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(54) **CODING TUMBLER FOR CYLINDRICAL LOCK CORE AND LOCK WITH CYLINDRICAL LOCK CORE COMPRISING CODING TUMBLER**

(57) Coding tumbler (10), which is adapted for being slidably mounted inside a cylindrical lock core (2) of a cylinder lock and which comprises a supporting end (11) for maintaining contact with an interlocking tumbler (6) and a working end (12), which comprises a recess, in which a contact element is accommodated with a clearance, said contact element being secured against slipping out of the recess in the direction of the longitudinal axis of the coding tumbler (10), and having, in at least one portion, a circular cross-section for providing a rolling contact with a coding edge of a key inserted into the cylinder lock. A cylindrical lock core (2) with such a coding tumbler and a cylinder lock with such a coding tumbler (10) are specified as well.

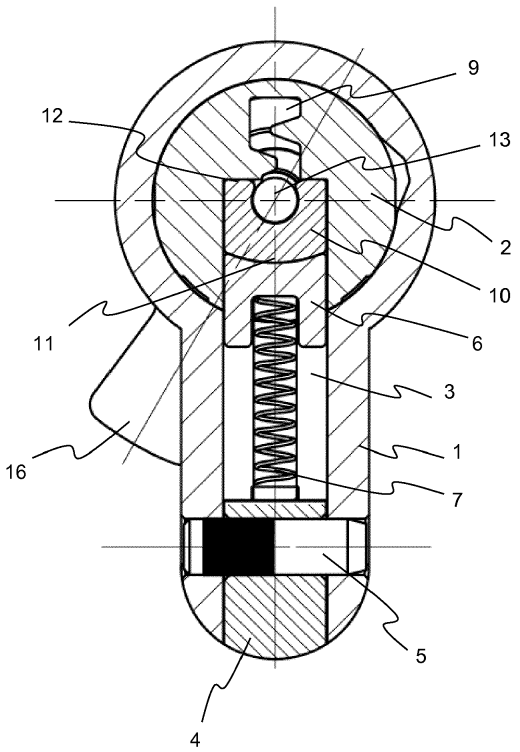

Fig. 1

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Description

Field of the invention

[0001] The present invention relates to a coding tumbler which is adapted for being slidably mounted inside a cylindrical lock core of a cylinder lock and which comprises a supporting end for maintaining contact with an interlocking tumbler, and a working end. The present invention also relates to a cylindrical lock core comprising such coding tumbler as well as to a cylinder lock comprising a case provided with a cylindrical cavity and with at least one guiding chamber arranged radially with respect to said cylindrical cavity of said case; a cylindrical lock core rotatably arranged inside said cylindrical cavity of said case and being provided with a key channel for inserting a corresponding key and at least one radial channel, which is displaceable to a position where it is coaxial with said guiding chamber; at least one interlocking tumbler, which is slidably mounted in said guiding chamber; and at least one spring arranged in said guiding chamber and forcing said interlocking tumbler in the direction from said guiding chamber towards said cylindrical cavity.

Background of the invention

[0002] Locks having cylindrical lock cores, which comprise tumblers for coding the respective lock, are generally known. A prior art lock comprises a case in which a cylindrical lock core is mounted, the latter being provided with a key channel for inserting a corresponding key. The case is further provided with guiding chambers, which are arranged inside the same and in which interlocking tumblers resting on spring elements are slidably mounted, while the cylindrical lock core is provided with radial channels accommodating coding tumblers. The lengths of the individual coding tumblers as well as the sequence of the same enable a code to be generated. Accordingly, a right key must have its blade provided with cut-outs / projections with individual depths corresponding to such code. Under the condition that a right key is inserted into the cylinder lock, a guiding chamber and a radial channel always adjoin in a coaxial manner. Simultaneously, the interlocking tumblers and coding tumblers, which are accommodated inside those chambers and channels, assume respective coaxial positions, the contact surfaces between such interlocking tumblers and coding tumblers being arranged in a cylindrically shaped partition plane due to the action of the key, said partition plane being identical with the outer cylindrical surface of the lock core or with the inner surface of the case. After having been inserted into the key channel, the coding edge of the key blade, namely the cut-outs and projections of the same, come into contact with the respective coding tumblers, causing the latter to be pushed in a radial direction towards the respective guiding chamber. Consequently, the coding tumblers force the respective interlocking tumblers into the chamber in a manner that ensures that each contact surface between a coding tumbler and an interlocking tumbler forming an individual tumbler pair matches with the above cylindrical partition plane. On the contrary, when no key is inserted into the lock, the interlocking tumblers are partly slid out of the chamber due to the action of the respective spring elements, so that they intersect said cylindrical partition plane, thus preventing the cylindrical core from rotating inside the case. When a key carrying a wrong code is inserted into the key channel, the cylindrical partition plane is intersected by the coding tumblers slid out of some chambers as well as by the interlocking tumblers slid out of the remaining chambers.

[0003] A prior art key has the coding edge of its blade formed in a manner which ensures that the individual projections and cut-outs comprise leading facets for facilitating the movement of the key in either direction. Thus, the coding tumblers are gradually pressed in by the leading facet of each individual projection while the key is being slid in / out, preventing the projection from being blocked by the respective coding tumbler. Nevertheless, the key still cannot be slid in the key channel and out of the same in a perfectly smooth manner. Moreover, when frequently used, the key becomes worn out due to the sliding contact between the projections of the coding edge and the surfaces of the coding tumblers, the latter becoming worn out in a similar extent.

Summary of the invention

[0004] The above mentioned drawbacks of the prior art are largely eliminated by a coding tumbler, which is adapted for being slidably mounted inside a cylindrical lock core of a cylinder lock and which comprises a supporting end for maintaining contact with an interlocking tumbler and a working end, wherein the working end comprises a recess, in which a contact element is accommodated with a clearance, said contact element being secured against slipping out of the recess in the direction of the longitudinal axis of the coding tumbler, and having, in at least one portion, a circular cross-section for providing a rolling contact with a coding edge of a key inserted into the cylinder lock.

[0005] Preferably, the contact element extends beyond the working end of the coding tumbler.

[0006] According to an especially preferred embodiment, the contact element has the shape of a ball or a cylinder or a barrel.

[0007] The above mentioned drawbacks of prior art are also eliminated with a cylindrical lock core for a cylinder lock, said lock core comprising a key channel for inserting a key and at least one radial channel which opens into the key channel, wherein it further comprises at least one above specified coding tumbler, said coding tumbler being slidably mounted in the radial channel.

[0008] A preferred embodiment of the cylindrical lock core has the radial channel provided with guiding recess-

es for guiding the coding tumbler, the guiding recesses being widened in the area, where they open into the radial channel, in order to form bearing surfaces for the contact element, said bearing surfaces preventing said contact element from slipping out of the recess in the direction, which is parallel to the longitudinal axis of the cylindrical lock core.

[0009] The above mentioned drawbacks of prior art are also eliminated by providing a cylinder lock, comprising

- a case provided with a cylindrical cavity and at least one guiding chamber arranged in a radial direction with respect to the cylindrical cavity of the case,
- a cylindrical lock core rotatably arranged in the cylindrical cavity of the case and being provided with a key channel for inserting a key and with at least one radial channel which may be set to a position in which it is coaxial with the guiding chamber,
- at least one interlocking tumbler, which is slidably mounted in the guiding chamber, and
- at least one spring arranged in the guiding chamber and forcing the interlocking tumbler in the direction from the guiding chamber towards the cylindrical cavity,
- at least one above specified coding tumbler, said coding tumbler being slidably mounted in the radial channel.

[0010] Preferably, the radial channel is provided with guiding recesses for guiding the coding tumbler, the guiding recesses being widened in the area, where they open into the radial channel, in order to form bearing surfaces for the contact element.

Brief description of the drawings

[0011] An exemplary embodiment of the present invention is schematically represented in the attached drawings, wherein Fig. 1 is a cross-sectional view showing a lock comprising a coding tumbler according to the invention, Fig. 2 shows the lock of Fig. 1 in a vertical longitudinal section and Fig. 3 shows the lock of Fig. 1 in a horizontal longitudinal section. For the sake of clarity, the individual representations are strongly magnified in the drawings.

Description of the exemplary embodiments

[0012] The lock according to the exemplary embodiment of the present invention comprises a case **1** provided with a cylindrical cavity in which a cylindrical lock core **2** is accommodated. The attached drawings show a lock comprising two pairs of cases **1** and corresponding cylindrical lock cores **2**, which means that there is one cylindrical lock core **2** provided for either side of the respective door. The two cylindrical lock cores **2** are interconnected through a coupling assembly **15**, an operating element **16** being arranged therebetween. The portions of the case **1** associated with either cylindrical lock core **2** are interconnected through a bridge **17**, the latter being provided with an anchoring hole **18** for securing the lock inside a door. The bridge simultaneously serves as an assembling stopper **4** for either case **1.**

[0013] The cylindrical lock core **2** comprises an array of guiding chambers **3** which open into the cylindrical cavity, the axes of said chambers being perpendicular to the longitudinal axis of the cylindrical cavity. The guiding chambers **3** are closed by the assembling stopper **4** secured by the retaining pin **5** arranged on the outside surface of the case. Each guiding chamber **3** accommodates an interlocking tumbler **6** slidably mounted therein. The space between the assembling stopper **4** and the interlocking tumbler **6** accommodates a compression spring **7**.

[0014] The cylindrical lock core **2** comprises an array of radial channels **8**, the rotation of the cylindrical lock core **2** inside the case **1** causing said radial channels to be aligned with the guiding chambers **3**. Consequently, each guiding chamber **3** assumes a coaxial arrangement with respect to a corresponding radial channel **8**. The cylindrical lock core also comprises an inner key channel **9** extending in the direction of the longitudinal axis of the cylindrical lock core **2**. The radial channels **9** individually open into the key channel **9.**

[0015] Furthermore, each radial channel **8** contains a coding tumbler **10**, which is slidably mounted inside the same and which has a supporting end **11** provided with a contact face for maintaining contact with an interlocking tumbler **6** or with a cylindrical inner surface of the cylindrical cavity of the case **1,** on the one hand, and a working end **12**, on the other hand. The working end **12** comprises a recess, in which a ball **13** is rotatably accommodated, the latter slightly projecting beyond the working end **12** and being adapted for coming into a rolling contact with a coding edge of the key, i.e. with the cut-outs and projections of said edge, when the key is being slid into the key channel **9** and out of the same.

[0016] Hence, both the coding tumblers **10** and the interlocking tumblers **6** are radially displaceable with respect to the cylindrical lock core **2**, i.e. in a direction which extends perpendicularly to the longitudinal axis of the cylindrical cavity or to that of the key channel **9.**

[0017] As particularly apparent in Figs. 1 and 3, the radial channels **8** formed in the cylindrical lock core **2** comprise guiding recesses **14** for guiding the coding tumblers **10** in a radial direction. The guiding recesses **14** are widened in the area, where they open into the key channel **9**, thus providing bearing surfaces for guiding the balls **13** during the sliding movement of the respective coding tumbler **10** inside the radial channel **8** and preventing the ball **13** from being slid out of the recess during the sliding movement of a key inside the key channel **9.**

[0018] The recess for accommodating the ball **13**, i.e. the recess formed at the working end **12** of the coding tumbler **10**, has a shape of a partial cylindrical surface which surrounds the ball **13** with a certain clearance, so

that the cross-sectional profile of the ball **13** forms a sector in the area where the ball **13** is in contact with the recess formed at the working end **12** of the coding tumbler **10** and the sector has an central angle between 190° and 330°. In other words, the recess for accommodating the ball **13** is formed in a manner which enables the ball **13** to freely rotate inside the recess while preventing the same from displacing with respect to the coding tumbler **10** in the direction of the sliding movement of the latter in the radial channel **8.** Nevertheless, differently shaped recess are also usable, provided that they enable the ball **13** to rotate while preventing it from sliding out of the recess in the radial direction. Thus, the shape of the recess does not have to exactly follow that of the ball **13** but must provide at least three supporting points which fulfil the above function.

[0019] It is obvious that the balls **13** can be replaced with another contact element which can create a rolling contact with a coding edge of a key blade. Such contact element can assume, for example, a shape of a cylindrical or barrel-like roller etc. In general, the contact element has a circular cross-section in a plane which defines the direction of the movement of the key being slid into the lock or out of the same. Moreover, as mentioned above, the shape of the recess formed at the working end **12** of the coding tumbler **10** must be adapted to that of the contact element in order that the latter is enabled to perform a rotational movement around an axis, which is perpendicular to the plane encompassing the direction of the insertion of the key into the key channel **9**. Simultaneously, the rotating contact element must be prevented from falling out of the recess in any radial direction with respect to the cylindrical lock core **2**. Thus, a rolling contact of the contact element with the coding edge of the key is achieved, causing the contact element to rotate around its axis extending in the movement direction of the key when the key is being slid into or out of the key channel **9**. Preferably, the contact element extends beyond the working end **12** of the coding tumbler **10**.

[0020] The structural arrangement of the coding tumbler **10** according to the present invention, namely the arrangement comprising the working end **12** provided with a contact element for providing a rolling contact with a key, reduces the wear of the coding tumbler and the key during the operation of the lock, on the one hand, and makes the movement of the key being slid into / out of the key channel considerably smoother, on the other hand.

[0021] As known from prior art, the coding tumblers **10** may also have a split arrangement which means that they comprise first portion with a supporting end **11** and a second portion with a working end **12**.

List of reference numerals

[0022]

1 case
2 cylindrical lock core
3 guiding chamber
4 assembling stopper
5 retaining pin
6 interlocking tumbler
7 spring
8 radial channel
9 key channel
10 coding tumbler
11 supporting end
12 working end
13 ball
14 guiding recess
15 coupling
16 operating element
17 bridge
18 anchoring hole

Claims

1. Coding tumbler (10), which is adapted for being slidably mounted inside a cylindrical lock core (2) of a cylinder lock and which comprises a supporting end (11) for maintaining contact with an interlocking tumbler (6) and a working end (12), **characterized in that** the working end (12) comprises a recess, in which a contact element is accommodated with a clearance, said contact element

   - being secured against slipping out of the recess in the direction of the longitudinal axis of the coding tumbler (10), and
   - having, in at least one portion, a circular cross-section for providing a rolling contact with a coding edge of a key inserted into the cylinder lock.

2. Coding tumbler according to claim 1, **characterized in that** the contact element extends beyond the working end (12) of the coding tumbler (10).

3. Coding tumbler according to claim 1 or 2, **characterized in that** the contact element has the shape of a ball (13) or a cylinder or a barrel.

4. Cylindrical lock core (2) for a cylinder lock, said lock core comprising a key channel (9) for inserting a key and at least one radial channel (8) which opens into the key channel (9), **characterized in that** it further comprises at least one coding tumbler (10) according to any of the claims 1 to 3, said coding tumbler being slidably mounted in the radial channel (8).

5. Cylindrical lock core (2) according to claim 4, **characterized in that** the radial channel (8) is provided with guiding recesses (14) for guiding the coding tumbler (10), the guiding recesses (14) being widened in the area, where they open into the radial

channel (8), in order to form bearing surfaces for the contact element, said bearing surfaces preventing said contact element from slipping out of the recess in the direction which is parallel to the longitudinal axis of the cylindrical lock core (2).

6. Cylinder lock, comprising

- a case (1) provided with a cylindrical cavity and at least one guiding chamber (3) arranged in a radial direction with respect to the cylindrical cavity of the case (1),
- a cylindrical lock core (2) rotatably arranged in the cylindrical cavity of the case (1) and being provided with a key channel for inserting a key and with at least one radial channel (8) which may be set to a position in which it is coaxial with the guiding chamber (3),
- at least one interlocking tumbler (6), which is slidably mounted in the guiding chamber (3), and
- at least one spring (7) arranged in the guiding chamber (3) and forcing the interlocking tumbler (6) in the direction from the guiding chamber (3) towards the cylindrical cavity,

characterized in that it further comprises at least one coding tumbler (10) according to any of the claims 1 to 3, said coding tumbler being slidably mounted in the radial channel (8).

7. Cylinder lock according to claim 6, **characterized in that** the radial channel (8) is provided with guiding recesses (14) for guiding the coding tumbler (10), the guiding recesses (14) being widened in the area, where they open into the radial channel (8), in order to form bearing surfaces for the contact element.

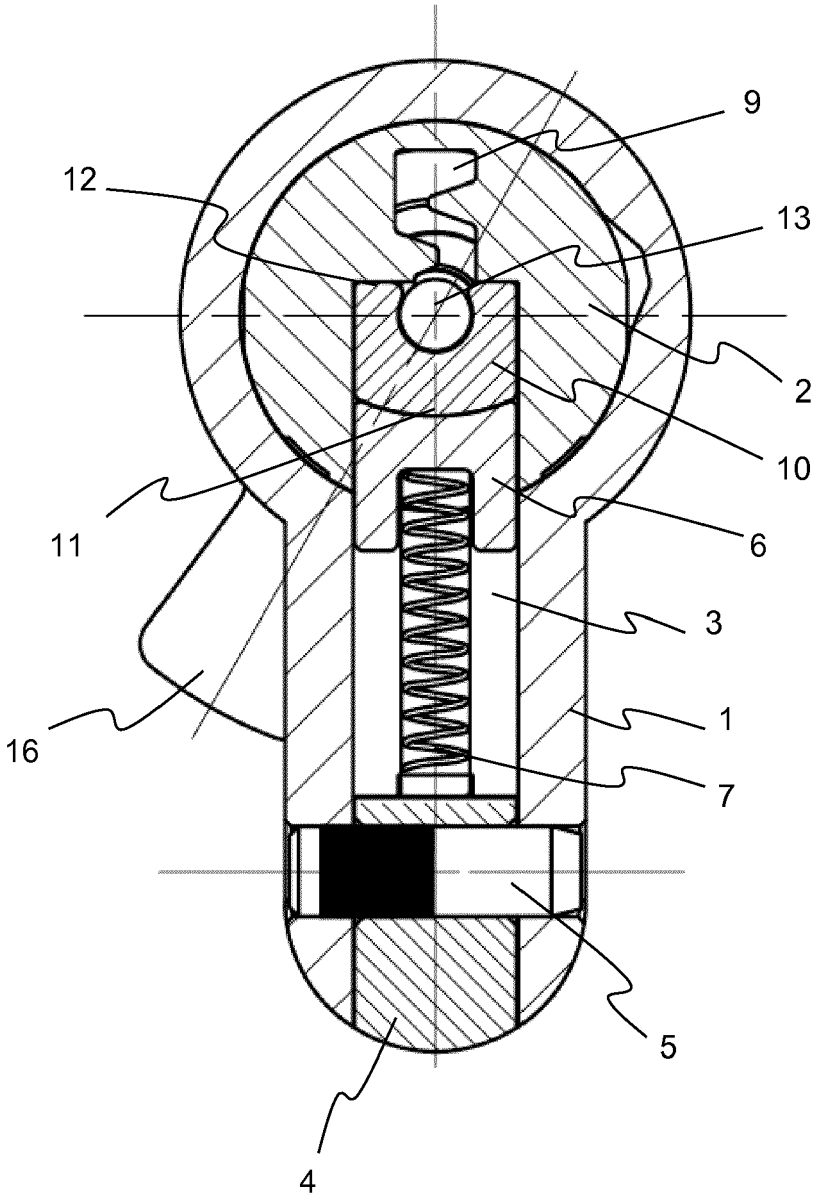

Fig. 1

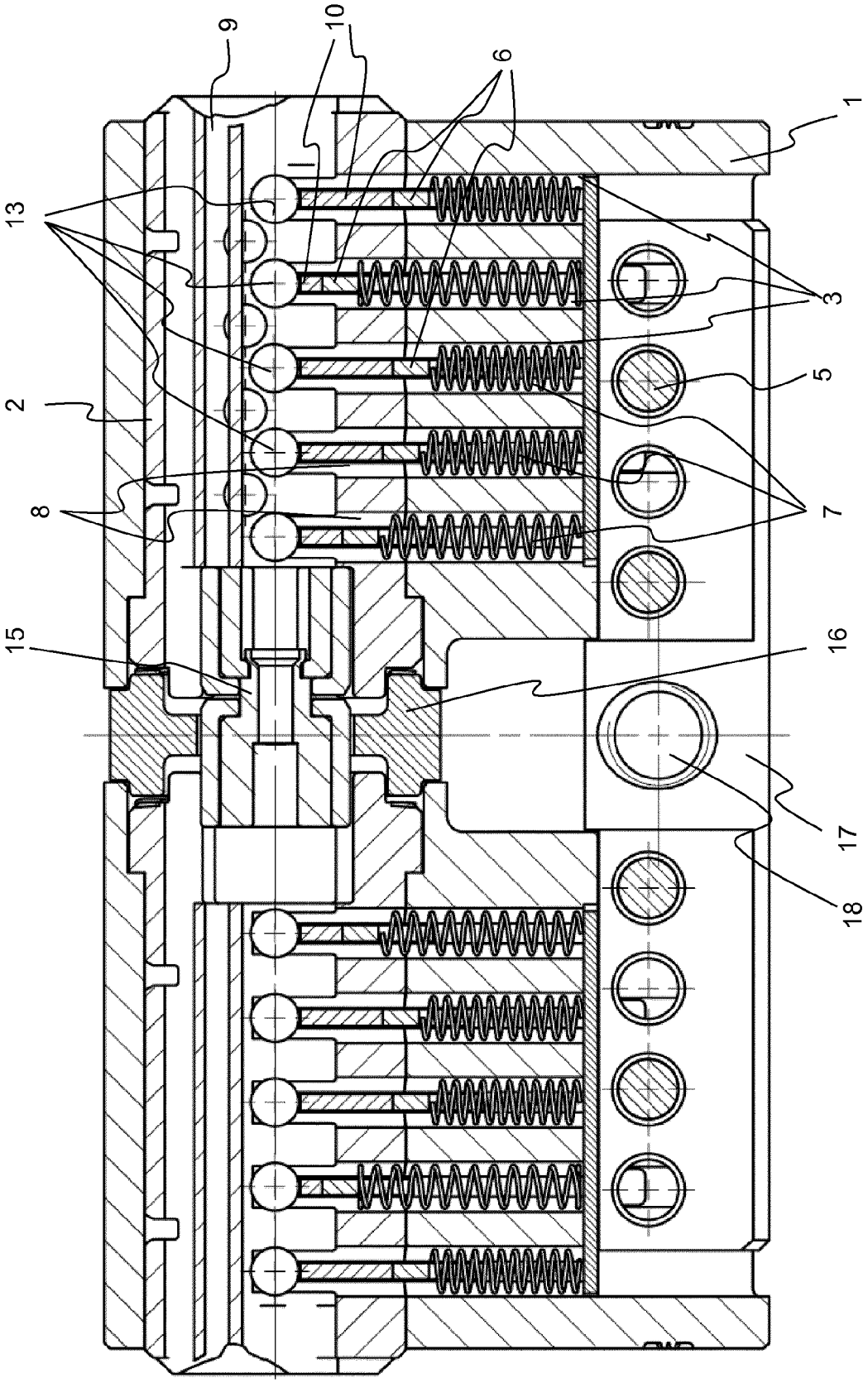

Fig. 2

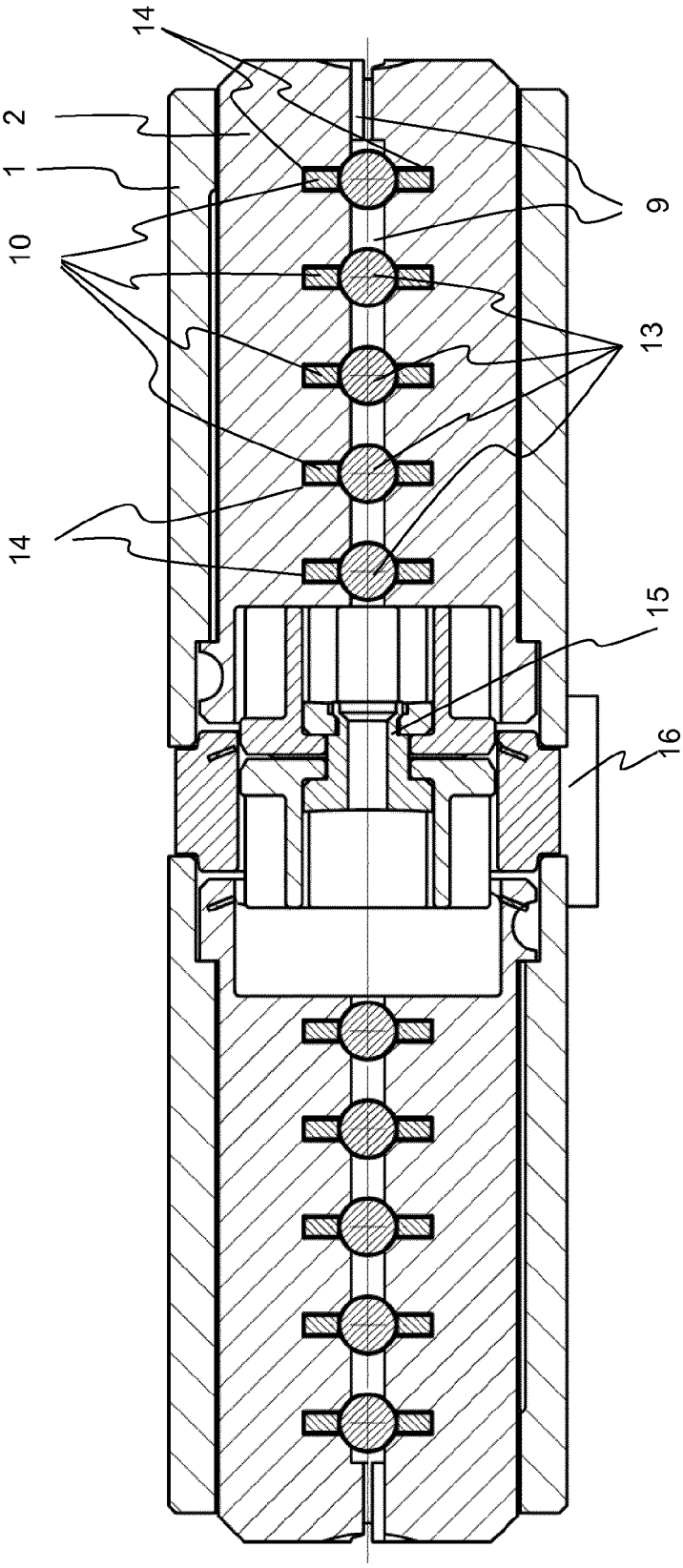

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 15 17 9837

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 96/41929 A1 (SHI) 27 December 1996 (1996-12-27) * abstract *; figures 62-98 *	1	INV. E05B27/00
A	US 3 190 093 A (SCHLAGE) 22 June 1965 (1965-06-22) * column 4, lines 44-70; figures 4-7 *	1	
A	GB 386 932 A (LONSDALE OLDHAM) 26 January 1933 (1933-01-26) * page 2, lines 19-44; claims 6,7; figures 1,2,4 *	1	
A	EP 2 273 042 A2 (EVVA SICHERHEITSTECHNOLOGIE GMBH) 12 January 2011 (2011-01-12) * paragraph [0017]; figures 1-4 *	1	
A	DE 30 16 393 A1 (EVVA WERKE) 13 August 1981 (1981-08-13) * figures 1,6 *	1	TECHNICAL FIELDS SEARCHED (IPC)
A	US 2 565 531 A (SPIEGLER) 28 August 1951 (1951-08-28) * column 2, lines 23-53; figures *	1	E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	21 January 2016	Van Beurden, Jason

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 15 17 9837

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