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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Actuator**

(57) An actuator (100) comprises a housing (101) and a drive mechanism arranged therein. The drive mechanism is provided for moving a position member (103). An outer end (105) of the position member is designed to move a movable component. The actuator comprises a pin element (120) that projects from the housing and has a face that is designed to rest against the movable component to prevent a rotation of the movable component.

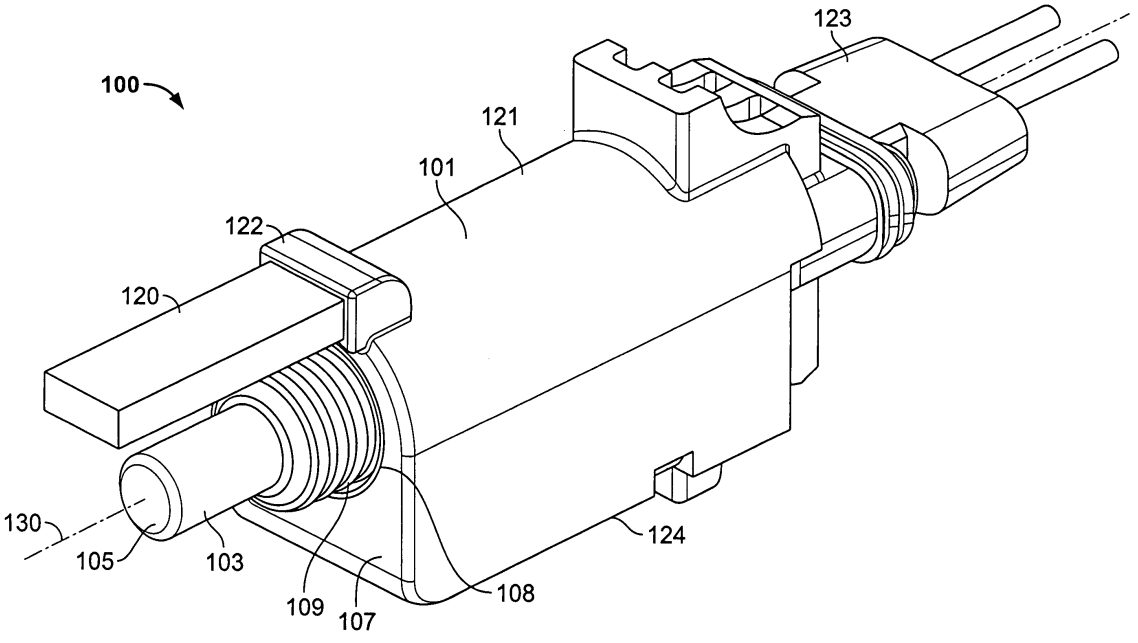

Fig. 1

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Description

[0001] The invention relates to an actuator according to claim 1.

[0002] Actuators are used in various technical fields in order to move movable components. Known actuators comprise a position member and a drive mechanism designed to move the position member. The position member is rotatable around a longitudinal axis of the position member.

[0003] The objective of the invention is to provide an improved actuator. This objective is achieved by an actuator according to claim 1.

[0004] According to the invention, an actuator comprises a housing and a drive mechanism arranged therein. The drive mechanism is provided for moving a position member. An outer end of the position member is designed to move a movable component. The actuator further comprises a pin element that projects from the housing. The pin element has a face that is designed to rest against the movable component to prevent a rotation of the movable component.

[0005] An advantage of this actuator is that an undesired rotation of the position member and the movable component can be prevented.

[0006] In one embodiment of the invention, the actuator comprises a metallic yoke and the pin element is part of the metallic yoke. That way, no additional components are needed and no extra assembly process step is necessary for producing the actuator.

[0007] Preferably, the metallic yoke is U-shaped with a front section, a lower section and a rear section, wherein the yoke embraces the drive mechanism between the front section and the rear section of the yoke, and the position member is fed through an opening provided in the front section of the yoke.

[0008] In a preferred configuration, the pin element is connected to the front section of the yoke.

[0009] According to another embodiment, the pin element is a metallic pin mounted in the housing of the actuator.

[0010] In another embodiment, the pin element is made of plastic material.

[0011] Preferably, the plastic material is polyamide.

[0012] Preferably, the plastic material comprises a friction reduction, for example Teflon.

[0013] In a preferred configuration, the pin element is made in one part with the housing. An advantage of this configuration is that no extra components are needed for the actuator and no extra assembly process step is necessary for producing the actuator.

[0014] In a preferred configuration of the actuator, the pin element is arranged in parallel with the position member.

[0015] In one configuration, the pin element has a cross-section with the shape of the letter T.

[0016] The invention is now explained in greater detail with reference to the figures in which

Figure 1 shows a perspective view of an actuator;

Figure 2 shows a sectional drawing of an actuator;

Figure 3 shows a perspective view of an actuator;

Figure 4 shows a sectional drawing of an actuator; and

Figure 5 shows a sectional drawing of an actuator.

[0017] Throughout the description of figures 1 to 5, the same reference symbols are used for equal or equally acting components.

[0018] Figure 1 shows a sectional drawing of an actuator 100. The actuator 100 comprises a housing 101. The housing 101 may, for example, be made of plastic material.

[0019] A front surface 107 of the housing 101 comprises an opening 108. A position member 103 is fed through the opening 108 in the front surface 107 of the housing 101, such that a longitudinal axis 130 of the position member 103 is oriented perpendicular to the front surface 107 of the housing 101. In the direction of the longitudinal axis 130 of the position member 103 the position member 103 is partially located inside the housing 101 and partially located outside the housing 101.

[0020] The position member 103 is rotationally symmetric with respect to the longitudinal axis 130 of the position member 103. The position member 103 may for example comprise a cylindrical shape. In any case, the position member 103 is rotatable around the longitudinal axis 130 of the position member 103.

[0021] The position member may be made of a metal. The position member 103 may, for example, be an armature of an electromagnet.

[0022] The position member 103 is movable in the direction of the longitudinal axis 130 of the position member 103. The position member 103 can be moved farther into the housing 101 or farther out of the housing 101. Two discrete positions of the position member 103 may be provided, one farther inside the housing 101, one farther outside the housing 101. The position member 103 may then be movable between the two discrete positions.

[0023] The position member 103 is encircled by a coil spring 109. One end of the coil spring 109 is connected to or supported by the position member 103, the other end of the coil spring 109 is connected to or supported by the housing 101. The coil spring 109 may support moving the position member 103 into the housing 101 or out of the housing 101.

[0024] An outer end 105 of the position member 103 may be connected to a movable component in order to move the movable component with the position member 103.

[0025] An upper surface 121 of the housing 101 comprises a common edge with the front surface 107 of the housing 101. Near this common edge an opening 122 is

provided on the upper surface 121 of the housing 101. A pin element 120 is fed through the opening 122 in the upper surface 121 of the housing 101. The pin element 120 may comprise the shape of a cuboid arranged in parallel with the position member 103. The pin element 120 may, for example, be made of a metal. The pin element 120 may comprise a length such that the pin element 120 projects over the position member 103.

[0026] On a side of the housing 101 that is opposed to the front surface 107, the housing 101 comprises an electrical connector 123. The electrical connector 123 may electrically connect the actuator 100 to an external device to provide the actuator 100 with electric energy and to control movements of the position member 103 of the actuator 100.

[0027] Figure 2 shows a sectional drawing of the actuator 100 where the actuator 100 is sliced on a plane that is parallel to the longitudinal axis 130 of the position member 103 and perpendicular to the upper surface 121 of the housing 101.

[0028] The housing 101 houses a drive mechanism 102. The drive mechanism 102 may be an electromagnet. In alternative embodiments, the drive mechanism may be a piezoelectric drive mechanism or another kind of drive mechanism. The drive mechanism 102 comprises a position member guiding 104. The position member guiding 104 houses the position member 103 which may be an armature. The drive mechanism 102 is designed to move the position member 103 in the position member guiding 104 along the longitudinal axis 130 of the position member 103. The drive mechanism 102 may drive the position member 103 to a first position in which the position member 103 protrudes farther out of the housing 101 and to a second position in which the position member 103 protrudes to a lesser extend out of the housing 101.

The housing 101 further houses a yoke 110. The yoke 110 may, for example, be made of a metal. The yoke 110 comprises the shape of the letter U with a front section 111, a lower section 112 and a rear section 113. The front section 111 of the yoke 110 is arranged in parallel to the front surface 107 of the housing 101. The lower section 112 of the yoke 110 is arranged in parallel to a lower surface 124 of the housing 101 that is opposed to the upper surface 121 of the housing 101.

[0029] The yoke 110 embraces the drive mechanism 102 between the front section 111 and the rear section 113 of the yoke 110. The yoke 110 may guide a magnetic field of the drive mechanism 102.

[0030] The front section 111 of the yoke 110 comprises an opening 114 that is arranged next to the opening 108 of the front surface 107 of the housing 101 such that the opening 108 and the opening 114 provide a common opening. The position member 103 is fed through the opening 108 in the front surface 107 of the housing 101 and the opening 114 on the front section 111 of the yoke 110.

[0031] The pin element 120 is connected to the front section 111 of the yoke 110. To this end, the front section 111 of the yoke 110 extends through the opening 122 on the upper surface 121 of the housing 101 to form the pin element 120. Outside the housing 101 the pin element 120 extends in parallel to the position member 103. The pin element 120 is made of the same material as the yoke 110. An advantage of this embodiment is that only one member is necessary to form the yoke 110 and the pin element 120.

[0032] The outer end 105 of the position member 103 is connected to a movable component 106. The outer end 105 of the position member 103 may comprise a smaller diameter than the rest of the position member 103. The movable component 106 may be clipped onto the outer end 105 of the position member 103. The position member 103 may be used to move the movable component 106.

[0033] The position member 103 is rotatable around the longitudinal axis 130 of the position member 103. Since the movable component 106 is connected to the position member 103, a rotation of the position member 103 leads to a rotation of the movable component 106 around the longitudinal axis 130 of the position member 103 as well. The movable component 106 may also be rotatable around the position member 103.

[0034] The pin element 120 is provided to prevent a rotation of the movable component 106 and/or the position member 103. The pin element 120 rests against the movable component 106. Since the pin element 120 is fixed on the actuator 100, the pin element 120 resting against the movable component 106 prevents a rotation of the movable component 106.

[0035] The pin element 120 may, for example, rest against a flat surface of the movable component 106. This may have the advantage of low friction between the pin element 120 and the movable component 106. The pin element 120 may as well be bound in a recess of the movable component 106. This may provide a higher friction between the pin element 120 and the movable component 106 but may allow for a better suppression of a rotation of the movable component 106. The pin element 120 may as well be fed through an opening of the movable component 106. This may suppress a rotation of the movable component 106 even better.

[0036] Figure 3 displays a perspective view of another embodiment of the actuator 100. In the embodiment of figure 3, the pin element 120 projects from the front surface 107 of the housing 101 of the actuator 100. In this embodiment, the pin element 120 is arranged at a position of the front surface 107 of the housing 101 that is near a common edge of the front surface 107 and the lower surface 124 of the housing 101.

[0037] In the embodiment of figure 3, the pin element 120 comprises a cross-section having the shape of the letter T. This may stabilize the pin element 120 against a bending or skewing the pin element 120.

[0038] The pin element 120 of figure 3 may, for example, be made of a plastic material. The pin element 120

may, for example, be made of the same material as the housing 101 of the actuator 100. This is depicted in the sectional drawing of figure 4. In figure 4, the actuator 100 is sliced on a plane that is parallel to the longitudinal axis 130 of the position member 103 and perpendicular to the lower surface 124 of the housing 101. Figure 4 shows that the pin element 120 is connected to the housing 101. An advantage of this embodiment is that for the pin element 120 and the housing 101, only one member is necessary. No additional members or processing steps are necessary for providing the pin element 120.

[0039] Figure 5 shows a sectional drawing of another embodiment of the actuator 100. In the sectional drawing of figure 5, the actuator 100 is sliced on a plane that is parallel to the longitudinal axis 130 of the position member 103 and perpendicular to the lower surface 124 of the housing 101.

[0040] In the embodiment of figure 5, the pin element 120 is assembled into the housing 101 or overmolded into the housing 101. To this end, the front surface 107 of the housing 101 comprises an opening 125 that is arranged near a common edge of the front surface 107 and the lower surface 124 of the housing 101. The pin element 120 is fed through the opening 125 in the front surface 107 of the housing 101 and jammed inside the housing 101. The pin element 120 may be made of a metal or a plastic material. The pin element 120 may comprise a ripping arranged at an end of the pin element 120 that is inserted into the housing 101 to support the pin element 120 getting jammed in the housing 101. The pin element may, for example, comprise a cuboid or a cylindrical shape.

Claims

1. An actuator (100)
comprising a housing (101) and a drive mechanism (102) arranged therein,
wherein the drive mechanism (102) is provided for moving a position member (103),
wherein an outer end (105) of the position member (103) is configured to move a movable component (106),
characterized in that
the actuator (100) comprises a pin element (120) that projects from the housing (101),
wherein the pin element (120) is having a face that is configured to rest against the movable component (106) to prevent a rotation of the movable component (106).

2. The actuator (100) as claimed in claim 1,
wherein the drive mechanism (102) is an electromagnet,
wherein the position member (103) is an armature of the electromagnet.

3. The actuator (100) as claimed in any of claims 1 or 2,
wherein the actuator (100) comprises a metallic yoke (110),
wherein the pin element (120) is part of the metallic yoke (110).

4. The actuator (100) as claimed in claim 3,
wherein the metallic yoke (110) is u-shaped with a front section (111), a lower section (112) and a rear section (113),
wherein the yoke (110) embraces the drive mechanism (102) between the front section (111) and the rear section (113) of the yoke (110),
wherein the position member (103) is fed through an opening (114) provided in the front section (111) of the yoke (110).

5. The actuator (100) as claimed in claim 4,
wherein the pin element (120) is connected to the front section (111) of the yoke (110).

6. The actuator (100) as claimed in any of claims 1 or 2,
wherein the pin element (120) is a metallic pin mounted in the housing (101) of the actuator (100).

7. The actuator (100) as claimed in any of claims 1 or 2,
wherein the pin element (120) is made of plastic material.

8. The actuator (100) according to claim 7,
wherein the plastic material is polyamide.

9. The actuator (100) according to any of claims 7 or 8,
wherein the plastic material comprises a friction reduction, for example Teflon.

10. The actuator (100) according to any of the previous claims,
wherein the pin element (120) is made in one part with the housing (101).

11. The actuator (100) according to any of the previous claims,
wherein the pin element (120) is arranged in parallel with the position member (103).

12. The actuator (100) according to any of the previous claims,
wherein the pin element (120) has a cross section with the shape of the letter T.

Amended claims in accordance with Rule 137(2) EPC.

1. An actuator (100)
comprising a housing (101) and a drive mechanism (102) with a position member (103) arranged therein,

wherein the drive mechanism (102) is provided for moving the position member (103),
wherein an outer end (105) of the position member (103) is configured to move a movable component (106),
characterized in that
the actuator (100) comprises a pin element (120) that projects from the housing (101),
wherein the pin element (120) is having a face that is configured to rest against the movable component (106) to prevent a rotation of the movable component (106).

2. The actuator (100) as claimed in claim 1,
wherein the drive mechanism (102) is an electromagnet,
wherein the position member (103) is an armature of the electromagnet.

3. The actuator (100) as claimed in any of claims 1 or 2,
wherein the actuator (100) comprises a metallic yoke (110),
wherein the pin element (120) is part of the metallic yoke (110).

4. The actuator (100) as claimed in claim 3,
wherein the metallic yoke (110) is u-shaped with a front section (111), a lower section (112) and a rear section (113),
wherein the yoke (110) embraces the drive mechanism (102) between the front section (111) and the rear section (113) of the yoke (110),
wherein the position member (103) is fed through an opening (114) provided in the front section (111) of the yoke (110).

5. The actuator (100) as claimed in claim 4,
wherein the pin element (120) is connected to the front section (111) of the yoke (110).

6. The actuator (100) as claimed in any of claims 1 or 2,
wherein the pin element (120) is a metallic pin mounted in the housing (101) of the actuator (100).

7. The actuator (100) as claimed in any of claims 1 or 2,
wherein the pin element (120) is made of plastic material.

8. The actuator (100) according to claim 7,
wherein the plastic material is polyamide.

9. The actuator (100) according to any of claims 7 or 8,
wherein the plastic material comprises a friction reduction, for example Teflon.

10. The actuator (100) according to any of the previous claims,
wherein the pin element (120) is made in one part with the housing (101).

11. The actuator (100) according to any of the previous claims,
wherein the pin element (120) is arranged in parallel with the position member (103).

12. The actuator (100) according to any of the previous claims,
wherein the pin element (120) has a cross section with the shape of the letter T.

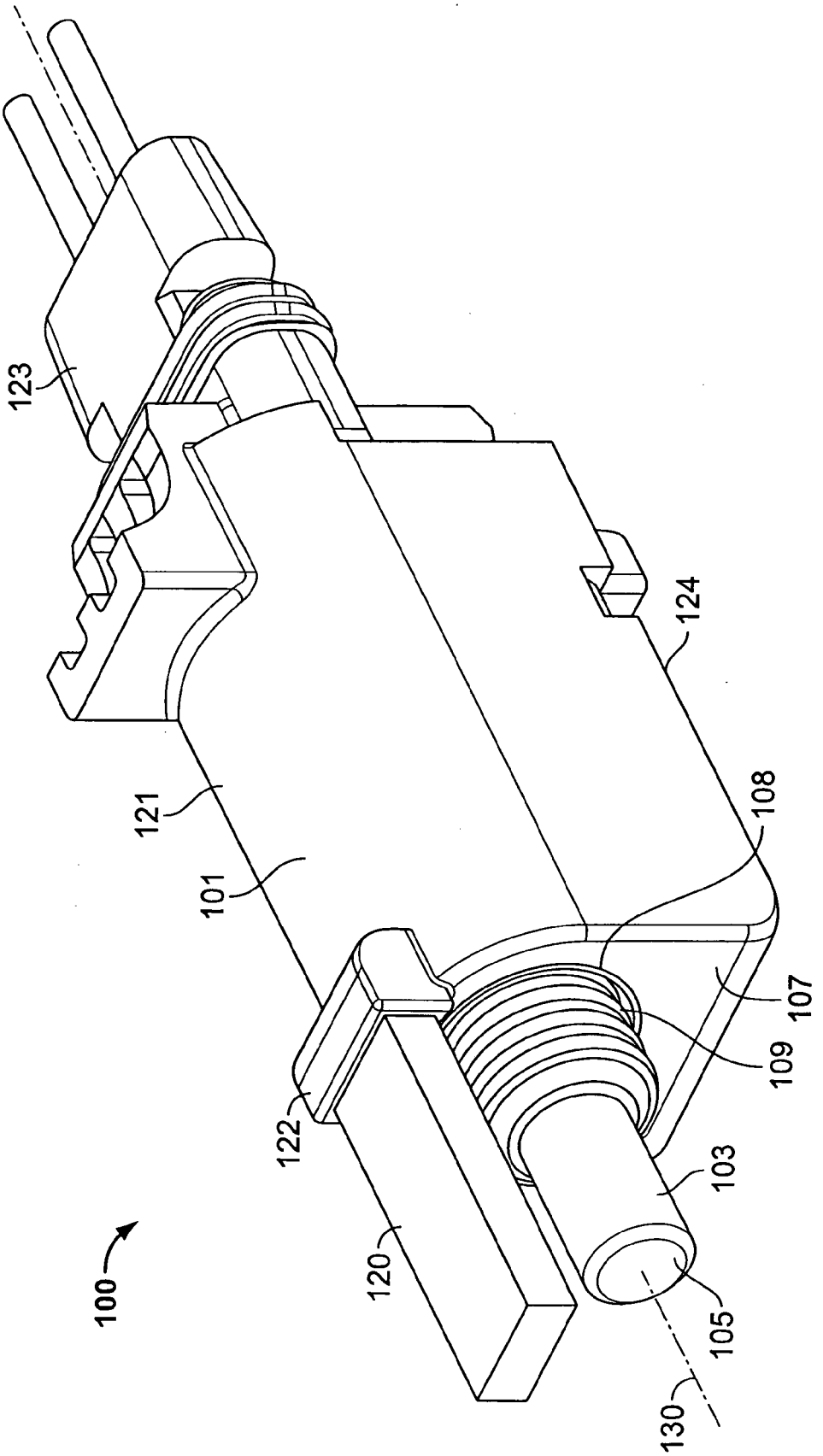

Fig. 1

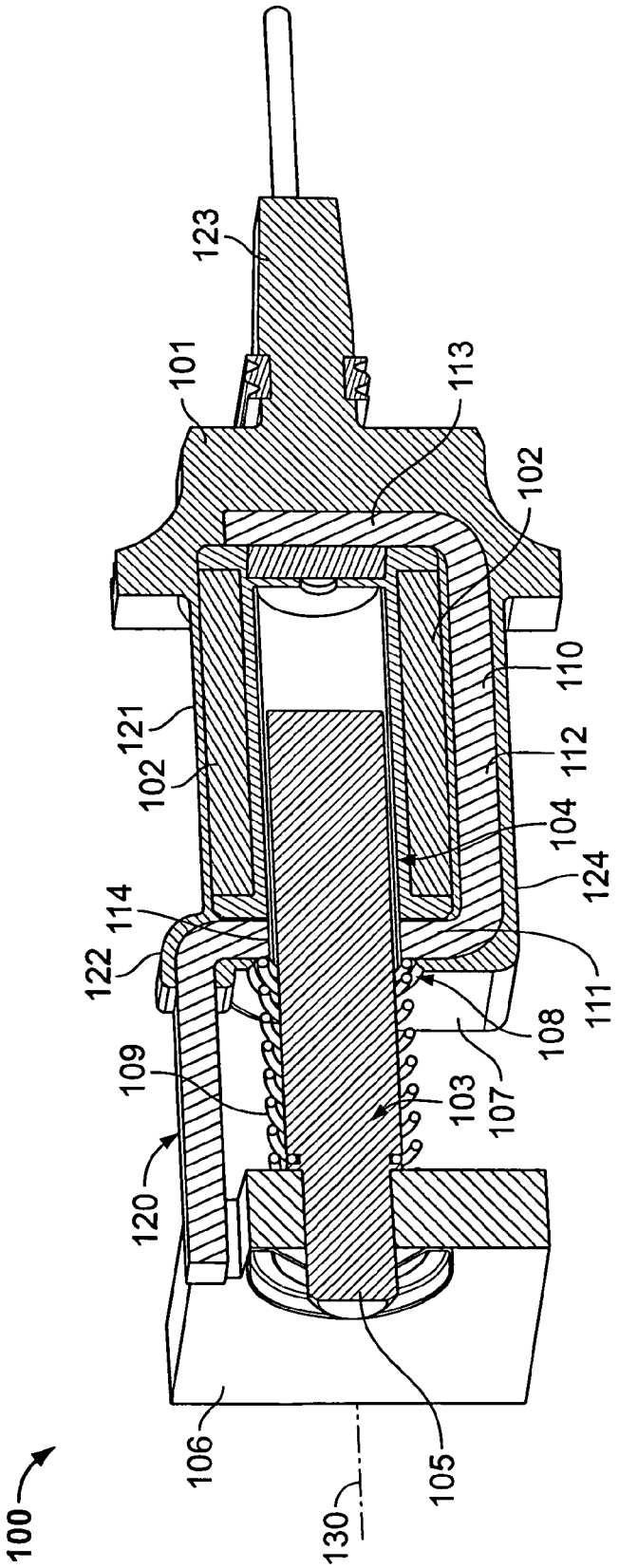
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Fig. 2

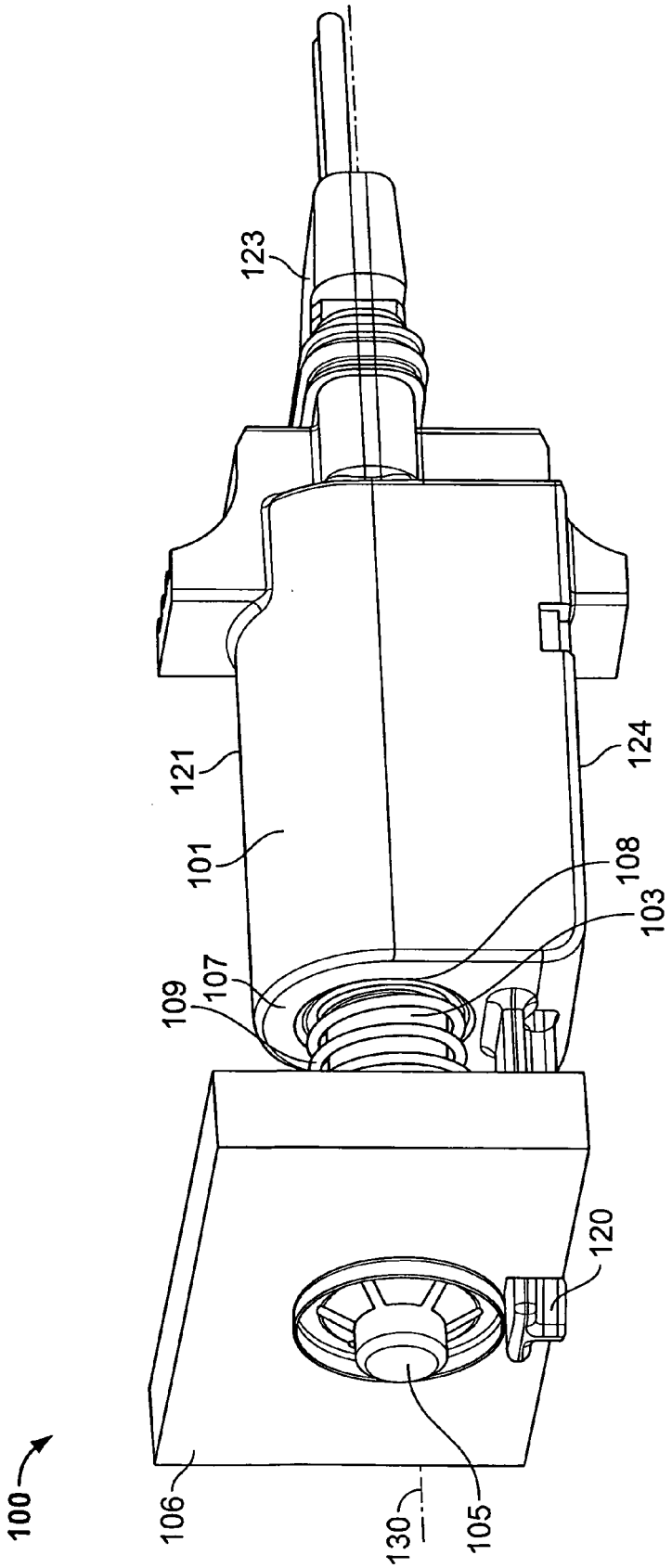

Fig. 3

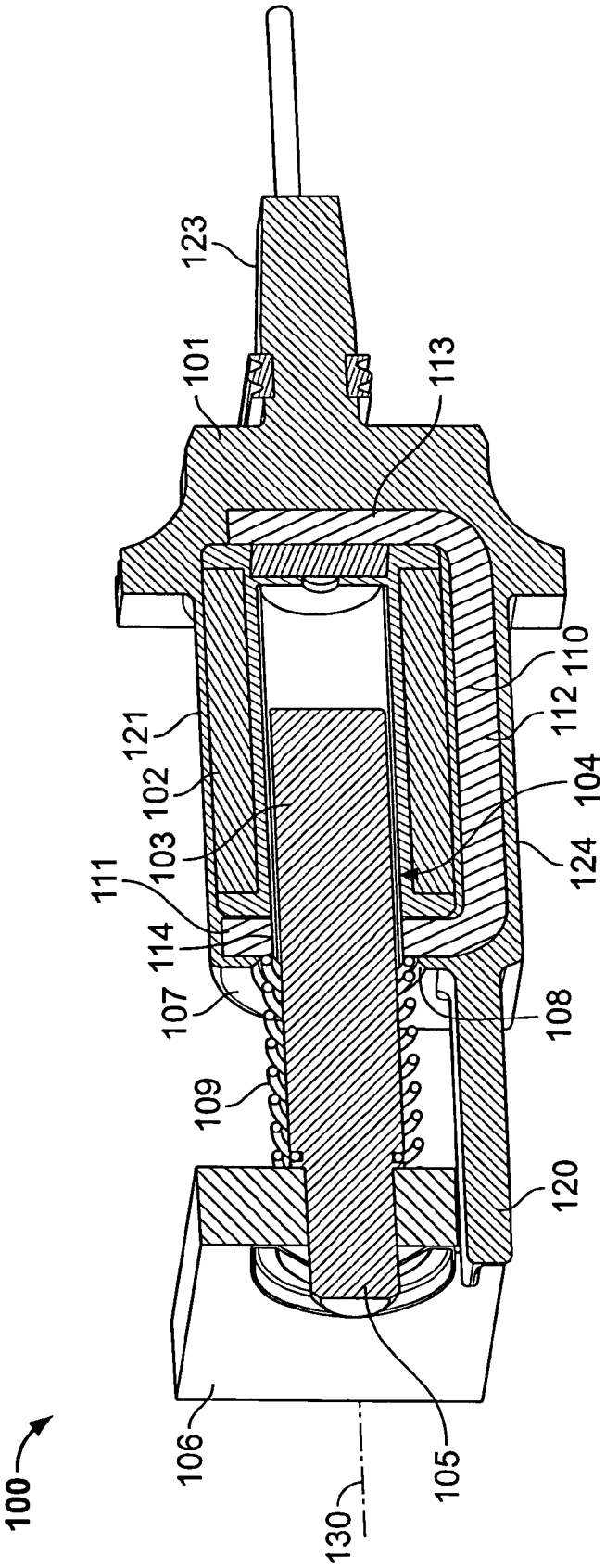
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Fig. 4

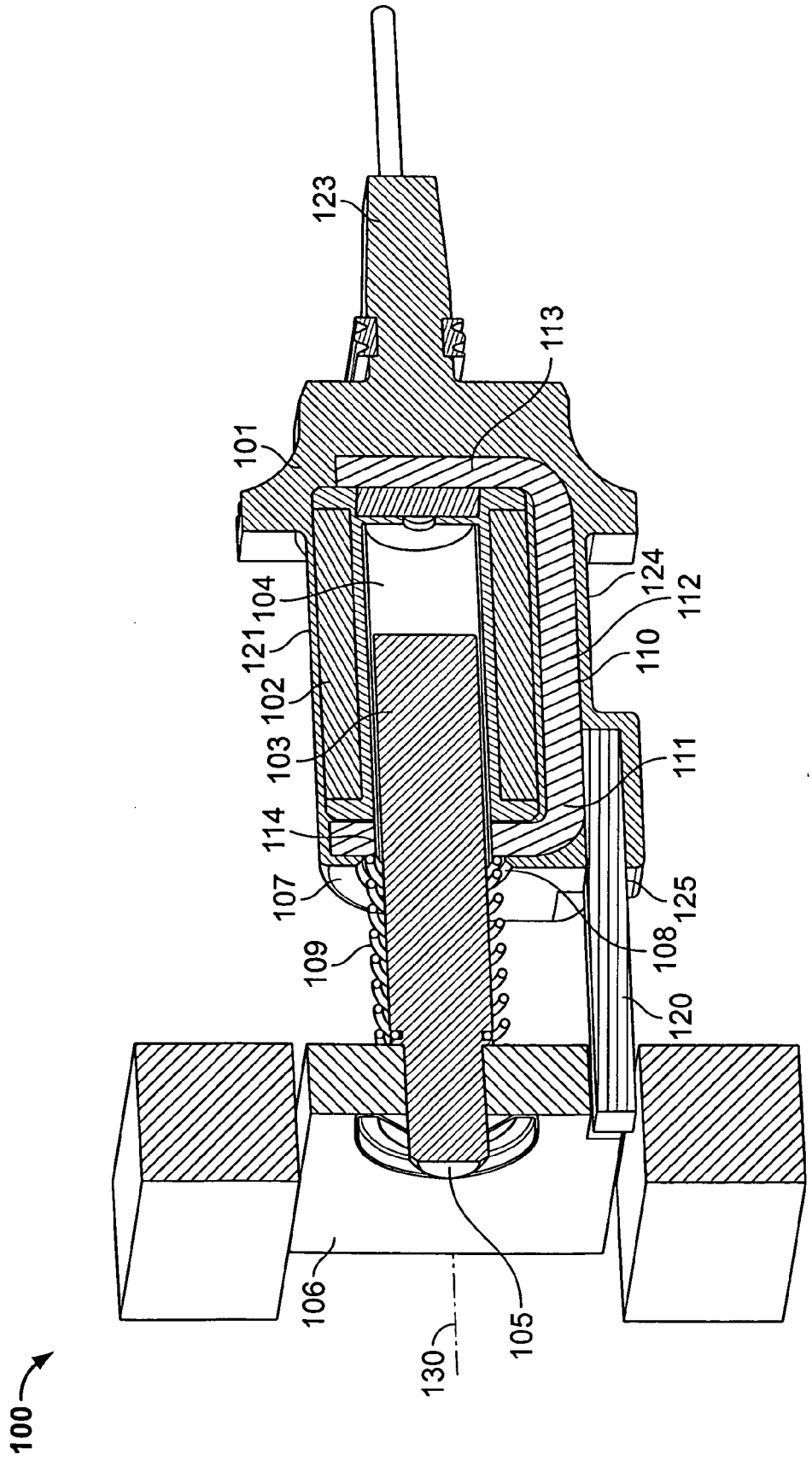
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Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 4071

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2002/130745 A1 (KOBOW WOLFGANG [DE] ET AL) 19 September 2002 (2002-09-19) * claims 1-4 * * paragraphs [0012], [0014] * * figures *	1,2,6,7, 10-12	INV. H01F7/121 H01F7/16
A	US 4 518 939 A (READ REGINALD A [US] ET AL) 21 May 1985 (1985-05-21) * claims 1,5-7 * * figure 2 *	1,3-5,7, 10,11	
A	US 2 482 840 A (EDWARD COLLINS JOHN ET AL) 27 September 1949 (1949-09-27) * column 2, line 6 - line 50 * * figures *	1-3,6,11	

TECHNICAL FIELDS SEARCHED (IPC)

H01F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	11 February 2009	Stichauer, Libor

CATEGORY OF CITED DOCUMENTS

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11-02-2009

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