



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 721 035 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.07.1996 Bulletin 1996/28

(51) Int. Cl.⁶: **E05B 27/00**

(21) Application number: **95119473.7**

(22) Date of filing: **11.12.1995**

(84) Designated Contracting States:
AT CH DE ES FR GB IT LI NL SE

(30) Priority: **27.12.1994 IT VE940054**

(71) Applicant: **SILCA S.p.A.**
I-31029 Vittorio Veneto (Treviso) (IT)

(72) Inventor: **Botteon, Renato**
I-31029 - Vittorio Veneto (IT)

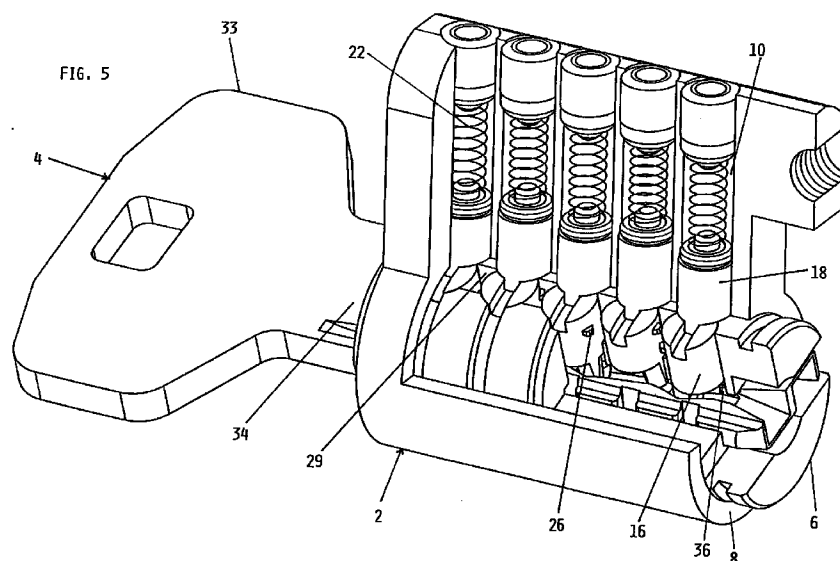
(74) Representative: **Piovesana, Paolo**
Corso del Popolo, 70
30172 Venezia-Mestre (IT)

(54) **Key and cylinder lock unit**

(57) A key and cylinder lock unit, in which the lock (2) comprises a plug (6) and a cylinder (8), both provided with a plurality of substantially radial cylindrical recesses (12,10) housing pins (16,18) formed in two parts separated by a surface, which when they assume a predetermined axial and rotational position enable the plug (6) to rotate relative to the cylinder (8) under the control of a key inserted into a corresponding seat (14) provided in the plug (6) and interacting with the end of said pins which extend into said seat, characterised in that:

- that end of said pins which extends into said seat (14) is provided with an eccentric appendix (30),

- in that face facing said pins (16,18), the key (4) comprises a continuous channel (36) open towards the end of the key shank (34) and of width and cross-section suitable for housing the appendices (30) of the pins, it extending longitudinally with different depths and with a non-rectangular path,
- the shape of said channel (36) being such that when the key (4) is totally inserted into its seat (14), the axial and rotational position of each pin (16,18) are such that said plug (6) is released from said cylinder (8).



EP 0 721 035 A1

Description

This invention relates to a key and cylinder lock unit.

Locks are known comprising a cylinder forming the lock body and a plug housed in the cylinder and provided with a radially projecting pawl for operating a bolt.

The cylinder and plug comprise a plurality of radial cylindrical recesses in which pins formed in two parts are housed and can slide axially. When the key is absent the axial position of the pins is such that the separation surface between their two constituent parts does not coincide with the surface of discontinuity between the plug and cylinder, with the result that the pins act as locking members for preventing the plug rotating relative to the cylinder. When however the key is inserted into a corresponding seat provided in the plug, it causes the various pins to move axially in accordance with its pattern, such as to make the separation surface between the two constituent parts of each pin coincide with the surface of discontinuity between the plug and cylinder, to enable the plug to be rotated by said key.

Various types of patterned keys exist, one of these consisting of a key comprising along one edge a series of notches, which determine, by supporting them, the correct positioning of pins present in the lock and urged against said notches by springs.

This type of key is advantageous in that if for example the notches are formed by a cutter the axis of which is inclined to the longitudinal axis of the shaft, they are able to cause each pin to move not only axially but to also rotate, hence considerably increasing the number of possible different patterns, to the advantage of security. However this type of key also has certain drawbacks, and in particular enables the key pattern to be read on sight by an expert, hence enabling it to be duplicated even without the original key being available.

Moreover this type of key has one or both its edges toothed, such that it may damage clothing, bags and surfaces in general with which the key comes into contact.

Another known type of key uses a flat shank with its major surface and possibly its other surfaces comprising recesses for housing the ends of the pins which lock the cylinder to the plug. As the depth of each recess varies, the axial position of the respective pin also varies, and only if the key pattern corresponds to that particular lock can its insertion into the plug cause this latter to be released and to be able to be rotated relative to the cylinder.

This known type of key has a smooth edge and therefore cannot damage bags or clothing, and in addition makes it more difficult to identify the pattern merely by viewing the key. However it can cause the pins only to translate axially but not to rotate, and consequently offers a relatively limited number of different combinations, and hence an unsatisfactory degree of security.

An object of the invention is to obviate the aforesaid drawbacks by providing a key and cylinder lock unit having a high degree of security.

A further object of the invention is to provide a unit in which for releasing the plug from the cylinder the pins are required not only to move axially but also to rotate.

A further object of the invention is to provide a unit in which the key pattern cannot be easily identified by direct viewing.

A further object of the invention is to provide a unit in which it is extremely difficult to duplicate the key, in contrast to known keys, which can be cut by a file or drill, according to the type.

A further object of the invention is to provide a unit in which key duplication requires machining along three axes.

All these objects are attained according to the invention through a key and cylinder lock unit as described in claim 1.

Two embodiments of the present invention are described in detail hereinafter with reference to the accompanying drawings, in which:

- Figure 1 is perspective view of a key of the unit according to the invention;
- Figure 2 is a longitudinal section on the line II-II of Figure 3 showing a lock of the unit according to the invention in the locked state without its key;
- Figure 3 is a longitudinal section on the line III-III of Figure 2;
- Figure 4 is a cross-section on the line IV-IV of Figure 2;
- Figure 5 is a partly sectional perspective view showing the lock in the released state with the key inserted;
- Figure 6 is a longitudinal section on the line VI-VI of Figure 7;
- Figure 7 is a longitudinal section on the line VII-VII of Figure 6;
- Figure 8 is a cross-section on the line VIII-VIII of Figure 6;
- Figure 9 shows a different embodiment in the same view and the same state as Figure 2;
- Figure 10 is a longitudinal section on the line X-X of Figure 9;
- Figure 11 is a cross-section on the line XI-XI of Figure 9;
- Figure 12 shows it in the same view as Figure 11, but in the released state with the key inserted.

As can be seen from Figures 1-8, the unit according to the invention comprises a lock, indicated overall by 2, and a key, indicated overall by 4. The lock comprises a plug 6 housed in a cylindrical cavity of a cylinder 8, of the type for example commonly known as a "European cylinder", ie with a cylindrical portion housing the plug 6 and a radial appendix housing the pin mechanism for locking and releasing the plug.

Specifically, the cylinder 8 comprises a plurality of cylindrical recesses 10 (five in the illustrated example) having their axes mutually parallel and perpendicular to

the axis of the cylindrical cavity housing the plug 6, which also comprises a like number of cylindrical recesses 12 of the same diameter, these being coaxially aligned with the corresponding recesses in the cylinder 8 when the plug 6 is in a certain precise angular position.

The five recesses 12 of the plug 6 open into a longitudinal seat 14, also provided in the plug 6, for the insertion of the key 4.

Pairs of pins 16 and counterpins 18 are free to slide axially in and rotate within each pair of aligned recesses 10, 12 and are in mutual contact along a castellated surface. Each counterpin 18 is associated with a spring 22 also housed in the corresponding cylindrical recess 10 and interposed between a disc 20, resting on said counterpin 18, and a cap 24 applied to the end of the same recess 10. The purpose of the spring 22 is to urge the pin-counterpin pair towards the longitudinal seat 14 until a retention appendix 26 emerging radially from the pin 16 encounters a shoulder 28 of a longitudinal channel 29 provided in the body of the plug between the adjacent pins 16, its purpose being to limit the rotation of the pin-counterpin pair between the two walls of said channel 29.

That end of each pin 16 distant from the counterpin 18 is provided with an eccentric appendix 30, the dimensions of the various parts concerned being such that when each retention appendix 26 rests against the corresponding shoulder 28, the eccentric appendix 30 of each pin 16 projects into the longitudinal seat 14 for the key 4.

Although the cavity in the cylinder 8 which houses the plug 6 is perfectly cylindrical, the corresponding lateral surface of the plug has a characteristic stepped shape compatible with the castellated shape of the surface of separation between each pin 16 and the relative counterpin 18 (see Figures 2,5,6).

The key 4 comprises a handgrip 33 and a shank 34 of overall parallelepiped section, with a chamfered tip and with each major face comprising a continuous channel 36 of width just greater than the diameter of the eccentric appendices 30. For the operation of the key it would be sufficient for the channel 36 to be provided on only one face of the key, however the presence of two channels symmetrical about the longitudinal axis of the key makes this reversible.

The channel 36, which is open and is slightly flared at the end of the key 4, is formed from a succession of several rectilinear portions arranged at an angle to each other so as to cause the channel to assume a broken-line configuration. In addition, the depth of the various portions is not constant and consequently the junction points of adjacent portions are at different distances from the outer face of the key.

The operation of the key and lock unit according to the invention is as follows:

with the key extracted, for the reasons which will be more apparent hereinafter, all the pin-counterpin pairs are positioned such that the radial appendices 26 provided on the pins 16 adhere to the corresponding shoulders 28 and the eccentric appendices 30 have the same angular

position in the recess 12 housing the corresponding pin 16. In this position the stepped surface of discontinuity between each pin 16 and the relative counterpin 18 is such as not to allow the plug 6 to be rotated relative to the cylinder 8.

If a key 4 provided with the correct channel 36 for operating that lock is now inserted into the seat 14 of the plug 6, this insertion causes the channel 36 to engage the appendices 30 successively encountered and, because of the shape of said channel 36, to rotate and axially move the corresponding pin-counterpin pair within the respective cylindrical seat 10, 12.

When the key has been completely inserted into its seat (see Figures 5-8), the arrangement of each pin-counterpin pair is such that the separation surface between the two exactly prolongs the stepped lateral surface of the plug 6, to hence enable this latter to be rotated by the key 4.

After the lock has been operated, extraction of the key 4 causes the various pin-counterpin pairs to move in the reverse direction, and when the key has been completely extracted all the pairs lie at the same angle corresponding to the position of the open end of the channel 36.

This position is totally different from that set by the key 4 when completely inserted, and maintains the plug 6 locked to the cylinder 8.

In a different embodiment illustrated in Figures 9-12, the surface of separation between each pin and the relative counterpin is cylindrical instead of stepped, and the plug surface is cylindrical without steps. Each pin 16 comprises in its lateral surface a rectilinear groove 38, which for that angular position of each pin-counterpin pair established by the insertion of the key 4 is in phase with the others, to allow engagement by a further pin 40 movable axially between a position totally housed within the plug 6 and a position emerging from said plug to engage a front-standing recess 42 provided in the cylinder 8.

According to this second embodiment of the invention, when the key 4 is inserted into its seat 14 it causes all the pin-counterpin pairs to rotate and move axially; the axial movement brings the surface of discontinuity between the pin and counterpin of each pair to the level of the surface of discontinuity between the plug and cylinder, whereas the rotation of each pair brings all the grooves 38 in the pins 16 to face the pins 40, which can withdraw completely into the plug 6, to release it from the cylinder 8 and enable it to be rotated.

Independently of the embodiment used, the key and cylinder lock unit according to the invention is considerably advantageous, and in particular:

- the key shank is without teeth, but at the same time is able to subject the pin-counterpin pairs to axial and rotational movement;
- it does not allow simple pattern identification by merely viewing the key;

- it uses a pattern with a very large number of different combination, making the lock particularly secure;
- extracting the key causes the various pin-counterpin pairs to rotate, so arranging them in a state in which they reliably lock the plug;
- for key duplication it requires expressly dedicated equipment.

Claims

1. A key and cylinder lock unit, in which the lock (2) comprises a plug (6) and a cylinder (8), both provided with a plurality of substantially radial cylindrical recesses (12,10) housing pins (16,18) formed in two parts separated by a surface, which when they assume a predetermined axial and rotational position enable the plug (6) to rotate relative to the cylinder (8) under the control of a key inserted into a corresponding seat (14) provided in the plug (6) and interacting with the end of said pins which extend into said seat, characterised in that:
 - that end of said pins which extends into said seat (14) is provided with an eccentric appendix (30),
 - in that face facing said pins (16,18), the key (4) comprises a continuous channel (36) open towards the end of the key shank (34) and of width and cross-section suitable for housing the appendices (30) of the pins, it extending longitudinally with different depths and with a non-rectangular path,
 - the shape of said channel (36) being such that when the key (4) is totally inserted into its seat (14), the axial and rotational position of each pin (16,18) are such that said plug (6) is released from said cylinder (8).
2. A unit as claimed in claim 1, characterised in that each pin comprises a first part (16) or actual pin, housed completely within the corresponding cylindrical recess (12) provided in the plug (6), and a second part (18) or counterpin, which is housed within the corresponding cylindrical recess (10) provided in the cylinder (8) and of which a part becomes housed within the relative cylindrical recess (12) of the plug (6) when the lock is locked.
3. A unit as claimed in claim 2, characterised in that the surface of discontinuity between each pin (16) and the relative counterpin (18) is step-shaped such as to prolong the similarly shaped lateral surface of the plug (6) when the lock is in its released state.
4. A unit as claimed in claim 1, characterised in that the channel (36) provided in the key (4) is formed from several portions of length corresponding to the distance between the axes of the appendices (30) of the pins (16) when these assume that angular position by which the lock is released.
5. A unit as claimed in claim 1, characterised in that the open end of the channel (36) is flared.
6. A unit as claimed in claim 1, characterised in that in the two opposing surfaces of its shank (34), the key (4) comprises two channels (36) symmetrical about the longitudinal axis of said shank.
7. A unit as claimed in claim 2, characterised in that with each pin (16) there is associated a radial appendix (26) delimiting the axial and rotational movement of said pin (16) and of the counterpin (18) associated with it.
8. A unit as claimed in claim 7, characterised in that the plug (6) comprises a longitudinal channel (29) traversing all the cylindrical recesses (12) and delimiting between adjacent recesses a space for the movement of said radial appendices (26).
9. A unit as claimed in claim 2, characterised in that in the lateral surface of each pin (16) there is provided a longitudinal groove (38), the grooves of all the pins (16) having an angular position such that when the key (4) is inserted into the lock, all said grooves (38) face further pins (49) for locking the plug (6) to the cylinder (8).
10. A unit as claimed in claim 9, characterised in that each pin (40) is housed completely in a corresponding seat in the plug (6) when one of its ends is housed in the groove (38) of the corresponding pin (16), part of it being housed at its other end in a corresponding recess (42) provided in the cylinder (8) when the first end (40) is not housed in the groove (38).

FIG. 1

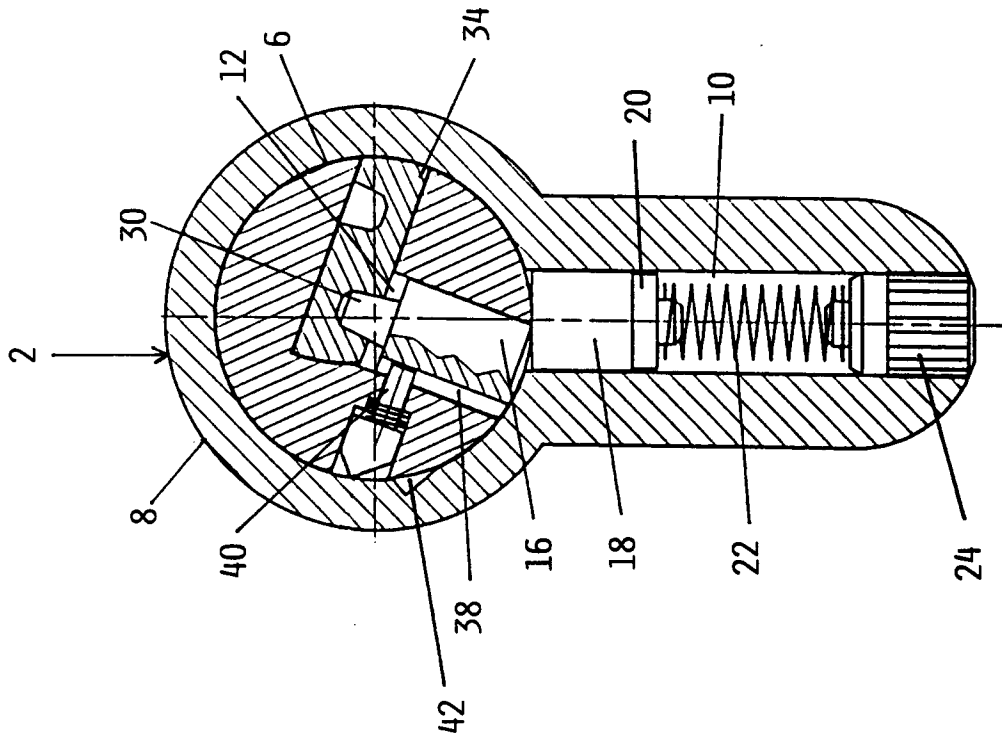
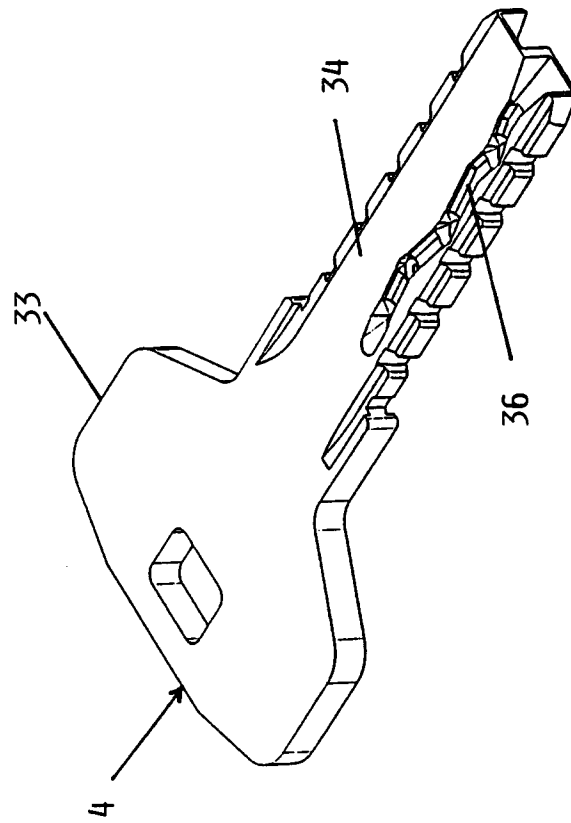


FIG. 12

FIG. 2

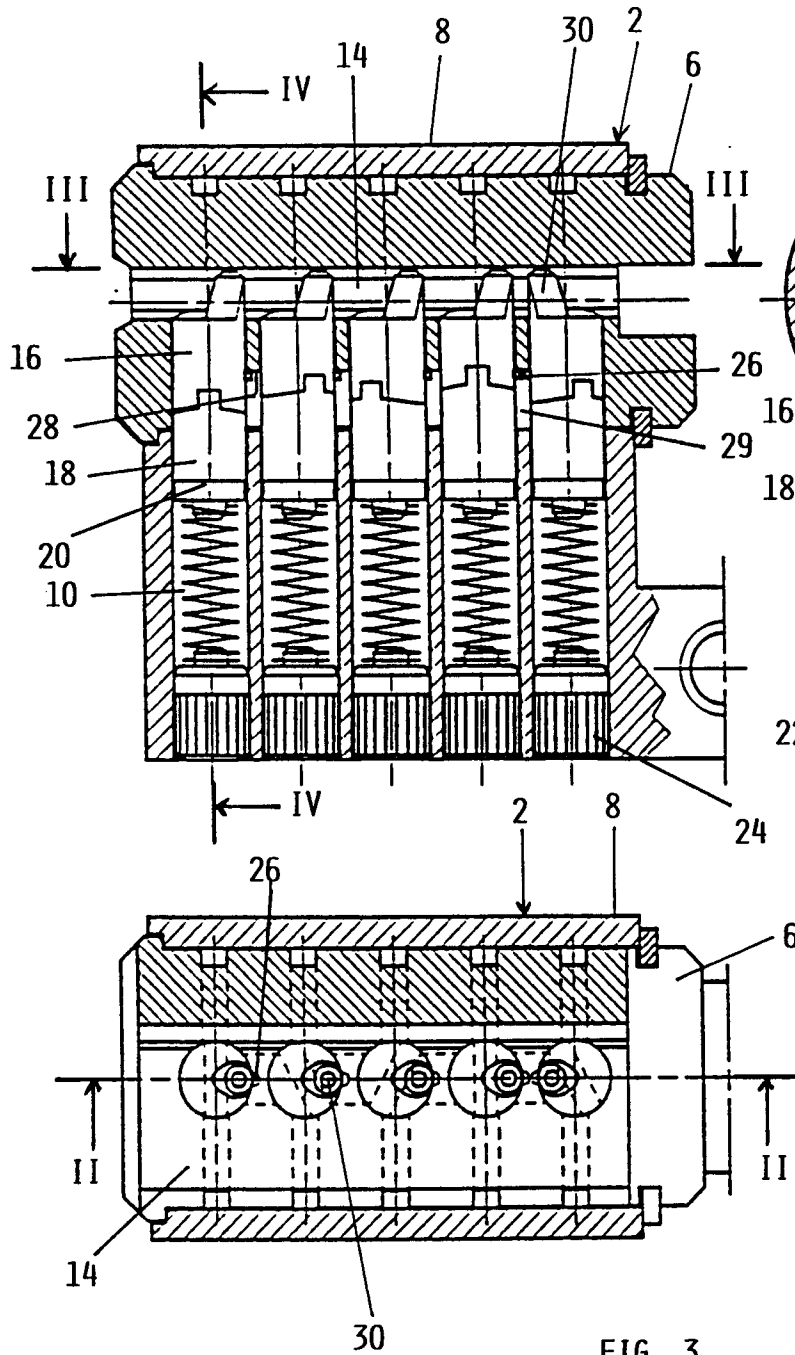


FIG. 4

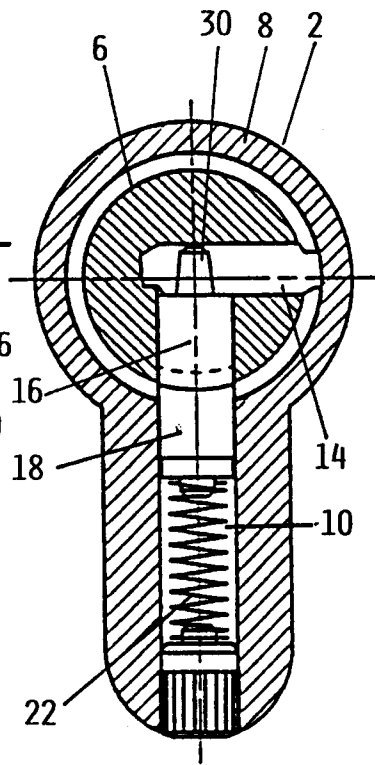
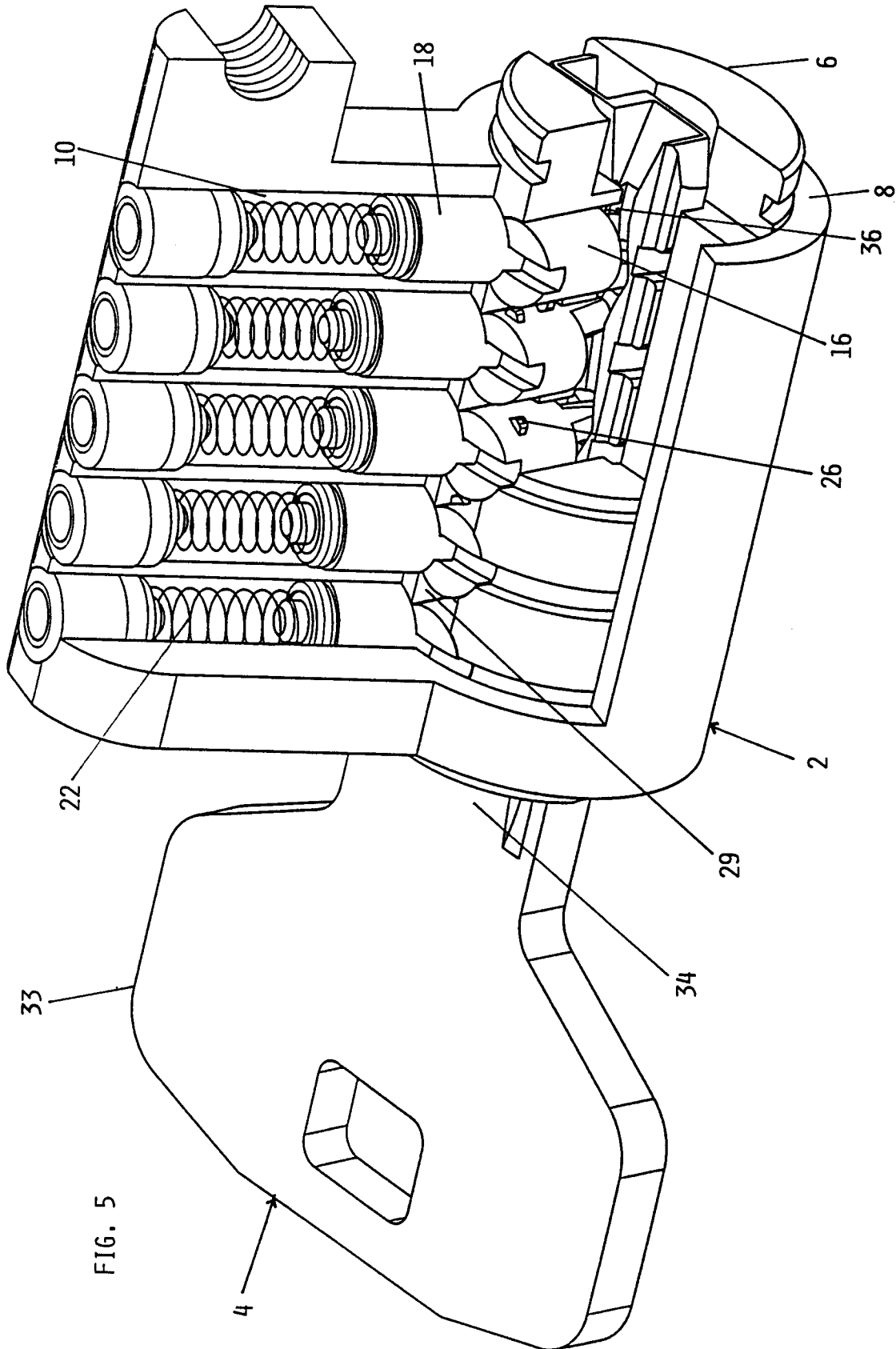


FIG. 3



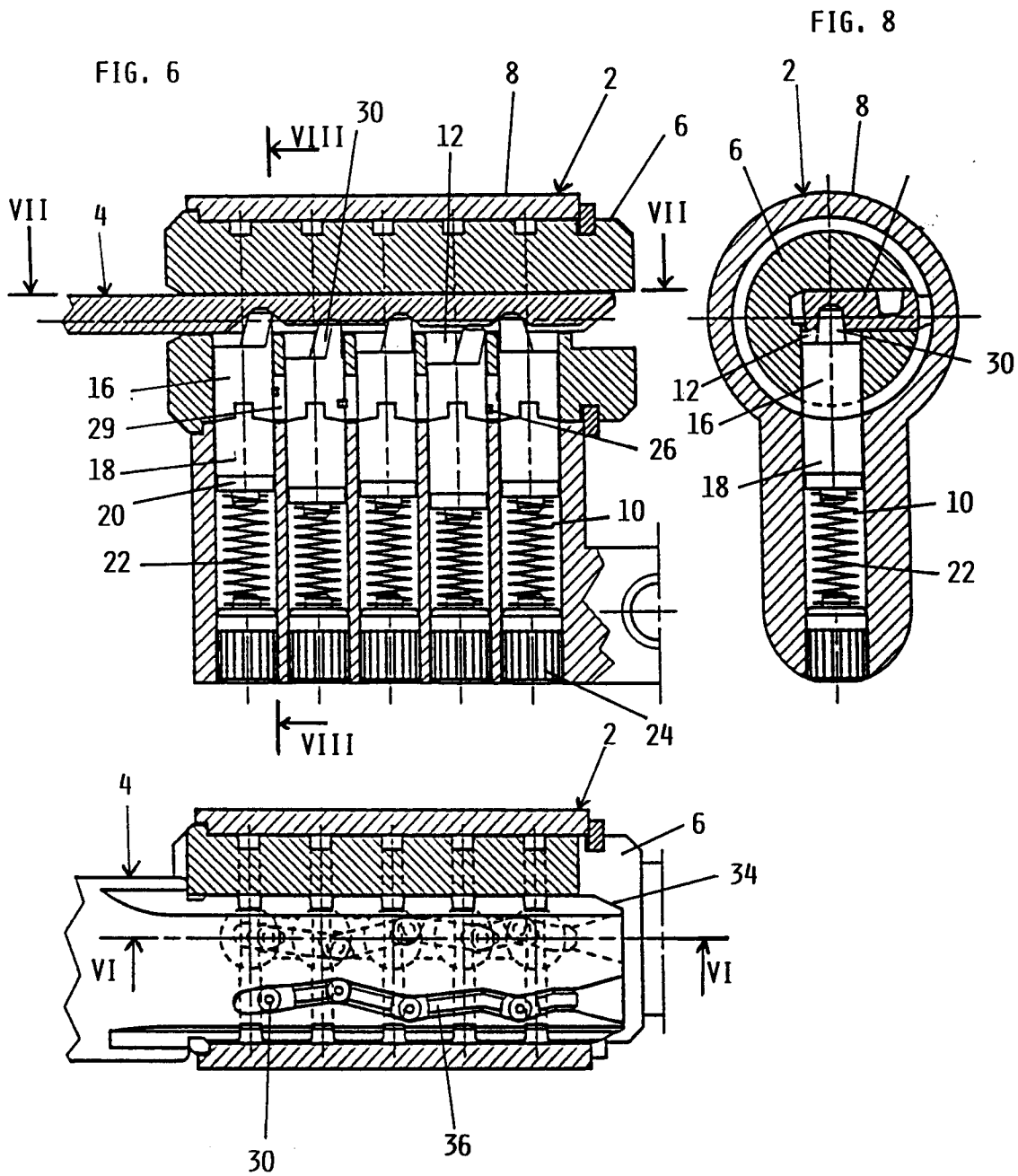


FIG. 7

FIG. 9

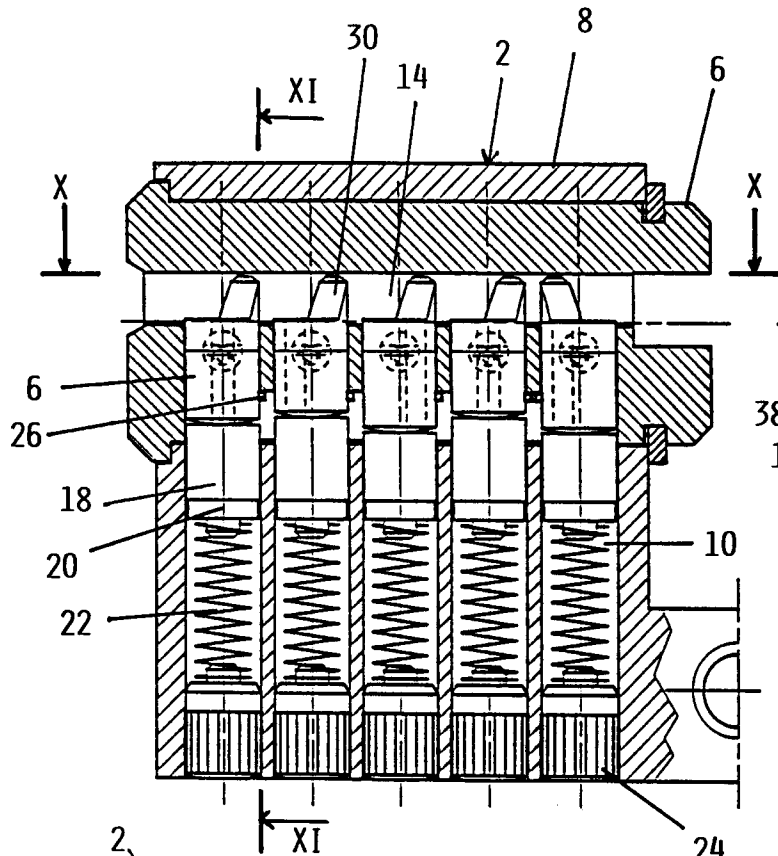


FIG. 11

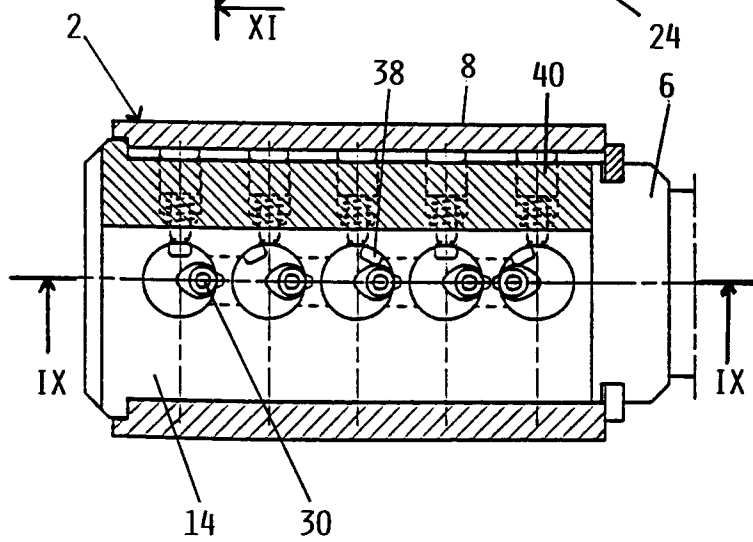
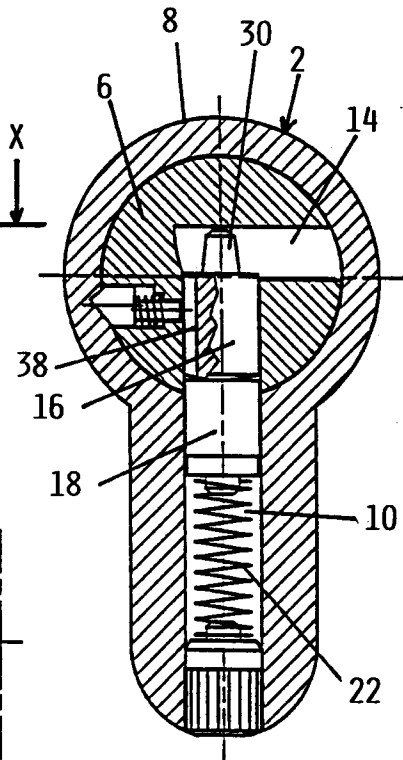


FIG. 10

Application Number
EP 95 11 9473