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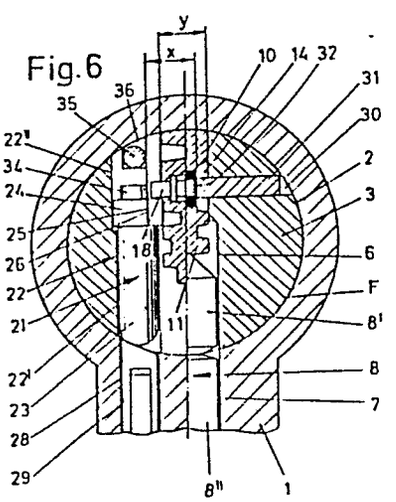
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(54) Locking devices and keys for use therewith.

(57) A locking device of the cylinder-type has an additional tumbler (21) movable in a bore (22) extending in a direction parallel to the longitudinal central plane of the keyway (10) and opening into a side wall (10') of the keyway. The tumbler (21) has an enlarged head (24) in which a run-up slope (26) is provided extending lengthwise of the keyway (10). A key (12) has a control element (pin) (18) captive in a transverse bore (15) in the blade (11), said pin being caused to project, by engagement of one end with an abutment in the opposite side wall (10") of the keyway (10), with its opposite end beyond the wide side of the key, thus to operate the additional tumbler (21). The diameter of the pin (18) is substantially less than the lengthwise dimension of the run-up slope (26).

Fig.6



EP 0 202 949 A2

LOCKING DEVICES AND KEYS FOR USE THEREWITH

This invention is concerned with locking devices and keys for use therewith.

There is described in DE-A 3424307 a locking device comprising a lock of the cylinder type wherein the cylinder has a housing in which a cylinder plug is rotatably accommodated, together with a plurality of tumblers, the plug having a profiled keyway into which said tumblers extend in the rest condition of the cylinder, wherein an additional tumbler is provided which is mounted for sliding movement in a bore the longitudinal axis of which is parallel to but offset from the longitudinal central plane of the keyway, and further wherein an abutment is also provided in the keyway in the region of the additional tumbler but spaced therefrom, the locking device being adapted for use with a key having a profiled blade corresponding to the keyway and having mounted in the blade, for sliding transverse movement therein, a control element which is urged by engagement of one end portion thereof with the abutment into a condition in which an opposite end portion thereof projects outwardly from the key blade, said projecting end portion serving to operate the additional tumbler.

The additional tumbler (in fact in this case there are two) is movable in its bore through a distance which cannot exceed the heightwise dimension of the control element of the key and indeed in the particular case is movable through a stroke which is substantially smaller than such dimension. In this regard, it has to be considered that for moving the tumbler some form of camming surface or run-up slope has to be provided on the control member and clearly the heightwise distance over which such run-up slope extends cannot exceed the overall height of the control element. What is more, the run-up slope may

not exceed a certain angle of inclination if jamming of the key during insertion is to be avoided.

In the aforementioned specification, therefore, a key is provided comprising a longitudinal groove along one wide face of the key blade.

More particularly, in order to enhance the stroke through which the additional tumbler is moved, the control element has to be formed as large as possible while the additional tumbler(s) have a diameter as small as possible so as to be accommodated within the lengthwise surface of the control element provided adjacent the run-up slope. To form the additional tumbler thin, however, is disadvantageous in that it affords a weak locking function.

It is thus an object of the present invention to provide an improved locking device wherein the dimensional disadvantages of the aforementioned disclosure are avoided.

In accordance with the present invention, therefore, this object is resolved, in a locking device as set out in the first paragraph above, in that the end portion, engageable by the control element of the key, of the additional tumbler is elongated in a direction extending lengthwise of the keyway and has a run-up slope extending in said direction. It will be appreciated that, by so dimensioning the end portion of the additional tumbler, the additional tumbler can be displaced through a larger distance than was previously the case and further a tumbler of a much more substantial construction than was previously the case can be afforded.

In the locking device of the aforementioned specification, the additional tumbler is located in the floor of the keyway, so that the construction of the keyway becomes relatively complicated in terms of its machining and would be especially so e.g. in the case of a so-called double entry cylinder. In the device according to the present invention, on the other hand, preferably the bore in which the additional tumbler is accommodated opens into

a side wall of the keyway and the abutment is provided on an opposite wall of the keyway, the run-up slope being disposed in the open region of the bore, when the additional tumbler is in its rest condition. A more convenient construction is afforded. Furthermore, the requirements for the shaping of the control element of the key are rendered less demanding by this arrangement, in particular since in the earlier case the control element, though moved transversely of the key blank by the abutment, nevertheless was required to operate tumblers lying in the floor of the keyway, in the present case the arrangement of the bore opening into the side wall enables the transversely moved control element to act directly on the additional tumbler, the run-up slope of which is positioned at or substantially at the same level as the abutment.

In order readily to accommodated the transverse movement of the control element, in the earlier case the abutment was so arranged along the keyway in relation to the run-up slope (in this case provided on the control element) that the control element was caused to project outwardly by its engagement with the abutment prior to engagement of the run-up slope. In order to accommodate such prior transverse movement in the locking device in accordance with the present invention, preferably a recess is provided in said side wall and runs into the open region of the bore and is arranged opposite the abutment for receiving the outwardly projecting end portion of the control element of the key prior to its engaging the run-up slope.

In a preferred embodiment the additional tumbler has a stem and an enlarged head which provides the elongated end portion thereof. In this way, the lengthwise and heightwise dimensions of the head determine the heightwise dimension of the run-up slope, so that by varying the dimensions of the head the dimension of the slope can also be varied, within only the constraints set

down by the overall dimensions of the cylinder and the arrangement of tumblers therein.

A further advantage of the provision of a headed additional tumbler resides in that the additional tumbler can be held against rotation by the head being offset in relation to the axis of the stem and the stem being mounted for sliding movement in a bore portion in the cylinder plug, the axis of which bore portion is offset in relation to that of a further bore portion in which the head is accommodated for sliding movement. In this way, in a straight forward manner the orientation of the run-up slope is fixed. Furthermore, a constructional advantage is achieved in that the side of the head of the additional tumbler is flatted adjacent the run-up slope, the flatted surface thereof lying flush with the side wall of the keyway.

As referred to above, in the device disclosed in DE-A 3424307 the keyway is rendered complicated by the need to effect transverse movement of the control element. In the present invention, by contrast, conveniently the abutment is provided by an insert set in the cylinder plug and projecting into the keyway thereof, the projecting portion being formed with an inclined slope in the direction of key insertion.

A further advantage of the locking device in accordance with the present invention can also be achieved by the provision of a further abutment in the cylinder plug by which the rest position of the additional tumbler is determined. Furthermore for cooperating with such further abutment conveniently a projection is formed on the additional tumbler, extending beyond the run-up slope thereof. By the provision of the further abutment and the projection, the initial position of the additional tumbler can readily be determined in relation to the position of the control element of the key when inserted in the keyway.

It is a further object of the present invention to provide an improved key for use with a locking device as set out hereinbefore, which key is of simpler construction, requiring less customised parts, than was the case of the key in accordance with DE-A 3424307.

In accordance with the present invention, therefore, in a key as set out in the last paragraph but , the bore has a portion of enlarged diameter and the control element is in the form of a pin disposed in said bore and having a collar freely movable in the enlarged diameter portion thereof between an end face forming the bottom of said portion and a retaining ring arranged at the open end of the bore.

It will be appreciated that in comparison with the key of the earlier case, a simple pin is now sufficient to actuate the additional tumbler, the pin being of course provided with a collar, which may be integral with the pin, by which, in combination with the bottom of the enlarged bore portion and the retaining ring, the pin is held captive in the bore.

Moreover, in such a key it is now possible, by the provision of a longitudinal groove along one of the wide faces of the key blade, to provide a pin which does not exceed the transverse dimension of the key blade, this being achieved in that the bore opens into the groove and further in that the length of the pin, while it does not exceed the transverse dimension of the key blade, is such that, when the opposite end portion thereof is caused to project outwardly as aforesaid, it extends beyond the outside dimension of the key.

A significant advantage of the key of the present invention resides in that, because the control element is in the form of a relatively small pin, the handling of the key by the user becomes more comodious and in particular the key does not exhibit projections of the type of the key of the earlier case, which projections are likely to snag

in the users pocket or with the users apparel when being carried or handled by the user.

It will thus be appreciated that in accordance with the present invention, a significant advantage is achieved by the combination of the locking device with the key referred to above in that the dimension of the end portion of the additional tumbler in a direction extending lengthwise of the keyway is large in comparison with the corresponding dimension of the outwardly projecting end portion of the control element engaging it, and further in that said end portion of the additional tumbler has the run-up slope which extends in said direction extending lengthwise with the keyway.

Where, in a combination of locking device and key as aforementioned, the length of the pin does not exceed the transverse dimension of the key blade, it is of course desirable to ensure, without interference from the user, that the pin does not project as the key is being inserted. To this end, therefore, in accordance with the present invention, preferably the entry end of the keyway is provided with lead-in surfaces by which the control element is centralised in the key blade as the key is inserted in the keyway.

As a further one of its several aspects, the present invention also provides a key blank comprising a blade having a longitudinal groove formed therein into which a bore, extending through the transverse width of the blade, opens, in which bore a control element is accommodated for transverse movement such that, when one portion of the element is moved flush with the surface of one side of the blade adjacent the bore, an opposite portion of the element projects outwardly beyond the surface of the other side of the blade adjacent the bore, the bore has a portion of enlarged diameter and the control element is in the form of a pin having a collar freely movable in said portion of enlarged diameter between an end

surface of said portion and a retaining ring arranged in the open end of the bore, and further in that the length of the pin does not exceed the overall transverse dimension of the blade but is such that, when the opposite end portion thereof is caused to project outwardly as aforesaid, it extends beyond the outside dimension of the key blade.

There now follows a detailed description, to be read with reference to the accompanying drawings, of a locking device and a key in accordance with the present invention. It will be appreciated that the locking device and key and the combination thereof have been selected for description merely to illustrate the invention by way of non-limiting example.

In the accompanying drawings:-

Fig. 1 is a view of the blade end of a flat key before insertion into a lock cylinder shown in elevation;

Fig. 2 is a horizontal section, on a very enlarged scale, through the lock cylinder housing and the associated key blade in the region of the control element before the key has been inserted into the hole;

Fig. 3 is a cross-section, along offset planes, through the lock cylinder when the key is not inserted;

Fig. 4 is a partial longitudinal section through the lock cylinder in the region of the additional tumbler;

Fig. 5 is a cross-section corresponding to Fig. 2, but with the key inserted;

Fig. 6 is a cross-section corresponding to Fig. 3, likewise with the key inserted;

Fig. 7 is an illustration corresponding to Fig. 4, wherein the additional tumbler is moved by the control pin when the key is inserted; and

Fig. 8 is a view in perspective, on a very enlarged scale, of the additional tumbler with the control element shown in chain-dot.

The lock cylinder has a profiled lock cylinder housing 1, in which a cylinder plug 3 is rotatably mounted

in a longitudinal bore 2. The plug 3 is non-rotatably secured to a thrower ring 5 having a thrower 4.

In the lock cylinder housing 1 and the cylinder plug 3 are provided, in the longitudinal central plane of the lock cylinder, bores 6,7 which lie in alignment with one another and which receive tumblers 8 comprising plug pins 8' and housing pins (or drivers) 8''. The housing pins are urged outwardly towards the pins 8' by compression springs 9.

A keyway 10 of profiled cross-section extends in the plug 3 in the axial longitudinal direction thereof. The keyway 10 is adapted to the cross-section of the key blade 11 of a flat key 12. The one narrow edge of the key blade 11 is provided with a row of V-cuts 13 of different depths, which cooperate with the tumbler pins 8 and operate them, when the key is inserted, so that the joint line between the plug pins 8' and housing pins 8'' lies at the level of the plug rotation line F (see Fig. 6).

The key blade 11 has profiled longitudinal grooves on both wide sides, corresponding to the transverse profiling of the keyway. A counter-sunk recess 15 extends from the bottom of a central one of the profiled longitudinal grooves 14, which is wider than the other grooves, and extends almost up to the opposite wide side of the key. At the bottom 16 of the countersink is a central bore 17 through which the control element 18 in the form of a pin extends. A retaining ring 19 is disposed at the open end of the recess 15 and serves to guide the control pin 18. The control pin 18 is restrained in the transverse direction by a central collar 20, which fixedly projects from the control element and is freely movable between the annular area of countersink bottom 16 and the retaining ring 19. The latter is pressed into the key blade and thus ensures the non-releasable mounting of the control element 18. The length of the control element 18 corresponds to

the transverse dimension, i.e. thickness of the key blade 11 (see especially Fig. 2).

In a region between two tumbler pins 8 extends an additional tumbler 21 which is movable in a bore 22 opening into one side of the keyway 10 and extending parallel to the key insertion plane. More particularly, the additional tumbler 21 comprises a stem 23 and head 24, the latter being axially offset from the stem 23. The centre point M of the stem 23 is thus at a greater distance from the keyway than the centre point M 1 of the head 24. The additional tumbler 21 is secured against rotation by guiding the stem 23 in a bore section 22', which is axially offset from a bore section 22'' of larger cross-section in which the head 24 is movable. The head is flatted on the side facing the keyway 10 so as to lie flush with the side wall 10' of the keyway. Adjacent the flatted surface is formed a run-up slope 26 which extends up to a side wall portion 25 of the head. The run-up slope 26 increases in the direction of key insertion. Adjacent the bore 22, at the key entry side thereof, and running thereinto, is formed a recess 27 extending into the side wall 10' of the keyway. A projection or spigot 34 projects from the head 24 in opposed relationship with the stem 23 and cooperates with a stroke-limiting abutment in the form of a pin 35 in-set in the outer surface of the cylinder plug 3. To this end, the cylinder plug 3 has a groove 36 intersecting the bore 22 and running in the longitudinal direction of the cylinder plug 3, the depth of the groove corresponding approximately to the diameter of the stroke-limiting pin 35. Lateral recesses 37 in the groove 36 ensure the correct location of the stroke-limiting pin 35.

The stem 23 of the additional tumbler 21 cooperates with a housing tumbler 29, which is guided in a bore 28 of the lock cylinder housing 1. The tumbler 29 is secured against rotation as a consequence of its being offset from the longitudinal central plane of the lock

cylinder. This tumbler 29 is also acted upon by a compression spring (not shown) so that, when the key is withdrawn, the position as shown in Fig. 3 pertains, wherein the tumbler 29 projects with its end facing the cylinder plug into the bore section 22', brings the tumbler 21 into abutment with the stroke-limiting pin 35, and provided additional security against rotation.

In opposed relationship with the head 24 there extends on the other side of the keyway 10 a slot 30 which lies transversely of the keyway and into which an abutment in the form of an insert 31 is fixedly inserted. The end of this insert 31 projects into the keyway beyond the corresponding side wall 10'' of the keyway. The edge projecting into the keyway 10 provides a surface 32 for actuating the control element 18, the side of said surface 32 facing the keyway insertion direction forming a roof-shaped slope 33. This surface lies at the level of the profiled longitudinal groove 14 of the key and projects thereinto when the key is inserted.

The distance x between the side wall 25 of the head 24 and the opposite surface 32 of the insert 31 corresponds to the amount y of the dimension extending transversely of the key 12.

The entry area of the keyway 10 is provided with funnel-shaped tapering guide surfaces 34 which guide the control element 18, if projecting, into the keyway.

The mode of operation is as follows: When the flat key 12 is inserted into the keyway 10, its V-cuts 13 operate the tumbler pins 8. The control element 18 is guided through the keyway (see chain dotted illustration in Fig. 5). Upon engagement of one end portion of the pin 18 with the roof-shaped slope 33 of the insert 31, the control element 18 is shifted transversely in the direction of the run-up slope 26 of the additional tumbler 21. The recess 27 disposed in front of slope 33 receives the opposite end portion of the pin 18 during this transverse motion, so

that the control element 18 reaches the chain-dotted position in accordance with Fig. 4, but at this stage no shifting of the additional tumbler 21 has taken place. This position corresponds to the end position of the transverse displacement of the control element 18. When the key is inserted further, the run-up slope 26 is engaged by the end portion of the control element 18 which projects beyond the wide side of the key, and a corresponding downward displacement of the additional tumbler takes place. This downward motion ends when the key has been completely inserted. At this stage the control element 18 is then disposed with its projecting end on the end face of the head 24, the stem 23 thereof has forced the housing tumbler 29 out of the cylinder plug 3, and the joint line between the additional tumbler 21 and the housing tumbler 29 lies on the plug rotation line, as do also the joint lines between the other tumblers 8 in the longitudinal central plane. The cylinder plug 3 can then be rotated by means of the flat key 12. After the key has been withdrawn, all the tumblers return to their initial position shown in Fig. 3, thus preventing a rotating movement of the plug 3 inside the lock cylinder housing 1.

It will be appreciated that the diameter of the projecting end portion of the pin 18 is substantially less than the lengthwise dimension of the run-up 26 formed on the additional tumbler 21 (see e.g. Fig. 7), while the amount by which said projecting end portion projects beyond the wide face of the key 12 is not greater than the transverse dimension of said run-up slope 26 (see e.g. Fig. 6).

It will also be appreciated that the key 12 is made from a key blank exhibiting the longitudinal grooves and the bore with the pin 18 held captive therein as aforesaid.

Claims:

1. A locking device comprising a lock of the cylinder type wherein the cylinder has a housing (1) in which a cylinder plug (3) is rotatably accommodated, together with a plurality of tumblers (8), the plug having a profiled keyway (10) into which said tumblers (8) extend in the rest condition of the cylinder, wherein an additional tumbler (21) is provided which is mounted for sliding movement in a bore (22) the longitudinal axis of which is parallel to but offset from the longitudinal central plane of the keyway (10), and further wherein an abutment (32) is also provided in the keyway (10) in the region of the additional tumbler (21) but spaced therefrom, the locking device being adapted for use with a key (12) having a profiled blade (11) corresponding to the keyway (10) and having mounted in the blade (11), for sliding transverse movement therein, a control element (18) which is urged by engagement of one end portion thereof with the abutment (32) into a condition in which an opposite end portion thereof projects outwardly from the key blade (11), said projecting end portion serving to operate the additional tumbler (21), said locking device being characterised in that the end portion, engageable by the control element (18) of the key, of the additional tumbler (21) is elongated in a direction extending lengthwise of the keyway (10) and has a run-up slope (26) extending in said direction.

2. A locking device according to Claim 1 characterised in that the bore (22) in which the additional tumbler (21) is accommodated opens into a side wall (10') of the keyway (10) and the abutment (32) is provided on an opposite wall (10'') of the keyway (10), the run-up slope (26) being disposed in the open region of the bore (22), when the additional tumbler (21) is in its rest condition.

3. A locking device according to Claim 2 wherein the abutment (32) is so arranged along the keyway in relation to the run-up slope (26) that the control element of a key inserted in the latter is caused to project outwardly by its engagement with the abutment prior to engagment of the run-up slope, characterised in that a recess (27) is provided in said side wall (10') and runs into the open region of the bore (22) and is arranged opposite the abutment (32) for receiving the outwardly projecting end portion of the control element (32) of the key (12) prior to its engaging the run-up slope (26).

4. A locking device according to any one of the preceding Claims characterised in that the additional tumbler (21) has a stem (23) and an enlarged head (24) which provides the elongated end portion thereof.

5. A locking device according to Claim 4 characterised in that the additional tumbler (21) is held against rotation by the head (24) being offset in relation to the axis (M) of the stem (23) and the stem (23) being mounted for sliding movement in a bore portion (22') in the cylinder plug (3), the axis of which bore portion (22') is offset in relation to that of a further bore portion (22'') in which the head (24) is accommodated for sliding movement.

6. A locking device according to either one of Claims 4 and 5 when tied to Claim 2 characterised in that the side of the head (24) of the additional tumbler (21) is flatted adjacent the run-up slope (26), the flatted surface thereof lying flush with the side wall (10') of the keyway (10).

7. A locking device according to any one of the preceding Claims characterised in that the abutment (32) is

provided by an insert (31) set in the cylinder plug (3) and projecting into the keyway (10) thereof, the projecting portion being formed with an inclined slope (33) in the direction of key insertion.

8. A locking device according to any one of the preceding Claims characterised in that an abutment (35) is provided in the cylinder plug (3) by which the rest position of the additional tumbler (21) is determined.

9. A locking device according to Claim 8 characterised in that the abutment (35) is engaged by a projection (34) formed on the additional tumbler (21) and extending beyond the run-up slope (26).

10. A key for use with a locking device according to any one of the preceding Claims comprising a profiled key blade (11) having a control element (18) accommodated for transverse movement in a bore (15) extending transversely of the key blade (11) and opening into the opposite wide faces thereof, such that when the element (18) is urged, by engagement of one portion thereof, in one direction so that said one end portion lies flush with one of the wide faces of the key blade (11), an opposite portion thereof projects outwardly beyond the other wide face of the key blade (11), characterised in that the bore (15) has a portion of enlarged diameter and the control element (18) is in the form of a pin (18) disposed in said bore (15) and having a collar (20) freely movable in the enlarged diameter portion thereof between an end face (16) forming the bottom of said portion and a retaining ring (19) arranged at the open end of the bore (15).

11. A key according to Claim 10 comprising a longitudinal groove (14) along one wide face of the key

blade (11) characterised in that the bore (15) opens into said groove (14) and in that the length of the pin (18) does not exceed the transverse dimension (y) of the key blade (11) but is such that, when the opposite end portion thereof is caused to project outwardly as aforesaid, it extends beyond the outside dimension of the key blade (11).

12. A locking device comprising a lock cylinder having a housing (1) in which a cylinder plug (3) is rotatably accommodated, together with a plurality of tumblers (8), the plug (3) having a profiled keyway (10) into which said tumblers (8) extend in the rest condition of the cylinder, wherein an additional tumbler (21) is provided which is mounted for sliding movement in a bore (22) the longitudinal axis of which is parallel to but offset from the longitudinal central plane of the keyway (10), and further wherein an abutment (32) is also provided in the keyway (10) in the region of the additional tumbler (21) but spaced therefrom, in combination with a key (12) having a profiled blade (11) corresponding to the keyway (10) and having mounted in the blade (11), for sliding transverse movement therein, a control element (18) which, when the key is inserted in the cylinder, by engagement of one end portion thereof with the abutment (32) is urged into a condition in which an opposite end portion thereof projects outwardly from the key blade (11) and engages an end portion of the additional tumbler (21) to operate said tumbler (21),
said locking device being characterised in that the dimension of said end portion of the additional tumbler (21) in a direction extending lengthwise of the keyway (10) is large in comparison with the corresponding dimension of the outwardly projecting end portion of the control element (18) engaging it,

and in that said end portion of the additional tumbler (21) has a run-up slope (26) extending in said direction extending lengthwise of the keyway (10).

13. A locking device according to Claim 12 characterised in that the control element (18) is accommodated in a transverse bore (15) opening into the wide faces of the key blade (11), a longitudinal groove (14) being provided along one of said wide faces into which groove (14) said bore (15) opens,
in that the length of the control element (18) does not exceed the overall transverse dimension (y) of the key blade (11),
and further in that the entry end (34) of the keyway (10) is provided with lead-in surfaces (34) by which the control element (18) is centralised in the key blade (11) as the key (12) is inserted in the keyway (10).

14. A locking device according to either one of Claims 12 and 13 characterised in that the bore (22) in which the additional tumbler (21) is accommodated opens into a side wall (10') of the keyway (10) and the abutment (32) projects with its operative surface from an opposite side (10'') of the keyway (10),
and in that the run-up slope (26) of the additional tumbler (21) is bounded at its edge remote from the keyway (10) by a side wall portion (25), the distance (x) between which and the operative surface of the abutment (32) is equal to the transverse dimension (y) of the key blade (11).

15. A key blank comprising a blade (11) having a longitudinal groove (18) formed therein into which a bore (15), extending through the transverse width of the blade (12), opens, in which bore (15) a control element (18) is accommodated for transverse movement such that, when one portion of the element (18) is moved flush with the surface

of one side of the blade (11) adjacent the bore (15), an opposite portion of the element (18) projects outwardly beyond the surface of the other side of the blade (11) adjacent the bore (15), characterised in that the bore (15) has a portion of enlarged diameter and the control element (18) is in the form of a pin (18) having a collar (20) freely movable in said portion of enlarged diameter between an end surface of said portion and a retaining ring (19) arranged in the open end of the bore (15), and further in that the length of the pin (18) does not exceed the overall transverse dimension (y) of the blade (11) but is such that, when the opposite end portion thereof is caused to project outwardly as aforesaid, it extends beyond the outside dimension of the key blade (11).

Fig.1

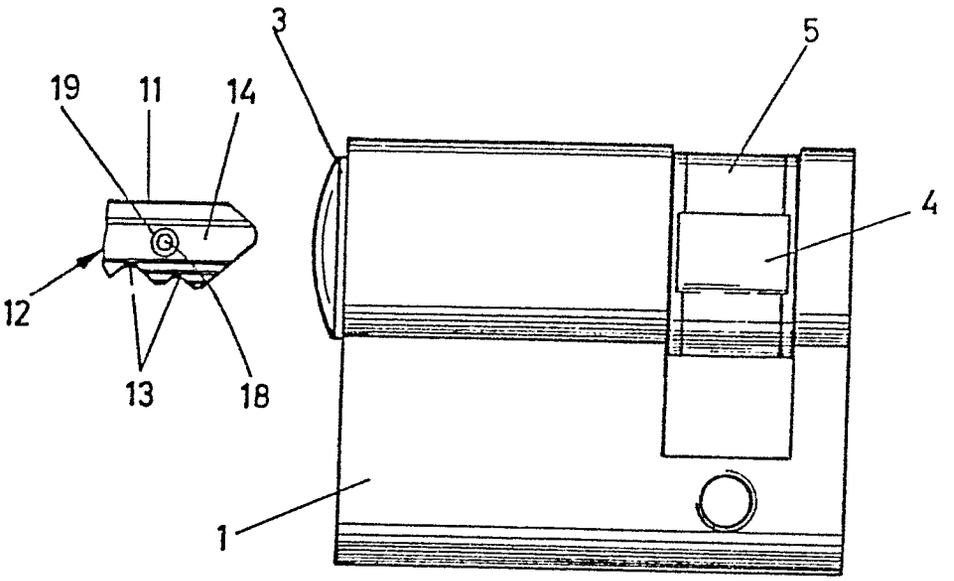

3
5
19
11
14
4
12
13
18
1

Fig.2

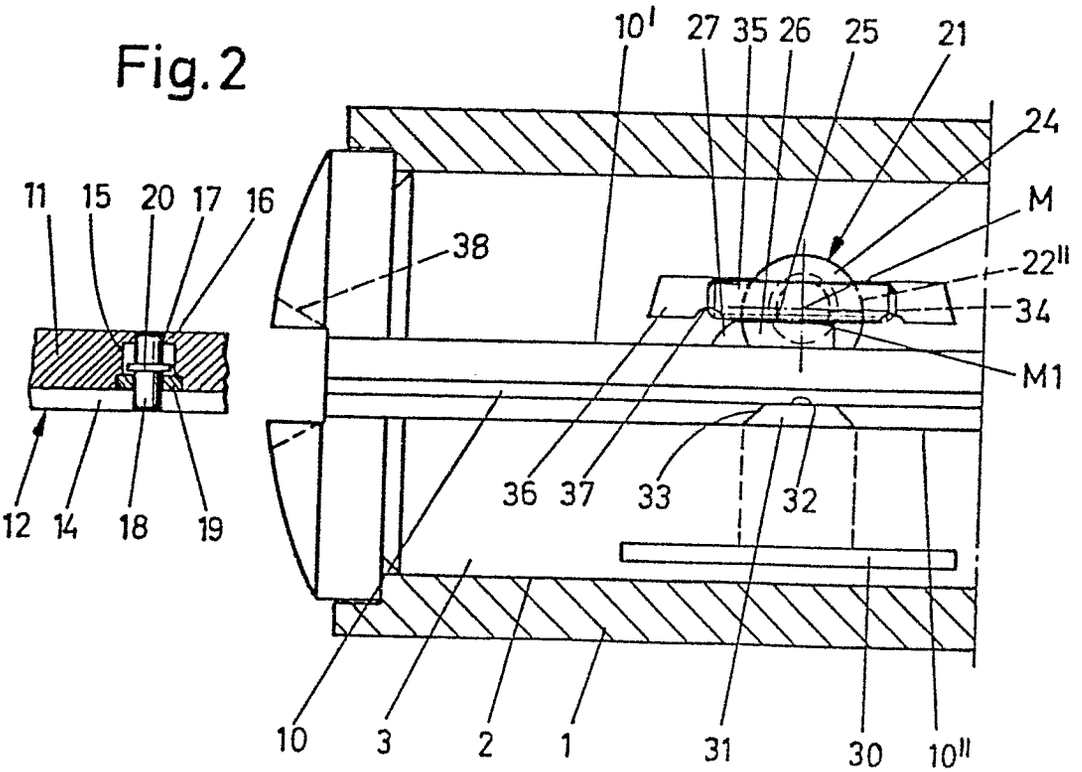

10'
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35
26
25
21
24
M
22''
34
M1
11
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17
16
38
12
14
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19
36
37
33
32
10
3
2
1
31
30
10''

Fig. 3

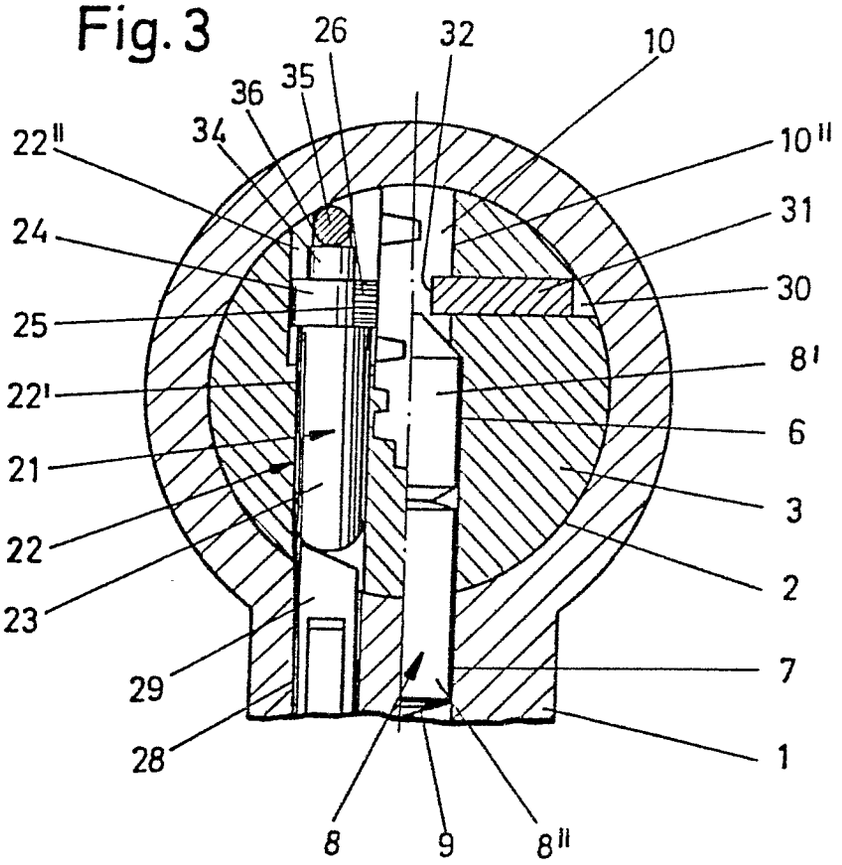


Fig. 4

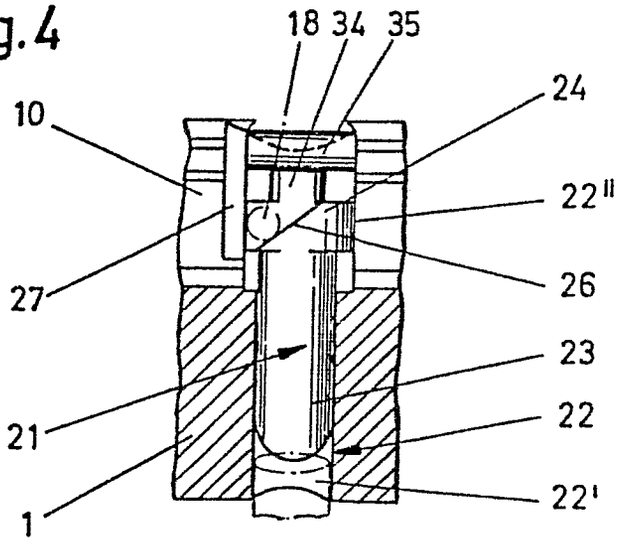


Fig. 7

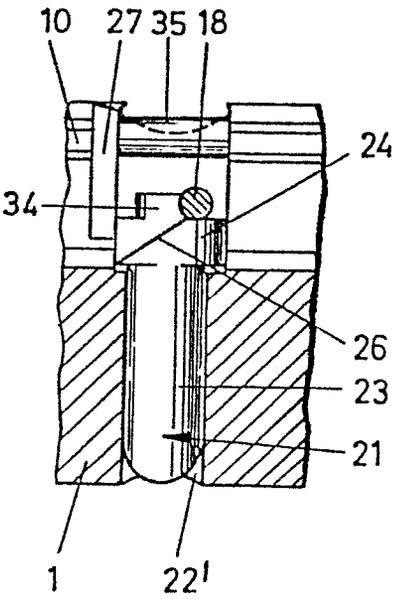


Fig.5

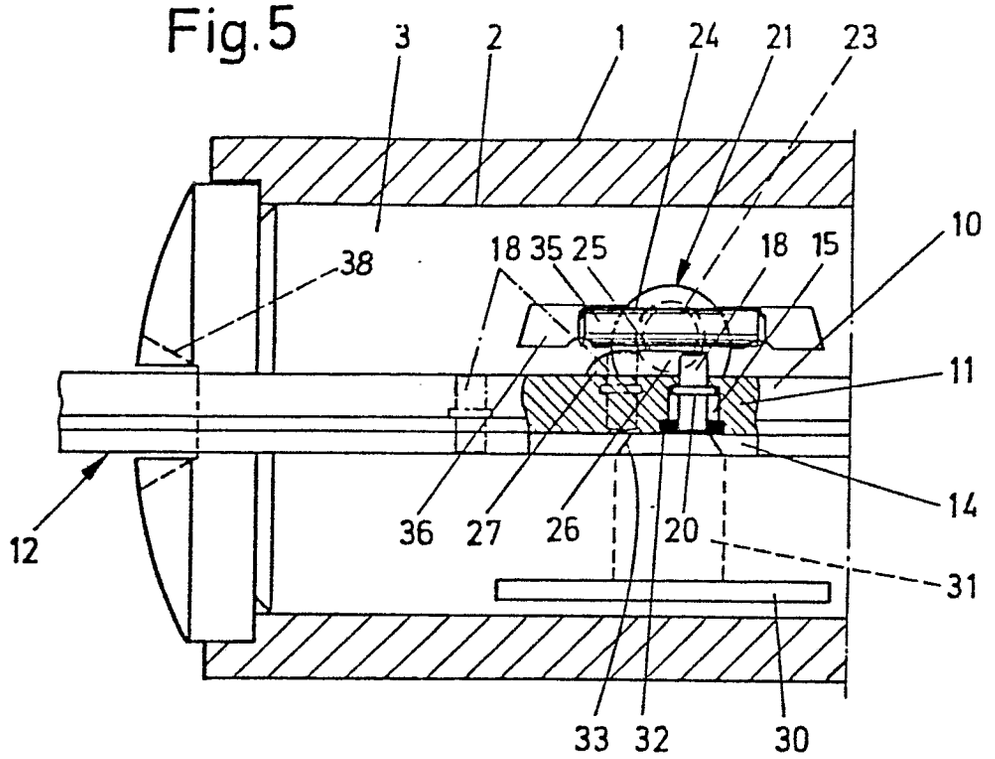


Fig.6

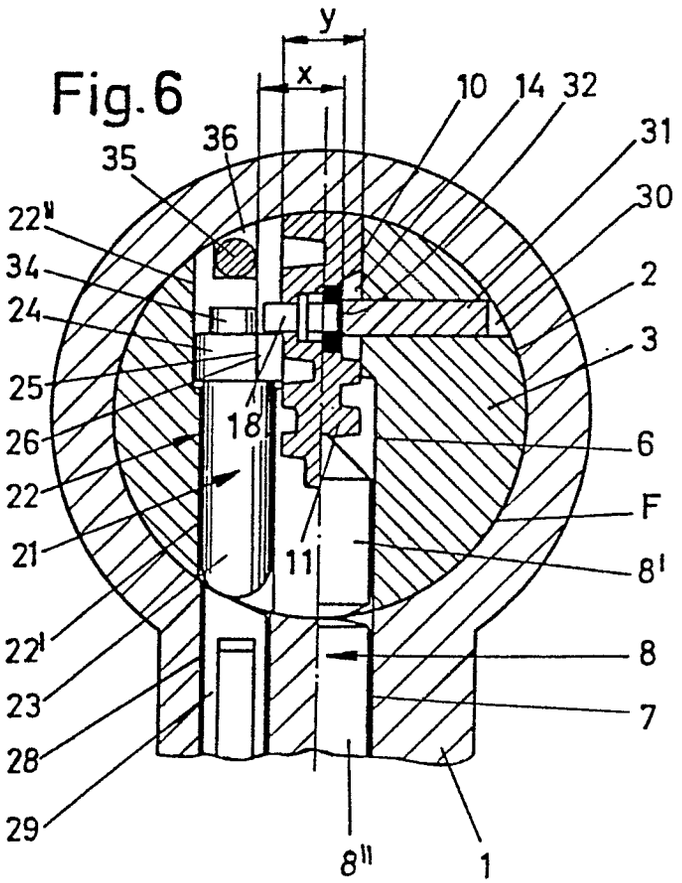


Fig.8

