

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO KEYS

(71) We, WILMOT-BREEDEN LIMITED, a British Company, of Amington Road, Birmingham 25, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

- 10 This invention relates to keys for locking devices of the plug and cylinder type, with a plug or "barrel" in which the key is inserted to turn the plug. The plug houses a row of tumblers which normally engage the surrounding housing or "cylinder" in which the plug is housed, the tumblers being retracted into the plug on insertion of the key thereby freeing the plug for rotation by the key which is formed with edge "cuts" correctly positioned and dimensioned to suit the specific tumbler arrangement.

- In order to shorten the axial length of such a locking device for a given number of tumblers, it has been proposed to arrange the tumblers in two separate banks respectively positioned at opposite sides of the key slot, with the two banks in register with one another. Thus the tumblers are arranged in coplanar pairs spaced axially of the plug, the two tumblers of each pair being retracted in opposite directions by respective cuts on the two edges of the key. Both key edges are operative at the same time, and to provide a degree of security equivalent to the total number of tumblers the key must have a different profile on each edge.

- Although it is possible with a double-banked tumbler device to use a normal double-entry key as commonly used with conventional locking devices with single row of tumblers, with identical profiles on the two key edges so that it can be inserted either way round (i.e. in either of two positions 180° apart) this would give

only the security provided by two identical sets of tumblers. The object of the invention is to provide a double-entry key for use with a locking device having double-banked tumblers, giving the security provided by the number of differences of key form theoretically obtainable from the total number of tumblers used.

According to one aspect of the invention a double-entry is formed for different depths of insertion in the two key positions, the two key edge profiles being different whereby to operate a high security locking device with the tumblers thereof arranged in two paired banks, respectively operable simultaneously by the different key profiles.

According to a further aspect of the invention a double-entry key is formed for different depths of insertion for the two entry positions and has different edge profiles each of which comprises an arrangement of identical "cuts" with, considered in paired groups lengthwise of the key, are transposed diagonally of the pair groups across the key. In other words, if the cuts on one edge are arranged A, B, C, D . . . the cuts on the other edge are arranged B, A, D, C The difference between the two depths of insertion is equal to the spacing of consecutive cuts, i.e. half the spacing of the tumbler pairs along the plug of the lock with which the key is to be used.

Thus, according to another aspect of the invention a double-entry key is formed for different depths of insertion for the two entry positions and has different edge profiles, each profile comprising two series of cuts with the cuts of the two series alternating in each profile and the series respectively arranged for operation of each bank of tumblers of a double-banked tumbler locking device, the same series of cuts on the two edges being relatively dis-

placed therealong by an amount equal to the difference between the two depths of insertion of the key.

The key tip may be formed so as to limit the insertion to different depths according to the entry position, but in preferred embodiments the key has a shoulder or shoulders at the end of the key shank which is or are arranged to engage a limiting abutment or abutments on the locking device and which are relatively displaced lengthwise of the key.

A key in accordance with the invention, and a typical locking device plug for operation by the key, are illustrated in the accompanying drawings and will now be described, by way of example, with reference thereto. In the drawings:

Figure 1 is a profile view of the key,

Figure 2 is a cross-section on the line II-II in Figure 1,

Figure 3 is a diagrammatic view of the locking device plug illustrating the operative relationship with the key,

Figure 4 is a view of the key-receiving slot of the plug, and

Figure 5 is a side view of the plug.

The locking device has two banks each of five tumblers W1, W2 W5 and W6, W7 W10 with corresponding tumblers of the two banks thereof coplanar. The tumblers W are thus "paired", for example W1: W6 and W4: W9, laterally of the lock plug with the two tumblers of each pair projecting from the plug body 1 in opposite directions and respectively being disposed on opposite sides of the key slot 2. On their inner side edges the tumblers have cut-out slots providing shoulders (not illustrated) to engage the key with accompanying retraction of the tumblers W into the plug 1, and each tumbler W is independently spring loaded to the projecting locking position shown in Figure 3. The two tumblers such as W1 and W6 of each pair are thus respectively operated by directly opposed cuts H1 and H6 on the two key edges, and to provide maximum security these two cuts are different so that the tumblers operate independently in the sense that they provide the same security as an equal number of tumblers arranged in a single row axially of the lock plug in the more usual manner.

The foregoing brief description of the locking device is given to enable the function of the various features of the key 3, now to be described, to be appreciated. To guide the key the plug body 1 has relatively offset key guides 4 projecting into the slot 2 on opposite sides thereof, for engagement with complementary guide grooves 5 along the sides of the key shank. Insertion limiting shoulders 6 and 7 at the inner end of the key shank are relatively displaced

lengthwise of the key 3 by an amount equal to the spacing of consecutive cuts on the key edges, and the lock plug body 1 has abutment faces 8 and 9 which are similarly relatively displaced. Thus, in one key position the depth of key insertion is greater than in the other key position, i.e. with the key shoulders 6 and 7 respectively engaging the plug faces 8 and 9, the difference being equal to the spacing of consecutive key cuts, i.e. half the spacing of immediately adjacent pairs of tumblers W of the lock plug.

As the two tumblers W of each pair, such as W1: W6, are operated by different key cuts the two edge profiles of the key 3 are different. In the diagrammatic showing of Figure 3 the heights of the tumbler shoulders, in the ward retracted positions, are indicated by H1, H2 H10, corresponding cuts on the key 3 being similarly identified. There are an equal number of cuts H on each edge equal to the total number of tumblers and, when considered in paired groups lengthwise of the key, the cuts of one profile are transposed diagonally of the pair groups across the key with the spacing between cuts equal to half the tumbler spacing. In the embodiment concerned each profile has ten cuts, thus the cuts on one edge are denoted H1, H6, H2, H7, H3, H8, H4, H9, H5, H10 and those on the other edge are H6, H1, H7, H2, H8, H3, H9, H4, H10, H5 in that order. It will be appreciated that in most cases all the cuts on one edge will not be different, a full range of all possible combinations of ten different cuts being obtainable, and in the particular example illustrated the cuts can be denoted 1, 2, 4, 3, 5, 4, 3, 3, 2, 1 along one edge profile, each numeral identifying a corresponding height of cut as shown in Figure 3. In this case the same cuts are rearranged to provide the opposite edge profile in the order 2, 1, 3, 4, 4, 5, 3, 3, 1, 2.

Thus each profile has two series of cuts H1, H2 H5 and H6, H7 H10 which alternate along the profile. The same series of cuts on the two edges are relatively displaced by an amount equal to the difference between the two depths of key insertion, i.e. half the tumbler spacing in the lock plug.

It will be appreciated that the different depths of key insertion can be limited in other ways, for example by formation of the key tip so that it engages stop surfaces in the lock plug in an appropriate manner. Alternatively, for example, a single shoulder 6 at the end of one edge of the key shank will suffice for engagement with the relatively displaced limiting abutment faces 8 and 9 at the two edges of the key slot 2 at the outer end of the lock plug.

**WHAT WE CLAIM IS:—**

1. A double-entry key formed for different depths of insertion in the two key positions, the two key edge profiles being different whereby to operate a high security locking device with the tumblers thereof arranged in two paired banks respectively operable simultaneously by the different key profiles.
2. A double-entry key formed for different depths of insertion for the two entry positions and having different edge profiles, each profile comprising an arrangement of identical cuts which, considered in pair groups lengthwise of the key, are transposed diagonally of the pair groups across the key.
3. A double-entry key formed for different depths of insertion for the two entry positions and having different edge profiles, each profile comprising two series of cuts with the cuts of the two series alternating in each profile and the series respectively arranged for operation of each bank of tumblers of a double-banked tumbler locking device, the same series of cuts on the two edges being relatively displaced therealong by an amount equal to the difference between the two depths of insertion of the key.
4. A key according to any one of the preceding claims having a shoulder or

shoulders at the inner end of the key shank arranged to engage a limiting abutment or abutments on a locking device whereby to define said different depths of insertion.

5. A key according to claim 4, wherein two insertion limiting shoulders at the end of the key shank are relatively displaced lengthwise of the key by an amount equal to the spacing between adjoining cuts of each edge profile.

6. A key according to any one of claim 1 to 3, wherein the key tip is formed so as to limit the insertion to different depths according to the key entry position.

7. A key in accordance with any of the preceding claims in combination with a double-banked tumbler locking device operable by the key.

8. A key constructed and arranged substantially as herein particularly described with reference to the accompanying drawings.

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