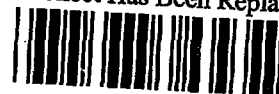


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Key and cylinder for a safety lock

5 The invention relates to a key and cylinder according to the preamble of the independent patent claim 1 and a key for a cylinder with an additional tumbler.

10 Keys of this generic type have the advantage that it is hardly possible for them to be copied without authorization owing to the control element arranged in the shank and thus that the lock systems equipped with such keys have a higher security value. The keys of this generic type which have previously been disclosed, also called "mechanical keys", are, however, still subject to various disadvantages such that, despite the very high security against copying, these keys, in particular as turning keys, have not yet become very widespread.

15 A key of this generic type has been disclosed, for example, by DE-A-35 17 660, which key can be inserted into the keyway of a cylinder and has, in its flat shank, a movable device with which an additional tumbler can be moved into the release state. The movable device of the key comprises a projecting pin which is held displaceably in a blind bore of the key. Arranged additionally in the blind bore is a spring which presses the pin outwards, the pin being prevented from dropping out by steps in the blind bore of the shank and on the pin. Protruding pins are generally disadvantageous in a key since the key easily becomes stuck on the pin.

25 A further key of this generic type has been disclosed by US-A-4,667,495, which key has a pin which is displaceable to a limited extent for positioning the additional tumbler in the shank. When the shank is introduced into the keyway, the pin moves up onto a ramp which is arranged in the rotor and displaces the pin

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radially, and the latter thus positions the additional tumbler. In order that the ramp can move towards the pin when the shank is introduced, grooves or other recesses are required on the shaft, which limit the surface available for control bores in the case of a flat key. In practice, the pin therefore has to be arranged as near to the front end of the shank as possible. The loosely displaceable pin usually protrudes with one end on the shank, which means that, here too, the key can become hooked.

A key of this type has likewise been disclosed by EP-A-202 949. In this case, the additional tumbler is likewise positioned by a pin mounted so as to be displaceable to a limited extent in the key shank, which means that the difficulties mentioned above also exist in this case.

The invention is based on the object of providing a key and cylinder of the said generic type, which does not require recesses for a ramp arranged in the cylinder on the outer side of the shank, and which can nevertheless be produced in a simple manner and is extremely secure against copying. The object is achieved by the invention according to Claim 1.

In the key according to the invention, the control element can be precisely flush on the outside with a narrow side of the key, such that such a key can only be differentiated from one without a control element if scrutinized closely. If a corresponding control element is absent in a copied key, the tumbler of the rotor moves radially outwards into the locking position when the key shank is inserted into the keyway. The rotor now cannot be turned and the lock thus cannot be opened. If, instead of the control element, the key has a bore on the corresponding outer side of the key, the tumbler of the rotor blocks the cylinder whenever this tumbler has reached a counter-bolt in the stator after a specific turn of the rotor. This counter-bolt is then not positioned as a result of the absent control element and blocks the cylinder by means of engagement in the recess

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of the rotor.

The cylinder can be produced in a comparatively simple and thus cost-effective manner. The additional measures on the stator are comparatively simple, since
5 only a conical depression has to be machined on the inner side of the stator. The tumbler of the rotor can be a quite simple bolt which is guided so as to be radially displaceable without spring loading in a blind bore of the rotor.

10 According to a further development of the invention, the stator has an insert which has the said recess for the tumbler which interacts with the control element. The insert can be produced in a relatively simple manner from hardened steel or from hard metal,
15 thus considerably improving the security against forcible opening of the cylinder. Further advantageous features emerge from the other dependent claims, the following description and the drawing.

An exemplary embodiment of the invention is
20 explained in greater detail below with reference to the drawing, in which:

Figure 1 shows a cross-section through a cylinder according to the invention with an inserted key;
25 Figure 2 shows a cross-section according to Figure 1, but after the rotor has been turned through 90°;
Figure 3 shows a section according to Figure 2, but with a key without a control element;
30 Figures 4a and 4b respectively show a view and a cross-section through an insert;
Figures 5a and 5b respectively show a view and a cross-section through a stator housing;
Figures 6a and 6b show views of a rotor; and
35 Figures 7a and 7b respectively show a partial view and a section through a key according to the invention.

Figure 1 shows a stator 3 with a customary steel casing 4 and a housing 5 in which a rotor 1 is rotatably



mounted. By means of a key 7 introduced in a keyway 2 of the rotor 1, customary pin tumblers (not shown here) are positioned, it being possible for the rotor 1 to be turned to actuate a lock which is not shown in greater detail here. To position these customary tumblers, the key 7 has corresponding blind bores. However, the key 7 can also be a so-called notch key, in which case the cylinder is then obviously adapted accordingly.

As shown in Figures 5a and 5b, the housing 5 of the stator 3 can be produced from lamellae 30 which are soldered together. The lamellae 30 are preferably made of hardened steel. Provided at the rear end of the housing 5 in the upper region is a partially circular recess 29 into which a curved insert 6, preferably made of hardened steel or hard metal, is inserted. The insert 6 has a conical blind bore 6a which interacts with a tumbler 15 of the rotor 1. The housing 5 additionally has longitudinal channels 25 into which slides 19 are inserted, which are known per se and in which housing pins 16 with their springs 20 are guided in bores 31. Such slides 19 are known per se.

The rotor 1 is provided with a radial bore 28 into which a bush 13 with a through bore 14 is inserted. A tumbler 15 in the form of a cylindrical bolt is guided so as to be radially displaceable in the bush 13 which is preferably produced from hardened steel. The radially outer end of the tumbler 15 has a conical surface 15a which is designed to correspond to the bore 6a of the insert 6. A cylindrical part 15b arranged at the other end of the tumbler 15 protrudes through or into the opening 14 in the bush 13. As shown in Figure 1, when a key 7 is introduced in the keyway 2, the tumbler 15 is pressed radially outwards against the insert 6 by a control element 10.

The key 7 preferably has two control elements 9 and 10 which are inserted into a continuous stepped bore 8 at the front end of the key shank, and which are held by a common compression spring 12 in the positions shown in Figure 1. The two control elements 9 and 10 are



cylindrical pins, each having a radially outwardly protruding flange 9a and 10a respectively. The flange 9a rests against a shoulder 8a of the stepped bore 8, thus preventing the control element 9 from being able to move out of the stepped bore 8 at the outer end. The flange 10a of the control element 10 rests correspondingly against a casing 11 which is inserted by press-fitting into the stepped bore 8. As can be seen, the control faces 9b and 10b of the elements 9 and 10 are precisely flush with the narrow sides 7a of the key 7 in the positions shown in Figure 1. The mechanical control device with the elements 9 and 10 and the compression spring 12 can be produced in a comparatively simple manner and is functionally reliable.

The control elements 9 and 10 can be moved inwards into the stepped bore 8 to a limited extent counter to the restoring force of the compression spring 12. The purpose of this mobility emerges from the following functional description.

In order to actuate the cylinder, the shank of the key 7 is inserted, as is customary, into the keyway 2. In this case, the customary tumblers (not shown here) are positioned by the customary bores of the key. In the arrangement shown in Figure 1, the tumbler 15 is additionally raised by the control element 10 so that it engages in the recess 6a of the insert 6. If the key is turned, it would then correspondingly be the control element 9 which would correspondingly raise the tumbler 5. Since the tumbler 15 and the control element can now be moved inwards counter to the restoring force of the compression spring 12, the rotor 1 can be turned with the key, for example anticlockwise in Figure 1, despite the engagement of the tumbler 15 in the recess 6a. This is obviously only possible if the recess 6a and correspondingly the surface 15a are of conical design. When the rotor 1 is turned, the tumbler 15 moves radially inwards until a flat end face 15b has reached the shearing line 27 between the rotor 1 and the stator 3.

If it is now attempted to actuate the cylinder



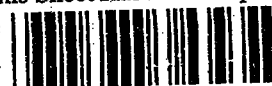
with a key without a movable control element, the rotor 1 will be blocked by the tumbler 15 even when the customary tumbler is positioned, since the said tumbler 15 rests against the shank of the key and cannot deflect radially inwards. If the insert 6, the tumbler 15 and the bush 13 are made of hard material, for example hardened steel, it is impossible, even using force, to turn the rotor 1. If higher forces are applied, the gripping part of the key is then simply broken off.

10 If, instead of a control element 9 or 10, a key 24 according to Figure 3 has a bore 33 at a corresponding position, the tumbler 15 is not engaged with the insert 6 and, correspondingly, with the customary tumblers being positioned the rotor can provisionally be turned. After
15 the rotor has been turned through 90° clockwise or anticlockwise, however, the counter-bolt 16 in this case drops into the interior of the casing 13 and blocks the cylinder. In this case, the rotor 1 cannot be turned into the position in which the lock is unlocked. If a key 7
20 according to the invention and provided for the cylinder is used, the counter-bolt 16 is positioned by the tumbler 15, and the rotor can thus be turned further than 90° into the position in which the lock is unlocked. In order that the tumbler 15 can position the counter-bolt 16, the
25 compression spring 12 is designed to be stronger than the compression spring 20 which presses the counter-bolt 16 radially inwards. As is customary per se, the counter-bolt 16 has a conical bore 23 which is designed to correspond to the surface 15a of the tumbler 15. The
30 counter-bolt 17 arranged opposite with the bore 22 and the compression spring 21 fulfils precisely the same function. It is illustrated clearly in Figure 2 how the counter-bolt 16 is positioned by the tumbler 15 at a corresponding rotary position of the rotor 1. When the
35 rotor 1 is turned further out of this position, for example anticlockwise, the tumbler 15, in turn, deflects radially inwards, the control element 10 correspondingly also being moved radially inwards counter to the restoring force of the compression spring 12. As can be



seen, the cylinder can be actuated, as is customary, by means of an associated key 7 according to the invention. In the case of a key without a control element, however, actuation is impossible even when high forces are applied.

5



Patent claims

1. Key and cylinder for a safety lock, having at least one control element (9, 10) which is arranged in the shank of the key (7) and interacts with an additional
5 tumbler (15) of the rotor (1), the control element (9, 10) being radially displaceable counter to the restoring force, for example of a compression spring, characterized in that the stator (3) has, on the inner side, a recess (6a) in which the tumbler (15) of the rotor (1) engages
10 due to the action of the control element (9, 10), in that, when the rotor (1) is turned, the tumbler (15) can be moved radially inwards counter to the restoring force, and in that a counter-bolt (16) is arranged with spacing from the recess (6a), which counter-bolt can be
15 positioned by the tumbler (15).
2. Key according to Claim 1, characterized in that an insert (6) is inserted into a recess (29) of the stator (3), which insert has the recess (6a) which interacts with the tumbler (15).
- 20 3. Key according to Claim 2, characterized in that the insert (6) consists of hardened steel or hard metal.
4. Key according to Claim 2 or 3, characterized in that the insert is of curved design.
5. Key according to one of Claims 1 to 4,
25 characterized in that the recess (6a) is a conical bore.
6. Key according to one of Claims 1 to 5, characterized in that the tumbler (15) is a bolt which is guided displaceably in a bush (13).
7. Key according to one of Claims 1 to 6,
30 characterized in that the shank of the key (7) has a continuous stepped bore (8) into which a compression spring (12) is inserted, which acts upon two mutually opposite control elements (9, 10).
8. Key according to Claim 7, characterized in that
35 a casing (11) is pressed into the stepped bore (8), in which casing a control element (10) is guided.
9. Key according to Claim 8, characterized in that the control elements (9, 10) each have, at the inner end,



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a flange (9a, 10a) which rests against a shoulder (8a) or the casing (11).

10. Key according to one of Claims 7 to 9, characterized in that the control elements (9, 10) have
5 control faces (9b, 10b) which are flush with narrow sides (7a) of the key (7).

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Abstract

The key has, in the shank, a continuous bore (8) in which two mutually opposite control elements (9, 10) are mounted, it being possible for these elements to be moved inwards counter to the restoring force of a compression spring (12) arranged in the bore (8). When the key is inserted into a keyway (2) of the cylinder, an additional tumbler (15) is raised by a control element (10), the said tumbler engaging radially in a recess (6a) of the stator (3). In the case of a key without a control element (10), the rotor is blocked by the tumbler (15). When using a key (2) [sic] according to the invention, the rotor (1) can be turned, the tumbler (15) being raised from the recess (6a) and the control element (10) being moved radially inwards. After rotation through, for example, 90°, a counter-bolt (16) of the stator (3) is positioned by the tumbler (15). Here too, if a control element (10) is absent, the rotor (1) is blocked by the counter-bolt (16).

(Figure 1)



Fig. 1

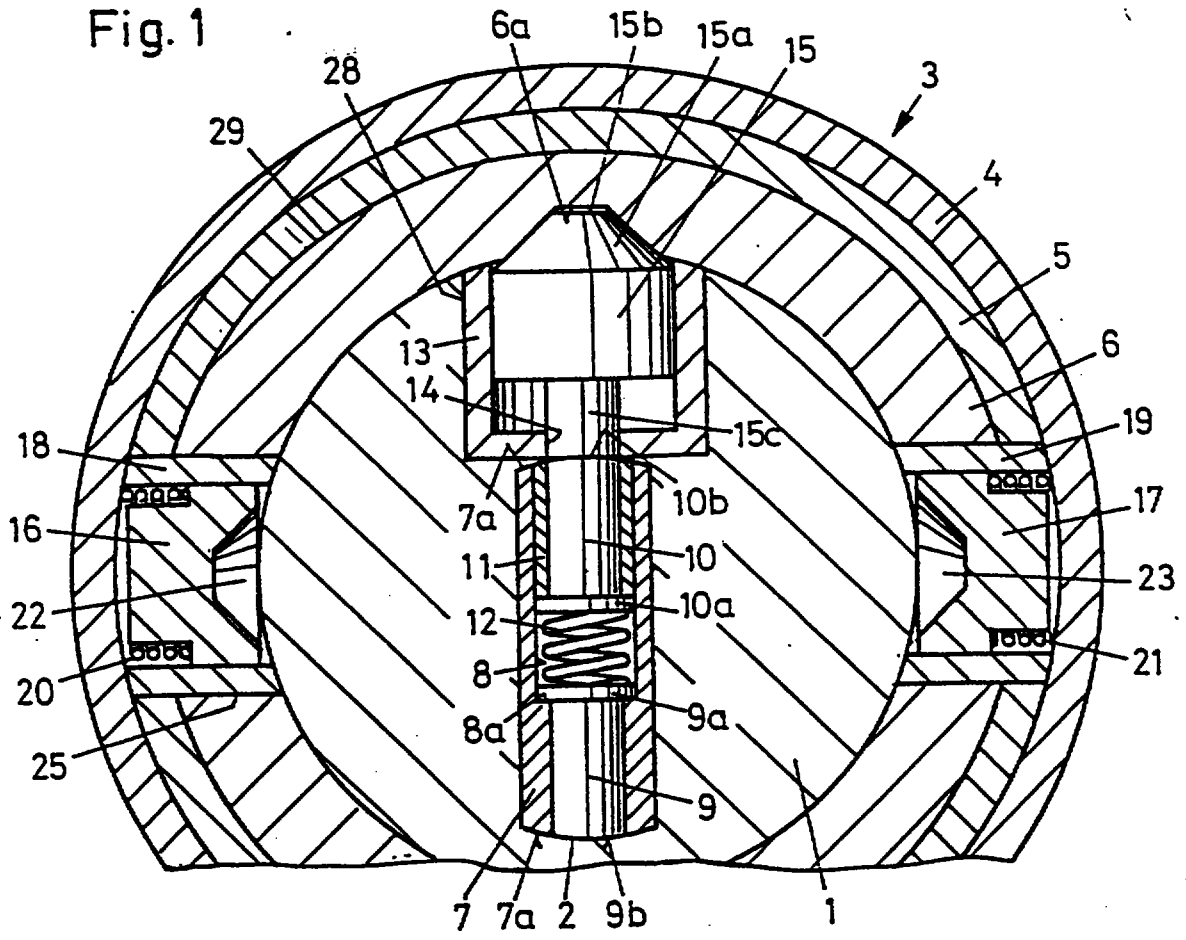
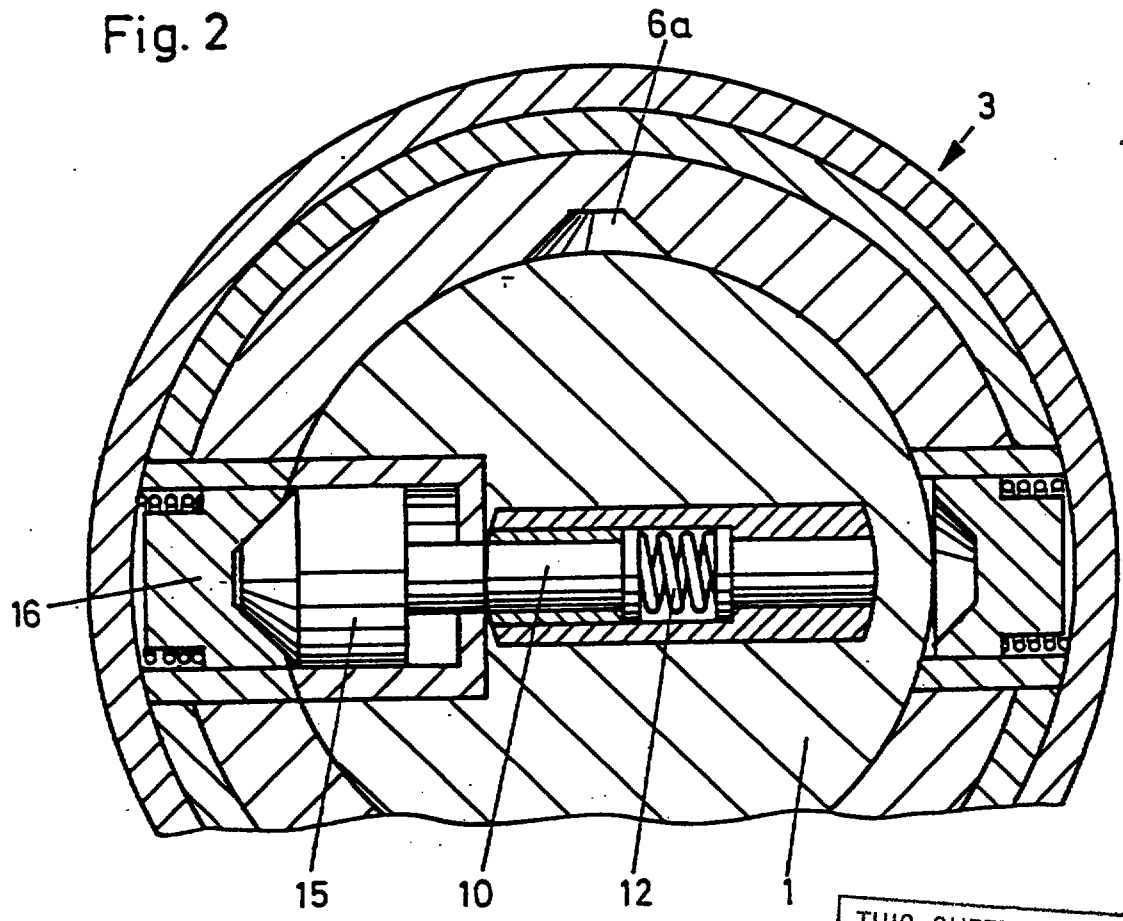


Fig. 2



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Fig. 3

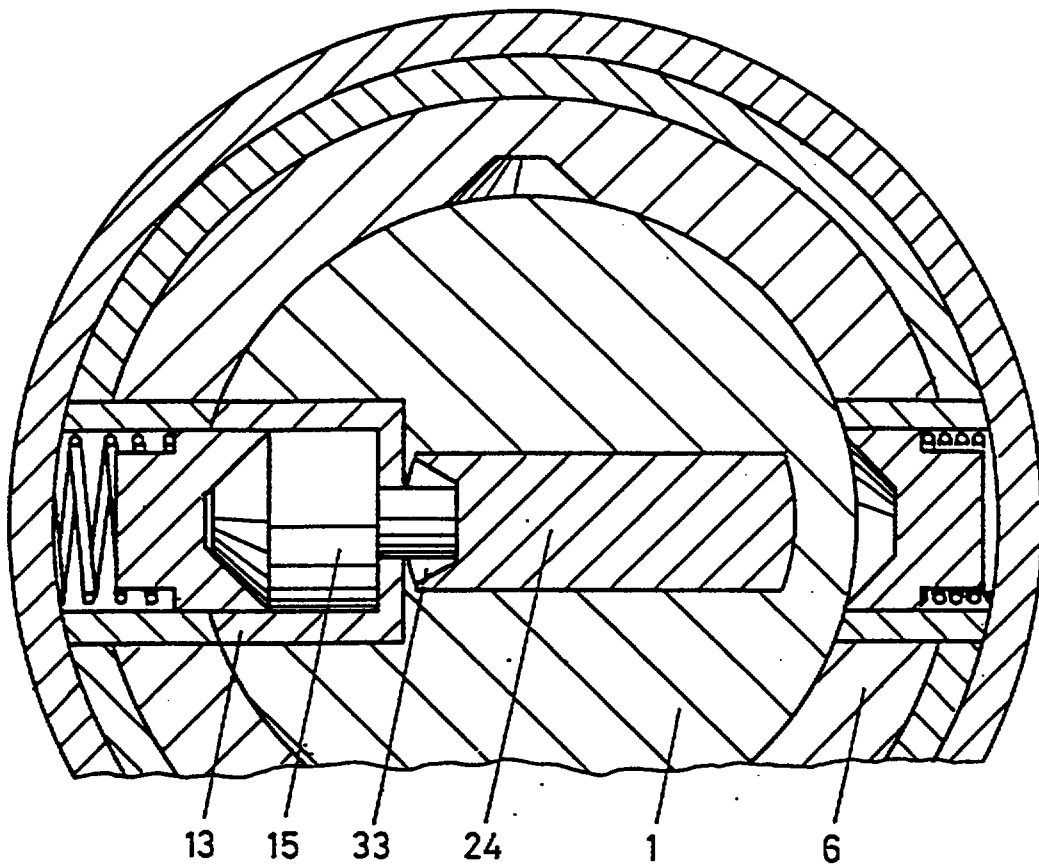


Fig. 4a

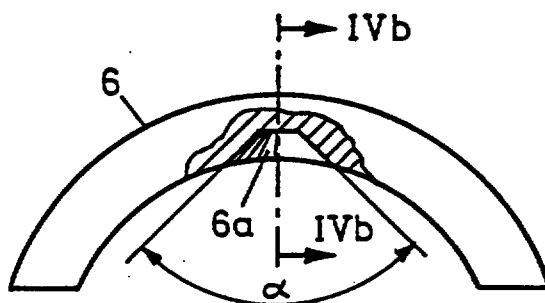


Fig. 4b

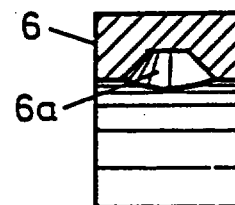




Fig. 5a

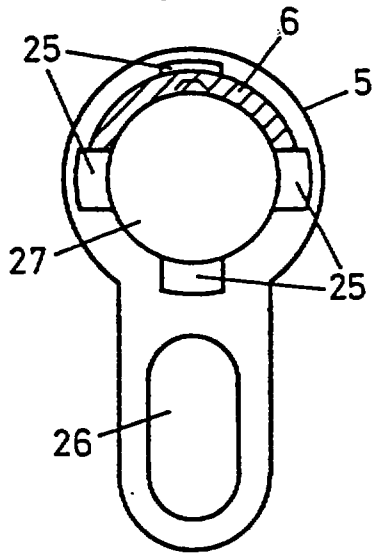


Fig. 5b

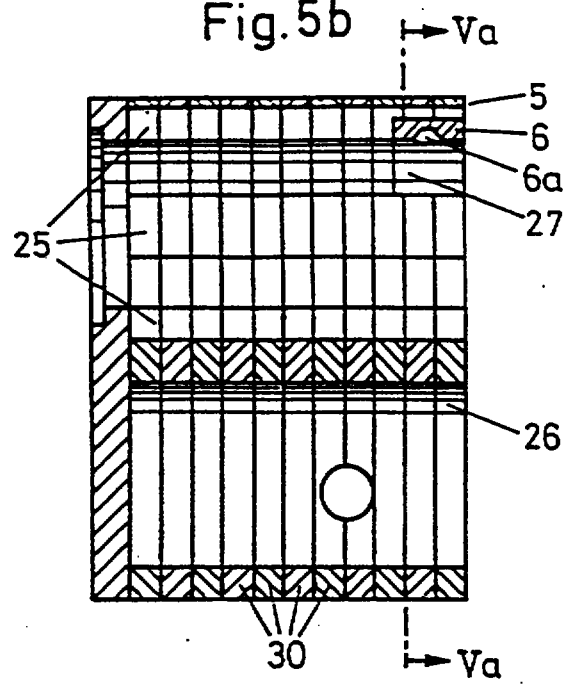


Fig. 6a

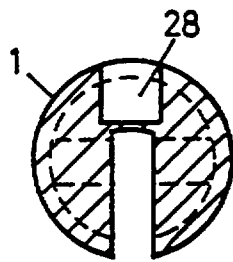


Fig. 6b

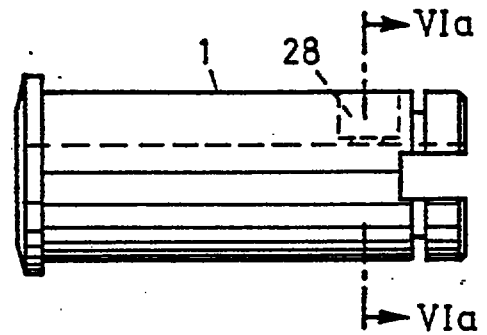


Fig. 7a

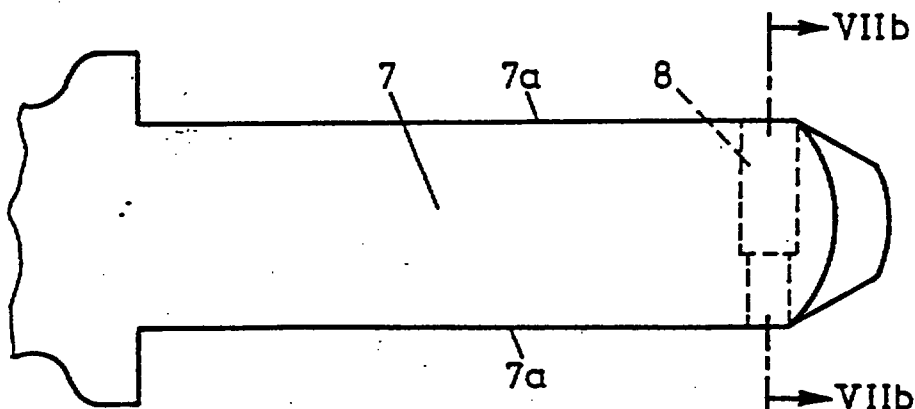
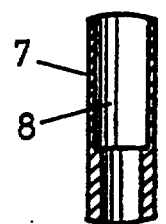


Fig. 7b



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Key and cylinder for a safety lock

5 The invention relates to a key and cylinder according to the preamble of the independent patent claim 1 and a key for a cylinder with an additional tumbler.

10 Keys of this generic type have the advantage that it is hardly possible for them to be copied without authorization owing to the control element arranged in the shank and thus that the lock systems equipped with such keys have a higher security value. The keys of this generic type which have previously been disclosed, also called "mechanical keys", are, however, still subject to various disadvantages such that, despite the very high security against copying, these keys, in particular as
15 turning keys, have not yet become very widespread.

A key of this generic type has been disclosed, for example, by DE-A-35 17 660, which key can be inserted into the keyway of a cylinder and has, in its flat shank, a movable device with which an additional tumbler can be
20 moved into the release state. The movable device of the key comprises a projecting pin which is held displaceably in a blind bore of the key. Arranged additionally in the blind bore is a spring which presses the pin outwards, the pin being prevented from dropping out by steps in the
25 blind bore of the shank and on the pin. Protruding pins are generally disadvantageous in a key since the key easily becomes stuck on the pin.

A further key of this generic type has been disclosed by US-A-4,667,495, which key has a pin which is
30 displaceable to a limited extent for positioning the additional tumbler in the shank. When the shank is introduced into the keyway, the pin moves up onto a ramp which is arranged in the rotor and displaces the pin

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radially, and the latter thus positions the additional
tumbler. In order that the ramp can move towards the pin
when the shank is introduced, grooves or other recesses
are required on the shaft, which limit the surface
5 available for control bores in the case of a flat key. In
practice, the pin therefore has to be arranged as near to
the front end of the shank as possible. The loosely
displaceable pin usually protrudes with one end on the
shank, which means that, here too, the key can become
10 hooked.

A key of this type has likewise been disclosed by
EP-A-202 949. In this case, the additional tumbler is
likewise positioned by a pin mounted so as to be
displaceable to a limited extent in the key shank, which
15 means that the difficulties mentioned above also exist in
this case.

The invention is based on the object of providing
a key and cylinder of the said generic type, which does
not require recesses for a ramp arranged in the cylinder
20 on the outer side of the shank, and which can
nevertheless be produced in a simple manner and is
extremely secure against copying. The object is achieved
by the invention according to Claim 1.

In the key according to the invention, the
25 control element can be precisely flush on the outside
with a narrow side of the key, such that such a key can
only be differentiated from one without a control element
if scrutinized closely. If a corresponding control
element is absent in a copied key, the tumbler of the
30 rotor moves radially outwards into the locking position
when the key shank is inserted into the keyway. The rotor
now cannot be turned and the lock thus cannot be opened.
If, instead of the control element, the key has a bore on
the corresponding outer side of the key, the tumbler of
35 the rotor blocks the cylinder whenever this tumbler has
reached a counter-bolt in the stator after a specific
turn of the rotor. This counter-bolt is then not
positioned as a result of the absent control element and
blocks the cylinder by means of engagement in the recess

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of the rotor.

The cylinder can be produced in a comparatively simple and thus cost-effective manner. The additional measures on the stator are comparatively simple, since
5 only a conical depression has to be machined on the inner side of the stator. The tumbler of the rotor can be a quite simple bolt which is guided so as to be radially displaceable without spring loading in a blind bore of the rotor.

10 According to a further development of the invention, the stator has an insert which has the said recess for the tumbler which interacts with the control element. The insert can be produced in a relatively simple manner from hardened steel or from hard metal,
15 thus considerably improving the security against forcible opening of the cylinder. Further advantageous features emerge from the other dependent claims, the following description and the drawing.

20 An exemplary embodiment of the invention is explained in greater detail below with reference to the drawing, in which:

Figure 1 shows a cross-section through a cylinder according to the invention with an inserted key;
25 Figure 2 shows a cross-section according to Figure 1, but after the rotor has been turned through 90°;
Figure 3 shows a section according to Figure 2, but with a key without a control element;
30 Figures 4a and 4b respectively show a view and a cross-section through an insert;
Figures 5a and 5b respectively show a view and a cross-section through a stator housing;
Figures 6a and 6b show views of a rotor; and
35 Figures 7a and 7b respectively show a partial view and a section through a key according to the invention.

Figure 1 shows a stator 3 with a customary steel casing 4 and a housing 5 in which a rotor 1 is rotatably

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mounted. By means of a key 7 introduced in a keyway 2 of the rotor 1, customary pin tumblers (not shown here) are positioned, it being possible for the rotor 1 to be turned to actuate a lock which is not shown in greater detail here. To position these customary tumblers, the key 7 has corresponding blind bores. However, the key 7 can also be a so-called notch key, in which case the cylinder is then obviously adapted accordingly.

As shown in Figures 5a and 5b, the housing 5 of the stator 3 can be produced from lamellae 30 which are soldered together. The lamellae 30 are preferably made of hardened steel. Provided at the rear end of the housing 5 in the upper region is a partially circular recess 29 into which a curved insert 6, preferably made of hardened steel or hard metal, is inserted. The insert 6 has a conical blind bore 6a which interacts with a tumbler 15 of the rotor 1. The housing 5 additionally has longitudinal channels 25 into which slides 19 are inserted, which are known per se and in which housing pins 16 with their springs 20 are guided in bores 31. Such slides 19 are known per se.

The rotor 1 is provided with a radial bore 28 into which a bush 13 with a through bore 14 is inserted. A tumbler 15 in the form of a cylindrical bolt is guided so as to be radially displaceable in the bush 13 which is preferably produced from hardened steel. The radially outer end of the tumbler 15 has a conical surface 15a which is designed to correspond to the bore 6a of the insert 6. A cylindrical part 15b arranged at the other end of the tumbler 15 protrudes through or into the opening 14 in the bush 13. As shown in Figure 1, when a key 7 is introduced in the keyway 2, the tumbler 15 is pressed radially outwards against the insert 6 by a control element 10.

The key 7 preferably has two control elements 9 and 10 which are inserted into a continuous stepped bore 8 at the front end of the key shank, and which are held by a common compression spring 12 in the positions shown in Figure 1. The two control elements 9 and 10 are

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cylindrical pins, each having a radially outwardly protruding flange 9a and 10a respectively. The flange 9a rests against a shoulder 8a of the stepped bore 8, thus preventing the control element 9 from being able to move out of the stepped bore 8 at the outer end. The flange 10a of the control element 10 rests correspondingly against a casing 11 which is inserted by press-fitting into the stepped bore 8. As can be seen, the control faces 9b and 10b of the elements 9 and 10 are precisely flush with the narrow sides 7a of the key 7 in the positions shown in Figure 1. The mechanical control device with the elements 9 and 10 and the compression spring 12 can be produced in a comparatively simple manner and is functionally reliable.

The control elements 9 and 10 can be moved inwards into the stepped bore 8 to a limited extent counter to the restoring force of the compression spring 12. The purpose of this mobility emerges from the following functional description.

In order to actuate the cylinder, the shank of the key 7 is inserted, as is customary, into the keyway 2. In this case, the customary tumblers (not shown here) are positioned by the customary bores of the key. In the arrangement shown in Figure 1, the tumbler 15 is additionally raised by the control element 10 so that it engages in the recess 6a of the insert 6. If the key is turned, it would then correspondingly be the control element 9 which would correspondingly raise the tumbler 5. Since the tumbler 15 and the control element can now be moved inwards counter to the restoring force of the compression spring 12, the rotor 1 can be turned with the key, for example anticlockwise in Figure 1, despite the engagement of the tumbler 15 in the recess 6a. This is obviously only possible if the recess 6a and correspondingly the surface 15a are of conical design. When the rotor 1 is turned, the tumbler 15 moves radially inwards until a flat end face 15b has reached the shearing line 27 between the rotor 1 and the stator 3.

If it is now attempted to actuate the cylinder

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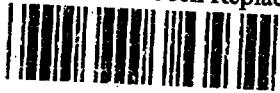
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with a key without a movable control element, the rotor 1 will be blocked by the tumbler 15 even when the customary tumbler is positioned, since the said tumbler 15 rests against the shank of the key and cannot deflect radially inwards. If the insert 6, the tumbler 15 and the bush 13 are made of hard material, for example hardened steel, it is impossible, even using force, to turn the rotor 1. If higher forces are applied, the gripping part of the key is then simply broken off.

10 If, instead of a control element 9 or 10, a key 24 according to Figure 3 has a bore 33 at a corresponding position, the tumbler 15 is not engaged with the insert 6 and, correspondingly, with the customary tumblers being positioned the rotor can provisionally be turned. After 15 the rotor has been turned through 90° clockwise or anticlockwise, however, the counter-bolt 16 in this case drops into the interior of the casing 13 and blocks the cylinder. In this case, the rotor 1 cannot be turned into the position in which the lock is unlocked. If a key 7 20 according to the invention and provided for the cylinder is used, the counter-bolt 16 is positioned by the tumbler 15, and the rotor can thus be turned further than 90° into the position in which the lock is unlocked. In order that the tumbler 15 can position the counter-bolt 16, the 25 compression spring 12 is designed to be stronger than the compression spring 20 which presses the counter-bolt 16 radially inwards. As is customary per se, the counter-bolt 16 has a conical bore 23 which is designed to correspond to the surface 15a of the tumbler 15. The 30 counter-bolt 17 arranged opposite with the bore 22 and the compression spring 21 fulfils precisely the same function. It is illustrated clearly in Figure 2 how the counter-bolt 16 is positioned by the tumbler 15 at a corresponding rotary position of the rotor 1. When the 35 rotor 1 is turned further out of this position, for example anticlockwise, the tumbler 15, in turn, deflects radially inwards, the control element 10 correspondingly also being moved radially inwards counter to the restoring force of the compression spring 12. As can be

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seen, the cylinder can be actuated, as is customary, by means of an associated key 7 according to the invention. In the case of a key without a control element, however, actuation is impossible even when high forces are applied.

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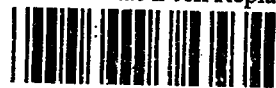
Patent claims

1. Key and cylinder for a safety lock, having at least one control element (9, 10) which is arranged in the shank of the key (7) and interacts with an additional
5 tumbler (15) of the rotor (1), the control element (9, 10) being radially displaceable counter to the restoring force, for example of a compression spring, characterized in that the stator (3) has, on the inner side, a recess (6a) in which the tumbler (15) of the rotor (1) engages
10 due to the action of the control element (9, 10), in that, when the rotor (1) is turned, the tumbler (15) can be moved radially inwards counter to the restoring force, and in that a counter-bolt (16) is arranged with spacing from the recess (6a), which counter-bolt can be
15 positioned by the tumbler (15).
2. Key according to Claim 1, characterized in that an insert (6) is inserted into a recess (29) of the stator (3), which insert has the recess (6a) which interacts with the tumbler (15).
- 20 3. Key according to Claim 2, characterized in that the insert (6) consists of hardened steel or hard metal.
4. Key according to Claim 2 or 3, characterized in that the insert is of curved design.
5. Key according to one of Claims 1 to 4,
25 characterized in that the recess (6a) is a conical bore.
6. Key according to one of Claims 1 to 5, characterized in that the tumbler (15) is a bolt which is guided displaceably in a bush (13).
7. Key according to one of Claims 1 to 6,
30 characterized in that the shank of the key (7) has a continuous stepped bore (8) into which a compression spring (12) is inserted, which acts upon two mutually opposite control elements (9, 10).
8. Key according to Claim 7, characterized in that
35 a casing (11) is pressed into the stepped bore (8), in which casing a control element (10) is guided.
9. Key according to Claim 8, characterized in that the control elements (9, 10) each have, at the inner end,

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a flange (9a, 10a) which rests against a shoulder (8a) or the casing (11).

10. Key according to one of Claims 7 to 9, characterized in that the control elements (9, 10) have
5 control faces (9b, 10b) which are flush with narrow sides (7a) of the key (7).

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KEY AND CYLINDER FOR A SAFETY LOCK

Abstract

The key has, in the shank, a continuous bore (8) in which two mutually opposite control elements (9, 10) are mounted, it being possible for these elements to be moved inwards counter to the restoring force of a compression spring (12) arranged in the bore (8). When the key is inserted into a keyway (2) of the cylinder, an additional tumbler (15) is raised by a control element (10), the said tumbler engaging radially in a recess (6a) of the stator (3). In the case of a key without a control element (10), the rotor is blocked by the tumbler (15). When using a key (2) [sic] according to the invention, the rotor (1) can be turned, the tumbler (15) being raised from the recess (6a) and the control element (10) being moved radially inwards. After rotation through, for example, 90°, a counter-bolt (16) of the stator (3) is positioned by the tumbler (15). Here too, if a control element (10) is absent, the rotor (1) is blocked by the counter-bolt (16).

(Figure 1)



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Fig. 1

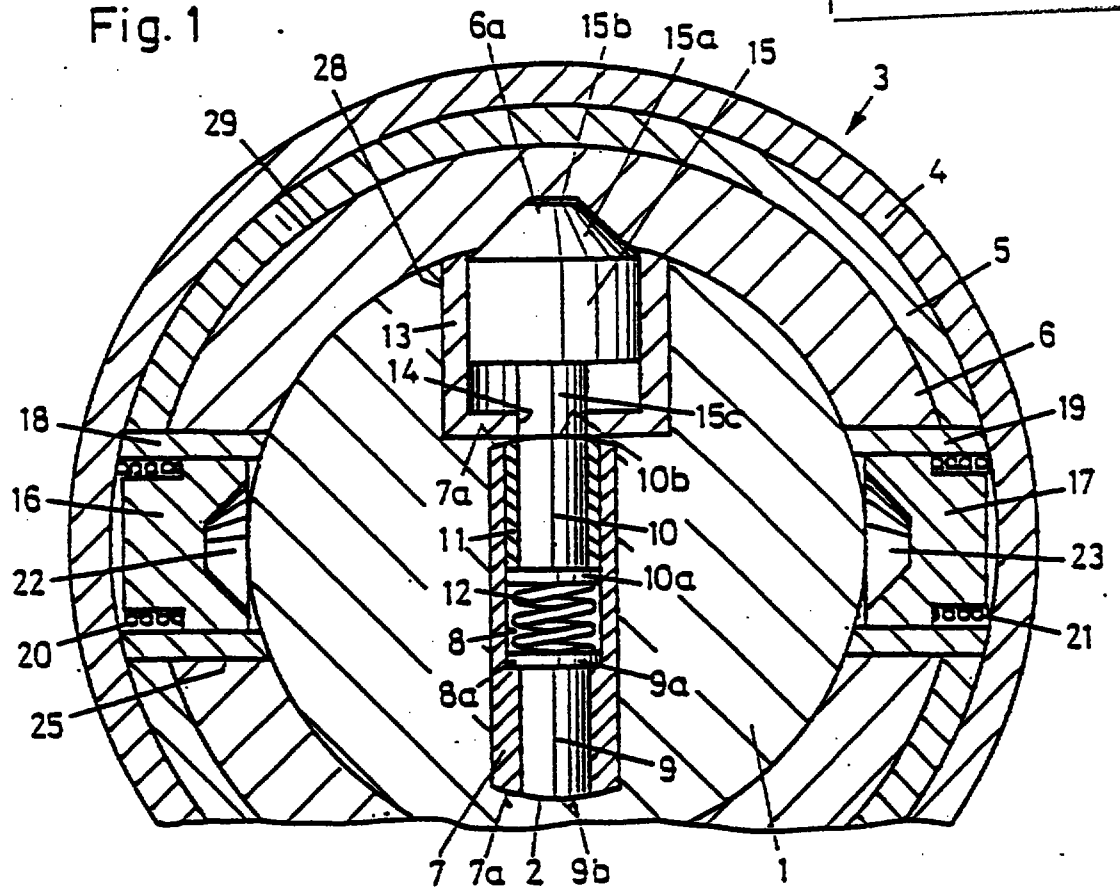
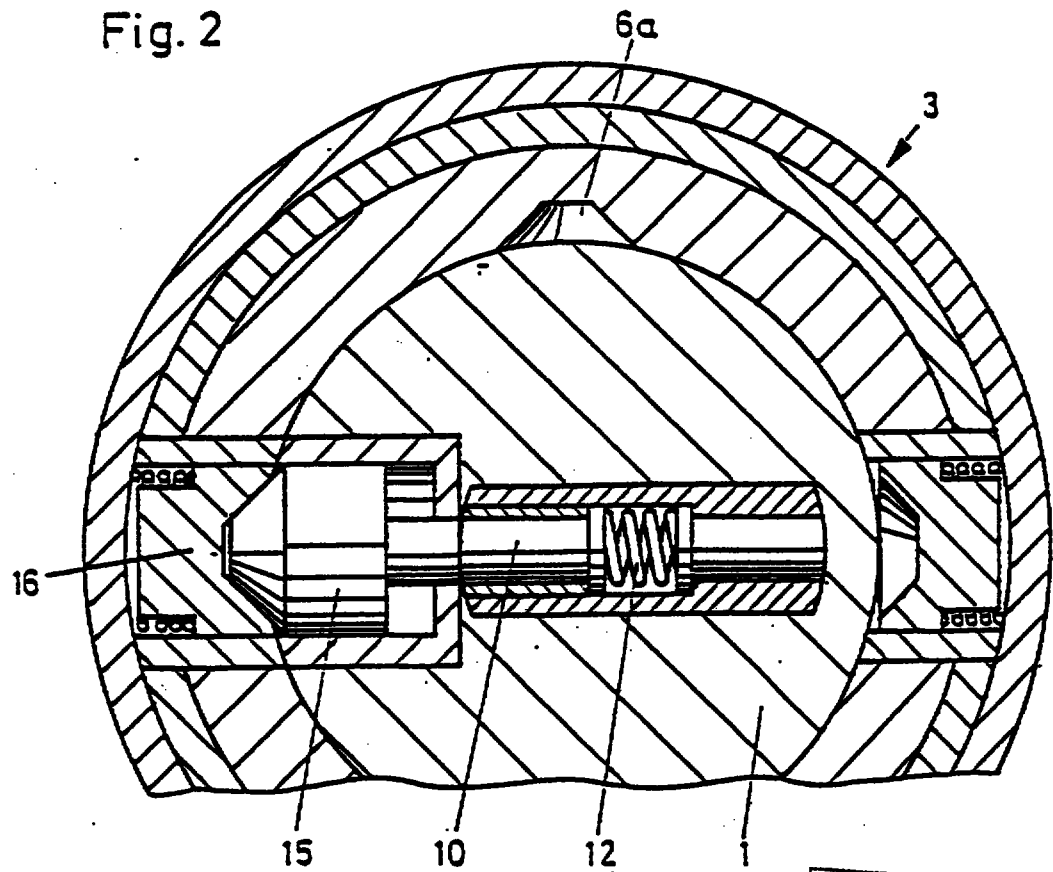


Fig. 2





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Fig. 3

2.

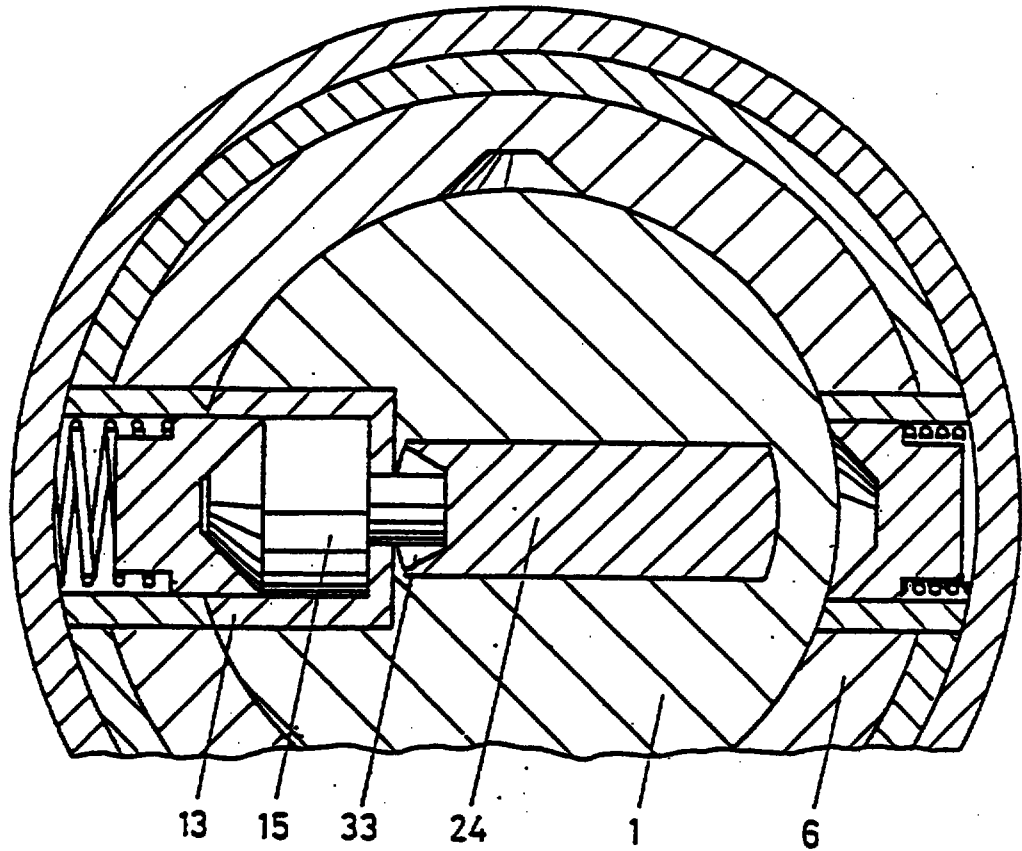


Fig. 4a

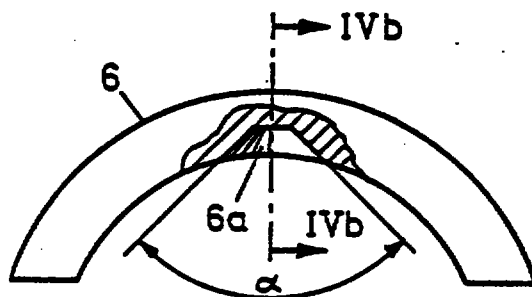
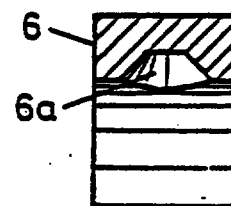


Fig. 4b





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Fig. 5a

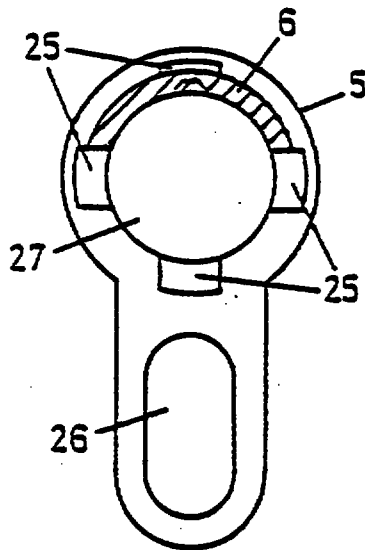


Fig. 5b

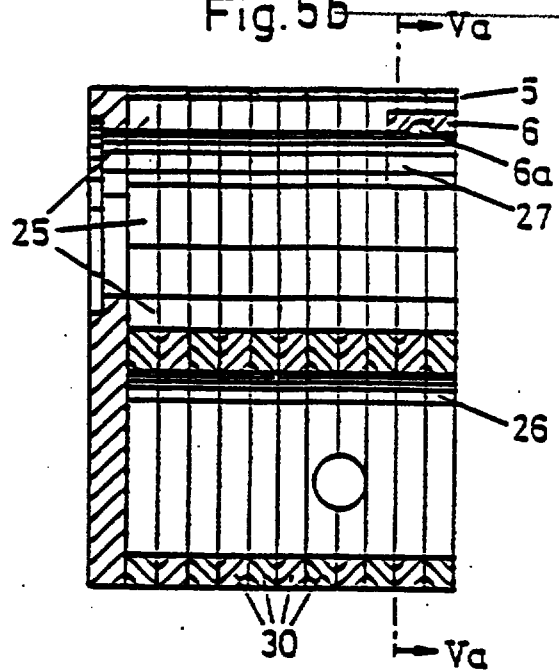


Fig. 6a

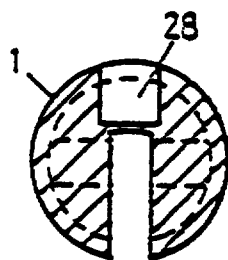


Fig. 6b

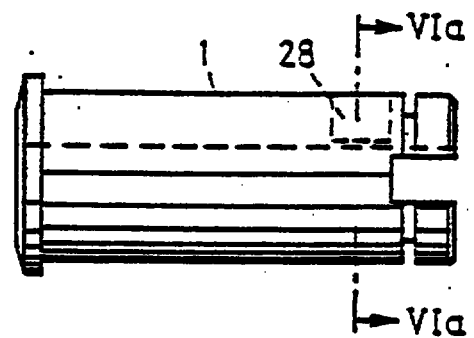


Fig. 7a

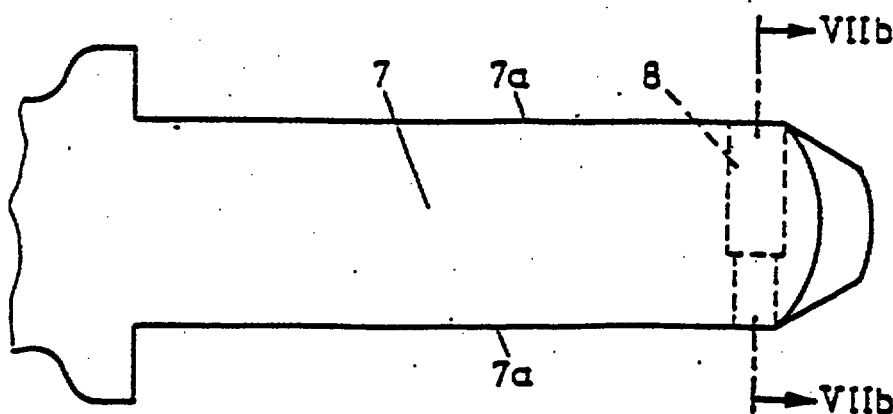
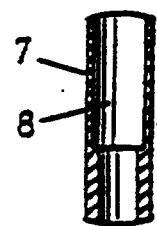


Fig. 7b



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KEY AND ROTARY LOCKING CYLINDER FOR A SAFETY LOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to a key and a rotary locking cylinder as well as to a key for a rotary locking cylinder with an additional tumbler.

2. Background Art

The advantage of keys of this generic type is that the control element arranged in the shank virtually prevents unauthorized copying so that locking arrangements outfitted with such keys are more secure. However, known keys of this type, also called "mechanical keys", are still subject to various disadvantages and so have not achieved widespread use, particularly as turning keys, in spite of their very high security against copying.

A key of this generic type is known, for example, from DE-A-35 17 660. This key can be inserted into the key slot of a rotary locking cylinder and has, in its planar shank, a movable device by means of which an additional tumbler can be moved into the releasing position. The movable device of the key is formed by a projecting pin which can be held displaceably in a pocket hole of the key. Also arranged in the pocket hole is a spring which presses the pin outward. The pin is prevented from falling out by steps in the pocket hole of the shank and at the pin. Projecting pins are generally disadvantageous in a key, as the key easily becomes caught on the pin.

Another key of this type having a pin which can be displaced in a defined manner for the purpose of bringing into line the additional tumbler in the shank is known from U.S. Pat. No. 4,667,495. When the shank is inserted into the key slot, the pin runs up onto an inclined plane or ramp arranged in the rotor. The ramp displaces the pin radially and the pin accordingly brings the additional tumbler into line.

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Grooves or other recesses are required at the shank to allow the ramp to reach the pin when the shank is inserted. In the case of a flat key, these grooves limit the surface available for control bore holes. Therefore, in practice, the pin must be arranged as close as possible to the front end of the shank. One end of the easily displaceable pin usually projects out at the shank so that the key can also become caught on this.

A key of this type is also known from EP-A-202 949. The additional tumbler is likewise brought into line in this instance by a pin which is displaceable in a defined manner in the key shank, resulting in the difficulties mentioned above.

OBJECT AND SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a key and rotary locking cylinder of the generic type mentioned above which does not require a recess on the outside of the shank for a ramp arranged in the rotary locking cylinder and which is nevertheless simple to manufacture and extremely secure against copying. This object is met in accordance with the invention by a key and rotary locking cylinder for a safety lock with at least one control element which is arranged in the shank of the key and cooperates with an additional tumbler of the rotor. The control element is displaceable radially against the restoring or reaction force of a pressure spring, for example. The stator has a recess at its inner side in which the tumbler of the rotor 3 engages by means of the action of the control element. The tumbler is movable radially inward against the reaction force when the rotor is rotated. A counterpin which can be brought into line by the tumbler is arranged at a distance from the recess.

In the key according to the invention, the control element can be exactly flush at the outside with a narrow side of the key so that such a key can be distinguished from one without such a control element only by careful scrutiny. If a copied key lacks the control element, the tumbler of the rotor will move out radially into the blocking position when the key

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shank is inserted into the key slot. This prevents the rotor from turning so that the lock cannot be opened. If there is a bore hole at the outside of the key rather than the control element, the tumbler of the rotor blocks the locking cylinder when this tumbler reaches a counterpin in the stator after the rotor is turned to a certain extent. Due to the absence of the control element, this counterpin is not brought into line and blocks the rotary locking cylinder by engaging in the recess of the rotor.

The rotary locking cylinder is comparatively simple and can accordingly be manufactured at low cost. The additional measures adopted with respect to the stator are comparatively simple, since a conical depression need only be incorporated on the inside of the stator. The tumbler of the rotor can be a simple bolt which is guided into a pocket hole of the rotor so as to be displaceable radially without spring loading.

According to a further development of the invention, the stator has an insert which has the abovementioned recess for the tumbler cooperating with the control element. The insert can be manufactured in a comparatively simple manner from hardened steel or hard metal so that protection against forceful opening of the rotary locking cylinder is considerably improved.

For a better understanding of the present invention, reference is made to the following description and accompanying drawings while the scope of the invention will be pointed out in the appended claims.

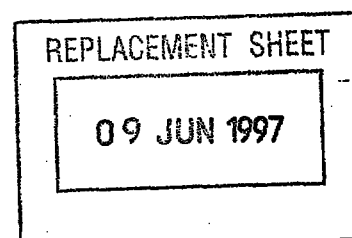
BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a cross section through a rotary locking cylinder, according to the invention, with inserted key;

FIG. 2 shows a cross section according to FIG. 1, but after the rotor has been rotated by 90°;

FIG. 3 shows a section according to FIG. 2, but with a key lacking the control element;

FIGS. 4a and 4b show a projected view and cross section, respectively, through an insert;



FIGS. 5a and 5b show a projected view and section, respectively, through a stator housing;

FIGS. 6a and 6b show views of a rotor;

FIGS. 7a and 7b show a partial view and section, respectively, through a key according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows a stator 3 with a conventional steel sleeve 4 and a housing 5 in which a rotor 1 is supported so as to be rotatable. Conventional pin tumblers (not shown in the drawing) are brought into line by a key 7 inserted into a key slot 2 of the rotor 1 and the rotor 1 can be turned to actuate a lock (not shown in the drawing). The key 7 has pocket holes appropriate for bringing these conventional tumblers into line. However, the key 7 can also be a so-called serrated key, in which case, of course, the rotary locking cylinder is adapted accordingly.

As will be seen from FIGS. 5a and 5b, the housing 5 of the stator 3 can be produced from bars or plates 30 which are soldered together. The plates 30 are preferably made of hardened steel. A semicircular recess 29 is provided at the rear end of the housing 5 in the upper region, a curved insert 6 which is preferably made of hardened steel or hard metal being inserted in the latter. The insert 6 has a conical pocket hole 6a which cooperates with a tumbler 15 of the rotor 1. In addition, the housing 5 has longitudinal slots 25 in which are inserted slides or bolts 19, known per se. The housing pins 16 are guided in these bolts 19 into bore holes 31 by their springs 20. Such bolts 19 are known per se.

The rotor 1 is provided with a radial bore hole 28 in which is inserted a bushing 13 with a through-opening 14. A tumbler 15 in the form of a cylindrical bolt or pin is guided in the bushing 13 so as to be displaceable radially. The bushing 13 is preferably made of hardened steel. The radial outer end of the tumbler 15 has a conical surface 15a which is constructed corresponding to the bore hole 6a of the insert 6. A cylindrical part 15b arranged at the other end of the

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tumbler 15 projects through or into the opening 14 of the bushing 13. As will be seen from FIG. 1, the tumbler 15 is pressed radially outward against the insert 6 by a control element 10 when the key 7 is inserted in the key slot 2.

The key 7 preferably has two control elements 9 and 10 which are inserted in a continuous stepped bore hole 8 at the front end of the key shank and are held in the positions shown in FIG. 1 by a cooperative or common pressure spring 12. The two control elements 9 and 10 are cylindrical pins, each having a flange 9a and 10a, respectively, which projects out radially. The flange 9a contacts a shoulder 8a of the stepped bore hole 8 so as to prevent the control element 9 from exiting at the outer end of the stepped bore hole 8. In a corresponding manner, the flange 10a of the control element 10 contacts a sleeve 11 which is inserted into the stepped bore hole 8 with a press fit. As will be seen, the control faces 9b and 10b of the elements 9 and 10 lie exactly flush with the narrow sides 7a of the key 7 in the positions shown in FIG. 1. The mechanical control device with the elements 9 and 10 and the pressure spring 12 is comparatively simple to produce and operates reliably.

The control elements 9 and 10 can be moved inward into the stepped bore hole 8 to a limited extent against the reaction force of the pressure spring 12. The reason for this movability will become clear from the following description.

In order to actuate the rotary locking cylinder, the shank of the key 7 is inserted into the key slot 2 in a conventional manner. In so doing, the conventional tumblers (not shown in the drawing) are brought into line by the conventional bore holes of the key. In the arrangement shown in FIG. 1, the tumbler 15 is also lifted by the control element 10 so that it engages in the recess 6a of the insert 6. When turning the key, the tumbler 15 is lifted by the control element 9 in a corresponding manner. Since the tumbler 15 and the control element can be moved inwardly against the reaction force of the pressure spring 12, the rotor 1 can be turned with the key, e.g. in the counterclockwise direction with reference to FIG. 1, in spite of the engagement of the tumbler 15 in the recess

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6a. Of course, this is only possible if the recess 6a and, in corresponding manner, the surface 15a are constructed conically. When the rotor 1 is turned, the tumbler 15 moves inward radially until a planar end face 15b reaches the shear line 27 between the rotor 1 and stator 3.

If an attempt is made to actuate the rotary locking cylinder using a key without the movable control element, the rotor 1 will be blocked by the tumbler 15 even if the conventional tumblers are brought into line, since this tumbler 15 contacts the shank of the key and cannot be deflected radially inward. When the insert 6, tumbler 15 and bushing 13 are produced from a hard material, e.g., hardened steel, the rotor 1 can also not be turned by force. Thus, when high forces are applied, only the handle of the key can break off.

If a key 24 according to FIG. 3 has a bore hole 33 at a corresponding position rather than a control element 9 or 10, the tumbler 15 is not engaged with the insert 6 and the rotor can accordingly be turned provisionally when the conventional tumblers are brought into line. However, after the rotor 1 turns by 90° in the clockwise direction or counterclockwise direction, the counterpin 16 falls into the interior of the sleeve 13 and blocks the rotary locking cylinder. In this case, the rotor 1 cannot be turned into the position in which the lock is unlocked. When using a key 7, according to the invention, provided for the rotary locking cylinder, the counterpin 16 is brought into line by means of the tumbler 15 and the rotor can accordingly be turned by an additional 90° into the position in which the lock is unlocked. In order for the tumbler 15 to bring the counterpin 16 into line, the pressure spring 12 is constructed so as to be thicker than the pressure spring 20 which presses the counterpin 16 radially inward. As is conventional, per se, the counterpin 16 has a conical bore hole 23 which is constructed corresponding to the surface 15a of the tumbler 15. The counterpin 17 which is arranged on the opposite side and has the bore hole 22 and the pressure spring 21 performs exactly the same function. FIG. 2 clearly shows how the counterpin 16 is brought into line by the tumbler 15 in the appropriate rotational position of the rotor 1. When the rotor 1 is rotated out of this position,

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e.g. in the counterclockwise direction, the tumbler 15 is deflected radially inward and the control element 10 is moved radially inward against the reaction force of the pressure spring 12 in a corresponding manner. As can be seen, the rotary locking cylinder can be actuated in a conventional manner with an appropriate key 7 according to the invention. However, it is not possible to actuate the lock with a key which lacks the control element even if extensive force is applied.

While the foregoing description and drawings represent the preferred embodiments of the present invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the true spirit and scope of the present invention.

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What is claimed is:

1. A key and rotary locking cylinder having tumblers for a safety lock comprising:

- a) a key having at least one control element arranged in a shank of said key, said control element being displaceable radially against a restoring force of a pressure spring; and
- b) a rotary locking cylinder having a rotor and a stator, said rotor having an additional tumbler for cooperating with said control element of said key, said stator having a recess at an inner side in which said additional tumbler of said rotor engages by means of action of said control element, said additional tumbler being moveable radially inwardly against the spring restoring force when said rotor is rotated;

said cylinder also including a counterpin which can be brought into line by said additional tumbler and which is arranged at a distance from said recess, wherein an insert having said recess which cooperates with said additional tumbler is inserted into another recess of said stator.

2. The key and cylinder according to claim 1, wherein said insert is made from a hard metal.

3. The key and cylinder according to claim 1, wherein said insert is made from hardened steel.

4. The key and cylinder according to claim 1, wherein said insert is constructed in a curved shape.

5. A key and rotary locking cylinder having tumblers for a safety lock comprising:

- a) a key having at least one control element arranged in a shank of said key, said control element being displaceable radially against a restoring force of a pressure spring; and
- b) a rotary locking cylinder having a rotor and a stator, said rotor having an additional tumbler for cooperating with said control element of said key, said stator having a recess at an inner side in which said additional

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tumbler of said rotor engages by means of action of said control element, said additional tumbler being moveable radially inwardly against the spring restoring force when said rotor is rotated;

said cylinder also including a counterpin which can be brought into line by said additional tumbler and which is arranged at a distance from said recess,

wherein said shank of said key has a continuous stepped bore hole in which is inserted a pressure spring which acts upon two opposite control elements, and

wherein a sleeve is pressed into the stepped bore hole and wherein a control element is guided into the sleeve.

6. The key and cylinder according to claim 5, wherein each control element has a flange at its inner end, which flanges contact a shoulder and said sleeve, respectively.

* * * * *

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KEY AND ROTARY LOCKING CYLINDER FOR A SAFETY LOCK

ABSTRACT

A key and rotary cylinder for a safety lock are disclosed. The key has in its shank a continuous bore hole in which two opposite control elements are supported. These control elements are movable inwardly against the restoring force of a pressure spring arranged in the bore hole. An additional tumbler is lifted by a control element when the key is inserted into a key slot of the rotary locking cylinder. This additional tumbler engages in a recess of the stator. When using a key without a control element, the rotor is blocked by means of the tumbler. When using a key according to the invention, the rotor can be turned and the tumbler is lifted out of the recess and the control element is moved inward radially. After turning by 90°, for example, a counterpin of the stator is brought into line by the tumbler. In the absence of a control element, the rotor is blocked by the counterpin in this case as well.

Figure 1.

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Fig. 1

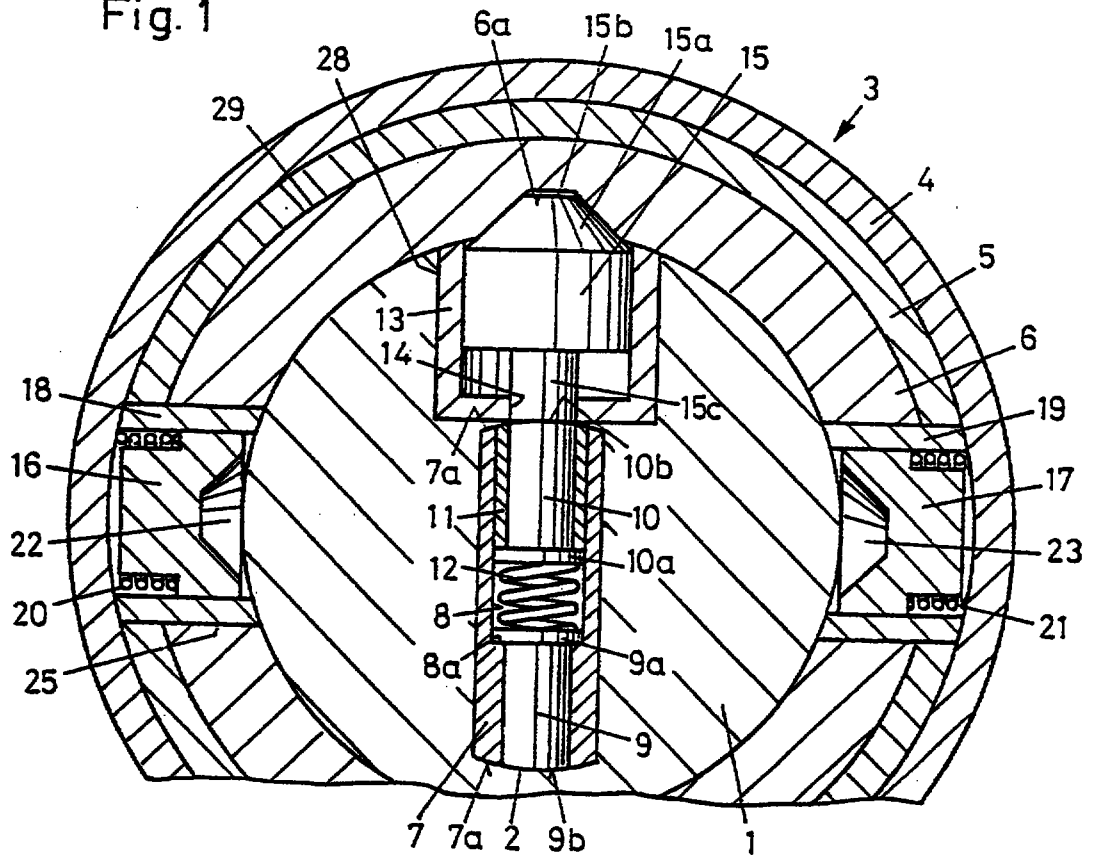
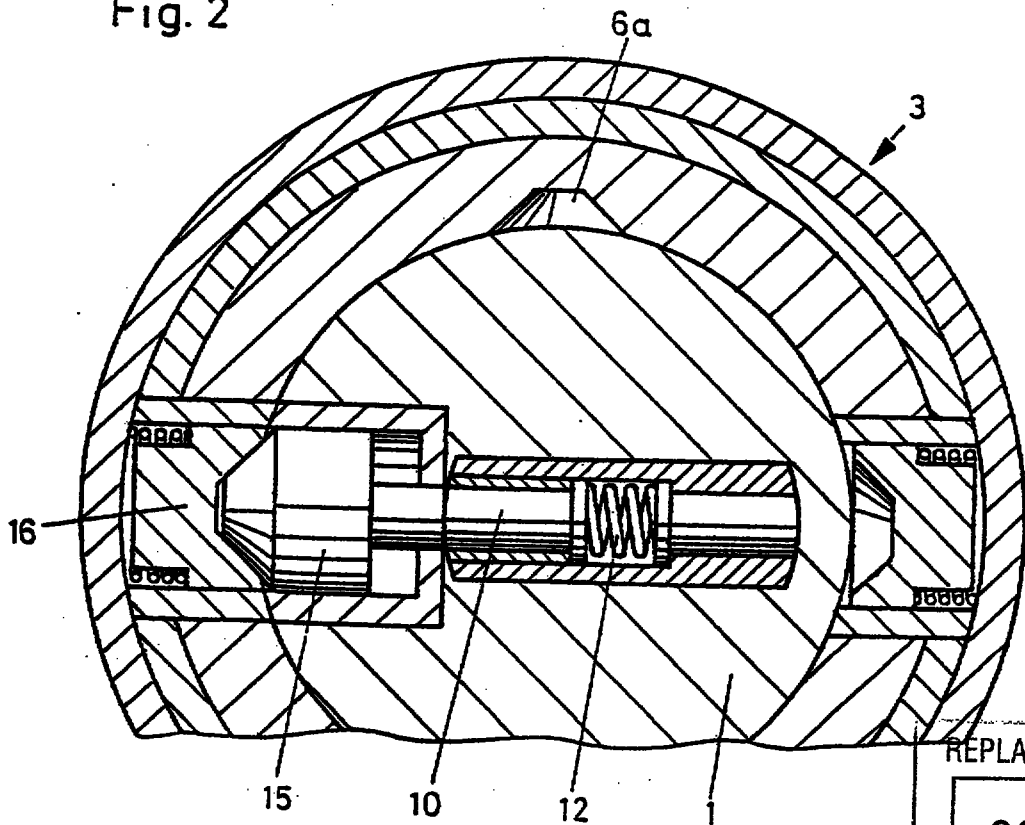


Fig. 2



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Fig. 3

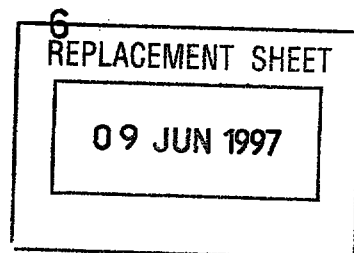
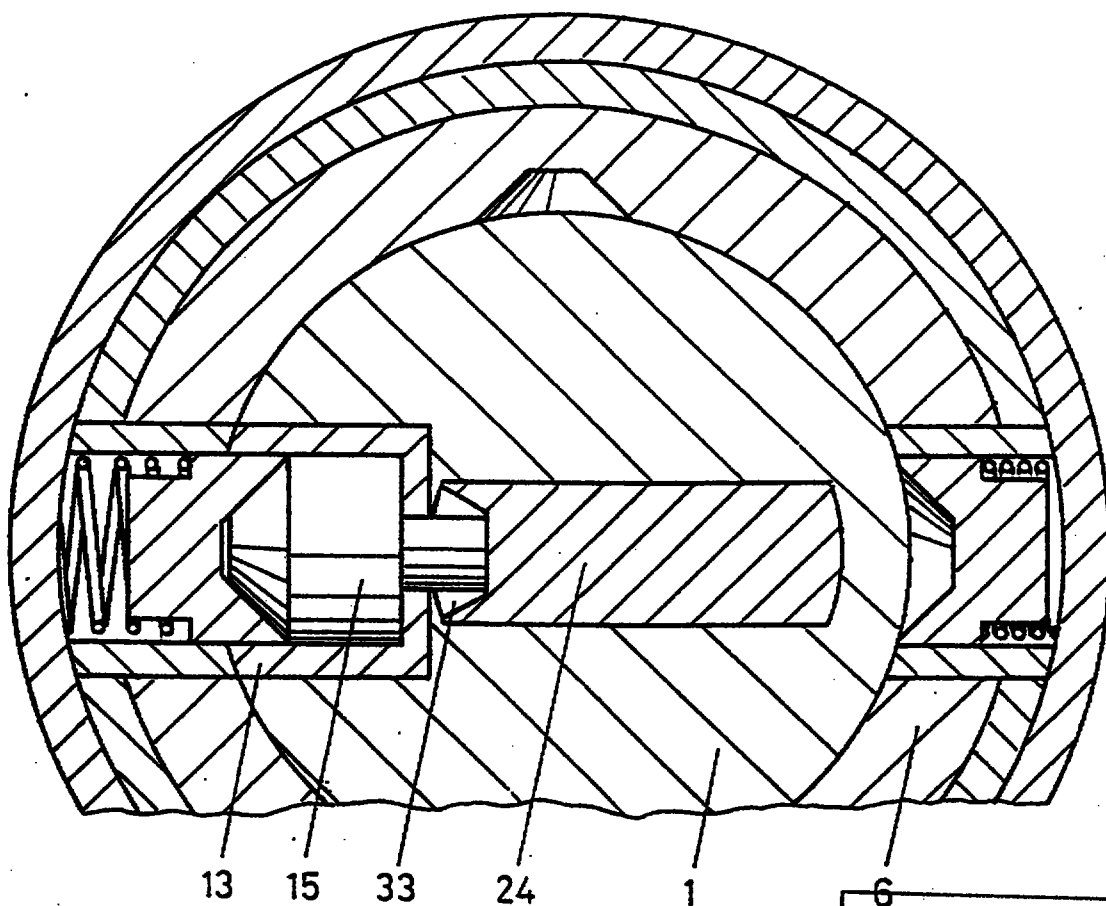


Fig. 4a

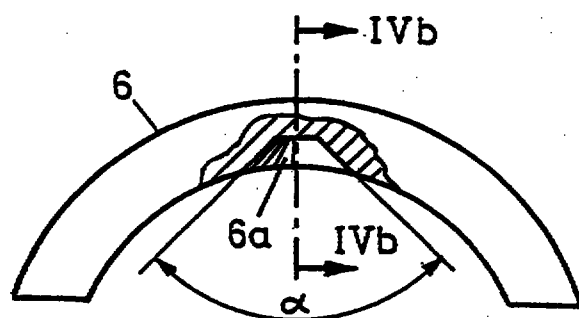


Fig. 4b

