DESCRIPTION

A Cylinder Lock Unit and an Associated Key

FIELD OF THE INVENTION

[0001] The present invention relates to a cylinder lock unit ~~of the kind indicated in the preamble of claim 1~~described herein. ~~Thus, the cylinder lock unit comprises a housing with an upper part and lower part,~~

~~**[0002]** said lower part of the housing having a cylindrical bore accommodating a rotatable key plug,~~

~~**[0003]** said rotatable key plug being formed in one piece and being adapted, via a torque transferring connection, to transfer a torque to a locking mechanism when the key plug is rotated,~~

~~**[0004]** said upper part of the housing being provided with a central row of upper and lower locking pins in associated cavities,~~

~~**[0005]** said key plug having a central row of corresponding cavities for accommodating said lower locking pins in said central row,~~

~~**[0006]** said key plug having at least one side locking mechanism being operative independently of said central row of upper and lower locking pins,~~

~~**[0007]** a keyway extending axially backwards from a front end of said key plug and being configured to accommodate an associated key,~~

~~**[0008]** said central row of upper and lower locking pins and said side locking mechanism being arranged to engage with and lock the key plug against rotation in said lower part the housing unless said associated key is inserted into the keyway.~~

~~**[0009]**~~**[0002]** The invention also relates to a cylinder lock unit of the ~~above-defined~~ kind described herein, in combination of a key for unlocking the cylinder lock unit, said key comprising a grip portion and a key blade.

~~**[0010]**~~**[0003]** Moreover, the invention relates to a key for unlocking such a cylinder lock unit having a rotatable cylindrical key plug with a keyway and at least one side locking mechanism confined to a front region thereof.

BACKGROUND OF THE INVENTION

~~[0011]~~[0004] Such lock and key systems, cylinder lock units, and keys are frequently used in locking systems with a large number of lock units serving e.g. as door locks.

~~[0012]~~[0005] However, in general, there are no really high security cylinder lock units on the market, with a compact structure and with sufficient room for possibly accommodating an extra lock component in the back region of the key plug. Indeed, there is a desire to make room for such extra lock components, e.g. a part of a torque transferring connection, a blocking mechanism for preventing a non-authorized key blade to be fully inserted into the keyway, or some electronic component which facilitates the utility of the cylinder lock unit.

~~[0013]~~[0006] Because of the extra lock component possibly being located in the back region of the key plug, there is no room for a conventional side bar or other kinds of side tumbler mechanisms which normally require a longitudinal extension along the full length of the key plug.

~~[0014]~~[0007] In a prior art lock construction of similar design, disclosed in the US patent 6,981,396 (Kim) and also disclosed in a service manual “CX5 HIGH SECURITY CYLINDERS – small format interchangeable core service manual”, there is a key plug with a side locking mechanism including a side bar which interacts with a number of side locking tumblers. The side bar also interacts with a retainer sleeve (a “tubular operation body”) which extends along the full length of the key plug. Accordingly, on the side provided with the side bar, the key plug will be solid virtually all the way to its rear end, and the associated prong in the associated lock unit will have to be sheared in order to accommodate the key plug and its security full length sidebar. With this construction, the torque to be transferred to the lock unit, by rotating the key plug by means of an inserted key, will be effected by means of a single prong, situated on the opposite side of the key plug.

[0008] Another similar prior art document is the published US patent application US 2002/0056301 A1 (Theriault), where the cylinder lock core includes two side bars, one on each lateral side of the keyway, and also a locking segment which is movable relative to the side bar and the lock shell in response to the insertion of a key blade having a uniquely configured camming projection. In this prior art embodiment, the side bars extend along substantially the whole length of the key plug.

~~[0015]~~[0009] In this specification where reference has been made to patent specifications, other external documents, or other sources of information, this is generally for the purpose of providing a context for discussing the features of the invention. Unless specifically stated otherwise, reference to such external documents is not to be construed as an admission that such documents, or such sources of information, in any jurisdiction, are prior art, or form part of the common general knowledge in the art.

OBJECT OF THE INVENTION

~~[0016]~~[0010] There is always a need for further improvement, and the main object of the present invention is to further increase the security and provide a cylinder lock unit with a high security side locking mechanism which is very difficult to manipulate so as to open the lock without using a properly cut key and which will also permit the key plug to possibly accommodate an extra lock component in the back region of the key plug, e.g. a part of a torque transferring connection, a blocking mechanism for blocking full insertion of a key blade which is not correctly cut, or an electronic component which facilitates the functioning of the lock unit.

~~[0017]~~[0011] SUMMARY OF THE INVENTION

~~[0018]~~[0012] Actually, the present invention is a further development of an invention for which a US application and an international patent application (PCT/EP2018/062713), have already been filed, but these pending patent applications have not yet been published as of the filing date of the present application. The present invention is different from the one disclosed in the earlier applications, the novelty being that the "shell" of the lock unit (with the terminology used in the earlier applications) is integrated with or is permanently retained in the housing of the lock unit, and there is no division into an external housing and an internal, exchangeable lock "core". Rather, the housing and the overall structure is more like a lock unit as disclosed in the US patent specification 8,720,241 (Widén), the housing being divided into an upper part with locking pins and a lower part with a bore accommodating a rotatable key plug.

~~[0019]~~[0013] The object stated above is achieved by providing a cylinder lock unit ~~of the kind defined in the opening paragraph, and having the following new features (in relation to the publicly available prior art):~~comprising a housing with an upper part and a lower part,

[0014] said lower part of the housing having a cylindrical bore accommodating a rotatable key plug, said rotatable key plug being formed in one piece and being adapted, via a torque transferring connection, to transfer a torque to a locking mechanism when the key plug is rotated,

[0015] said upper part of the housing being provided with a central row of upper and lower locking pins,

[0016] said key plug having a central row of corresponding cavities for accommodating said lower locking pins in said central row,

[0017] said key plug having at least one side locking mechanism being operative independently of said central row of upper and lower locking pins,

[0018] a keyway extending axially backwards from a front end of said key plug and being configured to accommodate an associated key,

[0019] said central row of upper and lower locking pins and said side locking mechanism being arranged to engage with and lock the key plug against rotation in said lower part of said housing unless the key blade of said associated key is fully inserted into said keyway,

[0020] wherein a back region of the key plug has a minimum length of ~~at least~~ 50% of a total length of the key plug,

[0021] whereas an adjoining front region of the key plug has a maximum length of 50% of said total length,

[0022] said back region of the key plug accommodates a rear part of the central row of corresponding cavities, which cooperate with said lower locking pins, as well as two ~~side~~ portions, at each lateral side of the keyway, being reserved for possibly accommodating at least one additional lock component,

[0023] said front region of the key plug accommodates, on at least one lateral side of said keyway, said at least one side locking mechanism,

[0024] said at least one side locking mechanism is confined entirely within said front region of the key plug,

[0025] said at least one side locking mechanism comprises a longitudinal row of at least two side locking tumblers, each interacting with the lower part of the housing, either directly or indirectly via a side bar, and

[0026] wherein in case the at least two coded side locking tumblers interact directly with the lower part of the housing, each such coded side locking tumbler is movable between a releasing confined position, where it is totally confined within the key plug, and at least one locking position, where it projects radially outside the key plug so as to fit into at least one recess in said housing and to engage with the housing and prevent rotation of the key plug, and in case the at least two coded side locking tumblers interact with the lower part of the housing via a side bar, which forms a part of said coded side locking mechanism and is located at the cylindrical outer circumference of the key plug so as to engage with an associated groove in said cylindrical bore of the housing, said side bar is configured to fit into and engage with at least one coded recess in said tumbler in a releasing retracted position permitting rotation of the key plug, and wherein each of said at least two coded side locking tumblers is positioned in a selected one of at least three possible positions, said selected position providing a code and permitting the key plug to rotate relative to the housing when the tumbler is positioned in said releasing confined position, in case of direct interaction, or the side bar is positioned in said releasing retracted position, in case of interaction

via a side bar, and there being consequently a plurality of possible code combinations for said coded front end side locking mechanism~~in each side locking mechanism are movable independently of each other, there being at least three different code positions for each coded side locking tumbler and a plurality of different code combinations for the at least two side locking tumblers in each said longitudinal row in said front region of the key plug~~.

~~[0026]~~[0027] In contrast to some prior art structures, there is a direct contact between the side locking tumblers and an associated key, without the intermediary of any other moving part. In this way, the structure will be relatively simple and reliable. Because of the different code positions for each side locking tumbler in the row, the number of possible combinations will be very large, so the security will be high. Even so, there is room for possibly accommodating an extra lock component, separate from the coded locking pins and tumblers, on each lateral side of the keyway in the relatively long back region of the key plug.

~~[0027]~~[0028] On the other hand, the relatively short front region of key plug is rather compact and preferably substantially solid, except for the keyway, the cavities for the locking pins and any recesses and holes for accommodating the side locking mechanism or mechanisms.

~~[0028]~~[0029] Thanks to the above-defined structure of the cylinder lock core, with a relatively short front region of the rotatable key plug, having a maximum length of 50% of the total length of the key plug, there will be a secure and distinct interaction between the key plug and the surrounding housing, by way of the side locking mechanism which is located in its entirety within the front region of the key plug, and yet leaving room for possibly accommodating an extra lock component in the back region of the rotatable key plug.

~~[0029]~~[0030] Preferably, there is one relatively short (in the axial direction) side locking mechanism on each side of the keyway in the front region of the key plug. Then, it is possible to accommodate at least four (two or more on each side) independently movable locking tumblers being separate and independent from the conventional central locking pins. However, it is also possible to arrange only one side locking mechanism arranged on one lateral side of the keyway.

~~[0030]~~[0031] The length of the front region of the key plug, where the at least one side locking mechanism is located in its entirety, is thus rather short, e.g. 50%, about 40% or about 30% of the total length of the key plug. Nevertheless, thanks to the compact structure of the side locking mechanism, it can still provide a very large number of code combinations and a high security for the cylinder lock core.

~~[0031]~~[0032] It has turned out that each longitudinal row of side locking tumblers, on one or both lateral sides of the key plug, may comprise at least two and preferably at least three (or even more) side locking tumblers.

CLAIMS

1. A cylinder lock unit ~~(100)~~, comprising

- a housing ~~(200)~~ with an upper part ~~(220)~~ and a lower part ~~(240)~~,

- said lower part ~~(240)~~ of the housing having a cylindrical bore accommodating a rotatable key plug ~~with a cylindrical outer circumference~~,

- said rotatable key plug ~~(300)~~ being formed in one piece and being adapted, via a torque transferring connection, to transfer a torque to a locking mechanism when the key plug is rotated,

- said upper part ~~(220)~~ of the housing being provided with a central row of upper and lower locking pins ~~(232a-232g, 231a – 231g) in associated cavities (221a-221g)~~,

- said key plug ~~(300)~~ having a central row of corresponding cavities ~~(331a-331g)~~ for accommodating said lower locking pins in said central row,

- said key plug having at least one side locking mechanism ~~(351a-351c; 451a, 451b, 461a, 461b; 551a,551b; 951a, 951b, 951c; 851a, 851b; 851a'-851d')~~ being operative independently of said central row of upper and lower locking pins;

- a keyway ~~(320; 420; 520; 920)~~ extending axially backwards from a front end ~~(310)~~ of said key plug and being configured to accommodate an associated key ~~(40; 140) with a key blade~~,

- said central row of upper and lower locking pins and said side locking mechanism being arranged to engage with and lock the key plug against rotation in said lower part of said housing unless the key blade of said associated key is fully inserted into said keyway,

wherein ~~**characterized in that**~~

- a back region of the key plug has a minimum length of 50% of a total length of the key plug~~said at least one side locking mechanism, on at least one lateral side of said keyway, is confined entirely within a front region of said key plug and comprises a longitudinal row of at least two coded side locking tumblers (351a-351c; 451a, 451b, 461a, 461b; 551a-551b; 951a, 951b, 951c; 851a, 851b; 851a'-851d'), which are located next to said front end (310) of the key plug and are movable~~

~~independently of each other and interact with the lower part of the housing, either directly or indirectly via a side bar, so as to form a coded front end side locking mechanism~~,

- ~~said~~ whereas an adjoining front region ~~(FR1; FR2; FR3)~~ of the key plug~~, on said at least one lateral side of the keyway,~~ has a maximum length of 50% of ~~a~~ said total length ~~of the key plug, whereas an adjoining back region (L1; L2; L3) thereof has a minimum length of 50% of said total length~~,

- said back region ~~(L1; L2; L3)~~ of the key plug accommodates a rear part of said central row of corresponding cavities, which cooperate with said lower locking pins ~~and~~, ~~a side portion being massive or~~as well as two portions, at each lateral side of said keyway, being reserved for possibly accommodating at least one additional lock component,

- said front region of the key plug accommodates, on at least one lateral side of said keyway, said at least one side locking mechanism,

- said at least one side locking mechanism is confined entirely within said front region of the key plug,

- said at least one side locking mechanism comprises a longitudinal row of at least two side locking tumblers, each interacting with the lower part of the housing, either directly or indirectly via a side bar, and

- wherein:

- in case the at least two coded side locking tumblers ~~(351a, 351b, 351c; 451a, 451b, 461a, 461b)~~ interact directly with the lower part of the housing, each such coded side locking tumbler is movable between a releasing confined position, where it is totally confined within the key plug, and at least one locking position, where it projects radially outside the key plug so as to fit into at least one recess ~~(242)~~ in said housing and to engage with the housing and prevent rotation of the key plug, and

- in case the at least two coded side locking tumblers ~~(551a, 551b; 951a, 951b, 951c; 851a, 851b; 851a' – 851d')~~ interact with the lower part of the housing via a side bar ~~(580, 980, 880, 880')~~, which forms a part of said coded side locking mechanism and is located at the cylindrical outer circumference of the key plug so as to engage with

an associated groove ~~(243)~~ in said cylindrical bore of the housing, said side bar is configured to fit into and engage with at least one coded recess ~~(555; 656,657)~~ in said tumbler in a releasing retracted position permitting rotation of the key plug,

and wherein:

- each of said at least two coded side locking tumblers is positioned in a selected one of at least three possible positions, said selected position providing a code and permitting the key plug to rotate relative to the housing when the tumbler is positioned in said releasing confined position, in case of direct interaction, or the side bar is positioned in said releasing retracted position, in case of interaction via a side bar, and

- there being consequently a plurality of possible code combinations for said coded front end side locking mechanism.

2. A cylinder lock unit as defined in claim 1, wherein

- said longitudinal row of ~~coded~~ side locking tumblers in said ~~at least one coded front end~~ side locking mechanism comprises at least three side locking tumblers ~~(351a-351c; 851a', 851b', 851c', 851d')~~.

3. A cylinder lock unit as defined in claim 1 or 2, wherein

- said at least one additional lock component comprises a part of said torque transferring connection.

4. A cylinder lock unit as defined in claim ~~1 or 2~~3, wherein

- said ~~at least one additional lock component comprises a blocking device for preventing the full insertion of an incorrectly cut key blade, or an electronic device for assisting in the proper functioning of the cylinder lock unit~~part of said torque transferring connection comprises at least one fastening screw.

5. A cylinder lock unit as defined in any one of the preceding claims, wherein

- said key plug is provided with two ~~coded front end~~ side locking mechanisms ~~(451a, 451b, 461a, 461b; 851a', 851b', 851c', 851d', 880'; 851a, 851b, 880)~~, one on each side of said keyway.

6. A cylinder lock unit as defined in any one of the preceding claims, wherein

- each of said coded side locking tumblers in said ~~coded~~ front ~~end side locking mechanism~~region of the key plug is provided with a transverse finger ~~(554;654;754)~~ being held in direct contact with a side code pattern ~~(41; 141'; 141)~~ on the key blade of said associated key when the key blade is being inserted into said keyway.

7. A cylinder lock unit as defined in any one of the preceding claims, wherein

- at least two of said coded side locking tumblers are movable between a coded releasing position where they are totally confined within the key plug, and at least one locking position where they project radially outside the key plug and engage with at least one recess in said housing, whereby they will prevent rotation of the key plug.

8. A cylinder lock unit as defined in any one of claims 1 to 6, wherein

- said longitudinal row of coded side locking tumblers in each side locking mechanism cooperate with an associated side bar, forming a part of said side locking mechanism and being located at the cylindrical outer circumference of the key plug and being adapted to engage with an associated groove at the inside of said housing, so as to prevent rotation of the key plug unless a correctly cut key is inserted into said keyway, the side bar being then seated inside the circumferential contour of the key plug.

9. A cylinder lock unit as defined in claim 8, wherein

- each of said coded side locking tumblers is provided with a transverse finger cooperating with a side code pattern on an associated key, and with at least one coded recess in an outside portion thereof at a vertical distance from said transverse finger, adapted to cooperate with said side bar, so as to enable the latter to disengage from said groove at the inside of said housing.

~~7. A cylinder lock core as defined in claim 6, wherein~~

~~- said at least one coded recess (555; 656,657) in each of said coded side locking tumblers is located at a vertical distance from said transverse finger (554; 654; 754), and is adapted to cooperate with said side bar (580; 680; 780), so as to enable the latter to disengage from said groove at the inside of said housing.~~

~~8~~10. A cylinder lock unit as defined in claim ~~6 or 7~~9, wherein

- said transverse finger ~~(754)~~ is longitudinally displaced, along said keyway, to form a coded location, in relation to a central axis of the associated coded side locking tumbler, each ~~coded side~~ locking tumbler being coded both in respect of the longitudinal displacement of the transverse finger ~~(754)~~, and the location of said at least one coded recess ~~(755)~~ cooperating with said side bar ~~(780)~~.

~~9~~11. A cylinder lock unit as defined in claim ~~6 or 7~~9, wherein

- each of said coded side locking tumblers ~~(651b)~~ is movable up and down as well as rotationally in an associated cavity, the rotational position also forming a code.

~~10~~12. A cylinder lock unit as defined in any one of claims ~~1-~~8 to ~~9~~11, wherein

- at least one of said ~~coded~~ side ~~locking~~ tumblers ~~(351c; 551b)~~ is positioned in front of a first cavity ~~(331g)~~ being located closest to said front end ~~(310)~~ in said central row of corresponding cavities.

~~11~~13. A cylinder lock unit as defined in claim ~~10~~12, wherein

- said at least one coded ~~front end~~ side locking mechanism ~~(551a, 551b, 580; 951a, 951b 951c, 951c, 980)~~ extends backwards from an area adjacent to said first cavity.

~~12~~14. A cylinder lock unit as defined in any one of claims ~~1~~ 8 to ~~11~~13, wherein

- at least one spring ~~(581; 981)~~ is disposed between two ~~coded~~ side locking tumblers ~~(551a, 551b; 951b, 951c)~~ cooperating with said side bar ~~(580; 980)~~, there being no spring located between a ~~coded~~ side locking tumbler ~~(551b; 951c)~~ and an end of the side bar.

~~13~~15. A cylinder lock unit as defined in claim ~~12~~14, wherein

- a single spring ~~(581)~~ is disposed between the two neighboring ~~coded~~ side locking tumblers ~~(551a, 551b)~~ being located closest to said front end of the key plug and cooperating with said side bar ~~(580)~~.

16. A cylinder lock unit as defined in any one of claims 8 to 15, wherein

- said back region of the key plug is massive except for said rear part of said central row of corresponding cavities.

17. A cylinder lock unit as defined in any one of the preceding claims, wherein

- the side locking tumblers are movable in a plane which is displaced laterally in relation to the keyway.

~~14. A cylinder lock unit as defined in any one the preceding claim, wherein~~

~~- said keyway (320; 420; 520; 920) is oriented in a central plane being aligned with said lower locking pins in said central row and said corresponding cavities, and~~

~~- the coded side locking tumblers (351a - 351c; 451a, 451b, 461b, 461a; 551a, 551b; 951a, 951b, 951c) in said coded front end side locking mechanism are movable in a plane which is displaced laterally in relation to the keyway (320, 420; 520; 920).~~

~~15~~18. A cylinder lock unit as defined in any one of the preceding claims, wherein

- said ~~central~~ row of ~~upper and lower~~ locking pins in said upper part of said housing comprises six or seven ~~lower~~ locking pins adapted to cooperate with bittings ~~(42; 142)~~ on an edge portion of ~~the key blade of~~ said associated key ~~(40; 140)~~ being inserted into said keyway.

~~16~~19. A cylinder lock unit as defined in any one of the preceding claims, in combination with a key ~~(40; 140)~~ for unlocking the cylinder lock unit ~~(200; 200')~~, said key comprising a grip portion and a key blade, wherein ~~said key blade has, on at least one lateral side thereof.~~:

- said key blade has an edge code pattern comprising a longitudinal continuous row of code portions defined by V-shaped bittings configured to interact with said central row of locking pins in said housing of the cylinder lock unit,

- said key blade also has a wave-like side code pattern configured to interact with said at least one side locking mechanism being located in the front region of the key plug on at least one lateral side of said key plug, and

- said ~~- a first portion with a~~ wave-like side code pattern ~~(41; 141; 141') being~~ is confined substantially to the longitudinal half of the key blade located closest to said grip portion and ~~comprising~~ comprises at least two coded ~~wave~~ portions configured to interact with said at least ~~one coded front end~~two side locking tumblers of said at least one side locking mechanism~~, and~~

~~- an adjoining second portion, which is straight and extends to a free end of the key blade,~~.

~~17~~20. A combination of a lock unit and a key as defined in claim ~~16~~19, wherein

- at least one of said side code ~~wave~~ portions of the wave-like side code pattern ~~(41; 141, 141')~~ of said key is located closer to the grip portion ~~(40; 140)~~ of the key than all the code portions of ~~an~~ the edge code pattern ~~(42, 142)~~.

~~18~~21. A combination of a lock unit and a key as defined in claim ~~16~~ 19 or ~~17~~20, wherein

- the side code ~~wave~~ portions of said wave-like side code pattern ~~(41; 141, 141")~~ are arranged in a continuous row in said longitudinal half of the key blade.

~~19. A key for unlocking an associated cylinder lock unit having a rotatable cylindrical key plug having a keyway and at least one coded front end side locking mechanism confined to a front region thereof, the key comprising a grip portion and a key blade, wherein~~

~~- said key blade has, on at least one lateral side thereof,~~

~~- a first portion with a wave-like side code pattern consisting of a row of at least two side code wave portions being substantially confined to the longitudinal half of the key blade located closest to said grip portion, and~~

~~- an adjoining second portion, which is straight and extends to a free end of the key blade.~~

~~20. A key as defined in claim 19, wherein~~

~~- said wave-like side code pattern is located at a ridge portion of an undercut profile groove in at least one side surface of the key blade.~~

~~21. A key as defined in claim 19 or 20, wherein~~

- said key blade also has an edge code pattern (42;142) comprising a longitudinal continuous row of code portions defined by V-shaped bittings.

22. A key as defined in claim 21, wherein

- said V-shaped bittings are skew cut with different angles.

23. A key as defined in claim 21 or 22, wherein at least one of said side code wave portions of the wave-like code pattern is located closer to the grip portion of the key than all the code portions of said edge code pattern.

24. A key as defined in any one of claims 19 to 23, wherein

- said key blade has a wave-like side code pattern on both sides thereof.

25. A key as defined in claim 24 wherein

- said key blade has different kinds of wave-like side code patterns (141, 141') on the two sides of the key blade.

26. A key as defined in any one of claims 19 to 25, wherein

- each of said side code wave portions is formed by a concavity in said wave-like side code pattern.

27. A key as defined in any one of claims 19 to 26, wherein

- each of said at least two side code wave portions of the wave-like side code pattern is selected from a group of possible code positions, said possible code positions including, at different vertical levels:

- a central position, corresponding to the position of an axis of a side locking tumbler of the associated cylinder lock unit, when the key is fully inserted into said keyway,

- a forwardly displaced position being displaced longitudinally at an incremental distance from said central position towards said free end of the key blade, and

- a rearwardly displaced position being displaced longitudinally at an incremental distance from said central position towards said grip portion of the key,

- said central position, said forwardly displaced position and said rearwardly displaced position each corresponding to a particular position of a transverse finger (654; 754) on said side locking tumbler of the associated cylinder lock unit when the key is fully inserted into said keyway of the rotatable key plug.

28. A key as defined in any one of claim 19 to 27, wherein

- the free end portion of said key blade, at said at least one of said two sides, includes an inclined ramp surface extending from a lower edge of the key blade so as to adjoin to said straight portion of said second portion of said key blade.