

A BLANK, SECURITY KEY, LOCK SYSTEM AND MANUFACTURING METHOD

The invention relates to a blank, to a security key and to a lock system with security keys and with assigned cylinders, as well as to a method for manufacturing the security key from a blank, according to the preamble of the independent claims.

With regard to lock technology, there exist the basic tasks of firstly preventing the unauthorised replication of keys with better and better means or rendering it more difficult, and on the other hand of increasing the number of possible permutations of a key and thus also the security of the lock systems.

A lock system with security turn keys is known from EP 1 185 755 as the closest state of the art, which at the key tip comprise a horizontal blocking groove with a coded blocking depth. A blocking tumbler pin pair, consisting of a standard coding pin (coding tumbler pin) and an extended standard blocking counter pin preventing the complete insertion of a key with a blocking groove which is not deep enough, is attached at the rearmost coding position in the assigned cylinder. This blocking groove coding results in high permutation capacities. Such a horizontal blocking groove however is still not too difficult to copy or replicate.

Embodiments of the present invention seek to provide a system with blanks, security keys and with assigned cylinders which significantly improves the characteristics of known systems, in particular of the known block-code system according to EP 1 185 755, with additional security functions, an improved replication protection for keys and blanks by way of a shaping which is difficult to define and copy and which moreover permits higher permutation capacities. Moreover, a reliable functioning over a long period of use and robustness with respect to wear are to be achieved, and a rational, inexpensive series production is to be possible. Above all, the new shaping should also not necessitate additional space on the key with several coding rows. A complete market range is to be covered by only one type of blank, and unauthorised key replications by way of key-cutting services are to be prevented.

According to a first aspect of the invention, a blank for manufacturing a security key with at least two coding rows / pin rows on the flat sides of the key for an assigned cylinder with tumbler pins and with counter pins of a lock system with an insertion block, acting by means of an extended counter pin is described, the blank is characterised by two parallel lateral grooves and a central projecting part between the lateral grooves, and which are formed parallel to the key axis and symmetrically to the central plane of a coding row / pin row, wherein the lateral grooves and the central projecting part are extending from the key tip to a coding region of first coding positions, and said lateral

grooves in an entry region at the key tip running at a high level and in the coding region of first coding positions running in a sunk manner at a lower level, wherein the lateral grooves are suitably shaped, in order to correspond to an additional lateral shoulder extending in the longitudinal and transverse direction to the key axis (x) of an associated cylindrical special tumbler pin and an extended counter pin at the rearmost coding position of the cylinder, so that an additional insertion block acting by means of the extended counter pin in the entry region and an additional rotation block in the coding region can be carried out by the lateral grooves of the blank and the lateral shoulder of the associated special tumbler pin.

According to a second aspect of the invention, a security key with at least two coding rows / pin rows on the flat sides of the key for an assigned cylinder with tumbler pins and with counter pins of a lock system with an insertion block, acting by means of an extended counter pin is described, the security key is characterised by two parallel lateral grooves, a central groove and a central projecting part between the lateral grooves, and these are formed parallel to the key axis and symmetrically to the central plane of a coding row / pin row, wherein the lateral grooves, the central groove and the central projecting part are extending from the key tip to a coding region of first coding positions, wherein coding recesses are formed at the first coding positions in the region of the central groove in the coding region, and wherein the lateral grooves in an entry region at the key tip running at a high level and in the coding region of the first coding positions running in a sunk manner at a lower level, wherein the lateral grooves are suitably shaped, in order to correspond to an additional lateral shoulder extending in the longitudinal and transverse direction to the key axis of an associated cylindrical special tumbler pin and an extended counter pin at the rearmost coding position of the cylinder, so that an additional insertion block acting by means of the extended counter pin in the entry region and an additional rotation block in the coding region can be carried out by the lateral grooves of the key and the lateral shoulder of the associated special tumbler pin.

According to a third aspect of the invention, a lock system with security keys with at least two coding rows / pin rows on the flat sides of the key and with assigned cylinders with tumbler pins and with counter pins and with an insertion block, acting by means of an extended counter pin is described, the lock system is characterised by keys with two parallel lateral grooves, a central groove and a central projecting part which are formed parallel to the key axis and symmetrically to the central plane of a coding row / pin row, with coding recesses in the region of the central groove at first coding positions, wherein the lateral grooves, the central groove and the central projecting part are extending from the key tip to a coding region of the first coding positions, and said lateral

grooves in an entry region at the key tip running at a high level and in the coding region of the first coding positions running in a sunk manner at a lower level, and with assigned cylinders with a cylindrical special tumbler pin at the rearmost coding position of the cylinder, said special tumbler pin comprising an additional lateral shoulder, which extends in the longitudinal and transverse direction to the key axis, wherein this lateral shoulder of the special tumbler pin is shaped such that it corresponds to the lateral grooves of the key, and wherein in the entry region, the length of the special tumbler pin and an extended counter pin up to the lateral shoulder corresponds to the distance from the cylinder housing up to the lateral groove, and at a first coding position, the length of the special tumbler pin up to the lateral shoulder corresponds to the distance from the shear line up to the lateral groove, with a tolerance region, so that an additional insertion block acting by means of the extended counter pin, in the entry region and an additional rotation block in the coding region can be carried out with the lateral grooves of the key and with the lateral shoulder of the assigned special tumbler pin.

This new blank block-code system emanates for example from the previous block-code system and additionally comprises new features, characteristics and functions, with which the mentioned objects can be achieved, as shown and explained further also by way of the figures.

The known block-code system EP 1 185 755 in contrast comprises a lock system with security turn keys for lock installations, with at least three coding rows / pin rows A1, A2 A3 which are arranged on the flat sides of the key S, with assigned cylinders Z with pin rows of tumbler pin pairs, consisting of tumbler pins and counter pins at the positions of a given drill pattern, wherein the keys comprise a horizontal blocking groove BN which runs parallel to the key axis x from the key tip at least up to the first coding position P1 of a pin row on the key, and the blocking groove has a coded blocking depth B1, B2, B3, and a tumbler pin pair corresponding to the blocking groove BN and with a standard tumbler pin as a blocking tumbler pin BZ and with an extended counter pin as a blocking counter pin BG, is provided in the assigned cylinder at least at the rearmost coding position P1, so that the blocking counter pin BG stands up on the cylinder housing 10 if the blocking groove is not deep enough and thus the complete insertion of a key with a blocking groove which is not deep enough is blocked by the tumbler pin pair, and wherein the blocking tumbler pin BZ with the blocking counter pin BG after insertion of the key, at the position P1 is also applied as a coding pin with standard coding steps C1, C2, C3, C4 with respect to the rotation of the cylinder.

New, important features of the new blank block-code system, amongst other things are: The new blank comprises two parallel lateral grooves and a central projecting part therebetween. The lateral grooves in an entry region run at a high level and in a first coding region at a low level. A key is manufactured from the new blank with the forming out of a central groove in the entry region and of coding recesses on the central projecting part in the coding region. The lateral grooves of the blank and the central groove of the key result in a new composite blank block-code groove. In the cylinder, a new special tumbler pin with lateral shoulders, whose shaping corresponds to the lateral grooves and the central groove, is assigned to the key, so that an additional insertion block in the entry region and an additional rotation block in the coding region are formed with the special tumbler pin. With this, the security of the locking system is significantly increased and counterfeits and unauthorised key copies are prevented.

The new features cannot be deduced from the known system of EP 1 185 755: Its simple, horizontal blocking groove BN corresponds to the standard coding pins and it is not sunk and the blocking tumbler pin BZ is a standard coding pin of the coding row. Further not present are: The two lateral grooves, sunk from the high level to a low level; the central projecting part on the blank and on the key with coding recesses; the special tumbler pin in the cylinder with the additional lateral shoulders which correspond to the lateral grooves and the central groove on the key. The additional insertion block and the additional rotation block are not possible according to EP 1 185 755.

The invention according to the independent claims permits different advantageous further embodiment variants with further improvements and optimisations of the desired characteristics - in accordance with the desired applications, e.g. with the following additional features: with a widening of the RB groove; with a sunk central projecting part; with RB coding steps which differ from the standard coding steps and/or with an additional side groove for non-vertical pin rows.

The dependent patent claims relate to advantageous further developments of the invention which permit further advantages with respect to the security of the lock system, duplication security of blanks, keys and cylinders, with respect to a long service life, with respect to the rational manufacture and reliable service as well as a greater number of permutations.

The invention is hereinafter explained in more detail by way of embodiment examples and figures. Thereby are shown in:

- Fig. 1 schematically, a blank according to the invention, with two vertical lateral grooves and a central projecting part and their levels,
- Fig. 1a - in a longitudinal section through the central plane of the pin row;
- Fig. 1b - in a cross section through the entry region at the key tip,
- Fig. 1c - in the coding region of the first coding position,
- Fig. 2 a blank with inclined inner walls of the lateral grooves,
- Fig. 2a - in a cross section through the entry region,
- Fig. 2b - in the coding region,
- Fig. 3 a key according to the invention, with two lateral grooves and with a central groove in the region of the central projecting part,
- Fig. 3a - in a longitudinal section, with lateral grooves, central projecting part and central groove at a high and at a low level,
- Fig. 3b - in cross section in the entry region, with lateral grooves, central groove and assigned special tumbler pin with lateral shoulders, central part as well as a milling cutter for coding,
- Fig. 3c - in the coding region at a first coding position,
- Fig. 3d - at a second coding position,
- Fig. 3e - a standard coding pin of the coding row and a standard coding recess,
- Fig. 3f - an example with a widened RB groove and a widened special RB tumbler pin,
- Fig. 4 a lock system according to the invention, with a key with lateral grooves, central projecting part and central groove and with an assigned cylinder with counter pin and special tumbler pin with lateral shoulders,
- Fig. 4a - in a longitudinal section
- Fig. 4b - in cross section in the entry region,

- Fig. 5-8 in cross section, a key with a special tumbler pin and counter pin of an assigned cylinder,
- Fig. 5 - in the entry region with the function of an insertion block,
- Fig. 6 - in the coding region with the function of a rotation block,
- Fig. 7 - in the coding region with a standard coding pin of the coding row,
- Fig. 8 - at a first coding position, a counterfeit key and the special tumbler pin of the cylinder,
- Fig. 9 - 11 on a key, different coding steps and groove shapes in the entry region and in the coding region,
- Fig. 9 - standard coding steps on a previous key with a previous blocking groove,
- Fig. 10 - standard coding steps on a new key with new, combined RB grooves,
- Fig. 11 new RB coding steps,
- Fig. 12 an example of a widened RB groove with RB tumbler pin,
- Fig. 13a in cross section, an example of a blank with an inclined coding row with lateral grooves, central projecting part and a side groove,
- Fig. 13b a plan view of the blank as well as a milling cutter for creating lateral grooves, central projecting part and side groove
- Fig. 13c a perspective view of the blank.
- Fig. 14a a perspective view of a coded key which is manufactured from the blank,
- Fig. 14b a cross section of the key with an assigned special tumbler pin and a standard tumbler pin of the coding row.
- Fig. 15 views of a key from above and perspectively, with different codings,
- Fig. 16 a manufacturing method of a blank and a key with milling cutters, in different steps,
- Fig. 17-19 a further example of a blank and key with a particularly wide central groove,
- Fig. 17 in a cross section, the key with RB groove in the cylinder with assigned tumbler pins,
- Fig. 18 in cross section, a wrong key at the same location in the cylinder with the RB tumbler pin,
- Fig. 19a perspectively, the blank with a sunk central projecting part,
- Fig. 19b the key with five coding rows and with codings.

Fig. 1a-c schematically show a blank R according to the invention, with two vertical lateral grooves RB-SN and with a central projecting part RB-M which run initially at a high level N1 and subsequently sunk or lowered to a lower level N2, parallel to the key axis x. Thereby, 7 indicates the area and 5 the central bisecting plane of the blank and key.

Fig. 1a shows the blank in a longitudinal section through the central plane of a coding row A with the coding steps C1 - C4 for the standard coding pins Cod-ZH of this coding row A.

The lateral grooves RB-SN in an entry region RB-E at the tip of the key run at a high level N1 and at a lower level N2 in the coding region RB-P of the first coding positions P1, P2 which e.g. correspond to the coding positions L11 and R5 of a left-hand or right-hand drill pattern. The central projecting part RB-M can run continuously at the height of the key surface 7 or also in a sunk manner.

In the simplest case, the central projecting part RB-M runs in a continuous manner RB-M(1) and is only formed by way of creating the sunk lateral grooves (e.g. by way of a disc milling cutter). The central projecting part on the blank can also be sunk in the coding region RB-P: RB-M(2), depending on the application. A simpler coding and a more rational manufacture of the key can be achieved with this. Manufacturing methods for this are e.g. described with regard to Fig. 13b and 16.

Fig. 1b shows a cross section through the entry region RB-E at the key tip with the high level N1 of the lateral grooves.

Fig. 1c in the coding region RB-P shows the deeper level N2 of the sunk lateral grooves and also a (less greatly) sunk central projecting part RB-M(2).

Fig. 1c also shows the widths of the complete RB groove, lateral grooves and central projecting part: bg, bn and bm (see Fig. 3d).

The blank R according to the invention, for manufacturing a security key S with at least two coding rows / pin rows Ai on the flat sides of the key for an assigned cylinder Z with tumbler pins ZH and counter pins GZH comprises two parallel lateral grooves RB-SN and a central projecting part RB-M between the lateral grooves, and these are formed parallel to the key axis x and symmetrically to the central plane of the coding row / pin row A. These lateral grooves RB-SN in an entry region RB-E at the key tip run at a high level N1 and in a coding region RB-P of the first coding positions P1, P2 run at a lower level N2. The lateral grooves RB-SN are suitably shaped, in order to correspond to the additional lateral shoulders RB-ZH-S of an assigned special tumbler pin RB-ZH and of an extended counter pin RB-GZH of the cylinder, so that an additional insertion block in the entry region RB-E and an additional rotation block in the coding region RB-P can be carried out with the lateral grooves RB-SN and the lateral shoulders RB-ZH-S.

Fig. 2a, 2b show a blank R with inclined inner walls 11 of the lateral grooves RB-SN which have an inclination angle Wm to the central plane of the coding row A (pin plane). This inclination angle Wm can e.g. be 10° - 40° and permit further shape variants of lateral grooves and be optimised according to the application.

Fig. 2a shows a corresponding shaping of the lateral grooves RB-SN in the entry region RB-E and in Fig. 2b in the coding region RB-P.

Only the lateral grooves RB-SN and the central projecting part RB-M are present on the blank. The composite blank block-code groove = RB-SN + RB-MN is not formed on the key until with the coding and a milling cutter for the coding by way of manufacturing the central groove RB-MN.

Fig. 3a - d show a key S according to the invention, with the two lateral grooves RB-SN and with a central groove RB-MN which is manufactured on the central projecting part RB-M or in its region. In this example, the coding position P1 is coded with the coding step C1, and the coding position P2 with the coding step C2, in the coding region RB-P.

Fig. 3a shows a longitudinal section through the key S.

Fig. 3b shows a cross section in the entry region RB-E with a composite RB groove = RM-MN + RB-SN. This corresponds to an assigned special tumbler pin RB-ZH in the cylinder with additional lateral shoulders RB-ZH-S which correspond to the lateral grooves RB-SN of the key S.

Also shown is a coding milling cutter 14 for coding standard codings Ci (and also RB codings) which corresponds to the shape of the standard coding pins Cod-ZH. A blocking groove BN which is (illegally) manufactured with this, in the entry region of a key would be blocked out by the lateral shoulders RB-ZH-S of the RB tumbler pin (with the additional blocking area Fs, see Fig. 5 and 10).

Fig. 3c shows a cross section in the coding region RB-P at the coding position P1, here with a deepest coding C1, at which the lateral grooves RB-SN lie at the level N2.

Fig. 3d at the coding position P2 shows a coding C2 with the central groove RB-MN on the central projecting part RB-M.

The width bn of the lateral grooves RB-SN and the width bm of the central projecting part RB-M are matched to one another. Together, the total groove width results: $bg = bm + 2 \cdot bn$.

These widths bn and bm can lie in a region of $bn = 20 - 33\%$ and $bm = 33 - 60\%$ of the total groove width bg.

Preferably, the width bm of the central projecting part is at least 33% of the complete groove width bg , and the width bn of the lateral grooves is at least 20% of the complete groove width bg .

Fig. 3e shows a standard coding pin Cod-ZH and a standard coding recess Cod-V of the coding row A.

The security key S according to the invention with at least two coding rows / pin rows A_i on the flat sides of the key for an assigned cylinder Z with tumbler pins ZH and counter pins GZH in a coding row A comprises two parallel lateral grooves RB-SN and a central groove RB-MN between the lateral grooves, and these are formed parallel to the key axis x and symmetrically to the central plane of a coding row - pin row A, wherein coding recesses are formed at the first coding positions P1, P2, in the region of the central groove RB-MN in a coding region RB-P. The key preferably comprises at least three or more coding rows A_i . These lateral grooves RB-SN in an entry region RB-E at the tip of the key run at a high level N1 and in a coding region RB-P of the first coding positions P1, P2 are sunk to a lower level N2. Additional permutations in the coding region are created with this.

The lateral grooves RB-SN are suitably shaped, in order to correspond to the additional lateral shoulders RB-ZH-S of an assigned special tumbler pin RB-ZH and an extended counter pin RB-GZH of the cylinder, so that an additional insertion block in the entry region RB-E or an additional rotation block in the coding region RB-P can be carried out with the lateral grooves RB-SN of the key and with the lateral shoulders RB-ZH-S of the tumbler pin RB-ZH, wherein in the region of the central projecting part RB-M, the additional central groove RB-MN can be created in the entry region RB-E and the codings of P1, P2 in the coding region RB-P. The special tumbler pin RB-ZH, in a manner corresponding to the first coding positions P1, P2 on the key, must be arranged at the rearmost position of the pin row A in the cylinder.

Fig. 3f shows a further example of a key S(2) with a widening of the RB-groove: RB-N(2) compared to the standard codings of the coding row A: The width $bg(2)$ of the RB groove (with lateral grooves RB-SN and central projecting part RB-M or central groove RB-MN) on both sides is greater than the width b_{cv} of the coding recesses Cod-V of the coding row A by an amount bb : $bg(2) = b_{cv} + 2bb$ (see Fig. 12 and 17). Further improvements of the characteristics such as functional reliability, counterfeit security and service life can be achieved with this widening, in particular for cylindrical tumbler pins and codings.

Fig. 4a, b in the longitudinal and transverse section show a lock system according to the invention, with a key S with lateral grooves RB-SN, a sunk central projecting part RB-M(2) and a central groove RB-MN as well as with an assigned cylinder Z with an extended counter pin

RB-GZH and a special tumbler pin RB-ZH with the lateral shoulders RB-ZH-S. These tumbler pins in the entry region RB-E effect an insertion lock for counterfeit or wrong keys: once by way of the central part RB-ZH-M and additionally by way of the lateral shoulders RB-ZH-S of the tumbler pin RB-ZH. With counterfeit keys which have an insufficiently deep central groove or lateral grooves, the extended counter pin RB-GZH stands up on the cylinder housing 10 and thus the complete insertion of the counterfeit key is prevented.

In an analogous manner, with non-matching coding shapes and coding depths of a wrong key, a rotation block is implemented in the coding region RB-P, by way of the lateral shoulders RB-ZH-S and/or of the central part RB-M of the special tumbler pin RB-ZH being present in an incorrect coding recess and thus the tumbler pin RB-ZH reaching beyond the shear line 9 and thus preventing the rotation of the key.

The lock system according to the invention with security keys S with at least two coding rows / pin rows A_i on the flat sides of the key and with assigned cylinders Z with tumbler pins ZH and counter pins GZH comprises keys S with two parallel lateral grooves RB-MN and a central groove RB-MN in a coding row A, and these are formed parallel to the key axis x and symmetrically to the central plane of the pin row A, with coding recesses in the region of the central groove RB-MN at the first coding positions P1, P2. These lateral grooves RB-SN in an entry region RB-E at the key tip run at a high level N1 and in a coding region RB-P of the first coding positions P1, P2 they are sunk to a lower level N2. The assigned cylinders Z at their rearmost coding position P1, P2 of the cylinder comprise a special tumbler pin RB-ZH with additional lateral shoulders RB-ZH-S.

These lateral shoulders RB-ZH-S of the tumbler pin RB-ZH are shaped such that they correspond to the lateral grooves RB-SN of the key, wherein at a first coding position P1, P2, the length l_s from the tumbler pin RB-ZH and the counter pin RB-GZH up to the lateral shoulder RB-ZH-S corresponds to the distance d_s from the cylinder housing 10 up to the lateral groove RB-SN and the length l_z of the tumbler pin RB-ZH up to the lateral shoulder RB-ZH-S corresponds to the distance d_z from the shear line 9 up to the lateral groove RB-SN, with a tolerance region to, so that an additional insertion block in the entry region RB-E and an additional rotation block in the coding region RB-P can be carried out with the lateral grooves RB-SN of the key and with the lateral shoulders RB-ZH-S of the assigned special tumbler pin RB-ZH, due to the counter pin RB-GZH standing on the cylinder housing 10 (insertion block) in the entry region and the special tumbler pin RB-ZH reaching beyond the shear line 9 in the coding region (rotation block), in the case of absent lateral grooves RB-SN or ones which are not deep enough.

Figs 5- 8 for example further illustrate the functions of the new blank block-code system and in cross section show a key as well as a special tumbler pin RB-ZH and a counter pin RB-GZH of an assigned cylinder.

Fig. 5 illustrates the function of the entry block in the entry region RB-E. The tumbler pin pair RB-ZH + RB-GZH has a length l_s up to the lateral shoulder RB-ZH-S, and d_s here indicates the distance from the cylinder housing 10 up to the lateral grooves RB-SN. The length l_s plus a small tolerance region to (of e.g. 0.05 - 0.1 mm) corresponds to the distance d_s and thus permits the insertion of the key, whereas with a counterfeit key with absent combined grooves RB-MN and RB-SN or ones which are not deep enough, the tumbler pin pair RB-ZH + RB-GZH would stand up on the cylinder housing 10 and thus would prevent the insertion of a counterfeit or wrong key (see Fig. 4a).

Fig. 6 illustrates the function of the rotation block in the coding region RB-P. The key can be rotated with correctly coded grooves RB-MN and RB-SN, with which the length l_z of the assigned tumbler pin RB-ZH up to the shoulder RB-ZH-S is also not greater than the distance d_z from the shear line 9 up to the lateral grooves RB-SN at the level N2. Otherwise not, as illustrated in Fig. 8.

Fig. 7 at a coding position P1, P2 shows a (previous) standard coding pin Cod-ZH of the pin row A, instead of the special tumbler pin RB-ZH which can also correspond to the shear line 9. According to the invention however, it is the special tumbler pin RB-ZH which is applied and not a standard coding pin of this pin row A, as with the previous block-code according to EP 1 185 755.

Fig. 8 at a first coding position P1, P2 shows a counterfeit (falsified) key Sb, with which the coding depth C1 in the region RB-MN would probably have been correctly copied in a standard coding recess Cod-V (matching with a previous standard coding pin Cod-ZH according to Fig. 7). The special tumbler pin RB-ZH however would stand up with the lateral shoulders RB-ZH-S on the coding recess Cod-V and thus reach beyond the shear line 9 (blocked out by a distance a) and would prevent the rotation. This additional rotation block, by way of the tumbler pins RB-ZH at the coding steps in the coding region RB-P of an incorrect key Sb, is also illustrated in the Fig. 9 and 10.

Figs. 9 - 11 on a key show different coding steps C_i and groove shapes in the entry region and at the first coding positions as well as a comparison of previous blocking grooves (BN) with new RB grooves.

Compared to the blocking area of the previous blocking groove (BN) in the entry region, the blocking area of a new, composite blank block-code RB groove = RB-MN + RB-SN of the same size and blocking effect is wider and less deep. A greater coding depth region (e.g. more coding steps) up to the deepest coding step C1 for the coding of the positions P1, P2 is available by way of this. Or the blocking area and the blocking effect of the new RB groove are accordingly greater in the entry region RB-E, given the same depth as with the previous blocking groove (BN). The distance dN between the level N1 and N2 must be at least one coding step dC. Preferably, N2 corresponds to the deepest coding step, here C1 in Fig. 10 and 11.

Fig. 9 shows standard coding steps C1 - C4 on a previous or on a counterfeit key Sb with a previous blocking groove BN with a depth B2, which lies below the coding step C3. Only two steps therefore remain for the coding of the coding positions P1, P2: C1 and C2.

Fig. 10 shows a new RB groove with a blocking area Fs of the same size as in Fig. 9 and with a lower depth = at the height of the coding step C3. Therefore three steps C1, C2, C3 remain for the coding P1, P2.

Fig. 11 shows a new RB groove with the same depth (B2) as that of the previous blocking groove BN of Fig. 9 and with a significantly larger blocking area Fs and blocking effect. Moreover, here the RB coding steps C2* and C3* could be set somewhat more deeply than the standard coding steps C2, C3, so that also three steps for the coding of P1, P2 are possible with this: C1, C2*, C3*. The RB coding steps Ci* in the coding region can be situated higher or more deeply than the standard coding steps Ci of the coding row A for the standard tumbler pins Cod-ZH with a correspondingly different length of the assigned special tumbler pin RB-ZH.

Preferably, at least one RB coding step Ci* does not need to correspond to a standard coding step Ci.

The number of possible permutations and the duplication security can thus be significantly increased with the new RB grooves.

A previous or a counterfeit key Sb with a previous blocking groove BN in the entry region RB-E and with the previous standard coding recesses (produced by way of a milling cutter 14 for coding), on account of the special tumbler pin RB-ZH (which corresponds to the RB-groove)

- in the entry region RB-E would be blocked against insertion (due to the additional blocking area Fs)

and at the coding positions P1, P2 in the coding region at all coding steps C1, C2, C3 would be blocked against rotation, even if the depths in the entry region and at the coding positions were to be equal as with a correct key S with RB groove and RB codings, as is illustrated in Fig. 6, 8, 9 and 10.

Such a false or unauthorised key copy (Sb) which would be copied by a key-cutting service by way of a milling cutter for coding, with the same depths in the entry region and at the coding positions P1, P2 as the original key, would therefore come up against an insertion block and a rotation block.

Fig. 12 shows a further example of a widened RB groove with RB tumbler pin, in comparison to the standard coding pins Cod-ZH and coding recesses Cod-V of the coding row A with cylindrical tumbler pins. Additionally to the widening bb, here the distance ba is shown, by which the RB tumbler pin RB-ZH reaches beyond the coding recesses Cod-V on both sides: $brz(2) = bcv + 2 ba$ (see also Fig. 3e, 3f and 18).

Fig. 13 and 14 show a further example of a blank and a key, according to the invention, wherein here the pin row A has an inclination angle Wa of 15° to the z-direction.

Fig. 13a, b, c in different views show the blank R with the new set down lateral grooves RB-SN and the central projecting part RB-M as well as with an additional side groove RB-nn

Fig. 13a in cross section shows the inclination angle Wa of the pin row A, the lateral grooves RB-SN, the central projecting part RB-M and the side groove RB-nn in the entry region RB-E as well as in the coding region RB-P.

Fig. 13b shows a view from above onto the blank which is rotated by 15° (thus in the direction of the pin plane A).

This figure also illustrates an advantageous rational manufacture of a blank, by way of firstly a sunk central projecting part RB-M(2) being able to be manufactured in the coding region RB-P by way of a cylinder milling cutter 15 and subsequently the lateral grooves RB-SN being able to be manufactured in the entry region RB-E at a level N1 and in the coding region RB-P at a level N2, by way of a milling cutter 16. In this example with perpendicular inner walls 11 of the lateral grooves RB-SN, e.g. by way of a cylinder milling cutter 16, and for inclined inner walls 11 by way of a cone milling cutter (see example Fig. 2a, b).

Fig 13c shows the blank in a perspective view.

With a blank or a key with an inclined pin plane A with an angle of inclination $W_a > 0$, on the inner side, an additional side groove RB-nn preferably can adjoin to the lateral groove RB-SN, said side groove forming a supporting surface which is orthogonal to the coding plane / pin plane A. The lead-in of a zero tumbler pin is rendered possible or can be optimised by way of this for example. Such a zero tumbler pin consists only of an upper part with a width b_0 without the lower coding part, as is illustrated in Fig. 14b.

With the method according to the invention, for manufacturing a key S from a blank R, a central groove RB-MN is manufactured in the entry region RB-E, and coding recesses Cod-V at the first coding positions P1, P2 in the coding region RB-P, by way of a coding on the blank R by way of removing material away from the central projecting part RB-M. Thereby, the lateral grooves RB-SN are firstly manufactured on the blank at a high level N1, and set down at a lower level N2 with the central projecting part RB-M.

Subsequently, the second part RB-MN of the combined RB groove = RB-SN + RB-MN is manufactured with the coding, and the coding on the central projecting part RB-M of the key is manufactured. This permits an improved copy protection and further security functions.

A blank with a non-sunk central projecting part RB-M can e.g. be simply manufactured by way of manufacturing the sunk lateral grooves RB-SN by way of a disc milling cutter.

Preferably, firstly a sunk central projecting part RB-M(2) can be manufactured on the blank in the coding region (RB-P) by way of a first milling cutter, and subsequently the lateral grooves RB-SN in the entry region (RB-E) at a high level (N1) and in the coding region (RB-P) at a lower level (N2) by way of a second milling cutter.

A coded key S with four coding rows A1 to A4 and manufactured from the blank is shown in Fig. 14a, b.

Fig. 14a shows a perspective view of the key with a coding step C1 at the coding position P1 and a coding step C2 at the coding position P2, in the coding region RB-P, and these are incorporated on the central projecting part RB-M.

Fig. 14b shows a cross section of the key with an assigned special tumbler pin RB-ZH at a coding position in the coding region RB-P and a standard coding pin Cod-ZH as well as a standard coding recess Cod-V of the same coding row (i.e. from position P3).

Fig. 15 from above and in a perspective manner shows a further example of a key with a RB groove which is widened on both sides by bb and has a width $bg(2) = b_{cv} + 2 \cdot bb$ and with

RB coding steps Ci^* which differ from the standard coding steps, here at position $P1:C1^*$, at $P2:C2^*$ and at $P3:C2$.

Fig. 16 shows a manufacturing method of a blank and a key with an inclined pin plane A with milling cutters, in different steps:

In a first step a the milling of a sunk central projecting part RB-MN(2) in the coding region RB-P and in step b the milling of a side groove RB-nn, by way of a first milling cutter 15, then in step c the milling of the two lateral grooves RB-SN by way of a second milling cutter 16, and later in step d the milling of the central groove RB-MN and the coding recesses in the coding region RB-P ($P1, P2$) as well as at the further coding positions $P3, P4$ etc. of the standard codings of the coding row A, by way of a milling cutter 14 for coding.

The central projecting part RB-M(2) preferably at the most is sunk to the height of the uppermost coding step - here at the most to $C2^*$. (In Fig. 10, at the most to $C3$, and in Fig. 11 at the most to $C3^*$).

Figs 17 - 19 show a further embodiment example of a blank and key, according to the invention, with a vertical pin row A in a cylinder. Here, a particularly wide central groove RB-MN with a width b_{mn} e.g. for a particularly good guidance of the tumbler pins through the central groove with *minimal wear* is envisaged.

Fig. 17 in cross section shows the key with an RB groove in the cylinder and with assigned tumbler pins of the coding row A1. The special tumbler pin RB-ZH lies in a deepest coding position, e.g. $P1:C1$, so that the correct key can be rotated at the shear line 9. The widening of the RB groove compared to the standard codings Cod-V of the same coding row A1 is: $2\ bb = bg(2) - bc_v$.

Fig. 18 in cross section shows a wrong key Sb at the same location in the cylinder with an RB tumbler pin, wherein the wrong key Sb has a standard coding Cod-V instead of the widened RB-grooves RB-SN and RB-MN. Here, the RB tumbler pin already stands up on the key surface 7 and thus at the shear line 9 blocks against rotation. This is the case even if here the width br_z of the tumbler pin RB-ZH is only slightly larger (ba) than the width bc_v of the standard coding recess Cd-V by the amount $2\ ba = br_z - bc_v$. This is because the springs of the counter pin (see Fig. 4a) cannot forcibly press the tumbler pin RB-ZH into the recess Cod-V which is too narrow. In contrast to the coding row A1 with cylindrical tumbler pins RB-ZH and Cod-ZH of Fig. 17, the key here also has a further coding row A2 with conical tumbler pins and recesses Cod-V2.

The Fig. 19a, b perspective show the blank R and the key S with (at least) five coding rows A1- A5 and with codings.

Fig. 19a shows the blank R with the lateral grooves RB-SN and the central projecting part RB-M in the entry region RB-E and, in a sunk manner, in the coding region RB-P for the coding positions P1, P2.

Fig. 19b shows a coded key S which is manufactured from the blank, wherein the RB shaping is incorporated in the vertical pin row A1 ($W_a = 0^\circ$). The key in the coding region RB-P here comprises the following codings on the central projecting part RB-M:

- the coding step C2 at the coding position P1 and
- the coding step C1 at the coding position P2.

The following terms are applied within the framework of this description:

x	key axis
x, y, z	directions in space
R	blank, key blank
S	key
Sb	previous key, wrong key
Z	cylinder
Pi	coding positions
Ri, Li	right-hand, left-hand coding positions of a drill pattern
A	coding row, pin row (central plane)
Ci, Ci*	coding steps, coding
RB	blank block-code (-function)
RB-SN	RB lateral grooves
RB-M	RB central projecting part
RB-MN	central groove on S
RB-N	composite RB groove = RB-SN + RB-MN or RB-SN + RB-M
RB-nn	side groove
Cod-V	coding recess
Cod-ZH	coding pin (standard), coding tumbler pin
Cod-ZH-M	centre part of coding pin (trace part)
RB-ZH	special RB tumbler pin
RB-GZH	RB counter pin
RB-ZH + RB-GZH	RB tumbler pin pair
RB-ZH-S	ZH lateral shoulder
RB-ZH-M	ZH central part (coding trace part)
Fs	additional blocking area
RB-E	entry region
RB-P	coding region (P1, P2...) of frontmost positions
ls	length of RB-ZH + RB-GZH to RB-ZH-S
ds	distance from 10 to RB-SN
lz	length of RB-ZH to RB-ZH-S
to	tolerance region
dz	distance of 9 to RB-SN
dN	distance of N1 to N2
a	lock-out distance
dC	one coding step
bm	width of RB-M
bn	width of RB-SN

bg	width of RB-N = RB-SN + RB-M
bnn	width of RB-nn
bg(1)	= bcv
bg(2)	= bcv + 2bb
brz	width of RB-ZH
bcv	width of Cod-V
bcz	width of Cod-ZH
bb	widening of RB-N: $bg(2) = bcv + 2\ bb$
ba	$brz - bcv = 2ba$
bmn	width of RB-MN
b0	upper width of ZH
Wm	inclination angle of l1
Wa	inclination angle of A
5	central (bisecting) plane of S
7	surface of S
9	shear line in Z
10	cylinder housing
11	inner walls of RB-SN
14	milling cutter for coding
15, 16	milling cutter for blank

PATENT CLAIMS

1. A blank (R) for manufacturing a security key with at least two coding rows / pin rows (Ai) on the flat sides of the key for an assigned cylinder (Z) with tumbler pins (ZH) and with counter pins (GZH) of a lock system with an insertion block, acting by means of an extended counter pin, characterised by
 - two parallel lateral grooves (RB-SN) and a central projecting part (RB-M) between the lateral grooves, and which are formed parallel to the key axis (x) and symmetrically to the central plane of a coding row / pin row (A),
 - wherein the lateral grooves (RB-SN) and the central projecting part (RB-M) are extending from the key tip to a coding region (RB-P) of first coding positions (P1, P2)
 - and said lateral grooves (RB-SN) in an entry region (RB-E) at the key tip running at a high level (N1) and in the coding region (RB-P) of first coding positions (P1, P2) running in a sunk manner at a lower level (N2),
 - wherein the lateral grooves (RB-SN) are suitably shaped, in order to correspond to an additional lateral shoulder (RB-ZH-S) extending in the longitudinal and transverse direction to the key axis (x) of an associated cylindrical special tumbler pin (RB-ZH) and an extended counter pin (RB-GZH) at the rearmost coding position (P1, P2) of the cylinder,
 - so that an additional insertion block, acting by means of the extended counter pin (RB-GZH), in the entry region (RB-E) and an additional rotation block in the coding region (RB-P) can be carried out by the lateral grooves (RB-SN) of the blank and the lateral shoulder (RB-ZH-S) of the associated special tumbler pin.
2. A blank according to claim 1, characterised in that the central projecting part RB-M is sunk to a lower level (RB-M(2)) in the coding region (RB-P).
3. A blank according to claim 1 or 2, characterised in that the complete width $bg(2)$ of lateral grooves RB-SN and the central projecting part RB-M on both sides is larger than the width (bcv) of the coding recesses (Cod-V) of the coding row (A) by an amount (bb): $bg(2) = bcv + 2\ bb$.
4. A blank according to one of the preceding claims, characterised in that the width (bm) of the central projecting part RB-M is at least 33% of the complete groove width (bg).
5. A blank according to one of the preceding claims, characterised in that the width (bn) of a lateral groove RB-SN is at least 20% of the complete groove width (bg).

6. A blank according to one of the preceding claims, characterised in that the inner walls (11) of the lateral grooves RB-SN are inclined at an angle W_m to the pin plane (A).

7. A blank according to claim 6, characterised in that the angle W_m is $= 10^\circ - 40^\circ$.
8. A blank according to one of the preceding claims, characterised in that with an inclined pin plane (A) with an inclination angle $W_a > 0$, on the inner side, an additional side groove RB-nn adjoins to the lateral groove RB-SN, said side groove forming a supporting surface orthogonal to the coding plane / pin plane (A).
9. A security key with at least two coding rows / pin rows (A_i) on the flat sides of the key for an assigned cylinder (Z) with tumbler pins (ZH) and with counter pins (GZH) of a lock system with an insertion block, acting by means of an extended counter pin, characterised by
 - two parallel lateral grooves (RB-SN), a central groove (RB-MN) and a central projecting part (RB-M) between the lateral grooves, and these are formed parallel to the key axis (x) and symmetrically to the central plane of a coding row / pin row (A),
 - wherein the lateral grooves (RB-SN), the central groove (RB-MN) and the central projecting part (RB-M) are extending from the key tip to a coding region (RB-P) of first coding positions (P1, P2)
 - wherein coding recesses are formed at the first coding positions (P1, P2) in the region of the central groove (RB-MN) in the coding region (RB-P),
 - and wherein the lateral grooves (RB-SN) in an entry region (RB-E) at the key tip running at a high level (N1) and in the coding region (RB-P) of the first coding positions (P1, P2) running in a sunk manner at a lower level (N2),
 - wherein the lateral grooves (RB-SN) are suitably shaped, in order to correspond to an additional lateral shoulder (RB-ZH-S) extending in the longitudinal and transverse direction to the key axis (x) of an associated cylindrical special tumbler pin (RB-ZH) and an extended counter pin (RB-GZH) at the rearmost coding position (P1, P2) of the cylinder,
 - so that an additional insertion block, acting by means of the extended counter pin (RB-GZH) in the entry region (RB-E) and an additional rotation block in the coding region (RB-P) can be carried out by the lateral grooves (RB-SN) of the key and the lateral shoulder (RB-ZH-S) of the associated special tumbler pin (RB-ZH).
10. A key according to claim 9, characterised in that the coding recesses of the first coding positions (P1, P2) are formed on a sunk central projecting part RB-M(2).
11. A key according to claim 9 or 10, characterised in that the complete width $bg(2)$ of lateral grooves RB-SN and the central groove RB-MN on both sides is larger than the width (bcv) of coding recesses (Cod-V) of the coding row (A) by an amount (bb): $bg(2) = bcv + 2 \text{ bb}$.

12. A key according to one of the claims 9 to 11, characterised in that with an inclined pin plane (A) with an inclination angle $W_a > 0$, on the inner side, an additional side groove RB-nn

adjoins to the lateral groove RB-SN, said side groove forming a supporting surface orthogonal to the pin plane (A).

13. A key according to one of the claims 9 to 12, characterised in that RB coding steps C_i^* in the coding region are situated higher or more deeply than the standard coding steps (C_i) of the coding row (A) with a correspondingly different length of the assigned tumbler pin RB-ZH.

14. A key according to one of the claims 9 to 13, characterised in that the distance (d_N) between the high level (N1) and the lower level (N2) is at least one coding step (d_C).

15. A lock system with security keys (S) with at least two coding rows / pin rows (A_i) on the flat sides of the key and with assigned cylinders (Z) with tumbler pins (ZH) and with counter pins (GZH) and with an insertion block, acting by means of an extended counter pin, characterised by

- keys (S) with two parallel lateral grooves (RB-SN), a central groove (RB-MN) and a central projecting part which are formed parallel to the key axis (x) and symmetrically to the central plane of a coding row / pin row (A), with coding recesses in the region of the central groove (RB-MN) at first coding positions (P1, P2),
- wherein the lateral grooves (RB-SN), the central groove (RB-MN) and the central projecting part (RB-M) are extending from the key tip to a coding region (RB-P) of the first coding positions (P1, P2)
- and said lateral grooves (RB-SN) in an entry region (RB-E) at the key tip running at a high level (N1) and in the coding region (RB-P) of the first coding positions (P1, P2) running in a sunk manner at a lower level (N2),
- and with assigned cylinders (Z) with a cylindrical special tumbler pin (RB-ZH) at the rearmost coding position (P1, P2) of the cylinder, said special tumbler pin comprising an additional lateral shoulder (RB-ZH-S), which extends in the longitudinal and transverse direction to the key axis (x),
- wherein this lateral shoulder (RB-ZH-S) of the special tumbler pin (RB-ZH) is shaped such that it corresponds to the lateral grooves (RB-SN) of the key,
- and wherein in the entry region (RB-E), the length (l_s) of the special tumbler pin (RB-ZH) and an extended counter pin (RB-GZH) up to the lateral shoulder (RB-ZH-S) corresponds to the distance (d_s) from the cylinder housing (10) up to the lateral groove (RB-SN),
- and at a first coding position (P1, P2), the length (l_z) of the special tumbler pin (RB-ZH) up to the lateral shoulder (RB-ZH-S) corresponds to the distance (d_z) from the shear line (9) up to the lateral groove (RB-SN), with a tolerance region (t_o),
- so that an additional insertion block, acting by means of the extended counter pin (RB-GZH), in the entry region (RB-E) and an additional rotation block

in the coding region (RB-P) can be carried out with the lateral grooves (RB-SN) of the key and the lateral shoulder (RB-ZH-S) of the assigned special tumbler pin (RB-ZH).

16. A method for manufacturing a key (S) according to one of the claims 9 to 14, from a blank (R) according to one of the claims 1 to 8, by way of a coding, characterised in that on the blank (R), the central groove RB-MN is manufactured in the entry region (RB-E) and coding recesses (Cod-V) are manufactured at the first coding positions (P1, P2) in the coding region (RB-P), by way of material removal at the central projecting part RB-M.

17. A method according to claim 16, characterised in that on the blank, firstly a sunk central projecting part RB-M(2) is manufactured in the coding region (RB-P) by way of a first milling cutter, and subsequently the lateral grooves RB-SN are manufactured in the entry region (RB-E) at a high level (N1) and in the coding region (RB-P) at a lower level (N2) by way of a second milling cutter.

18. A method according to claim 17, characterised in that on the blank, and with an inclined pin plane (A) with an inclination angle $W_a > 0$, firstly the sunk central projecting part RB-M(2) and an additional side groove RB-nn are created by way of the first milling cutter.