(12) STANDARD PATENT (11) Application No. **AU 2005202541 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Locking cylinder

(51) International Patent Classification(s)
E05B 27/00 (2006.01) ***E05B 27/06*** (2006.01)

(21) Application No: **2005202541** (22) Date of Filing: **2005.06.10**

(30) Priority Data

(31) Number	(32) Date	(33) Country
01009/04	**2004.06.15**	**CH**

(43) Publication Date: **2006.01.05**
(43) Publication Journal Date: **2006.01.05**
(44) Accepted Journal Date: **2010.08.05**

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(56) Related Art
US 5176015
US 4403486
US 4770014
US 473023
US 6532781

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Abstract

The locking cylinder has a basic code which can be changed using at least one change key (17, 17'). A rotor (3) is mounted in a cylinder housing (2a, 2b) and has a keyway (4) into which a shank of a standard key which is provided with control surfaces 18 can be pushed in order to position the tumblers which are arranged in three first rows (A, B, C). Further tumblers have coding elements (13) which are arranged in further bores in the cylinder housing (2a, 2b) in a programming position of the rotor (3). The change key (17, 17') interacts with three further rows (D, E, F) of tumblers in the programming position, these tumblers being arranged in slides. These further rows (D, E, F) each contain tumblers having coding elements (C). The locking cylinder can be produced with a smaller outside diameter and be installed in a particularly cost-effective manner.

(Fig. 1)

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Fig.1

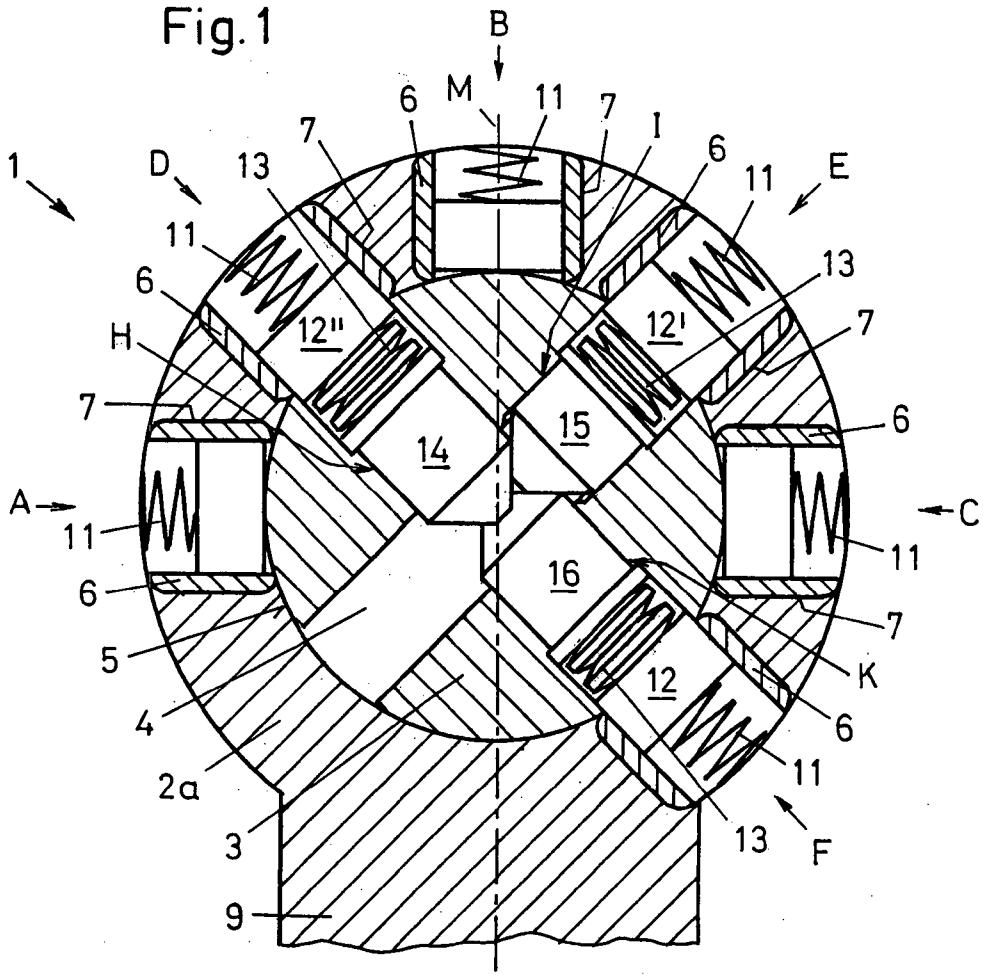
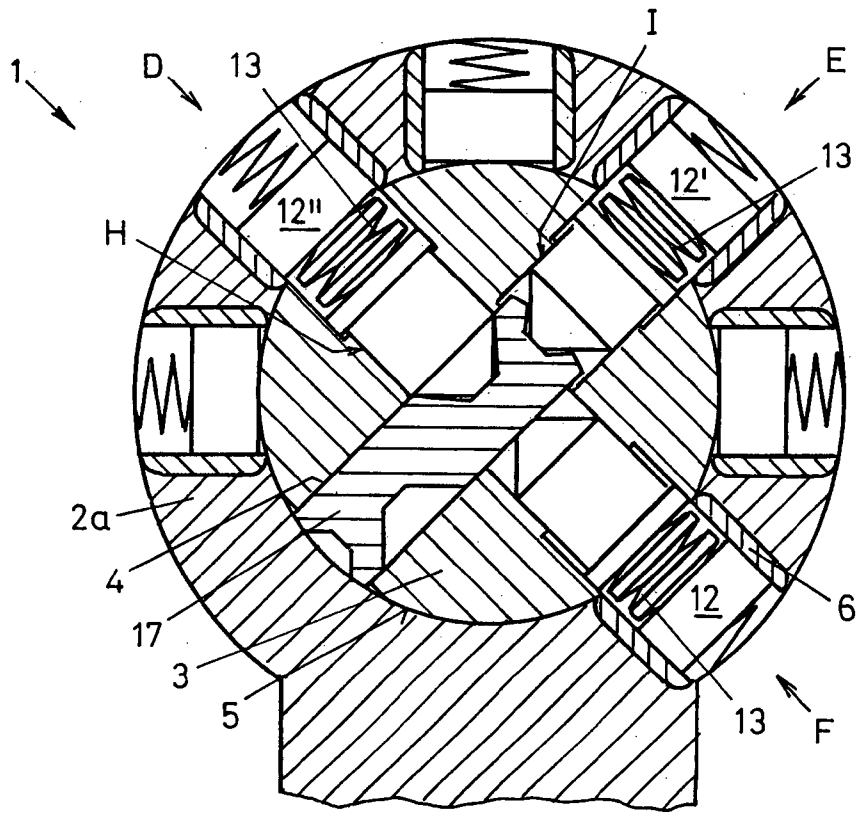


Fig. 2



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AUSTRALIA

PATENTS ACT 1990

COMPLETE SPECIFICATION

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INVENTION TITLE:

Locking cylinder

The following statement is a full description of this invention, including the best method of performing it known to me/us:-

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Locking cylinder

The invention relates to a locking cylinder having pin tumblers, in which a basic code can be changed using at least one change key, having a cylinder housing in which a rotor is mounted which has a keyway into which a shank of a standard key which is provided with control surfaces can be pushed in order to position the tumblers which are arranged in three first rows, and having further tumblers which have coding elements and which are arranged in further bores in the cylinder housing in a programming position of the rotor.

Numerous embodiments of locking cylinders having pin tumblers whose locking arrangement can be changed are already known. For example, EP 0250701 presents a cylinder lock in which at least one pin tumbler has what is known as a combination plate. This combination plate can be accommodated by a recess in the core and thus be removed from the region of the pin tumbler. The locking arrangement of this locking cylinder can be changed without replacing and even without dismantling the lock. This is necessary, for example, when a key is lost.

EP 0918124 A likewise discloses a locking cylinder in which a basic code can be changed. For this purpose, a key has a recess which can accommodate an auxiliary tumbler, and therefore this auxiliary tumbler can be removed or reinserted. Rekeying of this cylinder is comparatively complex and requires an expert.

GB 2154652 A discloses a locking cylinder which has coding disks for collecting locking elements in a separate bore and a separate core. These coding disks can be stored away. The locking cylinder has a plurality of shear lines and can therefore be produced

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only with a comparatively large outside diameter.

According to a first aspect the invention provides locking system including a standard key, and at least one change key and a locking cylinder having pin tumblers, in which a basic code can be changed using the at least one change key, said locking cylinder having a cylinder housing in which a rotor is mounted which has a keyway into which a shank of said standard key which is provided with control surfaces can be pushed in order to position the pin tumblers which are arranged in three first rows of bores, and further having three second rows of tumblers which have coding elements and which are arranged in further bores in the cylinder housing in a programming position of the rotor, wherein said at least one change key interacts with said three second rows of tumblers in the programming position, said tumblers of said second rows being arranged in slides, wherein said second rows each contain tumblers having coding elements.

In another aspect of the invention the change key interacts with three further rows of tumblers in the programming position, these tumblers being arranged in slides, and these further rows each contain tumblers having coding elements. In the locking cylinder according to the invention, the rekeying can be performed simultaneously in three rows or three bore lines. The rekeying positions, and thus the tumblers having coding elements, can therefore be arranged over three planes and thus over significantly more bores. The rekeying options are significantly increased in this way. This results in significantly higher reliability. The higher reliability is produced in particular by the rekeying positions or the coding positions being reliably disguised. It is therefore impossible to determine the location of the coding positions on the key. On account of the many rekeying options, the owner of the locking cylinder may rekey or

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program it back and forth several times, for example 10 or 20 times. Key sets which have been used can be archived and reused after a certain period of time. The fact that a small outside diameter and also particularly simple installation are possible as a result of the further rows being arranged in slides is also significant.

According to yet another aspect of the invention, provision is made for the cylinder housing to have recesses into each of which a slide is inserted which accommodates housing pins of the pin tumblers. These slides can be produced and fitted with the housing pins before being inserted into the abovementioned recesses. The rotor fitted with the tumbler pins can be installed in the cylinder housing when the slides are inserted, so that the locking cylinder is already functional after the slides are pushed into the housing. This development additionally has the significant advantage that the locking cylinder can be implemented with a customary outside diameter of 17 mm.

In yet another aspect of the invention provides for the further rows to be arranged asymmetrically with respect to a central plane of the locking cylinder. In this way, it is possible to produce a left-sided version and a right-sided version. This has the significant advantage that central systems can be constructed. In the case of an apartment block, the front door, for example, is then equipped with a left-sided locking cylinder. The apartment doors are then each equipped with a right-sided locking cylinder.

In yet another aspect of the invention provides for at least one of the three further rows to have a fixed pin position. This pin position is preferably the rearmost position. A standard key can therefore not be used for programming

purposes. A special change key or programming key is necessary for programming purposes, this key having a notch into and out of which the radially immobile pin can move. A standard key without this notch cannot be pushed into the keyway as far as the key stop in the programming position. All normal keys are therefore blocked in the programming position.

In yet another aspect of the invention, the locking cylinder is a double locking cylinder. The two cylinder housings are preferably produced separately and connected to a web. The division into two cylinder halves permits particularly simple installation, during which the abovementioned slides are inserted into the recesses in the cylinder halves.

In yet another aspect of the invention a locking cylinder according to Claim 14. In this case, provision is made for the change key to have at least one notch, which is open at the front, at the front end of the shank. This notch makes it possible to use the key in the programming position in which at least one pin is fixed.

Embodiments having two notches which are arranged to be rotationally symmetrical or four notches which are arranged symmetrically are of course also possible. Two or four fixed pins are correspondingly present in the locking cylinder.

Further advantageous features can be found in the dependent patent claims, the following description and the drawings. One exemplary embodiment of the invention is explained in greater detail in the text which follows with reference to the drawing, in which:

Figure 1 shows a locking cylinder according to the invention, with the rotor and the tumblers in the installation position,

Figure 2 shows the cylinder according to Figure 1, but with the change key inserted,

Figure 3 shows the locking cylinder after a reprogramming operation,

Figure 4 shows the locking cylinder with the key withdrawn,

Figure 5 shows the locking cylinder in the programming position with a second change key inserted

Figure 6 shows the locking cylinder after reprogramming using the second change key,

Figure 7 shows the locking cylinder after the

change key of the second type is withdrawn,

Figure 8 shows a further section through the locking cylinder according to the invention,

Figure 9 shows a section according to Figure 8, but with the rotor in the programming position,

Figure 10 shows examples of coding cards,

Figures 11a-11c show three exemplary embodiments of programming keys according to the invention,

Figures 12a-12c front views of the keys according to Figures 11a-11c,

Figures 13a-13c show longitudinal sections through fitted slides,

Figure 14 shows a front view of a cylinder housing with recesses for the slides arranged asymmetrically,

Figure 15 shows a view according to Figure 14, with the recesses oriented in a different manner, and

Figure 16 shows a schematic three-dimensional view of the cylinder housing according to Figure 14.

The locking cylinder 1 shown in Figure 1 has a rotor 3 which is mounted in a cylinder housing 2a. The cylinder housing 2a usually has a cylinder holder 9 which is only partially shown here. It can be seen from Figure 16 that the cylinder holder 9 has a recess 8 for accommodating a connecting web (not shown here) which connects the cylinder housing 2a to a further cylinder housing 2b. The locking cylinder is preferably a double locking cylinder having two cylinder housings 2a and 2b which are firmly connected to one another by a connecting web. The two cylinder housings 2a and 2b each have bores 10 for accommodating connecting pins (not shown here) for anchoring the connecting web.

The rotor 3 has a keyway 4 for receiving a standard key or a change key 17. The change key 17 or programming key is preferably what is known as a turning key or flat key which, according to Figure 2, has control surfaces 18 in the shank, these control surfaces being created by bores. The bores may be single bores, stepped bores, milled sections or the like. The bores are preferably arranged in the narrow sides and in the side surfaces of the key shank.

The cylinder housing 2a has six recesses 7 which extend in longitudinal directions of the keyway 4 and which each accommodate a slide 6. According to Figures 13a to 13c, the slides 6 each have a plurality of bores in various bore patterns, which bores are arranged in a row and each accommodate a housing pin 12 and, in some cases, at least one coding element 13. The housing pins 12 are each supported against a comparatively thin housing wall 30 (shown in Figure 16) by a helical spring 11 or another suitable spring element. This housing wall 30 is not shown in Figures 1 to 9 for illustrative reasons. The housing pins 12 are of different lengths, as shown in Figures 13a to 13c for example.

The slides 6 having the springs 11, the housing pins 12 and possibly the coding elements 13 form tumbler rows A to F. The tumbler rows A, B and C interact with the standard key. In contrast, the tumbler rows D, E and F serve merely to rekey or program the locking arrangements. As can be seen, the tumbler rows A, B and C according to Figure 1 are arranged symmetrically with respect to a central plane M. The tumbler row A is in the nine o'clock position, the tumbler row B is in the twelve o'clock position, and the tumbler row C is in the three o'clock position. However, the tumbler rows D, E and F which are provided for rekeying or programming purposes are arranged asymmetrically with

respect to the central plane M, as can also be seen in Figure 1. The tumbler row D is in the half past ten position, the tumbler row E is in the half past one position, and the tumbler row F is in the half past four position. These tumbler rows D, E and F are turned clockwise through 45° with respect to the tumbler rows A, B and C.

The rotor 3 is provided with three bore rows H, I and K, the first bore row H having core pins 14, the second bore row I having core pins 15 and the third bore row K having core pins 16. These pins 14, 15 and 16 generally have different lengths, even within one bore row. Core pins such as these are well known per se.

The rekeying of a locking arrangement using a change key 17 is explained in greater detail below with reference to Figures 1 to 4.

Figure 1 shows the locking cylinder 1 in the basic position after installation. The tumblers having the core pins 14, 15 and 16 are in the blocking position and are therefore not positioned by a key. The shear line 5 between the rotor 3 and the cylinder housing 2a is crossed by the housing pins 12, 12′ and 12′′ and the rotor 3 is thus locked to the cylinder housing 2a. The rotor 3 is in the programming position here, that is to say is turned clockwise through 45° with respect to the central plane M. If the change key 17 is now inserted into the keyway 4, the tumblers of the tumbler rows D, E and F are displaced radially outward. The housing pins 12, 12′ and 12′′ no longer form a block.

Two coding elements 13 of the tumbler row F are moved outward across the shear line 5 into the corresponding slide. One coding element 13 is located in the bore row H. Furthermore, the two coding elements 13 are located in the bore row I.

The rotor 3 is next turned through 45° by turning the change key 17 in the counterclockwise direction. As a result, the coding elements 13 in the rotor 3 are also turned through 45° in the counterclockwise direction. These coding elements therefore change position. The change key 17 is then withdrawn. The tumblers are then moved radially inward by the action of the springs 11 until the tips of the core pins 14, 15 and 16 touch. The rotor 3 is blocked as a result. This naturally applies simultaneously not only for three tumblers but for each of three rows of tumblers. The rekeying of the locking arrangement is thus concluded. As can be seen, rekeying such as this is extremely simple and can be performed very quickly by anyone in a few seconds.

Figures 5 to 7 show rekeying using a change key 17', where Figure 5 corresponds to Figure 2, but with the tumblers being radially offset in a correspondingly different manner in accordance with the various control surfaces of the change key 7'. The coding elements 13 are distributed over the rotor 3 and the cylinder housing 2a in a correspondingly different manner. The two coding elements 13 at the top left are located in the cylinder housing 2a when the change key 17' is inserted, while the two coding elements 13 are each located in the rotor 3 in the other positions. The rotor 3 is then turned counterclockwise through 45° into the position shown in Figure 6 using the change key 17'. The change key 17' is then withdrawn, and this is followed by the tumblers falling into the position shown in Figure 7. The rekeying is thus complete. As can be seen, the locking arrangement according to Figure 7 is different to that according to Figure 4. That is to say, the locking cylinder according to Figure 7 requires a different key to the one according to Figure 7 in order to position the tumblers. The locking cylinders according to Figures 4 and 7 can be rekeyed again as desired.

The arrangement according to Figure 4 can thus be achieved starting from the arrangement according to Figure 7, and vice versa. A used key set can be deactivated, archived and reused after a few years by rekeying the locking cylinder 1.

As shown in Figure 8, the last bore position of the tumbler row F does not have a radial bore into which the core pin 31 shown in Figure 9 could radially move. The result of this is that this pin position is radially fixed. If the rotor 3 is now turned to the rekeying position according to Figure 9 using a standard key, this standard key cannot be withdrawn in this position. It also impossible to fully push a standard key into the keyway 4 when the rotor 3 is in the programming position since the core pin 31 butts against the front end of the standard key and prevents it from penetrating any further. Therefore, a standard key cannot be used to rekey a locking arrangement. In order for this to be possible using the change key 17 or 17', according to Figures 11a to 11c and 12a to 12c, said change key has notches 23 at the front end, these notches extending in the longitudinal direction of the shank 20, 21 or 22 and being open at the front. The number of notches 23 in the change key 17 corresponds to the number of fixed core pins 31. According to Figures 12b and 12c, two notches 23 or four or else six notches 23 may be arranged to be rotationally symmetrical.

Figures 13a, 13b and 13c respectively show longitudinal sections through the fitted slides 6, 6' and 6'' of the tumbler rows D, E and F. As can be seen, each slide 6, 6' and 6'' has a plurality of coding positions P which each have at least one coding disk 13. These coding positions P and the bore patterns can be varied in many ways. It is also possible to turn the slide 6 through 180°, so that another arrangement is produced. The slides 6' and 6'' thus correspond to the slide 6, but

are merely turned through 180°. The slides 6, 6′ and 6′′ can be fitted outside the cylinder and form inserts 24, 25 and 26 which can be automatically installed. In the case of the insert 26, the abovementioned fixed pin position is formed by a pin 28 which is inserted into a corresponding bore in the slide 6′′.

A fixed core pin 31 correspondingly bears against the pin 28. The inserts 24, 25 and 26 can also be interchanged, so that other locking arrangements are produced in turn. The coding positions P can therefore be varied in three planes and thus over a large number of different bores. This significantly increases the rekeying options and thus reliability. The coding positions P are therefore completely disguised and cannot be identified.

The cylinder housing 2a may be in the form of the version according to Figure 14 or in the form of the version according to Figure 15. The difference between these two versions is the arrangement of the recesses 7. In Figure 14, three cutouts 7′ which are provided for rekeying purposes are turned to the right, whereas in the embodiment according to Figure 15 these recesses 7′ are turned to the left through 45°. This design means that two supplementary independent bore patterns can be included in the programming. As a result, a central system can be constructed. In this case, the cylinder housing 2a according to Figure 14 is, for example, used for the front door and the cylinder housing 2a according to Figure 15 is used for the apartment doors. The change keys 17 for the apartment doors can then not be used to rekey the front door, and vice versa. If the locking cylinder is a double locking cylinder, it correspondingly has two cylinder housings of the version according to Figure 14 or two cylinder housings according to the version of Figure 15. Figure 10 shows three examples of coding cards, where the coding positions are each marked with a K and the

customary locking positions are marked with an X.

List of reference symbols

1	Locking cylinder
2a	Cylinder housing
2b	Cylinder housing
3	Rotor
4	Keyway
5	Shear face
6	Slide
7	Recess
8	Recess
9	Cylinder holder
10	Bore
11	Spring
12	Housing pin
13	Coding element
14	Core pin
15	Core pin
16	Core pin
17	Change key
18	Control surface
19	Key bow
20	Key shank
21	Key shank
22	Key shank
23	Notch
24	Insert
25	Insert
26	Insert
27	Bore
28	Pin
29	Pin
30	Housing wall
31	Core pin
A	Tumbler row
B	Tumbler row
C	Tumbler row
D	Tumbler row
E	Tumbler row

F Tumbler row
H Bore row
I Bore row
K Bore row
P Coding position

Throughout this specification and the claims which follow, unless the context requires otherwise the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as an acknowledgment or any form of suggestion that, that prior art forms part of the common general knowledge of Australia.

The reference numerals in the following claims do not in any way limit the scope of the respective claims.

Claims

1. Locking system including a standard key, and at least one change key and a locking cylinder having pin tumblers, in which a basic code can be changed using the at least one change key, said locking cylinder having a cylinder housing in which a rotor is mounted which has a keyway into which a shank of said standard key which is provided with control surfaces can be pushed in order to position the pin tumblers which are arranged in three first rows of bores, and further having three second rows of tumblers which have coding elements and which are arranged in further bores in the cylinder housing in a programming position of the rotor, wherein said at least one change key interacts with said three second rows of tumblers in the programming position, said tumblers of said second rows being arranged in slides, wherein said second rows each contain tumblers having coding elements.

2. Locking system according to claim 1, characterized in that the three second rows are arranged as asymmetrically with respect to a central plane of the locking cylinder.

3. Locking system according to claim 1, characterized in that the three first rows and the three second rows are offset rotated through 45°.

4. Locking system according to claim 1, characterized in that the three first rows are arranged symmetrically to a central plane of the locking cylinder.

5. Locking system according to claim 1, characterized in that the coding elements are in the form of disks.

6. Locking system according to claim 1, characterized in that the cylinder housing has recesses into each of which a slide is inserted which accommodates housing pins of the pin tumblers.

7. Locking system according to claim 6, characterized in that six slides are arranged in the cylinder housing, with three slides being arranged in the programming position.

8. Locking system according to claim 1, characterized in that at least one of the further three second rows has a fixed pin position.

9. Locking system according to claim 8, characterized in that the fixed pin position is the rearmost position.

10. Locking system according to claim 1, characterized in that it is a double locking cylinder and has two housing halves which are produced separately.

11. Locking system according to claim 10, characterized in that the two housing halves are firmly connected to one another by a web.

12. Locking system according to claim 10, characterized in that the housing halves are of symmetrical design and are provided either in a version which is turned to the right or in a version which is turned to the left.

13. Locking system according to claim 1, characterized in that the standard key and also the change key have bores by which the abovementioned control surfaces are formed.

14. Locking system according to claim 1, wherein the at least one change key has at least one notch, which is open at the front, at a front end of the shank.

15. Locking system according to claim 14, characterized in that the at least one notch is arranged to be rotationally symmetrical with respect to the longitudinal axis of the key.

16. Locking system according to claim 14, characterized in that the at least one change key is a turning key.

17. Locking system according to claim 11, characterized in that the housing halves are of symmetrical design and are provided either in a version which is turned to the right or in a version which is turned to the left.

18. Locking system according to claim 2, characterized in that the three first rows and the three second rows are offset rotated through 45°.

19. Locking system according to claim 8, characterized in that the three first rows are arranged symmetrically to a central plane of the locking cylinder.

20. Locking system according to claim 19, characterized in that the coding elements are in the form of disks.

21. Locking system according to claim 5, characterized in that the disks are slidable within the cylinder housing between the three first rows and the three second rows.

22. Locking system substantially as hereinbefore described with reference to the accompanying drawings.

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Fig.1

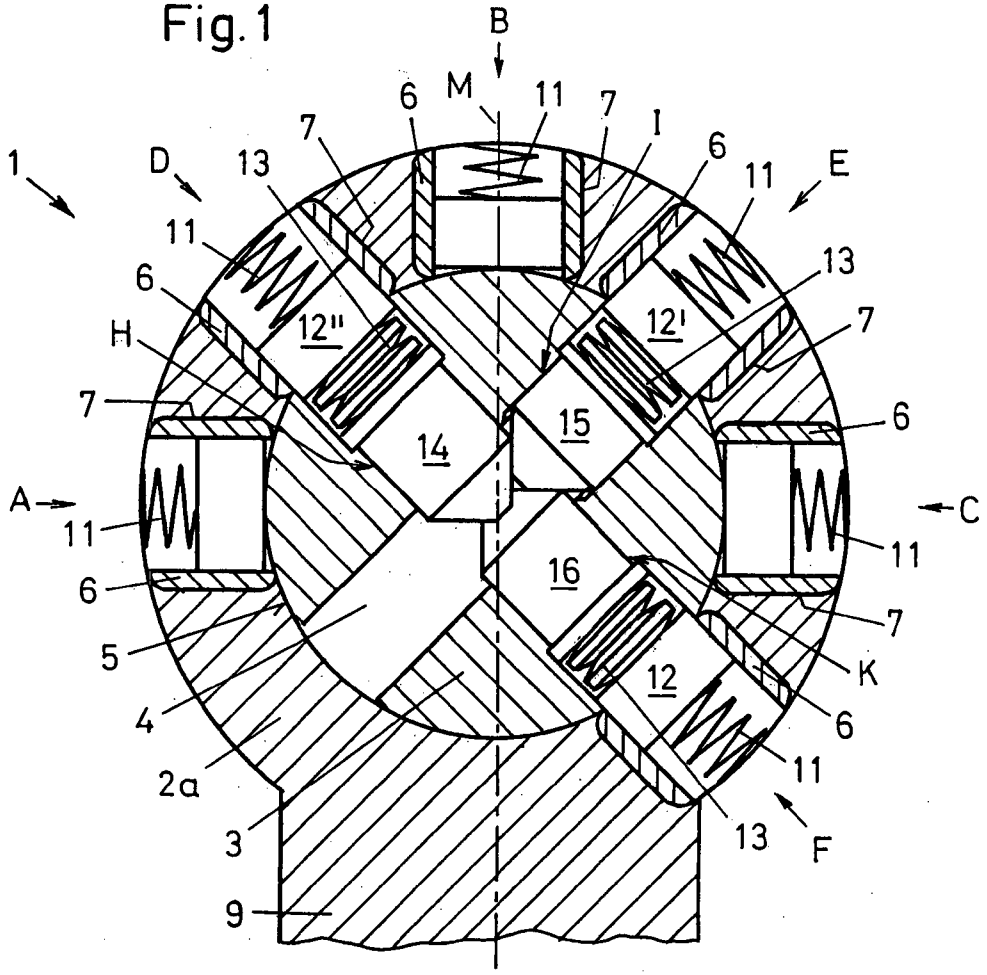

Fig. 2

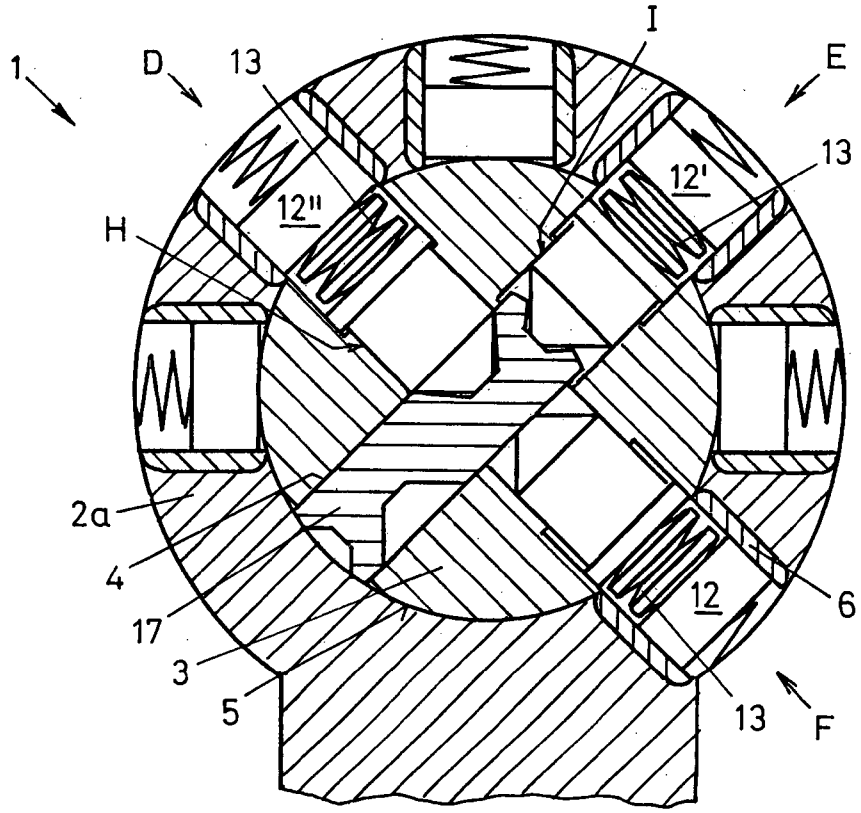

Fig. 3

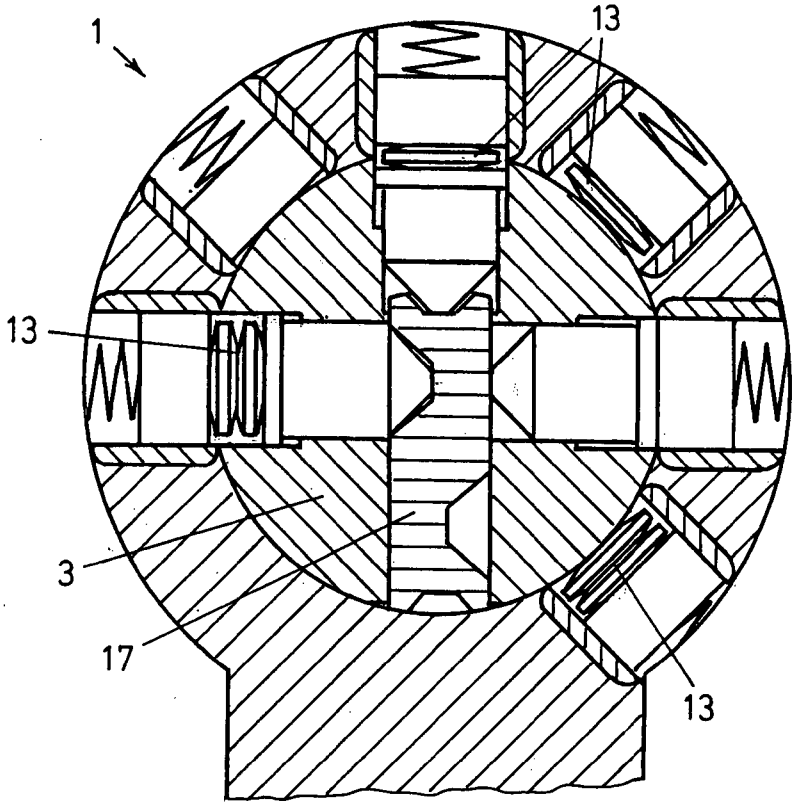

Fig. 4

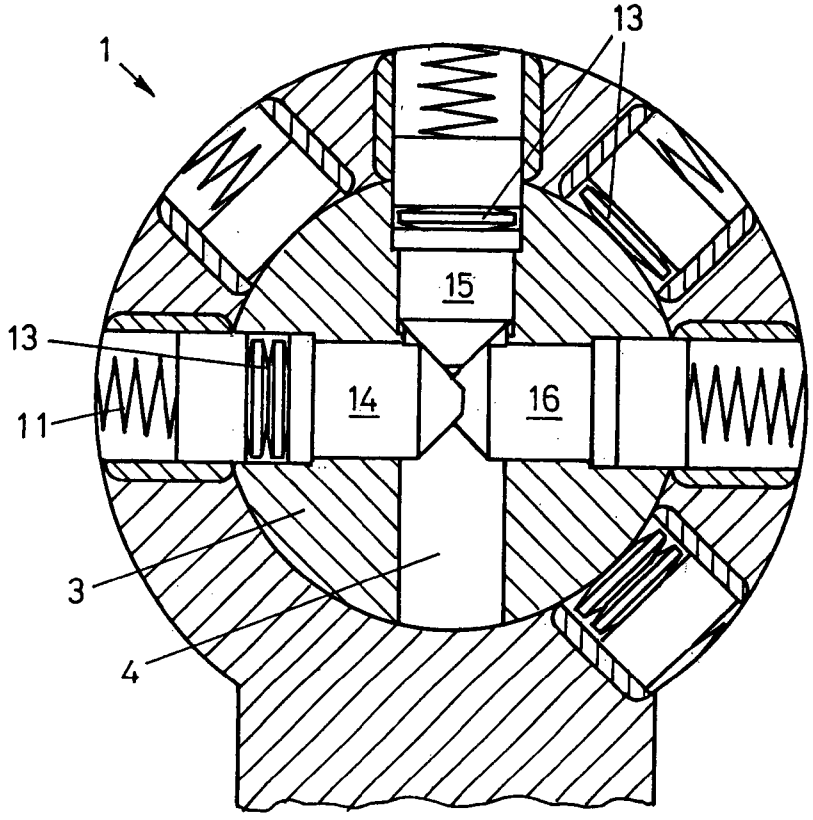

Fig. 5

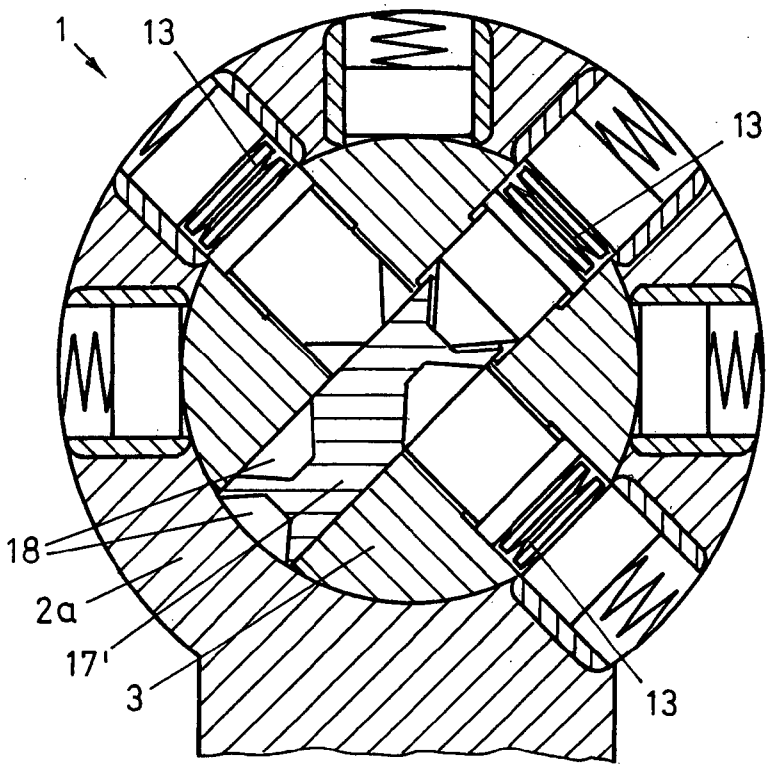

Fig.6

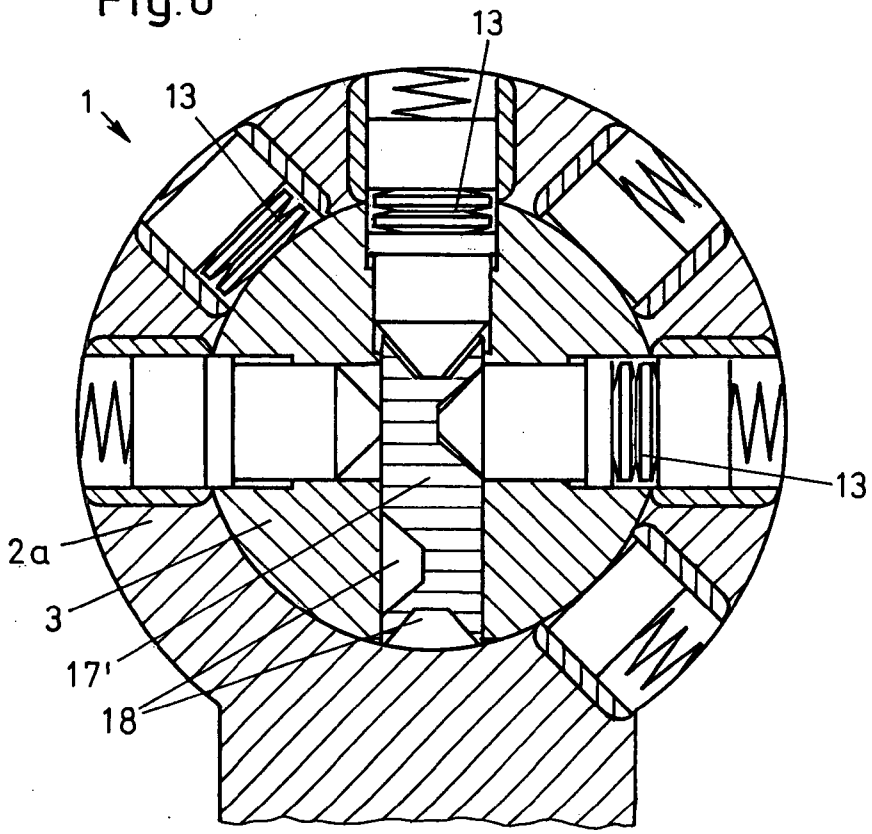

Fig. 7

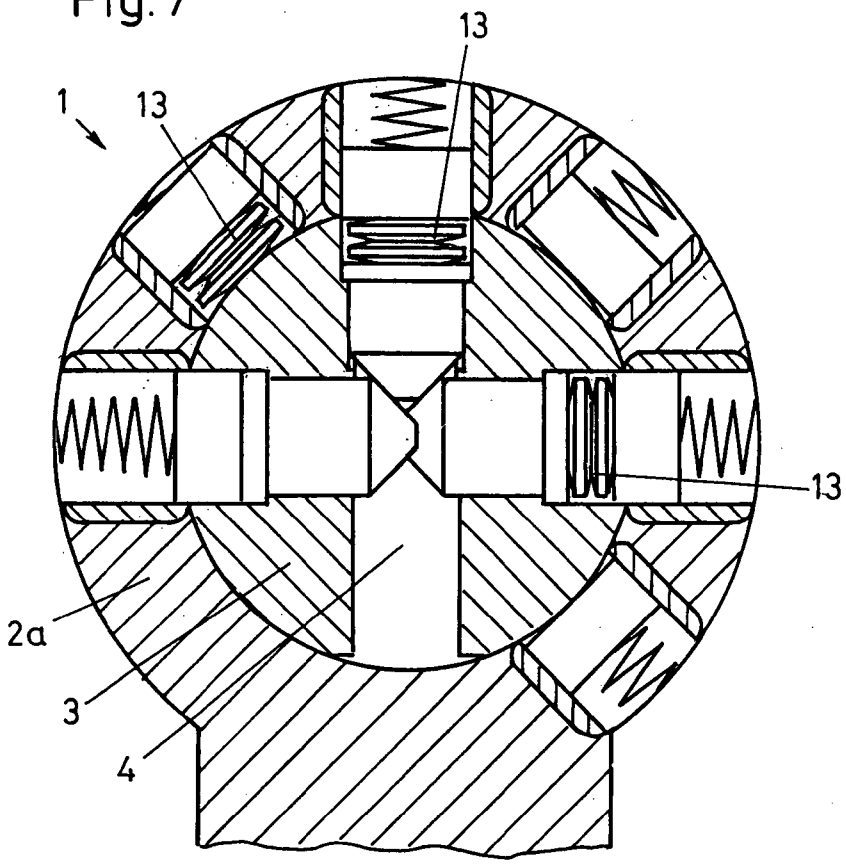

Fig. 8

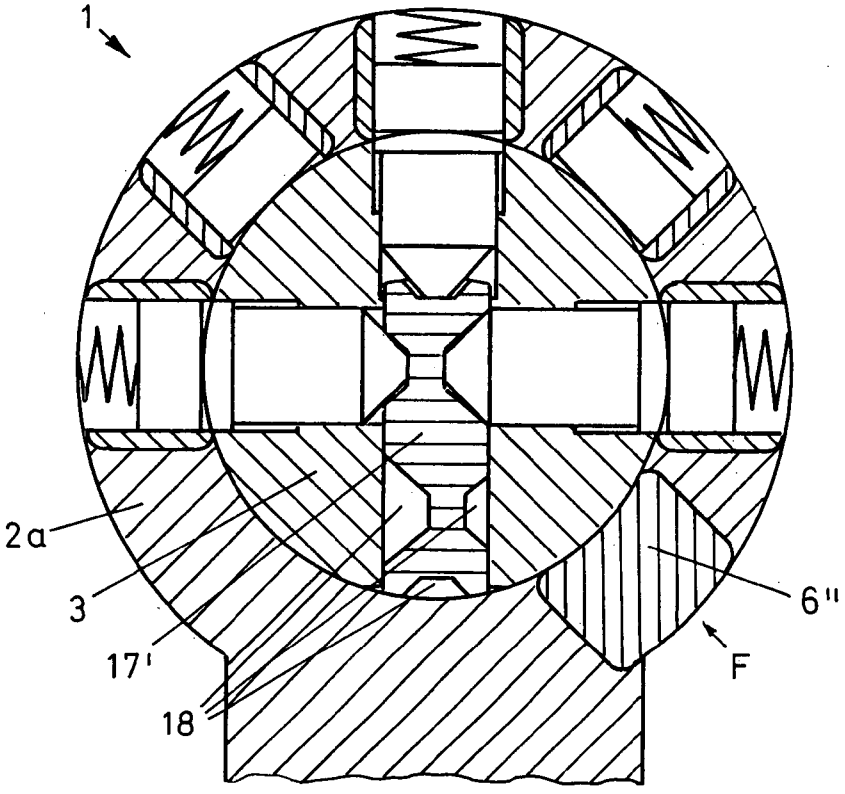

Fig. 9

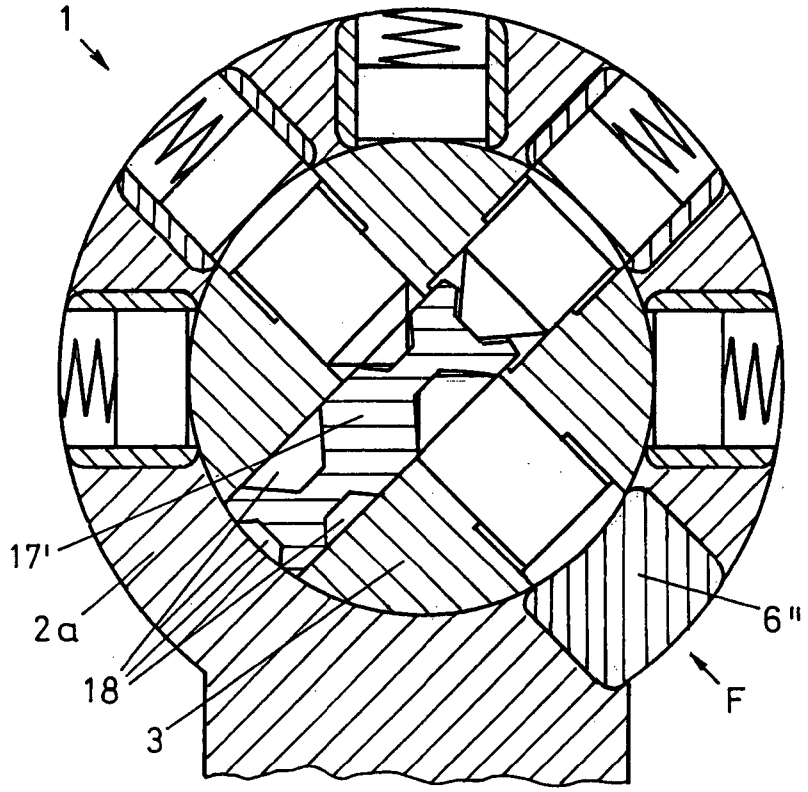

Fig. 10

02		X		K		X		X		X
02		X		X		K		K		X
01	X		X		K		K		X	

02		X		X		K		X		X
02		K		X		X		K		X
01	X		K		X		K		X	

02		X		X		X		K		X
02		X		K		K		X		X
01	X		X		K		X		K	

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Fig. 11a

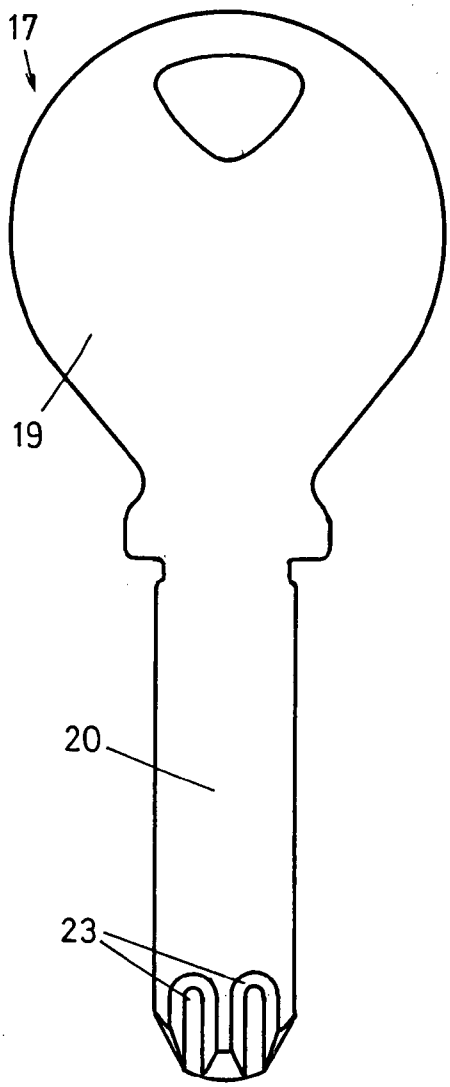

Fig. 11b

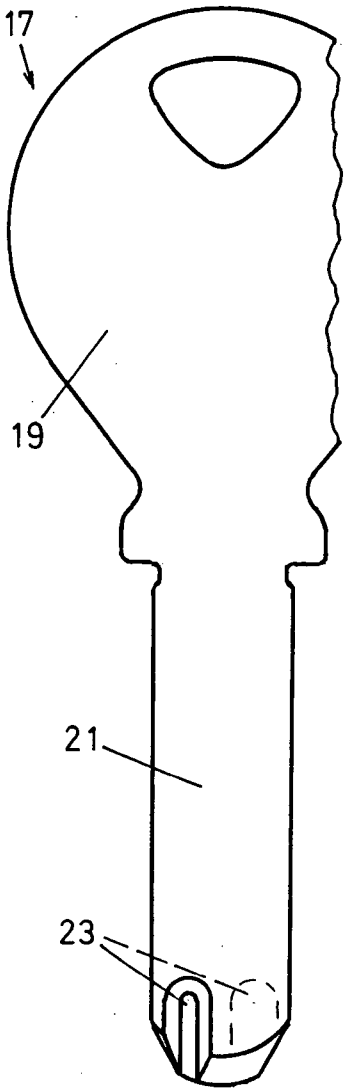

Fig. 11c

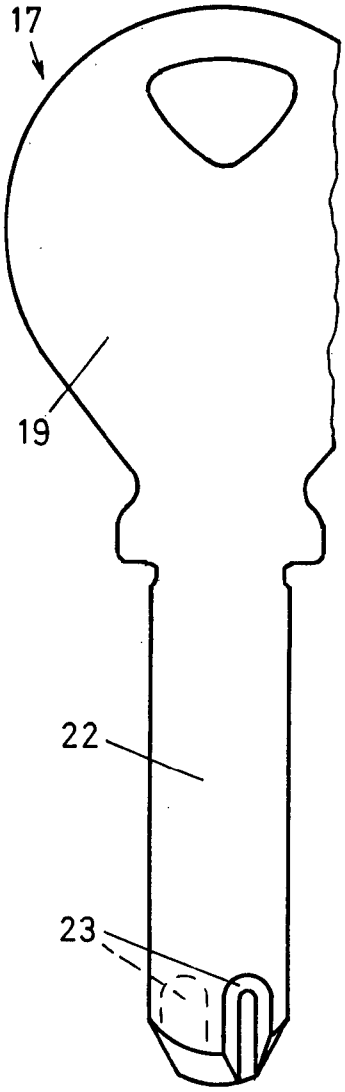

Fig. 12a

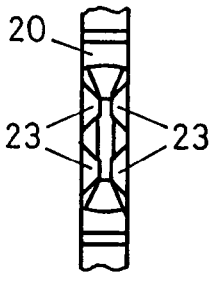

Fig. 12b

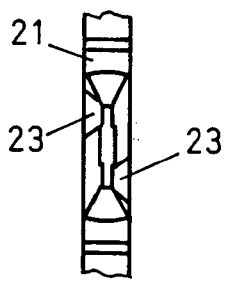

Fig. 12c

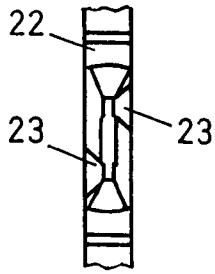

Fig. 13a

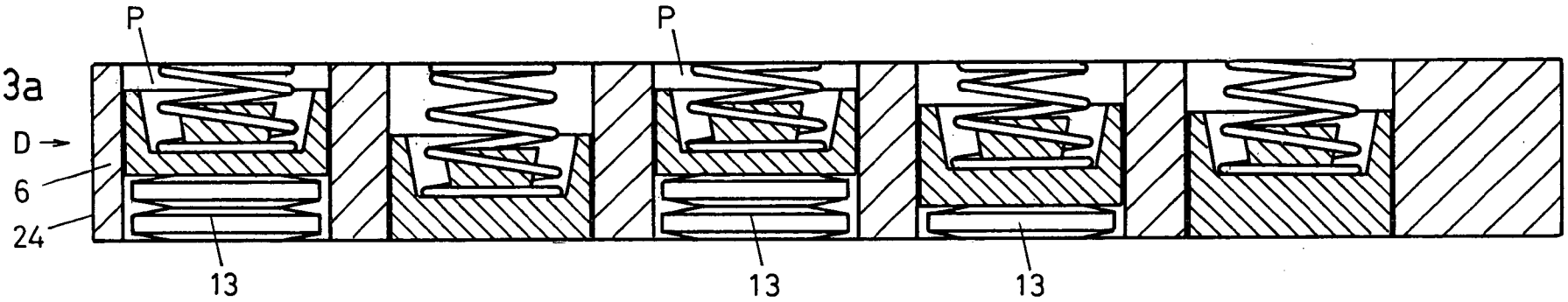

Fig. 13b

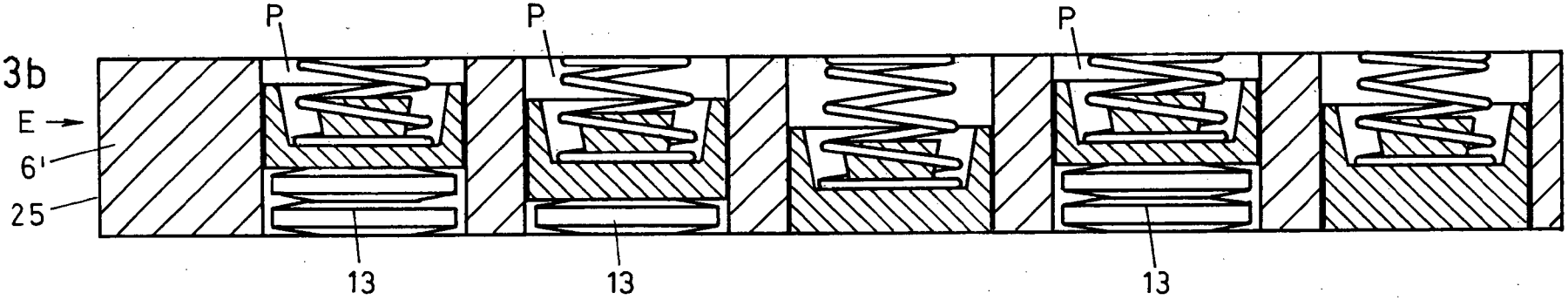

Fig. 13c

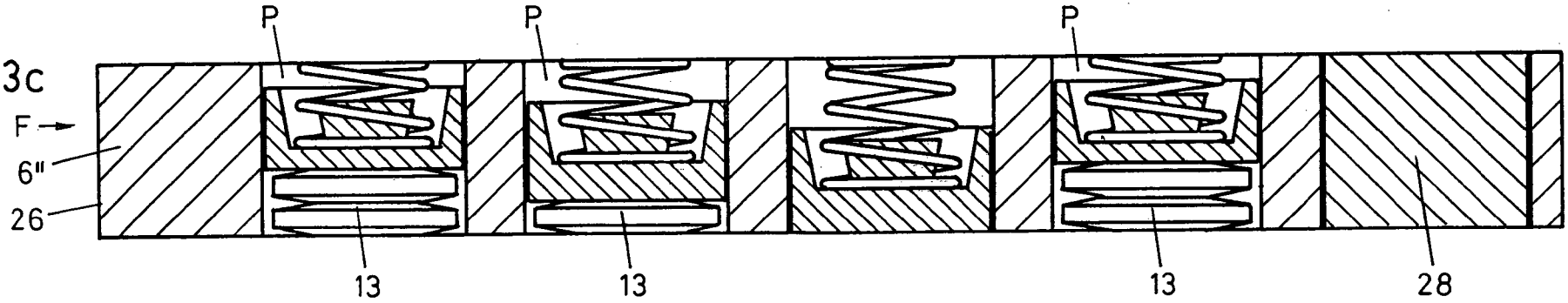

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Fig. 14

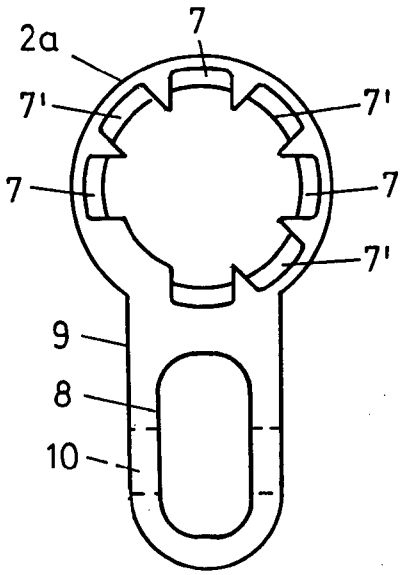

Fig. 15

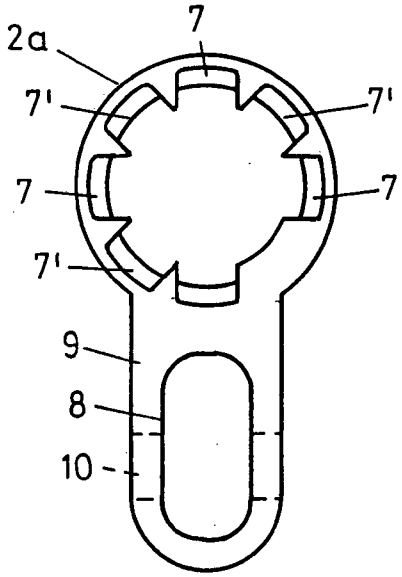

Fig. 16