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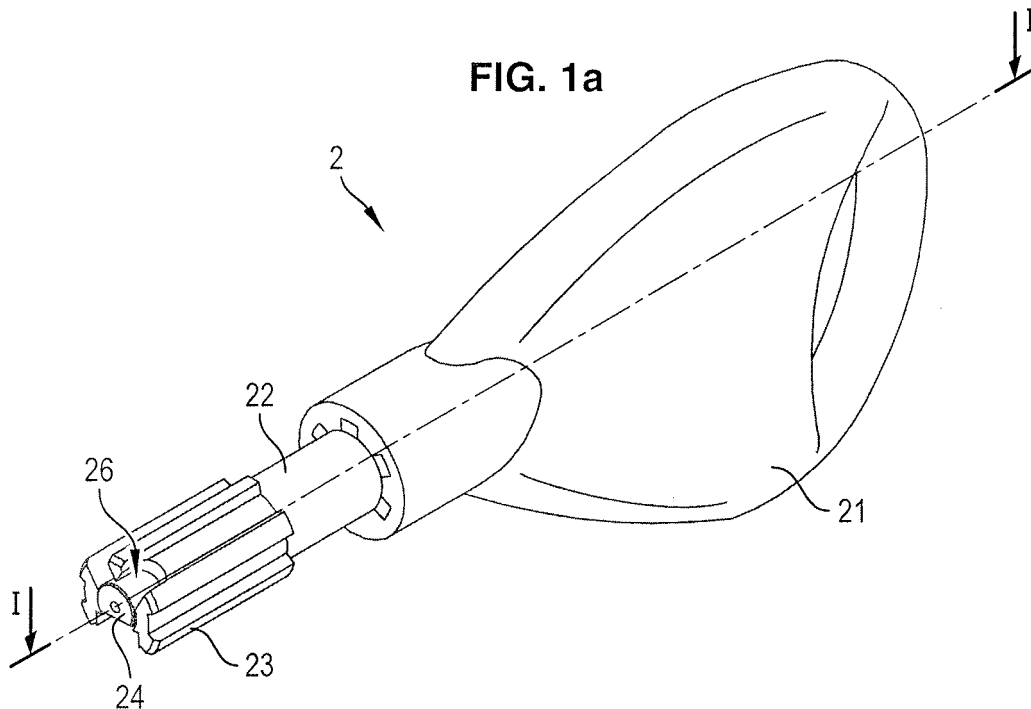
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(54) **Key for pump cylinder**

(57) A cylinder key (2) of the type comprising:  
- a tubular insert (22) and  
- a manoeuvring head (21),  
**characterised in that** the tubular insert (22) comprises at least one inner groove (26) terminating at the tubular

insert (22) free end, this groove being capable of being housed adjustably on at least one complementary projection of the sliding pushing button (14a) of the cylinder (1), which is driven only after adjusted engagement of the groove(s) on the complementary projection(s).



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## Description

### General field of the invention

[0001] The invention relates to a cylinder key of the type having a tubular insert and mobile piston.

[0002] It also relates to a cylinder associated with such a key, as well as a key/cylinder assembly.

### Prior art

[0003] Locks having tubular insert and mobile piston have been known for a long time.

[0004] A cylinder key of this kind is described for example in FR 2,604,206. This key comprises especially a tubular insert, which is open at its insertion end, and which contains a mobile piston stressed by a spring. During insertion of the key into the cylinder, this piston has its course limited by a stop in the key receptacle of the cylinder and is pushed back up to a retraction shoulder of the insert, such that the insert necessarily lies in a determined position inside the key receptacle. Also, the insert is fitted with projections intended to control locking and unlocking of the mobile locking bodies of the cylinder stator.

### Presentation of the invention

[0005] The aim of the invention is to provide a key having a tubular insert and mobile piston, as well as a cylinder, which have additional coding possibilities.

[0006] Another aim of the invention is to provide a key and a cylinder which limit a little more lock-picking possibilities.

[0007] Yet another aim of the invention is to provide a key and a cylinder which are reasonable to machine and assemble.

[0008] In these aims, according to the invention a cylinder key is provided, of the type comprising:

- a tubular insert and
- a manoeuvring head,

the tubular insert having at least one projection for controlling unlocking or locking of at least one locking element of a cylinder,

a mobile piston mounted on spring means extending inside the insert and being intended to be translated in a direction opposite the direction of insertion of the key into the cylinder, by a complementary projection of a sliding pushing button slidingly mounted in a cylinder key receptacle,

**characterised in that** the tubular insert comprises at least one inner groove terminating at the tubular insert free end, this groove being capable of engaging at least one complementary projection of the sliding pushing button of the cylinder, which is driven only after the additional projection is engaged into the groove.

[0009] Thus, the cooperation means enable the possibility of additional coding by making determination of the effective length of the key less obvious.

[0010] Another advantage offered by such a key is the possibility of increasing the number of combinations of coding means to ensure security of the cylinder-key mechanism while avoiding rendering the machining and assembly of the pieces more complex,

[0011] Other optional and non-limiting features of the key are:

- a groove has a determined longitudinal dimension such that the free end of the insert is stopped against a surface out of the projection of the sliding pushing button, and causes displacement of the sliding pushing button in the direction of insertion, said groove adjusting the insertion length of the key;
- the insert comprises more than one groove and the grooves have different longitudinal dimensions;
- a groove passes through the entire tubular thickness of the insert, defining a slotted recess at the free end of the insert;
- the insert comprises at its end two adjustment grooves of the length of insertion of the key;
- the mobile piston comprises a radial protrusion guided in an axial slot made in the insert and intended to actuate a secondary locking piston mounted to radially slide between the longitudinal rotor and the longitudinal stator.

[0012] Another advantage is that it is more difficult to lock-pick the cylinder, especially because of unusual coding means.

[0013] The invention also provides a cylinder comprising:

- a tubular cylindrical longitudinal stator comprising:
  - an inlet opening; and
  - a housing;
- a longitudinal rotating rotor adapted to control at least one locking tumbler and comprising:
  - a key receptacle;
  - a sliding pushing button mounted to slide in the key receptacle and comprising a first projection;
  - at least one mobile locking element projecting at least partially into the key receptacle and able to be stopped against the longitudinal stator;

the longitudinal rotor being lodged in the housing, the key receptacle and the inlet opening being arranged to enable insertion of a key insert of a key according to the invention,

**characterised in that** the sliding pushing button comprises at least one second projection at its end

facing the inlet opening and capable of engaging with a complementary inner groove of the key insert, the sliding pushing button being actuated only after the second projection engages in the inner groove of the insert.

**[0014]** In this way, the sliding pushing button enables the possibility of additional coding by making determination of the effective length of the key less obvious.

**[0015]** Other optional and non-limiting characteristics of the cylinder are:

- the second projection has a longitudinal dimension determined such that a surface not on the projection of the sliding pushing button is stopped against the free end of the key insert, causing displacement of the sliding pushing button in the direction of insertion, thus adjusting the length of insertion of the key;
- the sliding pushing button comprises more than one second projection and the second projections have different longitudinal dimensions;
- the first and second projections of the sliding pushing button form one single projection;
- the single projection formed by the first and second projections has a Y-shaped cross-section;
- an anti-picking pump is provided in the cylinder, the anti-picking pump is interposed between the longitudinal stator and the longitudinal rotor, arranged behind the sliding pushing button so as not to be accessible by a hook inserted into the key receptacle, and actuated by the sliding pushing button when the sliding pushing button is translating, a spring biasing the anti-picking pump into its initial position;
- the cylinder further comprises a secondary locking piston mounted to radially slide between the longitudinal rotor and the longitudinal stator, and capable of being actuated by a radial protrusion of a mobile piston sliding in the tubular insert of a key.

**[0016]** The advantages provided by the features of the cylinder are also advantages provided by the characteristics of the lock and inversely, since the key and the cylinder cooperate to allow secure locking and unlocking.

**[0017]** Finally, the invention provides a locking assembly comprising a key and a cylinder such as described above.

Presentation of figures

**[0018]** Other aims, characteristics and advantages will become apparent from the following detailed description in reference to the illustrative and non-limiting drawings, in which:

- Figure 1a schematically illustrates a key according to the invention;
- Figure 1b schematically illustrates a key according to the invention with an insert viewed in section and

with a manoeuvring head partially in section;

- Figure 2 illustrates an exploded view of a key and a cylinder according to the invention;
- Figures 2a and 2b illustrate details of the exploded view;
- Figures 3 to 8 schematically illustrate, and in different insertion phases, a key inserted into a cylinder according to the invention.

#### 10 Detailed description

##### Locking assembly

15 **[0019]** A locking assembly comprising a key 2 and a cylinder 1 is described below in reference to Figures 1a, 1b, 2, 2a, 2b and 3.

##### Key (Figures 1a, 1b and 2, 2a)

20 **[0020]** The key 2 comprises:

- a manoeuvring head 21 for manoeuvring the key 2, and
- a tubular insert 22 comprising a free end opposite the manoeuvring head 21.

**[0021]** The tubular insert 22 can be cylindrical in shape and extend along an axis I-I such as shown in Figure 1.

30 **[0022]** The tubular insert 22 is provided with one or more projections 23 for controlling locking elements 15a of the cylinder into unlocking and locking, as further described in detail below. These projections 23 extend axially and radially over a certain length of the tubular insert 22 and are distributed over a periphery of the tubular insert 22.

35 **[0023]** The inner housing of the tubular insert 22 houses a piston 24 which is mobile in translation in said insert 22 and which is supported against a spring 25 arranged in the bottom of the inner housing of the tubular insert 22, this spring 25 exerting axial effort against this piston 24 tending to push it back towards the free end of the tubular insert 22.

40 **[0024]** At its free end, the tubular insert 22 comprises one or more inner grooves 26 of determined position(s), form(s) and dimension(s) (see Figure 2a). Such a groove 26 extends along the tubular insert 22 parallel to the axis I-I of the tubular insert 22 and terminates at the free end of the tubular insert 22. The groove 26 passes through for example the entire tubular thickness of the tubular insert 22 defining a slotted recess at the free end.

45 **[0025]** In case where the end of the tubular insert 22 comprises more than one groove 26 (two in the example of the figures), these grooves 26 can have different longitudinal dimensions relative to the tubular insert 22.

50 **[0026]** The mobile piston 24 can also comprise a protrusion 27 which extends radially relative to said piston and which is guided in a longitudinal slot 28 provided in the tubular insert 22, in projecting out of the tubular insert

22. This protrusion 27, intended to cooperate with locking means of the cylinder, has a form defining:

- on the one hand, a stop at its end opposite the free end of the insert 22, this stop being intended to contact the back of the slot 28 when the piston 24 is pushed back into the inner housing of the tubular insert 22;
- on the other hand, on the other side of said protrusion 27, a ramp inclined relative to the axis of the piston 24.

**[0027]** The cylinder 1 with which the key 2 cooperates is described below.

Cylinder (Figures 2, 2b, 3)

**[0028]** The cylinder 1 comprises a tubular cylindrical longitudinal stator 10 comprising:

- an inlet opening 12; and
- a housing 10'.

**[0029]** The cylinder 1 also comprises a longitudinal rotating rotor 11 adapted to control at least one locking tumbler of a door, a window, a vault or the like.

**[0030]** This longitudinal rotor 11 comprises in particular:

- a key receptacle 13;
- a sliding pushing button 14a slidably mounted in the key receptacle 13 and comprising a first projection 14c; and
- mobile locking elements 15a projecting at least partially in the key receptacle 13 and able to contact the longitudinal stator 10 optionally via followers 18, these locking elements 15a being controlled into unlocking or locking by the projections 23 with which the tubular insert 22 of the key 2 is provided.

**[0031]** The longitudinal rotor 11 is housed in the housing 10'. The key receptacle 13 and the inlet opening 12 are arranged to enable insertion of the tubular insert 22 along the axis I-I.

**[0032]** The sliding pushing button 14a comprises at least one second radial projection 14c cooperating with an inner groove 26 terminating at the free end of the insert 22, the groove 26, such as the projection 14c having an angular position, a form and a size at least in width such that the groove 26 can receive the second projection 14c during introduction of the tubular insert 22 into the cylinder 1.

**[0033]** The longitudinal average plane of the second projection 14c can substantially pass through the axis of the sliding pushing button 14a.

**[0034]** As a variant, the first and second projections 14c of the sliding pushing button 14a form a single projection 14c.

**[0035]** This makes it easier to manufacture the sliding pushing button 14a while ensuring the robustness of the projection 14c.

5 **[0036]** The single projection 14c formed by the first and second projections 14c can have a Y-shaped cross-section.

**[0037]** A pump 17a anti-picking interposed between the longitudinal stator 10 and the longitudinal rotor 11, arranged behind the sliding pushing button 14a so as not to be accessible by a hook inserted in the key receptacle 13, and actuated by the latter in translation can be provided in the cylinder 1. A spring 17b biases the anti-picking pump 17a towards its initial position.

10 **[0038]** The anti-picking pump 17a ensures additional security to the cylinder-key mechanism.

**[0039]** A secondary locking piston 16a mounted to radially slide can be interposed between the longitudinal rotor 11 and the longitudinal stator 10. A spring 16b biases the piston 16a towards its interposition position.

20 **[0040]** The sliding pushing button 14a is connected to a driver 19 such that if it is displaced in translation, the driver 19 undergoes the same translation. Once this driver 19 is correctly positioned, it enables rotation of the rotor 11.

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Cooperation of the key 2 and of the cylinder 1 and operation (Figures 3 to 8)

Principles of cooperation

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**[0041]** Such a key structure whereof the tubular insert 22 has a groove 26 engaging a projection 14c of a sliding pushing button 14a of the cylinder 1 makes any possible lock-picking a little more complex, since it renders determination of the effective length of insertion of the tubular insert 22 less obvious.

35

**[0042]** In fact, due to the fact that the key 2 has a mobile piston 24 inside its tubular insert 22, and that the free end of its tubular insert 22 has at least one groove 26 which engages on the projection 14c of the sliding pushing button 14a during insertion of the key 2, three lengths of insertion of the insert 22 can be defined.

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**[0043]** A first length corresponds to the inserted length of the tubular insert 22 until the tubular insert 22 only contacts the sliding pushing button 14a.

45

**[0044]** A second length corresponds to the inserted length of the tubular insert 22 necessary for the sliding pushing button 14a to start being displaced in the same direction as the direction of insertion of the key 2.

50

**[0045]** The second length is the sum of the first length and of an additional length.

55

**[0046]** A third length corresponds to the inserted length of the tubular insert 22 necessary for the sliding pushing button 14a to sufficiently shift the driver 19 and correctly aligned the unlocking elements 15a relative to the followers 18 to free up rotation of the longitudinal rotor 11.

**[0047]** Consequently it is understood that to eventually succeed in lock-picking the cylinder 1, it is necessary to

determine the first length of insertion, the additional length of insertion and the third length of insertion at the same time.

**[0048]** The key 2 further enables several codings:

- the first is conferred by the projections 23 of the tubular insert 22 which cooperate with the mobile locking elements 15a of the cylinder 1 as known to the person skilled in the art and will not be described in further detail;
- the second corresponds to the first length of insertion of the key 2, which is a means known to the person skilled in the art and will not be described in further detail;
- the third corresponds to the additional length of the key 2, due to the inner mobile piston 24 cooperating with a contact surface 29 and/or the groove 26 cooperating with the second projection 14c;
- the fourth corresponds to the third length of insertion of the key 2.

**[0049]** In this way, cooperation between the tubular insert 22 of the key 2 and the sliding pushing button 14a makes it possible for additional coding. For the same model of key and cylinder, this increases the number of possible combinations and ensures the security of the cylinder-key mechanism.

**[0050]** In fact, there are several possibilities for getting the additional length. The additional length is obtained:

- either simply by contact between the end of the key 2 with a surface 14e not on the projection of the sliding pushing button 14a;
- or by contact between the second projection 14c of the sliding pushing button 14a in the groove 26;
- or by contact between the mobile piston 24 with the stop surface 29;
- or any combination of the three possibilities above.

**[0051]** The widths of the groove 26 and of the second projection 14c must therefore correspond, that is, they must be dimensioned so as to engage in each other.

**[0052]** Also, the protrusion 27 constitutes other coding means of the cylinder-key mechanism.

**[0053]** To allow the protrusion 27 to exert sufficient force to move the secondary locking piston 16a, either the spring 25 acting on the mobile piston 24 (and therefore on the protrusion 27) applies a stress force greater than the force exerted by the spring 16b acting on the locking piston 16a; or a stop surface 29 is provided inside the insert to prevent the mobile piston 24 from being displaced more than necessary in the direction opposite the direction of insertion of the key 2 by the secondary locking piston 16a via its protrusion 27.

#### Functioning of the cylinder-key mechanism

**[0054]** In reference to Figures 3 to 8, different locking

phases of a cylinder-key mechanism of the type which has just been described will now be described.

**[0055]** Figure 3 shows the cylinder 1 prior to introduction of the tubular insert 22. In this configuration, the initial mobile locking elements 15a, shown here in the form of pumps for the sake of illustration, contact for example tangentially, the longitudinal stator 10 via the follower 18 fixed to the longitudinal stator 10.

**[0056]** In this configuration, a secondary locking piston 16a mounted to radially slide is interposed between the longitudinal rotor 11 and the longitudinal stator 10 and an anti-picking pump 17a is interposed between the longitudinal rotor 11 and the longitudinal stator 10, here via the follower 18.

**[0057]** Figure 4 corresponds to insertion of the lock 2 via the inlet opening 12 in the key receptacle 13, until the mobile piston 24 contacts with the sliding pushing button 14a, that is, the key has been introduced up to the first length of insertion.

**[0058]** From this configuration, if the key 2 is introduced further inside the key receptacle 13, the sliding pushing button 14a moves the mobile piston 24 in the direction opposite the direction of insertion of the key 2. At the same time (or just after) as the sliding pushing button 14a starts to move the mobile piston 24, the second projection 14c of the sliding pushing button 14a is inserted in the groove 26.

**[0059]** Figure 5 corresponds to the configuration in which the key has been introduced up to the additional length. Either the mobile piston 24 comes into contact with the stop surface 29 provided inside the insert 22, or the second projection 14c engages the groove 26, or the end of the tubular insert 22 comes into contact with a surface 14e not in the projection of the sliding pushing button 14a.

**[0060]** From here, if the key 2 is further introduced inside the key receptacle 13, the tubular insert 22 translates the sliding pushing button 14a in the same direction as the direction of insertion of the key 2 into the cylinder 1. The sliding pushing button 14a, in its displacement, axially drives a driver 19 to free up rotation of the longitudinal rotor 11 as known to the person skilled in the art.

**[0061]** Figure 6 illustrates the moment when the radial protrusion 27 of the mobile piston 24 contacts the secondary locking piston 16a mounted to radially slide between the longitudinal rotor 11 and the longitudinal stator 10 of the cylinder 1. The protrusion 27 comprises a surface adapted to allow the secondary locking piston 16a to slide under the protrusion 27. For example and as illustrated in Figure 6, the protrusion 27 has a ramp inclined relative to the axis of the piston, the ramp then exerts pressure on the secondary locking piston 16a, shifting it radially to the axis I-I, when the key 2 is further introduced into the key receptacle 13.

**[0062]** Figure 7 corresponds to the moment when the sliding pushing button 14a contacts the anti-picking pump 17a, via a surface 14d opposite the projections 14c. When the key 2 is further introduced, the sliding pushing

button 14a drives the anti-picking pump 17a in translation.

**[0063]** Meanwhile, the locking elements 15a have been positioned by the projections 23 of the tubular insert 22 of the key 2 so as to free up rotation of the longitudinal rotor 11, that is, so as to no longer be interposed between the longitudinal rotor 11 and the longitudinal stator 10 where the followers 18 is.

**[0064]** All the phases described by Figures 4 to 7 can be in a different order, depending on the conception of the cylinder 1 and of the key 2. Irrespective of the selected order, the general operation of the cylinder-key mechanism remains the same.

**[0065]** When the locking elements 15a, the secondary locking piston 16a and the anti-picking pump 17a are no longer interposed between the longitudinal rotor 11 and the longitudinal stator 10, and when the driver 19 is correctly positioned, in other words the key 2 has been inserted by the third length of insertion, rotation of the longitudinal rotor 11 is freed and the key 2 can be turned as illustrated in Figure 8 by the arrow, allowing locking or unlocking of the cylinder 1.

**[0066]** When the key 2 is being pulled out of the key receptacle 13, the locking elements 15a, the locking piston 16a, the anti-picking pump 17a and the sliding pushing button 14a are biased towards their initial position, that is, those of the initial configuration (see Figure 3), by the springs, respectively 15b, 16b, 17b, and 14b.

## Claims

### 1. A cylinder key (2) of the type comprising:

- a tubular insert (22) and
- a manoeuvring head (21),

the tubular insert (22) having at least one projection (23) for controlling unlocking or locking of at least one locking elements (15a) of a cylinder (1), a mobile piston (24) mounted on spring means extending inside the insert (22) and to be translated in a direction opposite the direction of insertion of the key into the cylinder, by a complementary projection (14c) of a sliding pushing button (14a) slidingly mounted in a key receptacle (13) of the cylinder, **characterised in that** the tubular insert (22) comprises at least one inner groove (26) terminating at the tubular insert (22) free end, this groove being capable of engaging at least one complementary projection of the sliding pushing button (14a) of the cylinder (1) which is driven only after reception of the complementary projection (14c) into the groove (26).

### 2. The key (2) as claimed in Claim 1, in which a groove (26) has a longitudinal dimension determined so that the free end of the tubular insert (22) contacts a surface (14e) not on the projection of the sliding pushing

button (14a), and induces displacement of the sliding pushing button (14a) in the direction of insertion, adjusting the length of insertion of the key (2).

### 3. The key (2) as claimed in Claim 2, in which the tubular insert (22) comprises more than one groove (26) and the grooves (26) have different longitudinal dimensions.

### 4. The key (2) as claimed in Claim 1, in which a groove (26) passes through the entire tubular thickness of the tubular insert (22), defining a slotted recess at the free end of the insert.

### 5. The key (2) as claimed in any one of Claims 2 to 4, in which the tubular insert (22) comprises at its end two adjustment grooves (26) of the length of insertion of the key.

### 6. The key (2) as claimed in any one of Claims 1 to 5, in which the mobile piston (24) comprises a radial protrusion (27) guided in an axial slot (28) made in the tubular insert (22) and intended to actuate a secondary locking piston (16a) mounted to slide radially between a longitudinal rotor (11) and a longitudinal stator (10) of the cylinder (1).

### 7. A cylinder (1) comprising:

- a tubular cylindrical longitudinal stator (10) comprising:

- an inlet opening (12); and
- a housing (10'); and

- a rotating longitudinal rotor (11) adapted to control at least one locking tumbler and comprising:

- a key receptacle (13);
- a sliding pushing button (14a) mounted to slide in the key receptacle and comprising a first projection;
- at least one mobile locking element (15a) projecting at least partially into the key receptacle (13) and able to radially contact against the longitudinal stator (10);

the longitudinal rotor (11) being housed inside the housing,

the key receptacle (13) and the inlet opening (12) being arranged so as to enable insertion of a tubular insert (22) of a key (2), as claimed in any one of Claims 1 to 6,

**characterised in that** the sliding pushing button (14a) comprises at least one second projection at the sliding pushing button end turned towards the inlet opening (12) and capable of housing into a complementary inner groove (26)

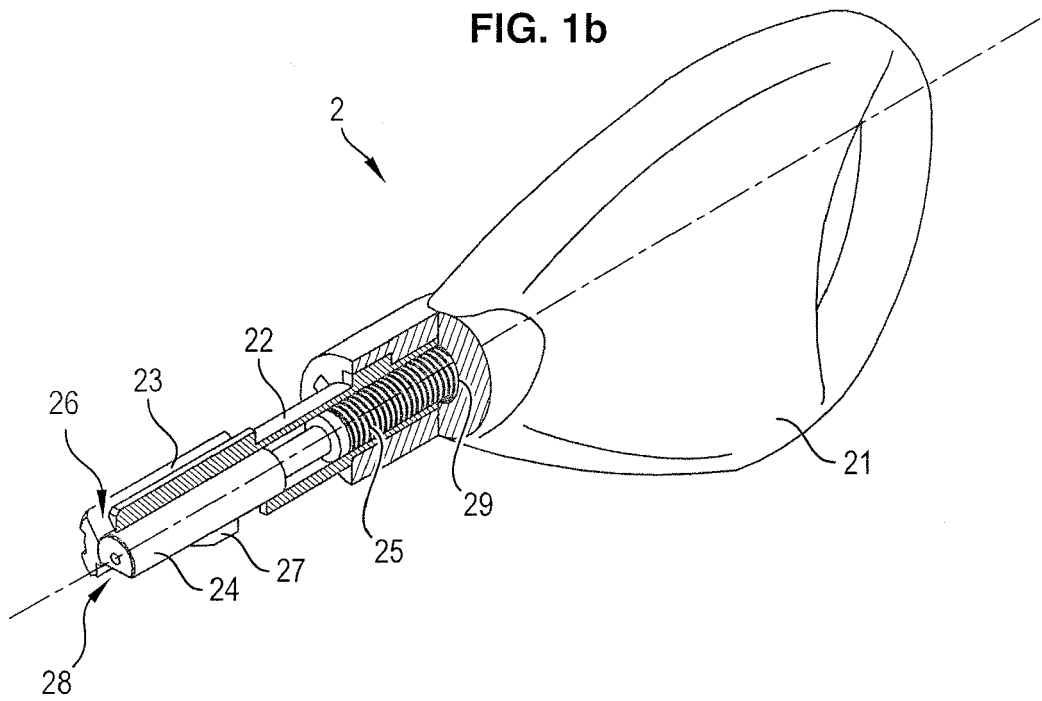
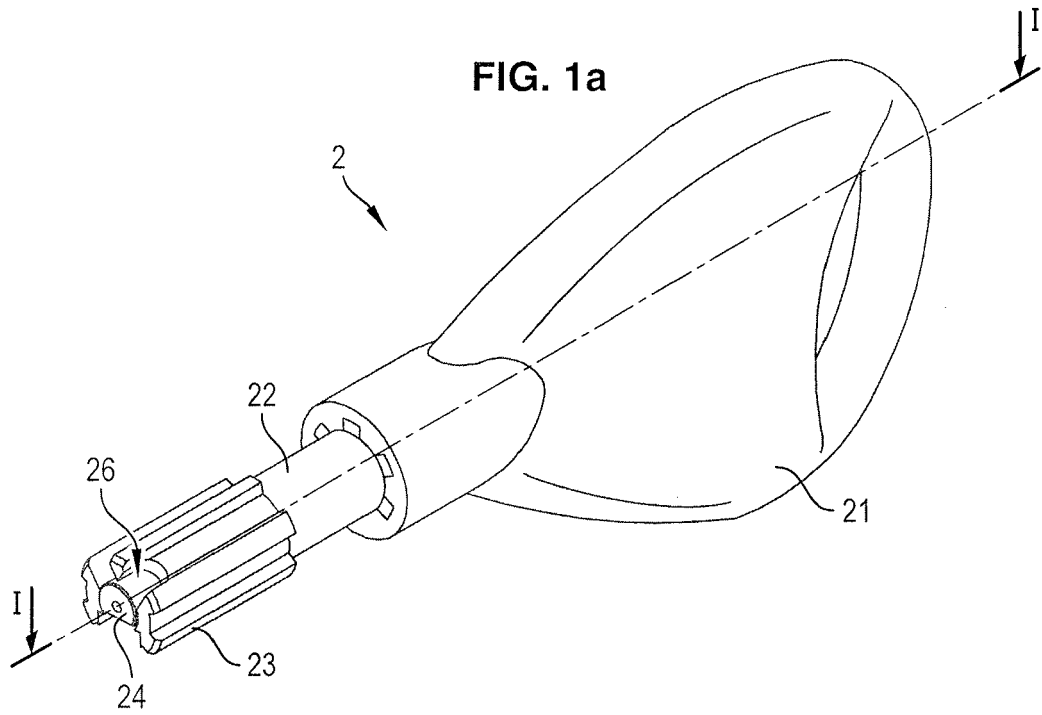
of a tubular insert (22) of a key (2); the sliding pushing button (14a) being driven only after the second projection is housed inside the inner groove (26) of the tubular insert (22).

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8. The cylinder (1) as claimed in Claim 7, in which the second projection (14c) has a longitudinal dimension determined to be housed in the groove (26) and so that a surface (14e) not on the projection of the sliding pushing button (14a) contacts the free end of the tubular insert (22), causing displacement of the sliding pushing button (14a) in the direction of insertion, adjusting the length of insertion of the key (2). 10
9. The cylinder (1) as claimed in Claim 7 or 8, in which the sliding pushing button (14a) comprises more than one second projection and the second projections have different longitudinal dimensions. 15
10. The cylinder (1) as claimed in Claim 7 or 8, in which the first and second projections of the sliding pushing button (14a) form a single projection (14c). 20
11. The cylinder (1) as claimed in Claim 10, in which a single projection (14c) formed by the first and second projections (14c) has a Y-shaped cross-section. 25
12. The cylinder (1) as claimed in any one of Claims 7 to 11, in which an anti-picking pump (17a) is interposed between the longitudinal stator (10) and the longitudinal rotor (11), arranged behind the sliding pushing button (14a) so as not to be accessible by a hook inserted in the key receptacle (13), and actuated by the sliding pushing button (14a) in translation, a spring (17b) biasing the anti-picking pump (17a) towards its initial position. 30 35
13. The cylinder (1) as claimed in any one of Claims 7 to 12, further comprising a secondary locking piston (16a) mounted to radially slide between the longitudinal rotor (11) and the longitudinal stator (10) for actuation by a radial protrusion (27) of a mobile piston (24) in the tubular insert (22) of a key (2). 40
14. A locking assembly comprising a key (2), as claimed in any one of Claims 1 to 6 and a cylinder (1) as claimed in any one of Claims 7 to 13. 45

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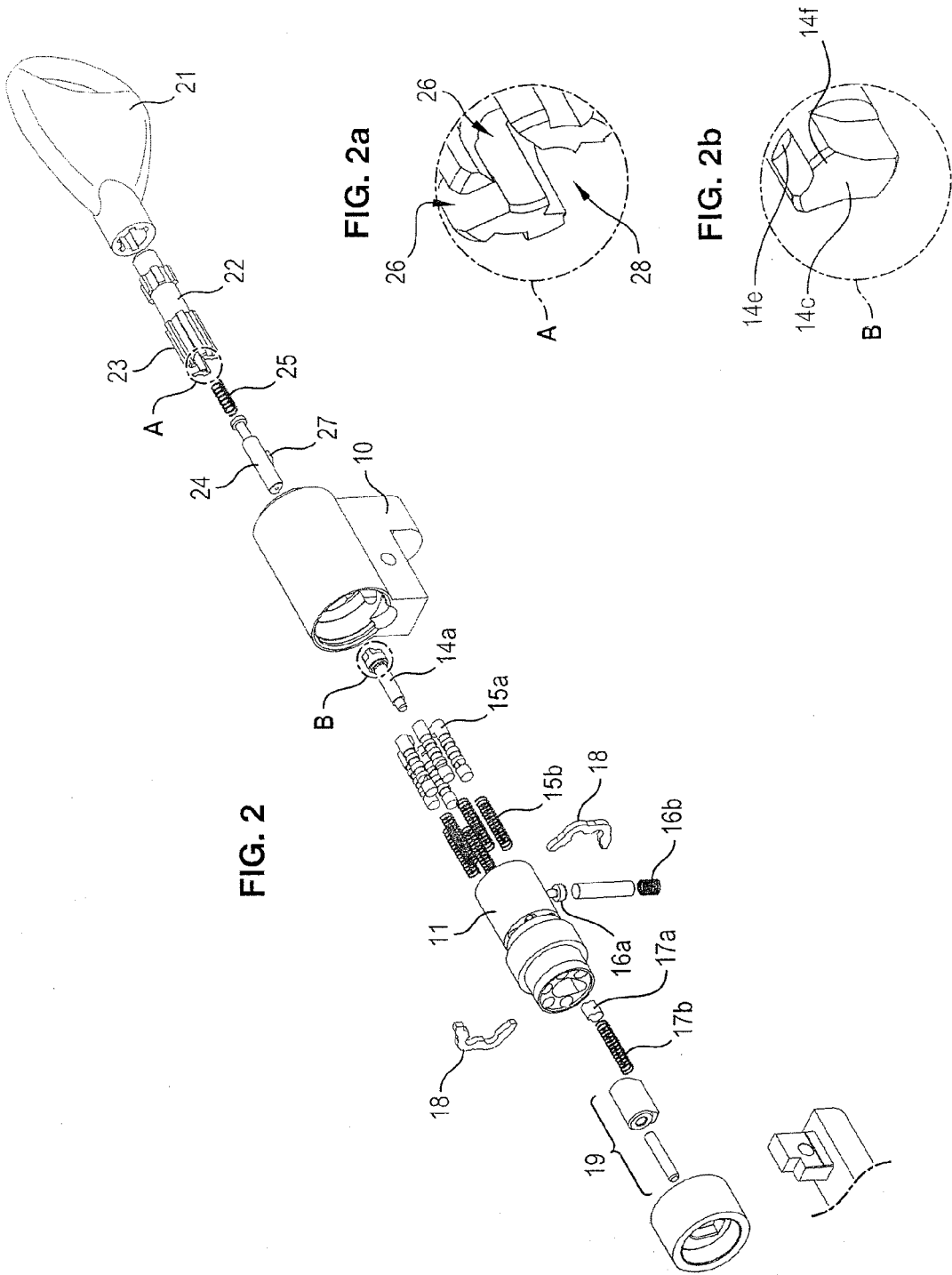


FIG. 3

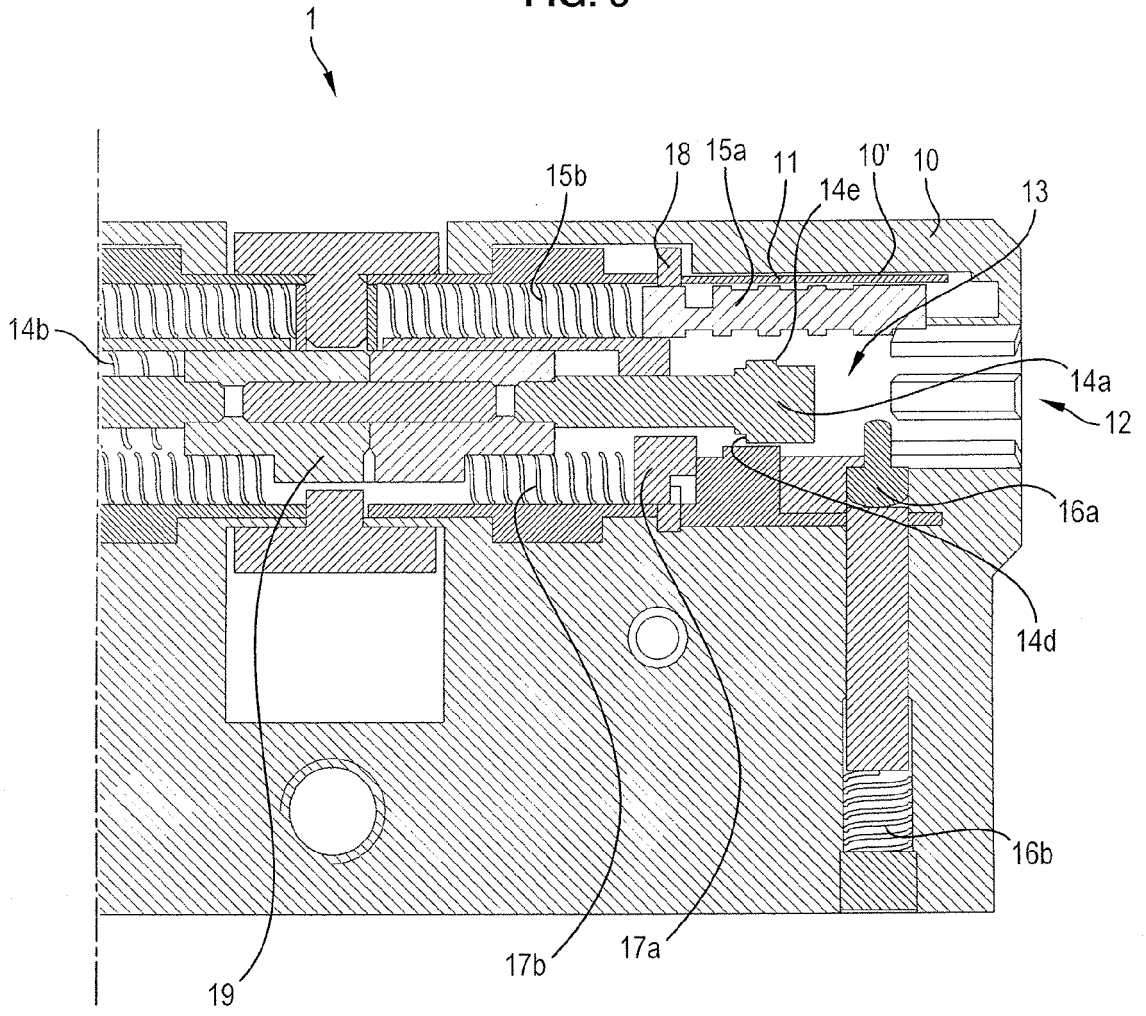


FIG. 4

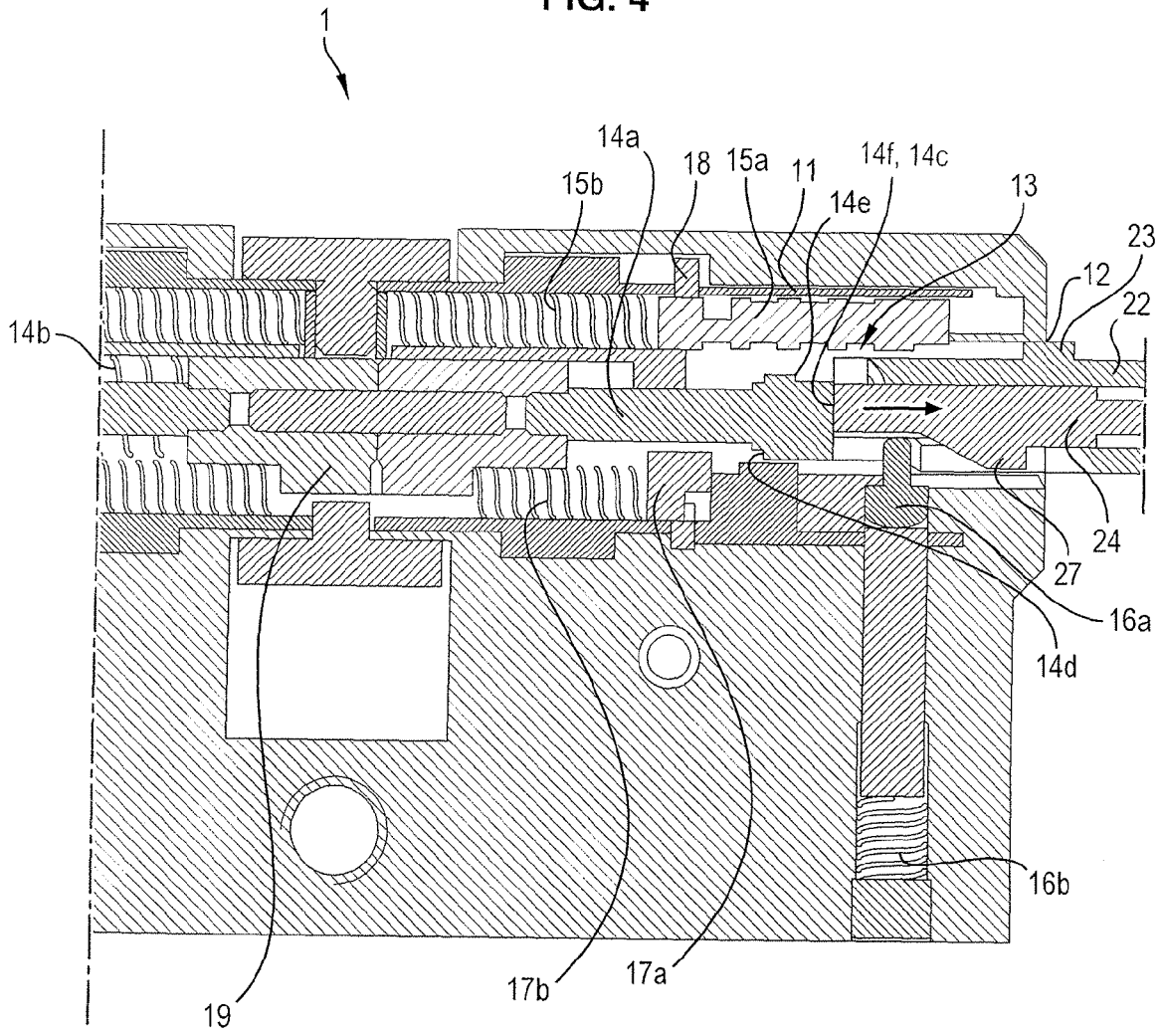


FIG. 5

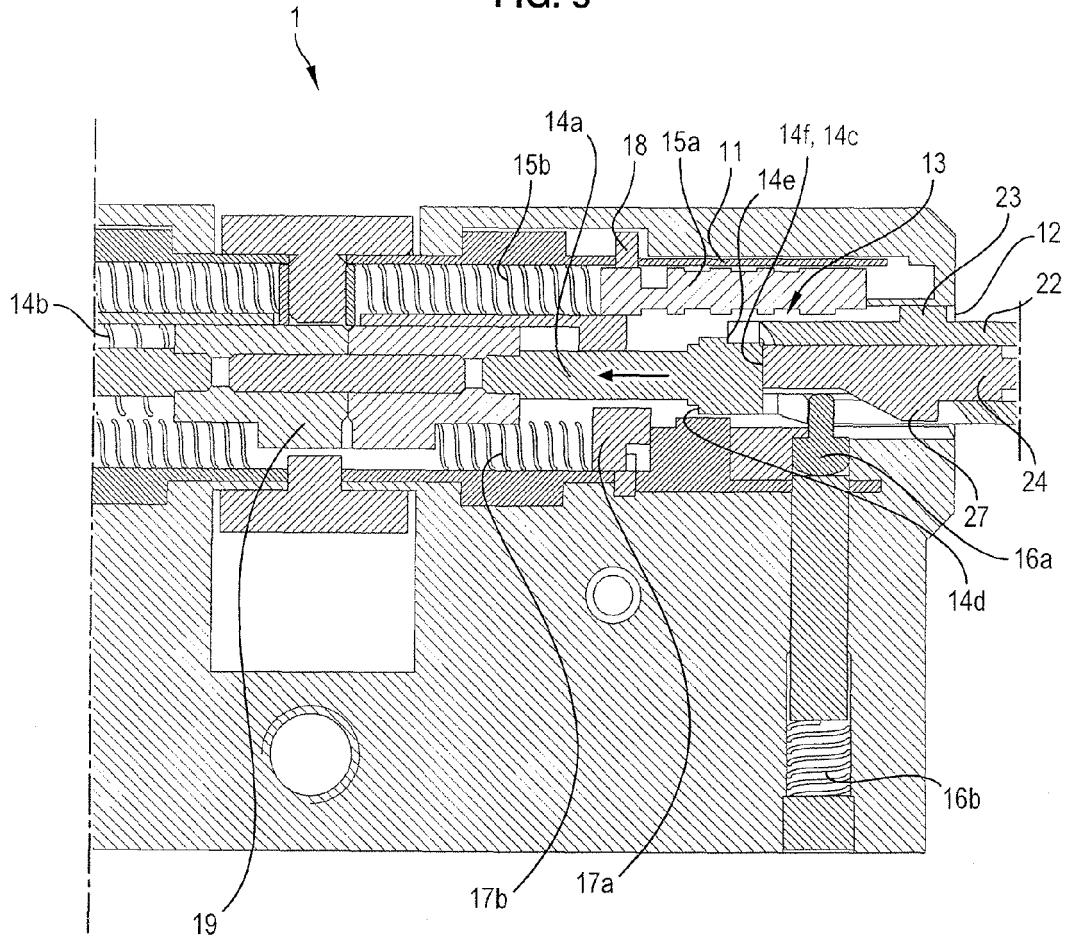


FIG. 6

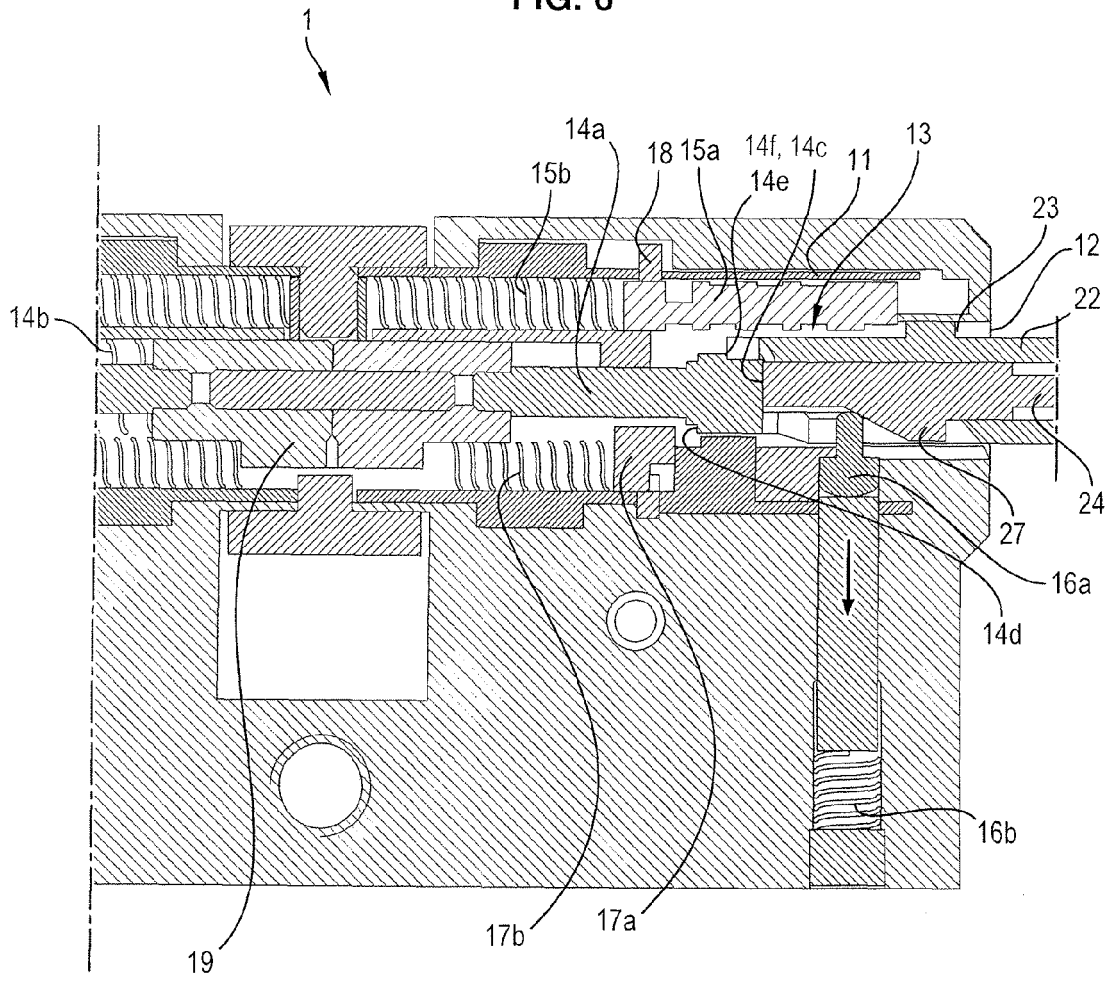


FIG. 7

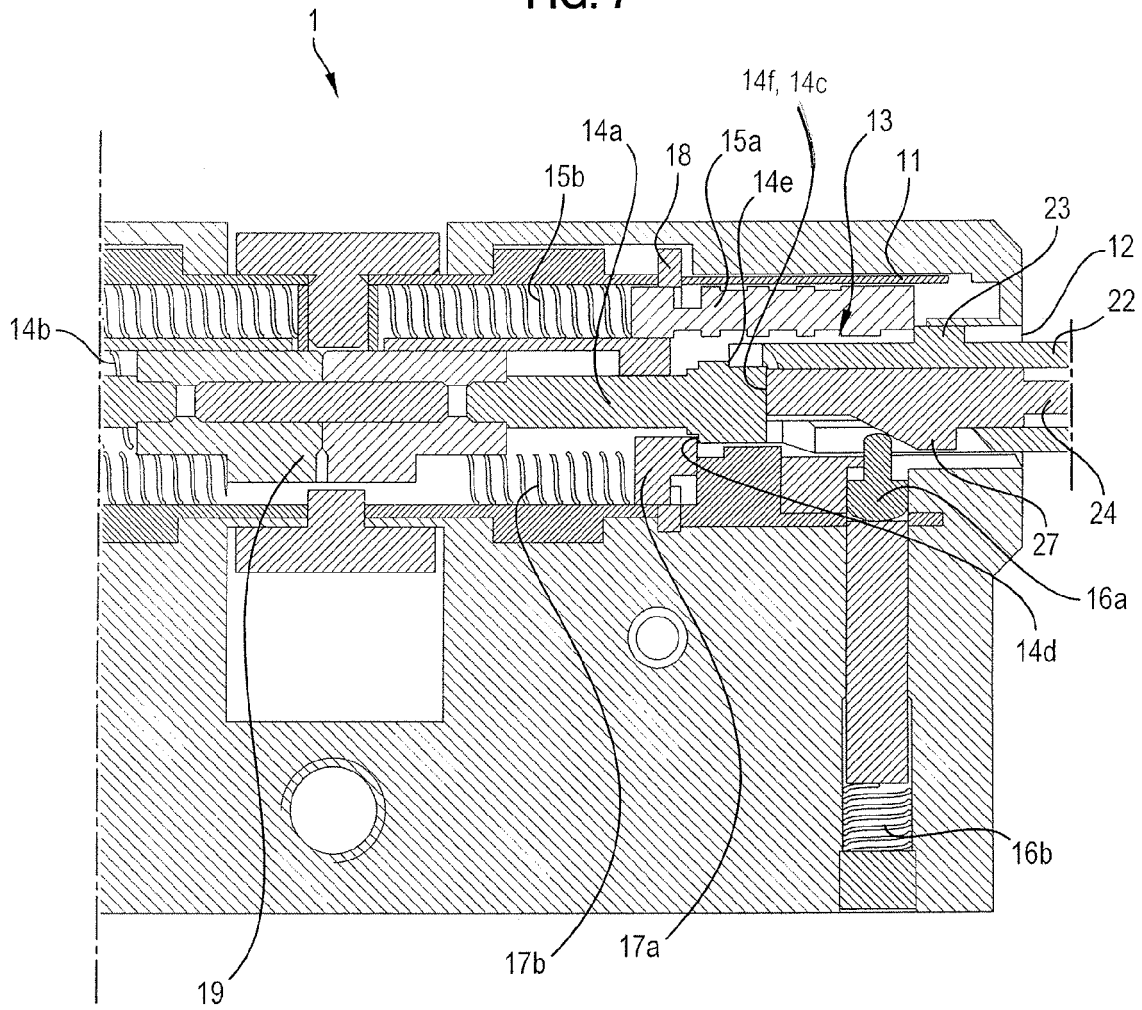
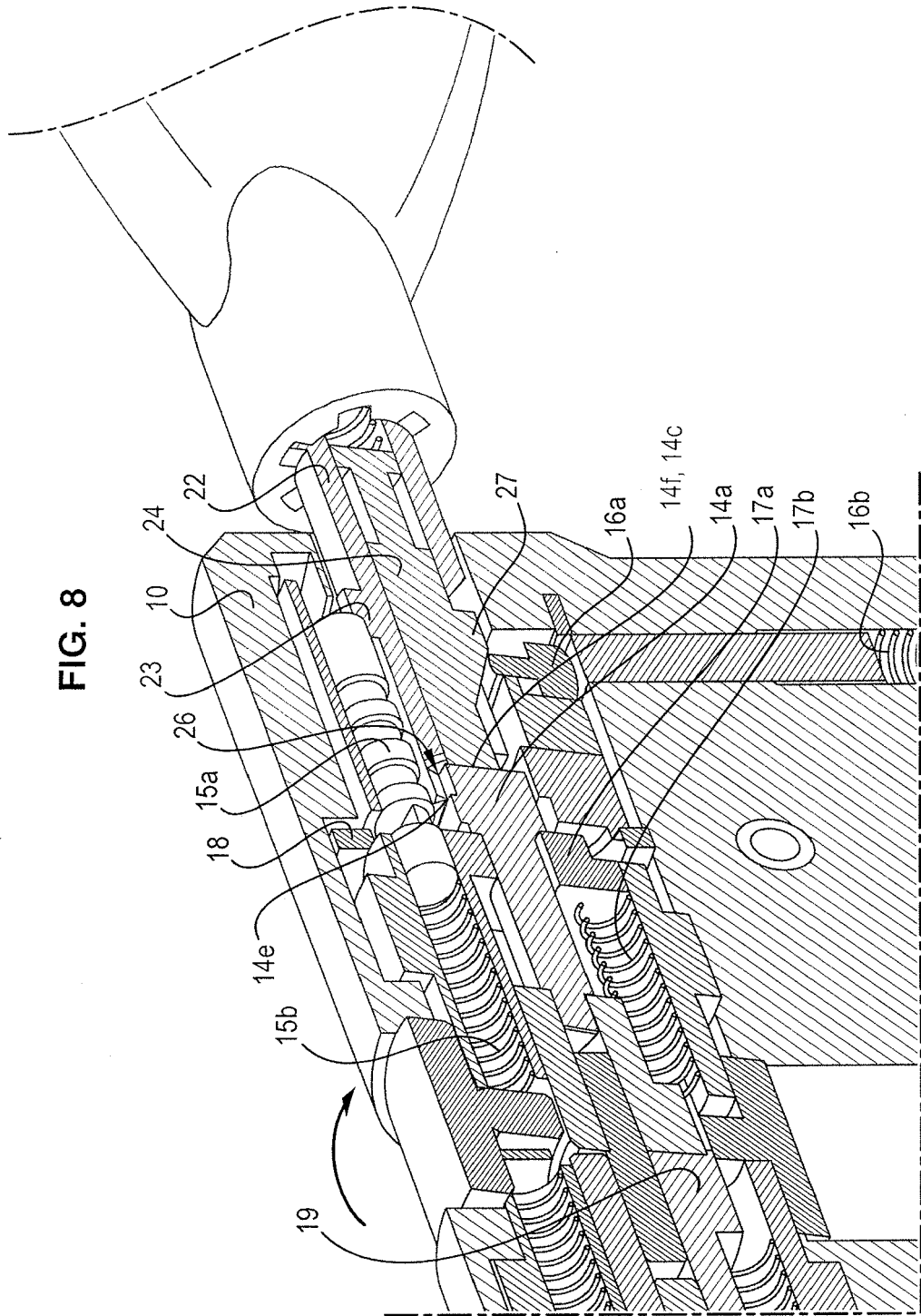


FIG. 8





EUROPEAN SEARCH REPORT

Application Number  
EP 10 15 7565

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search The Hague		Date of completion of the search 2 July 2010	Examiner Bitton, Alexandre
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