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(54) Cylinder lock with flat key provided with a seat for a movable element

(57) A cylinder lock with flat key (7) insertable in a plug which is supported so that it can rotate within a cylinder (2) and can be locked by means of tumbler pin assembly (12a) which, by inserting the key in the plug, is actuated into the position for rotating the plug, the key (7) having at least one movable element (30) which can move within a respective seat (31) which lies within the plane of the key and, in the key insertion position, cooperates with auxiliary tumbler pin assemblies (19,27); these are adapted to position the movable element so that the plug can rotate inside the cylinder; characterized in that in the key, at the seat, at least one hole (38) is provided through which a respective additional auxiliary tumbler pin assembly can engage a respective notch (37) of the movable element in order to assume a position which allows the rotation of the plug.

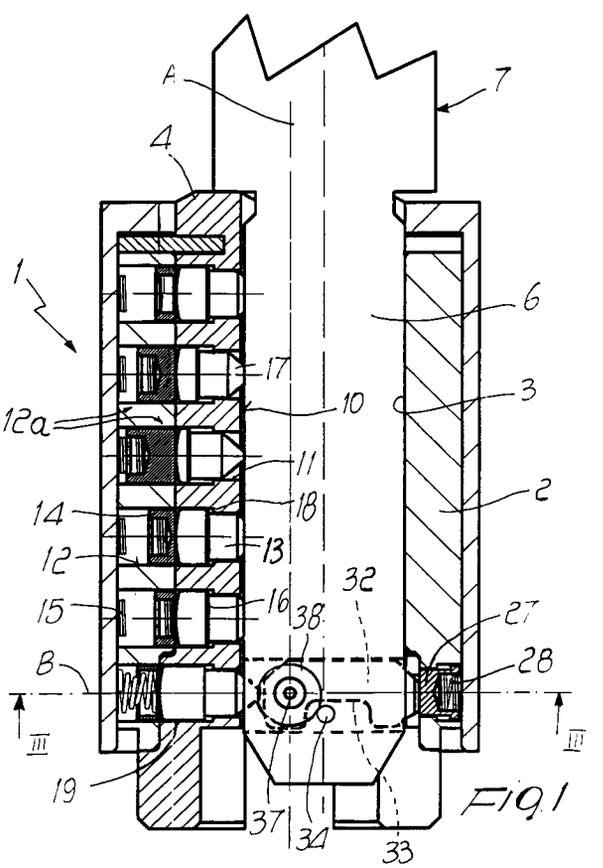

Fig.1

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Description

[0001] The present invention relates to a cylinder lock with flat key provided with a seat for a movable element.

[0002] Locks of the above-described type are known from US Patents Nos. 1,567,979, 1,735,868, 4,377,082, 4,667,495 and 5,170,651 and from French Patent No. 2,521,201.

[0003] Locks according to the above patents offer more coding possibilities but entail a greater constructive complexity of the key. In addition to difficulties in producing the seat for the movable element in the key, in order to allow perfect operation they require high precision in providing the dimensions of the stroke limits for the movable element.

[0004] Besides, this greater precision entails very narrow machining tolerances, with the consequence that the operating ranges are quickly abandoned due to wear and the operating conditions are no longer met.

[0005] The aim of the present invention is to provide a cylinder lock, with a corresponding key, overcoming the above drawbacks of the prior art.

[0006] An object of the present invention is to provide a cylinder lock with flat key provided with a movable element which allows a significant increase in the number of coding possibilities with respect to conventional locks of the same kind.

[0007] This aim and this object are achieved with a cylinder lock with flat key insertable in a plug which is supported so that it can rotate within a cylinder and can be locked by means of tumbler pin assemblies which, by inserting the key in the plug, are actuated into the position for rotating the plug, said key having at least one movable element which can move within a respective seat which lies within the plane of the key and, in the key insertion position, cooperates with auxiliary tumbler pin assemblies which are adapted to position said movable element so that said plug can rotate inside said cylinder; characterized in that in said key, at said seat, at least one hole is provided through which a respective additional auxiliary tumbler pin assembly can engage a respective notch of said movable element in order to assume a position which allows the rotation of said plug.

[0008] Further advantages and characteristics of the present invention will become apparent from the following detailed description of a preferred embodiment, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of the lock;
Figure 2 is a longitudinal sectional view, similar to Figure 1, but with key cutaway lines;
Figure 3 is a sectional view, taken along the transverse plane III-III of Figure 1.

[0009] In the description that follows, the reference numerals of the components are distributed in the three figures for the sake of clarity.

[0010] With reference to the above figures, the reference numeral 1 generally designates the lock. Said lock is composed, in a conventional manner, of a cylinder 2 in which a cylindrical cavity 3 is formed which accommodates the plug 4 so that it can rotate about the axis A.

[0011] The plug 4 is crossed by an axial slot 5 which lies on a diametrical plane D and constitutes the channel for the insertion of the profiled shank 6 of a key 7 for the actuation of the lock. The slot 5 has a substantially rectangular cross-section, with two larger faces 8 and 9 which are flat and parallel with respect to the plane D, are wider than the radius of the plug 4 and have slots and ridges which are complementary to the cross-section of the shank 6 of the key 7. The slot 5 is open longitudinally on one side at the peripheral region of the plug 4 and has a face 10 which lies opposite to said open side and is perpendicular to the plane D. Said face is referenced hereinafter as bottom face for the sake of convenience in description.

[0012] Two series of holes 11 and, respectively, 12 are formed in the plug 4 and in the cylinder 2 and are arranged along radial planes. The holes 11, 12 have the same diameter and are mutually equidistant, so that they are adapted to mutually align in an angular position of the plug 4 with respect to the cylinder 2. The holes 11 formed in the plug 4 are through holes and lead into the bottom face 10 of the slot 5, while the holes 12 are dead holes which are open toward the plug 4.

[0013] The holes 11 and 12 slidingly accommodate the tumbler pin assemblies of the lock 1. Each tumbler pin assembly is generally designated by the reference numeral 12a. In a conventional manner, when the key is not inserted the tumbler pin assemblies 12a lock the rotation of the plug 4, while when the key is inserted they are actuated into a radial position which allows to turn the plug 4.

[0014] Each tumbler pin assembly 12a is composed of an inner pin 13, which is guided in the respective hole 11 of the plug 4, and of an outer pin 14, which is guided in the respective hole 12 of the cylinder 2. A spring 15 is interposed between the outer pin 14 and the bottom of the respective hole 11 and actuates the outer pin 14 toward the axis A. The inner pin 13 has a narrower portion which forms a shoulder 16 and divides said inner pin into a portion having a greater diameter, which is externally rounded with a radius equal to the radius of the plug 4, and into a portion having a reduced diameter, ending with a frustum-shaped point 17. When the inner pin 13 is aligned with a respective outer pin 14 (in the position in which the key is extracted and the lock is accordingly locked), the spring 15 pushes the outer pin 14 and the inner pin 13 toward the axis A. The stop position of the pins is established by an annular abutment 18, against which the shoulder 16 of the inner pin 13 abuts. In this abutment position, the point 17 protrudes into the slot 5 through holes of the bottom 10 and the outer pin 14 intersects the connecting plane between the plug 4 and the cylinder 2, locking the rotation of the

plug 4.

[0015] An additional tumbler pin assembly is provided on the plane B of the last tumbler pin assembly, which is located furthest from the key insertion side and is designated by the reference numeral 19 for the sake of clarity. Said additional tumbler pin assembly has an axis C at right angles to the plane D and is generally designated by the reference numeral 20. As the preceding ones, the additional tumbler pin assembly 20 is composed of an inner pin 21, of an outer pin 22, and of a pusher spring 23. The holes 24, 25 for accommodating the inner pin 21 and the outer pin 22 are perpendicular to the holes 11 and, respectively, 12 and their axes pass through the rotation axis A of the plug 4.

[0016] A dead hole 26 is formed in the cylinder 2 and is diametrically aligned with the last tumbler pin assembly 19. An outer pin 27 is slidingly accommodated in the dead hole and is actuated by a spring 28 toward the axis A, so that when the key is not inserted, said outer pin can engage a hole 24 which is formed in the plug 4 and intersects the open side of the slot 5. The spring 28 has a lower elastic constant than the spring 15 of the tumbler pin assembly 19.

[0017] The tumbler pin assemblies 19, 20 and the outer pin 27, differently from the other tumbler pin assemblies 12a of the lock, are not actuated by coding the longitudinal edge of the shank 6 of the key 7 with which they make contact when the key is inserted, but by a movable element 30 which is fitted at the end of said key.

[0018] For this purpose, a seat 31 is formed in the end of the shank 6 of the key, passes through the key from one longitudinal edge to the other and lies within the thickness of the key at right angles to the axis A.

[0019] The seat 31 has a rectangular cross-section and when the key is inserted its opposite ends are aligned with the hole 26 of the outer pin 27 on one side and, respectively, with the hole 11 of the tumbler pin assembly 19 on the opposite side of the slot 8. The movable element 30 can slide within the seat 31 and is constituted by a plate 32 whose opposite ends are adapted to cooperate with the inner pin 13 of the tumbler pin assembly 19 and with the outer pin 27.

[0020] The length of the plate 32 is equal to the width of the shank 6, so that in a given transverse position said plate can be accommodated in the seat 31 without protruding from the longitudinal edges of the shank 6.

[0021] A recess 33 is formed along one edge of the plate 32, and a pin 34 driven into the shank 6 passes through said recess.

[0022] The opposite ends of the plate 32 have chamfers 35 and 36 at 45° and the stroke of the plate allowed by the recess 33 is such that it cannot protrude from the seat 31 by more than the extension of the chamfers at right angles to the axis A. In this manner, when the key 7 is inserted in the slot 5 the chamfers, by engaging the insertion edge of the slot, force the plate 32 to retract into the seat 31, allowing to insert the key 7 in the slot 5.

[0023] The plate 32 is provided with a circular notch 37 in which the inner pin 21 of the tumbler pin assembly 20 can engage through a hole 38 of the key formed at the seat 31.

[0024] The operation of the above-described lock is as follows.

[0025] When the key is not inserted, the outer pins 14 and 22 of the tumbler pin assemblies 12a, 19, 20 and the outer pin 27 protrude across the region that connects the plug 4 and the cylinder 2, preventing the rotation of the plug and the actuation of the lock.

[0026] In order to release the lock, the key 7 is inserted in the slot 5 until the plate 32 lies between the inner pin 13 of the tumbler pin assembly 19 and the outer pin 27. Since the spring 15 is stronger than the spring 28, the tumbler pin assembly 19, under the thrust of the spring 15, moves the plate 32 into a position which is determined by the abutment of the pin 34 against the edge of the recess 33 or of the outer pin 27 against the bottom of the hole 26. In this position, the outer pin 27 disengages from the hole 29, while the inner pin 13 of the tumbler pin assembly 19 is actuated into a position in which the plane of contact with the respective outer pin 14 lies on the plane that connects the plug 4 and the cylinder 2. At the same time, the movement of the plate 32 aligns the notch 37 with the hole 38 of the key, allowing the inner pin 21 of the tumbler pin assembly 20 to be actuated into a position in which the plane of contact between the outer pin 22 and the inner pin 21 lies on the plane that connects the plug 4 and the cylinder 2.

[0027] At this point, since the planes of contact between the inner pins and the outer pins of the tumbler pin assemblies 12a that engage the longitudinal edges of the shank 6 of the key 7 also lie on the plane that connects the plug 4 and the cylinder 2, it is possible to turn the plug and actuate the lock.

[0028] The above-described lock is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept. For example, it is possible to provide multiple tumbler pin assemblies of the type designated by the reference numeral 20, aligned along the axis A and actuated by the same movable element 30, which is conveniently constituted by a wider plate. By means of the same concept, it is possible to provide an additional tumbler pin assembly which is adapted to engage the opposite face of the plate 32 and is aligned with the tumbler pin assembly 20. It is also possible to provide an additional tumbler pin assembly which is suitable to engage the same face of the plate 32 and is laterally adjacent to the tumbler pin assembly 20.

[0029] The disclosures in Italian Patent Application No. BO97A000546 from which this application claims priority are incorporated herein by reference.

[0030] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of

increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A cylinder lock with flat key (7) insertable in a plug (4) which is supported so that it can rotate within a cylinder (2) and can be locked by means of a tumbler pin assembly (12a) which, by inserting the key in the plug (4), is actuated into the position for rotating the plug, said key (7) having at least one movable element (30) which can move within a respective seat (31) which lies within the plane of the key and, in the key insertion position, cooperates with an auxiliary tumbler pin assembly (19, 27) which is adapted to position said movable element (30) so that said plug (4) can rotate inside said cylinder (2); characterized in that at least on hole (38) is provided in said key (7), at said seat (31), a respective additional auxiliary tumbler pin assembly (20) engaging a respective notch (37) of said movable element (30) through said at least one hole (38), in order to assume a position which allows the rotation of said plug (4).

2. A cylinder lock, characterized in that said auxiliary tumbler pin assembly comprises two auxiliary tumbler pin assemblies (19, 27) which are actuated by differentiated springs (15, 28) and, in the position in which the key (7) is inserted, act on the opposite ends of said movable element (30), moving it into a stop position whereat said plug (4) can rotate inside said cylinder (2).

3. A lock according to claim 2, characterized in that one of said auxiliary tumbler pin assemblies is constituted by an outer pin (27) which is accommodated in a hole (26) of said cylinder (2) which is aligned with the other auxiliary tumbler pin assembly (19) and is actuated by a spring (28) whose elastic constant is smaller than that of the spring (15) of said other auxiliary tumbler pin assembly (19), so that it can engage, when the key is extracted, a hole (29) formed in said plug.

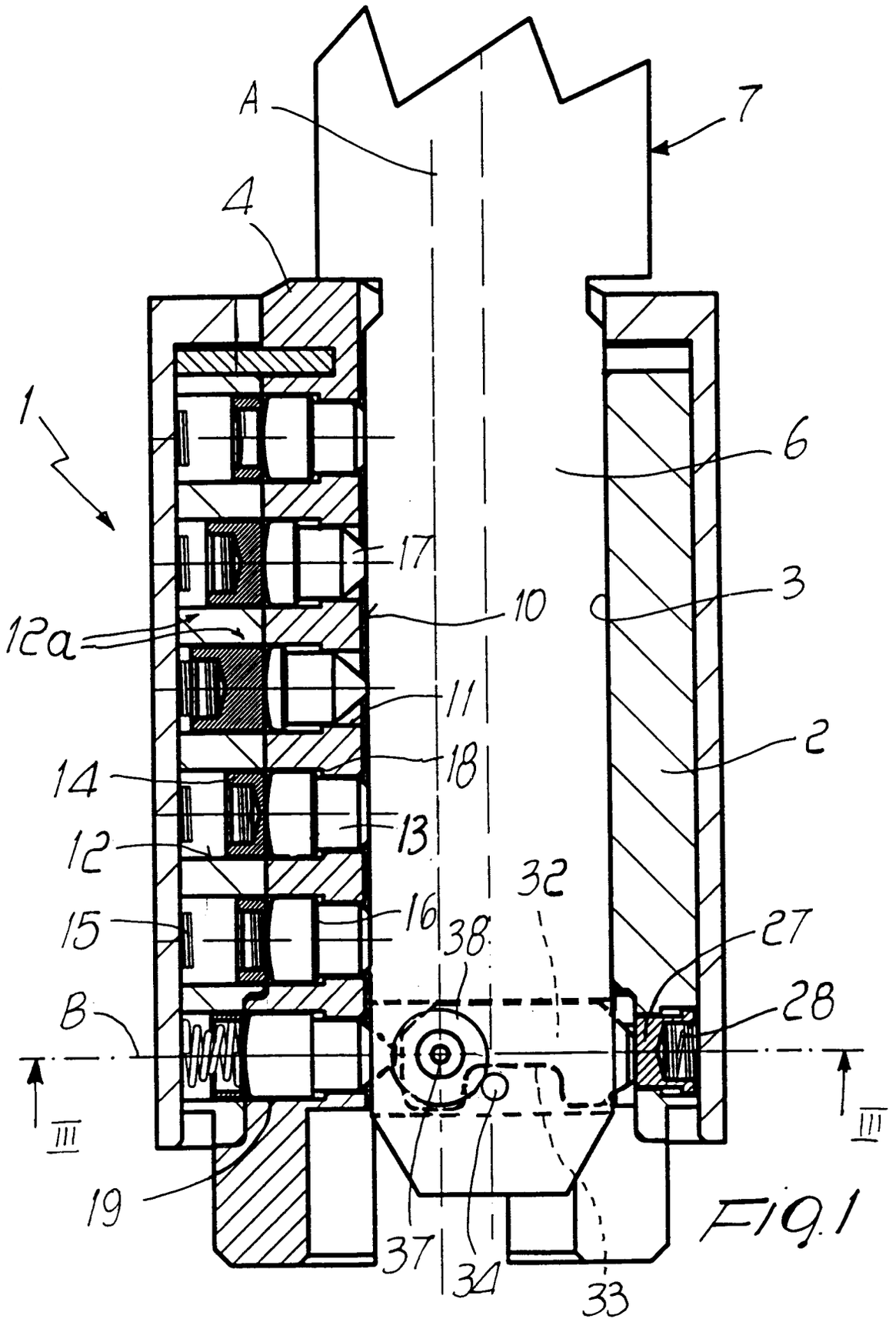
4. A lock according to one of the preceding claims, characterized in that said movable element (30) is constituted by a plate (32) which is guided in a seat (31) which passes through the key (7) from one longitudinal edge to the other and lies within the thickness of the key, at right angles to the rotation axis (A) of the plug (4), the opposite ends of said plate (32) being adapted to cooperate with said two auxiliary tumbler pin assemblies (19, 27), a recess (33) being formed along one edge of the plate, a pin (34) being guided through said recess, said pin being driven into the shank (6) of the key (7), the opposite ends of the plate having chamfers (35, 36), said recess (33) and said pin (34) having such dimensions that the stroke of the plate (32) is such that it cannot protrude from the seat by more than the extension of the chamfers (35, 36) at right angles to the rotation axis (A) of the plug (4).

5. A lock according to one of the preceding claims, characterized in that it has a plurality of holes (38) formed in said key (7) at said seat (31), through which respective additional auxiliary tumbler pin assemblies (20) can engage respective notches (37) of said movable plate (32) in order to assume a position which allows the rotation of said plug (4) when the key (7) is inserted.

6. A lock according to claim 5, characterized in that it comprises at least two holes (38) which are aligned along the axis of the key and through which respective additional auxiliary tumbler pin assemblies (20) can engage respective notches (37) of said movable plate (32) in order to assume a position which allows the rotation of said plug (4) when the key (7) is inserted.

7. A lock according to claim 5, characterized in that it comprises two holes (38) which are arranged on opposite sides with respect to the plate (32) and through which respective additional auxiliary tumbler pin assemblies (20) can engage respective notches (37) of said movable plate (32) in order to assume a position which allows the rotation of said plug (4) when the key (7) is inserted.

8. A lock according to claim 5, characterized in that it comprises two holes (38) which are arranged side by side on the same side with respect to the plate (32) and through which respective additional auxiliary tumbler pin assemblies (20) can engage respective notches (37) of said plate (32) which can move to assume a position which allows the rotation of said plug (4) when the key (7) is inserted.


A
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12a
11
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III
III
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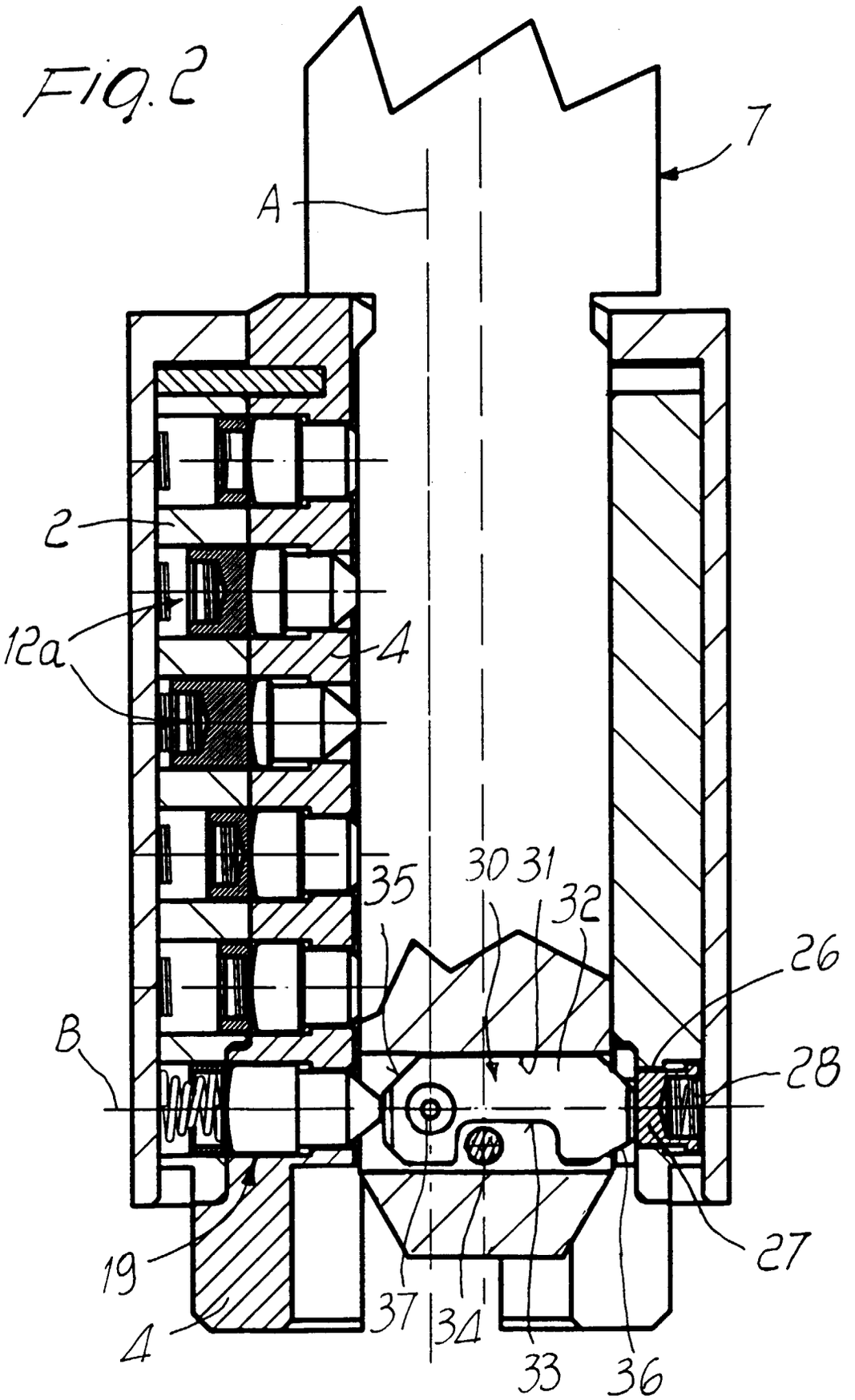
FIG.1

FIG. 2



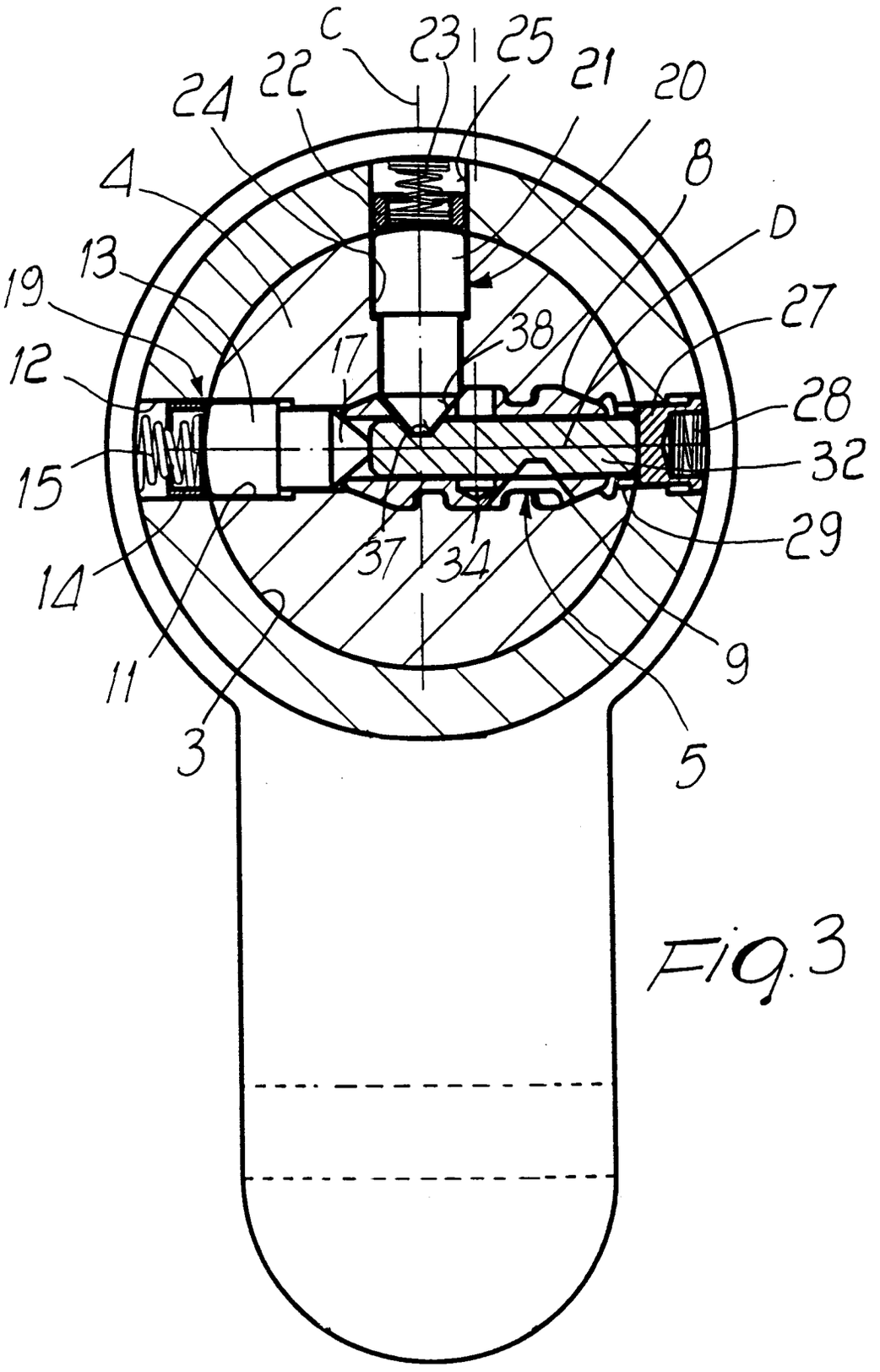


Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 98 11 5985

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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A	EP 0 472 495 A (KELLER,ERNST) 26 February 1992 * page 3, line 38 - page 5, line 3; figures *	1-3	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	24 November 1998	Vacca, R

CATEGORY OF CITED DOCUMENTS

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