A KEY BLANK, A CODED KEY AND A CYLINDER LOCK AND KEY SYSTEM WITH IMPROVED STOP ARRANGEMENT

FIELD OF THE INVENTION

[0001] The present invention relates to a key blank of the kind stated in the preamble of claim 1.

[0002] The present invention also includes a key blank having a coded bitting portion, so as to form a coded key, as well as a cylinder lock and key system, including a coded key and an associated lock with a key plug.

BACKGROUND OF THE INVENTION AND PRIOR ART

[0003] A similar key blank and a coded key is known, for example from the European patent specification EP 3,219,882 B1 (ASSA AB). In the embodiment shown in this document, there are selectable axial positions for first stop or abutment surfaces on each key, cooperating with second abutment surfaces on the key plug and being located adjacent to each other side by side, and being equidistantly separated in a respective set of keys by a stop separation distance, the selectable positions of one set being axially offset to at least one other set. Also, the first stop surfaces on the keys are all located on a step-like transition at a connecting portion of the substantially flat key blade. In this way, the security of the system cylinder lock and key system is enhanced because the offset configuration of the axial positions of the

two adjacent first abutment surfaces is difficult to predict for unauthorized persons who wish to reproduce the first surfaces correctly in an attempt to copy the key. However, since the first abutment surfaces on each key (see Figures 1c, 4a, 7b, 10c, 11c, and 13) are located on a step-like transition at the connecting portion of the key, the selectable locations of the first abutment surfaces will be confined to a limited longitudinal range within the step-like transition. Also, the second stop surfaces are defined by the bottom wall of a respective recess formed axially in the extension 110 of the plug 104" (see paragraph 48, column 10, lines 2-6). Thus, the possible variations are limited to a longitudinal range being less than the axial length of the extension 110 and will therefore affect the flexibility when selecting a particular pair of locations of the two adjacent first and second abutment surfaces on the key and the plug, respectively

[0004] Another prior art key blank (and coded key), which is likewise provided with a step-like transition portion at a connecting portion of a substantially flat key blade, is known from EP 0 377 135 A2, (BKS GmbH). This prior art key blank and coded key is of the same kind as referred to in the opening paragraph, i.e. as stated in the preamble of claim 1. In this prior art key blank (and coded key), the longitudinal rib portion is located at a lateral side of the relatively wide upper part (when comparing the upper and lower parts of the present invention and the BKS prior art key blank and coded key, it is necessary to take into consideration that the relatively wide part of the BKS cross-sectional profile of the key blade is the upper part and the relatively narrow part is the lower part). Thus, in the BKS key blank and coded key, the longitudinal rib portion 9 (see figures 1 and. 2 in EP 0 377 135 A2) forming a lateral extension of the key blade, is positioned within the area of the relatively wide part, having a maximum width being substantially the same as or slightly less than the width of any rectangle in which it is substantially confined, and not in the relatively narrow part.

[0004] A still further prior art key blank (and coded key), which is likewise provided with a step-like transition portion at a connecting portion of a substantially flat key blade, is known from the German published patent application DE 10 2013 106 028 A1 (WILKA). This prior art key blank and coded key has a connecting portion provided with a protrusion serving to interact with a rotatable key plug of an associated cylinder lock, and this protrusion operates in a special way by gripping and holding a pin being journalled in a transversal bore in the key plug adjacent to the keyway. When being held in a gripped position, the pin is withdrawn from a locking position into a releasing position where it will permit the key plug to be rotated. So, this prior art key blank or coded key interacts with the key plug of the associated lock in a different manner.

OBJECT OF THE INVENTION

[0005] An object of the present invention is to accomplish an improved stop arrangement which provides a flexible arrangement for stopping the insertion of a key into a key plug of an associated lock at a selectable position.

[0006] More, specifically, it is an object of the present invention to provide a more flexible structure of the substantially flat key blank or coded key so that the length and location of the lateral extension of the substantially flat key blade is broadly variable within the whole connecting portion between the grip portion and the bitting portion of the substantially flat key blade. Thus, the selectable length and location of the lateral extension should not be confined to a step-like transition or some other limited part of the connection portion. With such a more flexible structure, it should also be possible to update an existing system of cylinder locks and keys, so as to add a new, separate group of keys to the existing system, where the new, separate group of keys includes at least one lock and key combination which is backwards compatible with the existing system. Alternatively or additionally, it should be possible to create a totally new system, which includes sub-groups being either separated from each other or forming a hierarchical system with sub-groups of different ranks.

[0007] Another object of the present invention is to provide such a structure of the key wherein the abutment surface on the key will contribute to strengthening the key, without expanding the width of the key blade, even for an added new group of keys, and making it resistant to rather strong torques that may appear during attempts to open a lock with the new key.

SUMMARY OF THE INVENTION

[0008] The above objects are achieved by a key blank, and a coded key as stated in claim 1, where the new features, in relation to the above-mentioned EP 0 377 135 A2, (BKS GmbH), are recited in the characterizing portion thereof.

[0009] Owing to the structure provided by the present invention, in particular the longitudinal rib portion extending along a selected fractional part of the connecting portion, at a lateral side of the upper relatively narrow part of the substantially flat key blade, there will be obtained a great flexibility in designing a separate cylinder lock and key combination or system, being backwards compatible with an existing system, or in creating a totally new cylinder lock and key system, which may include various separate sub-groups of cylinder locks and keys or a hierarchical system with sub-groups of different ranks. Also, for a normal connecting portion of a key, typically of a length up to about 10 mm, the longitudinal range of the longitudinal rib portion will allow a wide span of possible lengths to be selected, such as 0 to 10 mm for a key blank or a coded key, for example for use in a small format inter-changeable core type of lock.

[0010] Since the rib portion is located within a vertical range of the bitting portion of the substantially flat key blade, it is independent of any possible step-like transition at the connecting portion of the substantially flat key blade. Therefore, the key may have or may not have such a step-like transition. Consequently, in case there is no step-like transition forming the first abutment surface, it will be more difficult for an unauthorized person to determine exactly how long the key is supposed to be inserted into an associated lock, since it cannot easily be determined where the corresponding, second abutment surface of the key plug of the associated lock should be located in the longitudinal direction.

[0011] Advantageously, the longitudinal rib portion is located in the vicinity of an upper edge of the upper part of the substantially flat key blade at the connecting portion

thereof. This will strengthen the relatively narrow part of the substantially flat key blade adjacent to the grip portion, in particular in respect of torques being applied to the grip portion when the latter is turned in order to rotate the key plug of an associated lock. The rib portion, being unitary or firmly attached to the grip portion, will effectively transfer the torque from the grip portion to the key plug, especially in embodiments where the second abutment surface is located in a cavity or recess in the front end portion of the plug, so that the torque is transmitted directly via the walls of a keyway to the plug of the associated lock, with a minimum stress affecting the relatively narrow upper part of the substantially flat key blade.

[0012] The prior art includes other published documents where attempts have been made to minimize the torque transmitted to the key plug during turning of the key to actuate a cylinder lock, see for example the U.S. Patent No. 5,272,895-A (Best Lock Corporation). In this prior art embodiment, there is a drive shoulder located adjacent to the grip portion of the key, the drive shoulder forming a step-like transition at the portion of the blade between the grip portion and the bitted portion of the substantially flat key blade, as shown in Fig. 5 of the ‘895 patent. However, as clearly described in the specification, column 4, lines 42-48, “the stop shoulder 56 is formed near the distal tip of blade 14.” So, in this case of the prior art, the drive shoulder 16, serving to minimize the torque transfer, and the stop shoulder 56, serving as a stop or abutment surface, are separated and located far away from each other. According to the present invention, on the other hand, the longitudinal rib portion serves both as a stopping device and a torque minimizing device.

[0013] The longitudinal rib portion may be located on one lateral side only or on both lateral sides of the upper relatively narrow part of the substantially flat key blade. As indicated above, it is located at a vertical level lying within a vertical range of the bitting portion of the substantially flat key blade. Accordingly, it is not located at any shoulder or step-like transition provided at a higher vertical level.

[0014] In case where the upper narrow part of the substantially flat key blade is located in the vicinity of a central vertical plane of the substantially flat key blade is it feasible to have two rib portions, one on each lateral side thereof. Then, the selected lengths of the two longitudinal rib portions may be mutually equal or mutually different.

[0015] In case where there are two longitudinal rib portions, one on each side of the upper part of the substantially flat key blade, and a first rib portion on one lateral side is too short to secure a proper alignment of the coded cuts of the key and the central locking pins of the key plug, and a second rib portion on the other lateral side is longer than the first rib portion, the second longer rib portion may serve as a further abutment surface and replace

the first rib portion so as to secure a proper stopping of the key when the key reaches the fully inserted position inside the key plug. Such further abutment surfaces may be formed also in other ways, as will be indicated below.

[0016] The cross-sectional profile of the upper relatively narrow part of the substantially flat key blade may be configured in various ways, as will be explained as follows:

[0017] In a first embodiment, a substantially vertical portion of the interconnecting part of the profile of the substantially flat key blade of the key blank (and thus also the keyway of the key plug) adjoins to one lateral side portion of the lower part, and the upper part is located substantially centrally along a mid-plane of the rectangle, within which the profile is confined, the longitudinal rib portion being located on one or both lateral sides of the upper, centrally located part of the substantially flat key blade, at the connecting portion thereof.

[0018] In such an embodiment, the substantially vertical portion of the interconnecting part may form an inner surface of an undercut groove being formed in a lateral side surface of the substantially flat key blade, the lateral width of the substantially vertical portion of the interconnecting part above the undercut groove being narrower than the lower part of the substantially flat key blade. Here, an undercut portion of the undercut groove may form an inside of a security ridge extending upwards from the lower part of the substantially flat key blade in parallel to the interconnecting part. The undercut groove may extend vertically downwards into a pocket having opposite side surfaces and a lowermost bottom surface. These opposite side surfaces may be substantially parallel to each other. Possibly, an upper inside portion of the security ridge may be inclined so as to face upwards towards an upper part of the undercut groove, the upper part of the groove being open in a lateral direction.

[0019] In a second embodiment, the cross-sectional profile of the substantially flat key blade includes, at one side of the substantially flat key blade, an undercut profile groove, and the lateral side surfaces located vertically above and below the undercut profile groove will lie substantially in a same vertical plane, whereas, at the opposite side of the substantially flat key blade, there is a shelf surface. In this embodiment, the longitudinal rib portion is located at the connecting portion of the key blade at a lateral side of the upper part of the substantially flat key blade, above the shelf surface.

[0020] In a third embodiment, the cross-sectional profile of the key blank comprises two relatively deep grooves in the two opposite lateral side surfaces of the substantially flat key blade, the two deep grooves being located in the interconnecting part of the substantially flat key blade, and the depths of these two grooves being greater than half the width of the rectangle in

which the substantially flat key blade is confined, whereas the upper part of the substantially flat key blade is located substantially centrally along a mid-plane of the rectangle, and the longitudinal rib portion is located on one or both lateral sides of the upper part of the substantially flat key blade at the connecting portion thereof. Advantageously, when there a two rib portions, one on each side of the upper part of the substantially flat key blade (even in other embodiments), a second longitudinal rib portion may be shorter and possible also displaced vertically in relation to a first one. In this way, there will be a large number of possible variants that will provide distinct differences between key blanks within a group or subgroup.

[0021] In a fourth embodiment, the upper part of the substantially flat key blade is inclined 3˚ to 12˚ relative to a mid-plane of the rectangle within which the cross-sectional profile of the substantially flat key blade is confined. Such an embodiment is disclosed in two other patent applications filed on the same day by the same applicant as the present application, these other patent applications being related to a key blank and a key plug, respectively.

[0022] As indicated above, the present invention also includes a key blank where the upper part of the major longitudinal portion of the substantially flat key blade is provided with a row of coded cuts so as to form a coded key.

[0023] The substantially flat key blade may also be provided with an additional code pattern located in the lower part of said major longitudinal portion of the substantially flat key, the additional code pattern being located at a bottom surface of a pocket formed at an undercut profile groove, between the interconnecting part and an upward security ridge, the additional code pattern including coded concavities longitudinally along said longitudinal portion at a number of different vertical levels, said coded concavities being at least partially concealed by said security ridge when being observed laterally sideways in a horizontal direction being substantially perpendicular to the vertical mid plane of said substantially flat key blade.

[0024] Moreover, the present invention includes a coded key in combination with a cylinder lock so as to form a cylinder lock and key system. Generally, such a cylinder lock and key system may include at least one cylinder lock and key combination forming a matching pair, so that a coded key can release the associated matching cylinder lock. Such a matching pair includes a coded key as recited above, and a cylinder lock of the kind including a

the detailed description of preferred embodiments below and will also be defined in the appended claims.

[0033] An embodiment of the present invention concerns a cylinder lock and key system including at least one sub-group of lock and key combinations which are backwards compatible with an existing cylinder lock and key system of the same kind but having neither any longitudinal rib portions on the keys, nor any corresponding cavities in the key plugs. In these new lock and key combinations, the radially widened front end portion of each key plug may have an enlarged thickness, as measured longitudinally along the key plug, the enlargement being equal to the selected depth of the cavity therein, and an optional step-like abutment portion, serving as a further abutment surface, on the key may have a reduced length, the length reduction being equal to the enlargement of the thickness, whereby the longitudinal rib portions of the keys in this sub-group will also enable opening of the cylinder locks of the existing system, and secure a correct stopping of the keys when being inserted into the corresponding key plugs belonging to the same sub-group by making contact with the front end surface of the corresponding key plug when the key reaches its releasing position.

[0034] The key blanks of the present invention are normally made of brass or of a nickel-silver alloy. Alternatively, they can be made of other metals, such as steel or aluminum.

[0035] Typical methods of production include stamping, milling and coining,

[0036] The key grip may be unitary in one piece with the connecting portion and the major longitudinal part of the substantially flat key blade. However, it is also possible to make key blanks as cutting lengths of a drawn elongated bar, and subsequently add on separate grip portions on each cutting length.

[0037] Further possible manufacturing methods are sintering, casting and also additive methods in a wide range of materials, such as polymers, metals and metal alloys, including 3D printing methods.

[0038] Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter.

with a possible lateral extension exceeding the width w of the rectangle by at most 25%, so that the substantially flat key blade as a whole is relatively flat.

[0078] The length of the longitudinal rib portion 121, measured from the grip portion 110 along the axis A of the substantially flat key blade, should be selected as any desired fraction of the total length of the connecting portion 120. So, this length may be minimal (as short as possible and close to zero) or any desired length up to the total length of the connecting portion 120. Thus, the forward end surface 125 may be located at any position between the grip portion 110 and the major longitudinal bitting portion 130. Possibly, the longitudinal rib portion 121 has such a length that its forward end surface 125 is located close to the bitting portion 130 of the substantially flat key blade 150. It may even be located so as to adjoin directly to a first coded cut in the bitting portion 130. Accordingly, the location of the forward end surface 125 of the rib portion is selectable along the whole length of the connecting portion 120.

[0079]

[0080] As shown clearly in Fig. 3e, the longitudinal rib portion 121 is located in the vicinity of the upper edge 171 of the upper part 170 of the substantially flat key blade 150 at the connecting portion 120 thereof. In this way, the longitudinal rib portion 121, forming a lateral extension of the relatively narrow upper part 170 of substantially flat key blade 150, will contribute significantly to the strength of the substantially flat key blade 150 and will directly transmit any torque from the grip portion via the walls of the keyway 910 to the key plug 900. This will be true for any embodiment where the second abutment surface 925 of the key plug is located in a longitudinal recess or cavity 921 adjacent to an entrance opening to the keyway 910 of the key plug 900. Typically, as is well-known in cylinder locks of this general kind, the entrance opening of the keyway 910 is located in a radially widened or extended front end portion 930 of the key plug 900. The front end portion 930 adjoins to a cylindrical, longer portion 940 having a smaller diameter than the widened front end portion 930.

[0081] As will appear from various embodiments to be described below, the key blank may be provided with one or more longitudinal rib portions, possibly two (or more) longitudinal rib portions, at least one on each lateral side of the upper relatively narrow part

end surface 2125 of the threshold step-like transition 2122 (Figs. 18b and 18d) will replace the longitudinal rib portion 2121 in this particular situation where the latter is too short. Of course, on the other hand, the longitudinal rib portion 2121 will be operative and make contact with a matching key plug (not shown) where the recess 2921 has a depth (not shown) being just as shallow as the length L1.

[0105] A similar supplemental stopping arrangement is shown in Figs. 19a, 19b, 19c, where the depth D2 (Fig. 19c) of the longitudinal cavity or recess 3921, is even shallower, and the length of the longitudinal rib portion is still too short to make contact. Here, the threshold step-like transition 3122 will replace the short longitudinal rib portion 3121 and make contact with the front end surface 3935 (Fig. 19c) of the key plug 3900 when the key 3100 reaches its releasing position.

[0106] Another supplemental stopping arrangement is shown in Figs. 20a, 20b, 20c, where the depth D3 (Fig. 20c) of the longitudinal cavity or recess 4921, is just as large as the length of the longitudinal rib portion 4121 protruding into the key plug. Thus, in the lock and key combination 4900-4100, there will be a contact between the longitudinal rib portion 4121 and the bottom of the longitudinal cavity or recess 4921 as well as between the threshold step-like transition 4122 on the key 4100 and the front end surface 4935 of the key plug 4900. The threshold step-like transition 4122 will supplement the rib portion and secure a proper alignment and a correct stopping of the key 4100 when it reaches its releasing position in the key plug 4900.

[0107] A modified variant of the second kind of supplemental stopping arrangement is shown in Figs. 21a to 21c and 22a to 22d. This variant can be used in case a new subgroup of keys 5100 and key plugs 5900 (Figs. 22a to 22c) is to be added to an existing system with keys (not shown) and key plugs 4900' similar to the kind shown in Fig. 20a to 20c, although there are no longitudinal rib portions 4121 on the substantially flat keys, but only regular threshold step-like abutment portions 4122 adjacent to the grip portions thereof, and no corresponding laterally widened cavities or recesses in the key plugs 4900'. For this purpose, the substantially flat key blades of the new keys 5100 are just as long as the substantially flat key blades of those in the existing system, but the length of the threshold step-like transition portion 5122, which is optional, is made somewhat shorter. As appears from Fig. 21b, the