionally, this also allows for further magnetic coding.

It may be provided that the recess is formed immediately adjacent to the incision milling. However, a ridge for guiding a core pin of the cylinder lock may alternatively be provided between the incision milling and the recess.

Further features according to the invention result from the claims, the exemplary embodiments and the figures.

The invention is explained in more detail below on the basis of non-limiting exemplary embodiments.

Fig. 1 is a schematic three-dimensional view of a key-lock combination from the prior art.

Fig. 2 is a schematic cross-sectional view of a combination of a cylinder lock according to the invention and a conventional flat key.

Fig. 3 is a schematic three-dimensional view of a key-lock combination according to the invention, wherein only the core pin and a detail of the key are shown.

Fig. 4 is a schematic three-dimensional view of a key according to the invention.

Fig. 5 is a schematic sectional view of a key-lock combination according to the invention.

Figs. 6a to 6e are sectional views of a core pin of a cylinder lock according to the invention.

Figs. 7a to 7c are a schematic three-dimensional view of a key-lock combination according to the invention, wherein Fig. 7b is a schematic three-dimensional view of a key according to the invention and Figs. 7a and 7c show the core pin and details of the key.

Fig. 8 is a schematic three-dimensional view of a further key-lock combination according to the invention.

Fig. 9 is a schematic three-dimensional view of a core pin of a cylinder lock according to the invention.

Fig. 1 first shows a schematic three-dimensional view of a key-lock combination from the prior art. The flat key 1 is inserted into the keyway 20 of the cylinder core 2 of a cylinder lock. It is known that the cylinder lock comprises a housing 12 with spring-loaded housing pins 3 and a rotatable cylinder core 2 with core pins 4. Housing pins 3 and core pins 4 are arranged in correspondingly aligned bores in the housing 12 and in the cylinder core 2. The core pins 4 are designed in such a way that they have a cylindrical base body 19 and have an adjacent ridge-shaped scanning extension 5. The scanning extensions 5 are narrower than the diameter of the base body 19 and are oriented in the longitudinal direction of the keyway 20.

The flat key 1 has incision millings 6 with different depths on its narrow side at defined control points. The scanning extensions 5 are designed to scan the incision millings 6. To prevent the scanning extensions 5 from blocking when the flat key 1 is inserted and pulled out, the incision millings 6 have a substantially circular arc-shaped cross section, so that the core pins 4 are guided along the curved base of the respective incision millings 6 to their respective end position. In the state shown, all housing pins 3 are located at the dividing plane between the housing 12 and the cylinder core 2, so that the cylinder core 2 can be rotated in the housing 12 and locks the lock.

Fig. 2 is a schematic cross-sectional view of a cylinder lock according to the invention with a conventional flat key 1. The flat key 1 is inserted into the keyway 20 of the cylinder core 2 of a cylinder lock. It is known that the cylinder lock comprises a housing 12 with spring-loaded housing pins 3 and a rotatable cylinder core 2 with core pins 4.

The housing pins 3 and the core pins 4 are arranged in correspondingly aligned bores in the housing 12 and in the cylinder core 2. The core pins 4 are designed in such a way that they have a cylindrical base body 19 and have an adjacent ridge-shaped scanning extension 5. The scanning extensions 5 are narrower than the diameter of the base body 19 and are oriented in the longitudinal direction of the keyway 20. Additionally, one of the core pins 4 has a projection 9 at its end pointing towards the keyway 20 extending from the base body 19 of the core pin 4 towards the keyway 20. The scanning extension 5 extends beyond the projection 9 by approximately twice the distance by which the projection 9 extends relative to the base body 19.

Again, the flat key 1 has incision millings 6 with different depths on its narrow side at defined control points, which is analogous to the flat key 1 from the exemplary embodiment shown in Fig. 1. In the shown situation, the core pin 4 gets stuck with the projection 9 on the incision milling 6 of the flat key 1, since the flat key 1 does not have a correspondingly shaped recess (7) for positively receiving the projection 9. The corresponding housing pin 3 does not release the dividing plane, and the lock blocks.

Fig. 3 is a schematic three-dimensional view of a key-lock combination according to the invention, wherein only the core pin 4 and a detail of the flat key 1 at a control point are shown. On its narrow side, the flat key 1 has a lateral surface 23 on which an incision milling 6 is formed. The incision milling 6 serves to receive a scanning extension 5 of the core pin 4. The core pin 4 has a cylindrical base body 19, from which the scanning extension 5 extends. A projection 9 extends from the cylindrical base body 19, which, in this embodiment, is immediately adjacent to the scanning extension 5. The projection 9 extends from the base body 19 by approximately one third of the length of the scanning extension 5.

A recess 7 is formed on the flat key 1 for positively receiving the projection 9. The recess 7 is located in the longitudinal extension of the key substantially in a central position to the incision milling 6.

The recess 7 merges into the lateral surface 23 of the flat key 1 via a stop 8 with a steep edge. The incision milling 6 and the scanning extension 5 are designed in such a way that the projection 9 is completely lifted out of the recess 7 when the flat key 1 is pulled out.

In particular, the incision milling 6 has a circular arc-shaped guide surface 11 that interacts with a slightly curved control surface 13 on the scanning extension 5 in such a way that, when the flat key 1 is pulled out, the projection 9 is completely moved out of the recess 7. With unauthorised keys, however, the projection 9 gets stuck on the abrupt edge of the stop 8, so that the key cannot be pulled out.

Fig. 4 is another schematic three-dimensional view of a key according to the invention, wherein this time the core pin 4 is not shown. The lateral surface 23 of the narrow side is visible, on which the incision milling 6 is located.

The width of the incision milling 6 is about $\frac{1}{4}$ of the width of the narrow side of the key. The incision milling 6 has a curved, substantially circular arc-shaped guide surface 11. Immediately adjacent to the incision milling 6 is the recess 7, which moves into the lateral surface 23 via a

specially shaped stop 8. The side wall 24 of the stop 8 is arranged at an angle of about 90° to the lateral surface 23.

The recess 7 has a significantly smaller depth x compared to the incision milling 6. In the present exemplary embodiment, the depth of the recess (7) is about $1/3$ of the depth of the incision milling 6.

Fig. 5 is a schematic sectional view of a key-lock combination according to the invention, wherein two control points A and B are shown. The cylinder lock comprises a cylinder core 2 that is rotatable in a housing 12. Housing pins 3 and core pins 4 are provided in aligned bores at defined control points.

A conventional system is shown at control point B, wherein the housing pin 3 is pushed into the keyway 20 via a spiral spring.

No spiral spring is provided at control point A. A ferromagnetic element 10 is provided at this control point in the flat key 1, which interacts with a magnetic element (not shown) in the core pin 4 at this control point. The core pin 4 is therefore not pushed into the incision milling 6 by a spring force at this control point, but is pulled into the incision milling 6 by a magnetic force. This provides further possibilities for variation.

The incision milling 6, in turn, has a circular arc-shaped guide surface 11 at the control point A for guiding the scanning extension 5 of the core pin 4.

The core pin 4, in turn, has a cylindrical base body 19, from which a projection 9 and the scanning extension 5 extend. Again, it can be seen that the length of the projection 9 is about $1/3$ of the length of the scanning extension 5.

Figs. 6a to 6e are views of a core pin 4 of a cylinder lock according to the invention in a three-dimensional representation as well as in two-dimensional views from four sides. In the views, the cylindrical base body 16 is shown, from which the scanning extension 5 and the projection 9 extend in the axial direction. The scanning extension 5 has the shape of a ridge 17 with a rectangular cross section. As shown in Fig. 6c and Fig. 6e, the scanning extension 5 is not central, but is slightly offset relative to the longitudinal axis of the base body 19.

The scanning extension 5 has two lateral surfaces 22 extending therefrom in the axial direction of the base body 19. Immediately adjacent to the scanning extension 5 is a projection 9, which

also extends from the base body 19 in the axial direction. However, the scanning extension 5 is significantly longer, as can be seen in Fig. 6d. Specifically, the scanning extension 5 extends from the base body 19 by a distance $y+z$, while the projection 9 extends from the base body 19 only by a distance y . The value z is about twice as large as the value y .

In the exemplary embodiment shown, the scanning extension 5 tapers towards the keyway 20, i.e. towards its tip. Specifically, the scanning extension 5 has the shape of an isosceles triangle flattened at its tip, with leg surfaces 14 that form an angle of approximately 45° with the end surface of the cylindrical base body 19.

A control surface 13 is provided at the tip of the scanning extension 5, the surface being slightly curved to allow blockage-free scanning of the guide surface 11 of the incision milling 6. For this purpose, the control surface 13 is also provided with chamfered lateral edges.

For positive engagement in the recess 7, the projection 9 has a specially shaped engagement surface 21, which is arranged substantially parallel to the control surface 13 and substantially parallel to the end surface of the cylindrical base body 19. The engagement surface 21 forms a substantially right angle with the lateral surface 22 of the scanning extension 5.

A retaining surface 16 is provided adjacent to the engagement surface 21 and forms an angle α of about 15° with the lateral surface 22 of the scanning extension 5 and an angle of about 75° with the engagement surface 21. A chamfer 15 is formed between the retaining surface 16 and the engagement surface 21. In the axial direction of the base body 19, the inclined retaining surface 16 forms an undercut, so that the inserted core pin 4 cannot be removed from the recess 7 in the axial direction.

Figures 7a and 7c are a schematic three-dimensional view of a key-lock combination according to the invention, wherein only the core pin 4 and details of the flat key 1 at a control point are shown. On its broad side, the flat key 1 has a lateral surface 23 on which an incision milling 6 is formed. The incision milling 6 serves to receive a scanning extension 5 of the core pin 4.

The core pin 4 has a cylindrical base body 19, from which the scanning extension 5 extends. A projection 9 extends from the cylindrical base body 19, which, in this embodiment, is immediately adjacent to the scanning extension 5.

A recess 7 is formed on the flat key 1 for positively receiving the projection 9.

The recess 7 merges into the lateral surface 23 of the flat key 1 via a stop 8 with a steep edge. The incision milling 6 and the scanning extension 5 are designed in such a way that the projection 9 is completely lifted out of the recess 7 when the flat key 1 is pulled out.

In particular, the incision milling 6 has a circular arc-shaped guide surface 11 that interacts with a slightly curved control surface 13 on the scanning extension 5 in such a way that, when the flat key 1 is pulled out, the projection 9 is completely moved out of the recess 7. With unauthorised keys, however, the projection 9 gets stuck on the abrupt edge of the stop 8, so that the key cannot be pulled out.

Figure 7b is a schematic three-dimensional view of the key from Figure 7a, wherein this time the core pin 4 is not shown. The lateral surface 23 of the broad side is visible, on which the incision milling 6 is located.

The width of the incision milling 6 is about 1/10 of the width of the broad side of the key.

The incision milling 6 has a curved, substantially circular arc-shaped guide surface 11. Immediately adjacent to the incision milling 6 is the recess 7, which moves into the lateral surface 23 via a specially shaped stop 8. The side wall 24 of the stop 8 is arranged at an angle of about 90° to the lateral surface 23.

The recess 7 has a significantly smaller depth x compared to the incision milling 6. In the present exemplary embodiment, the depth of the recess 7 is about 1/3 of the depth of the incision milling 6.

Fig. 8 is a schematic three-dimensional view of a further key-lock combination according to the invention, wherein again only the core pin 4 of the lock according to the invention is shown. In this exemplary embodiment, the incision milling 6 with the guide surface 11 and the recess 7 on the key are not arranged immediately next to each other, but a ridge 17 is provided in between. In particular, the ridge 17 serves to guide the core pin 4 of the cylinder lock.

Fig. 9 is a schematic three-dimensional view of the core pin 4 of a cylinder lock according to the invention according to the embodiment of Fig. 7. A groove 18 is provided on the core pin 4 between the scanning extension 5 and the projection 9, which serves to engage with the ridge 17 described above.

The invention is not limited to the exemplary embodiments illustrated herein, but rather comprises all locking systems according to the following patent claims.

The definition of incision milling is not intended to be limited to recesses in the key made by a milling cutter, but rather includes incisions in the key side made by any means.

In particular, the invention is not limited to circular arc-shaped incision millings, but rather includes all incisions suitable for moving the corresponding core pin in such a way that a projection located on the core pin is moved over a stop located on the key.

The recess according to the invention may run partially or completely along a lateral surface of the flat key. Therefore, an embodiment may also be provided, in which the recess runs partially or completely along a lateral surface of the flat key. In the case where the recess runs completely along a lateral surface of the flat key, the recess forms the lateral surface of the key.

In this embodiment, the first depth of the incision milling and the second depth of the recess are measured relative to another reference surface, preferably relative to the opposite lateral surface of the flat key. In the absence of a common reference surface, the feature according to which “the second depth is smaller than, preferably at most half the size of, the first depth” is to be understood in this embodiment in such a way that the extension of the recess relative to the other reference surface is larger than the extension of the incision milling relative to the other reference surface.

Optionally, more recesses may be provided, wherein the second depth of the respective recess determines whether the corresponding core pin can penetrate deep enough into the incision milling of the flat key. Preferably, the second depth of the recess is adapted to the geometry of the core pin. For instance, if the second depth of a recess is not large enough, the projection of the core pin may prevent the scanning extension from completely penetrating the incision milling.

List of reference signs

- | | |
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| 1 | Flat key |
| 2 | Cylinder core |
| 3 | Housing pin |
| 4 | Core pin |
| 5 | Scanning extension |
| 6 | Incision milling |
| 7 | Recess |
| 8 | Stop |
| 9 | Projection |
| 10 | Ferromagnetic element |
| 11 | Guide surface |
| 12 | Housing |
| 13 | Control surface of the scanning extension |
| 14 | Leg surface of the scanning extension |
| 15 | Chamfer |
| 16 | Retaining surface of the projection |
| 17 | Ridge |
| 18 | Groove |
| 19 | Base body |
| 20 | Keyway |
| 21 | Engagement surface of the projection |
| 22 | Lateral surface of the scanning extension |
| 23 | Lateral surface of the flat key |
| 24 | Side wall of the stop |

Claims

1. A locking system with a cylinder lock, comprising
 - a. a cylinder core (2) rotatably mounted in a housing (12) and comprising a keyway (20) and core pins (4) that can be moved into the keyway (20), wherein
 - b. at least one core pin (4) has a scanning extension (5) at its end pointing towards the keyway (20) extending towards the keyway (20),
 as well as a flat key (1) for locking the cylinder lock, comprising:
 - c. at least one encoded lateral surface (23) running along a longitudinal extension of the flat key (1) and having control points arranged along the longitudinal extension, wherein
 - d. at least one incision milling (6) is provided at at least one control point, which is designed to receive the scanning extension (5) when the flat key (1) is inserted into the keyway (20),**characterized in that**

the flat key (1) has a recess (7) which is designed to receive a projection (9) of the core pin (4) when the flat key (1) is inserted into the keyway (20), wherein the locking system is designed in such a way that, when the flat key (1) is pulled out of the keyway (20), the projection (9) is completely removed from the recess (7).
2. The locking system according to claim 1, characterized in that the recess (7) is arranged offset from the incision milling (6) along the transverse extension of the flat key (1).
3. The locking system according to claim 1, characterized in that the recess (7) of the flat key (1) is designed to receive, in particular positively receive, the projection (9), wherein the projection (9) extends from the base body (19) of the core pin (4) towards the keyway (20).
4. The locking system according to one of claims 1 to 3, characterized in that the incision milling (6) of the flat key (1) and the scanning extension (5) of the core pin (4) are designed in such a way that, when the flat key (1) is pulled out of the keyway (20), the projection (9) is completely removed from the recess (7).
5. The locking system according to one of claims 1 to 4, characterized in that the incision milling (6) of the flat key (1) has a guide surface (11) which interacts with a control surface (13) on the scanning extension (5) of the core pin (4) in such a way that, when the flat key (1) is pulled out, the projection (9) is completely moved out of the recess (7).

6. The locking system according to one of claims 1 to 5, characterized in that the projection (9) of the core pin (4) is designed in such a way that the projection (9) abuts onto a stop (8) of the flat key (1) when the flat key is pulled out, if the projection (9) is not completely removed from the recess (7).
7. The locking system according to one of claims 1 to 6, characterized in that the longitudinal extension of the incision milling (6) is greater than the longitudinal extension of the scanning extension (5).
8. The locking system according to one of claims 5 to 7, characterized in that the shape of the scanning extension (5) corresponds to the shape of the guide surface (11) of the incision milling (6), so that the scanning extension (5) can be guided along the guide surface (11).
9. The locking system according to one of claims 1 to 8, characterized in that the shape of the projection (9) substantially corresponds to the shape of the recess (7), so that the projection (9) positively engages in the recess (7) in that position in which the scanning extension (5) engages entirely in the incision milling (6).
10. The locking system according to one of claims 1 to 9, characterized in that the projection (9) has a retaining surface (16) extending obliquely to the keyway (20) and the stop (8) has a corresponding side wall (24) extending obliquely to the longitudinal extension of the flat key (1).
11. The locking system according to claim 10, characterized in that the retaining surface (16) and the side wall (24) are designed in such a way that the retaining surface (16) abuts onto the side wall (24) when the flat key (1) is pulled out, if the projection (9) is not completely removed from the recess (7).
12. The locking system according to one of claims 10 or 11, characterized in that the retaining surface (16) and the side wall (24) are undercut in such a way that the core pin (4) is not movable in its axial direction in the inserted state of the flat key (1).