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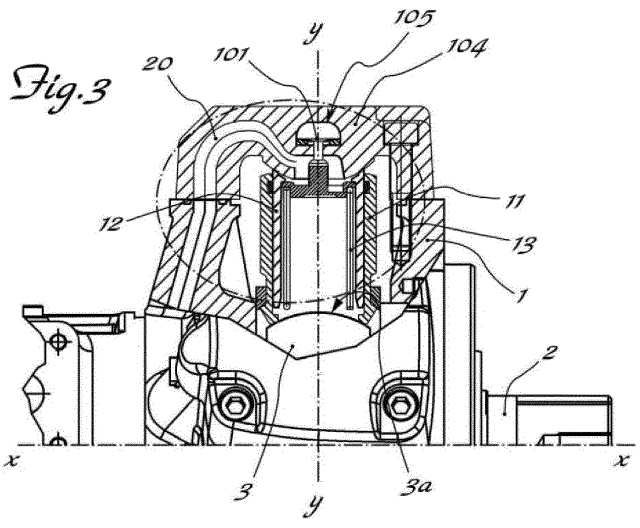
(54) **FLUID-COLUMN HYDRAULIC MOTOR WITH SIMPLIFIED MEANS FOR RETAINING THE PROPULSION MEMBERS AGAINST RESPECTIVE SLIDING SURFACES**

(57) Fluid-column hydraulic motor comprising a casing (1) which internally seats the drive shaft (2) provided with an eccentric cam (3) against which a plurality of propulsion members (10) act, said propulsion members being closed inside the casing (1) by a respective cover (104) which is fastened to the casing (1) by respective fixing means, each propulsion member (10) comprising an outer cylinder (11), one of the two end edges (11a) of which rests on the outer surface (3a) of the said eccentric cam (3), and a piston (12), telescopically slidable in the radial direction inside the cylinder (11) and having one of the two end edges making bearing contact against a respective sliding surface (104b) of the cover (104); means for sealingly retaining the piston (12) against the sliding surface (104b) of the cover (104), said retaining means comprising an anchoring pin (100) formed as one piece and provided with:

- a head (101) for engagement with the cover (104) of the motor;
- a shank (102) with a diameter smaller than that of the head;
- a radially inner disk (103) with an outer diameter smaller than the inner diameter of the piston (12) and designed to make axial contact against an inwardly projecting annular edge (12a) formed on the radially outer end of the said piston (12), correspondingly the cover (104) of the motor having:
- a radially inner keyed cavity (105).



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Description

[0001] The present invention relates to a hydraulic motor provided with improved means for retaining the propulsion members against associated sliding surfaces.

[0002] It is known in the technical sector relating to the construction of motors with propulsion members moved by means of a fluid supply and therefore referred to as being of the fluid column type that there exists the possibility of realizing said propulsion members with a cylinder and a piston which are telescopically coupled together so as to move relative to each other, being extended or shortened upon rotation of an eccentric cam associated with the drive shaft, thus transmitting a thrust to the said shaft by means of the fluid supplied/discharged inside them.

[0003] Said propulsion members may be arranged radially, axially or inclined.

[0004] For the purposes of the present patent below the hydraulic motors will also be understood as referring to said fluid column motors.

[0005] It is also known that, in the case of motors with radial propulsion members, one of the problems of the latter consists in the need to keep the end edge of the cylinder and the piston sealingly in contact respectively with the said eccentric cam and a reaction element formed by a cover fixed to the casing of the motor, so as not to cause seepage of fluid during the relative stroke of piston and cylinder.

[0006] In greater detail and with regard to retention of the element - normally the internal piston - which must remain in contact with a spherical surface of the motor cover, the prior art envisages complicated constraining means formed with a large number of parts which require separate machining, preassembly for installation and complicated operations carried out by skilled personnel for final assembly of the motor.

[0007] An example of this prior art is for example described and illustrated in EP 0,851,119 and EP 1, 609, 987.

[0008] The technical problem which is posed therefore is that of providing a fluid-column hydraulic motor, in particular, but not necessarily of the radial type, which has simplified means for retaining the external cylinder of the propulsion members against respective surfaces with which they must make contact in a sealingly stable manner.

[0009] In connection with this problem it is also required that such a hydraulic motor should have small dimensions, be able to produced and assembled in an easy and low-cost manner and be able to be installed at any user site, including those not specialized for this purpose, thus also allowing simplified ordinary maintenance operations to be performed.

[0010] These results are obtained according to the present invention by a hydraulic motor according to the characteristic features of Claim 1.

[0011] Further details may be obtained from the following description of a non-limiting example of embodiment of the subject of the present invention, provided with reference to the accompanying drawings, in which:

Figure 1: shows a schematic partially cross-sectioned view of a detail of a radial-motor propulsion member according to the prior art;

Figure 2: shows a schematic partially cross-sectioned view of a radial-motor propulsion member according to Fig. 1;

Figure 3: shows a schematic partially cross-sectioned view of a radial motor according to the present invention;

Figure 4: shows the enlarged detail of the retaining pin of the piston according to the present invention;

Figure 5: shows the sequence for assembly of the retaining pin of the piston according to the present invention.

[0012] As shown in Figs. 1 and 2 and assuming solely for the sake of convenience of the description and without a limiting meaning a longitudinal direction X-X corresponding to the axis of the motor and transverse/radial direction Y-Y corresponding to the axis of the propulsion member, the hydraulic motor in the version with radial propulsion members according to the prior art comprises a casing 1 having, housed inside it, the shaft 2 mounted on bearings and carrying the eccentric cam 3 against which a plurality of propulsion members 10 act. Each propulsion member 10 is contained externally inside the casing 1 by a respective cover 4 which is fastened to the casing 1 by respective fixing means which are preferably inserted in the radial direction.

[0013] Said propulsion members 10 are in turn formed by an external cylinder 11, one of the two end edges of which bears against the outer surface 3a of the said eccentric cam 3, and by a piston 12 telescopically slidable in a radial direction inside the cylinder 11 and having one of its two end edges in bearing contact against a respective sliding surface 4b of the cover 4.

[0014] The contact edge of said cylinder 11 and said piston 12 resting on the respective sliding surface 4b of the cover 4 and sliding surface 3a of the eccentric cam 3 (Fig. 2) is substantially formed by a respective annular edge 11a,12c having a contact surface 11b,12b parallel to the surface of the eccentric cam.

[0015] In the contact zone between the cylinder 11 and the eccentric cam 3 said retaining elements consist of: a coaxial shoe 13 having a diameter slightly greater than the external diameter of the cylinder 11 so as to allow the passage thereof as far as an end-of-travel stop consisting of a tooth 11c extending outwards and able to engage with the means for performing retaining in the radial direction described below.

[0016] Said shoe 13 has, moreover, at least one pair of opposite and parallel undercuts with a cylindrical surface designed to form an engaging element for a ring 15 (Figs. 1 and 2) arranged around each edge 13c of all the

shoes 13 for retaining each cylinder 11 and having its centre on an axis parallel to that of the drive shaft 2 and passing through the centre of the spherical cam 3.

[0017] In this way the opposite rings 15 retain radially all the shoes 13 which, in turn, keep the associated cylinder 11 in bearing contact against the eccentric cam 3 during rotation thereof.

[0018] In order to allow the to-and-fro movement while maintaining the sealed bearing contact of the piston 12 during the extension/shortening due to rotation of the eccentric cam 3 moved by the fluid supplied through the duct 20, the sliding surface 4b of the cover 4 has a convex spherical shape and correspondingly the contact surface of the piston 12 is shaped as a corresponding concave spherical surface 12b.

[0019] According to the prior art (Figs. 1 and 2) in the zone of contact between the piston 12 and the cover 4 the relative retaining elements are formed by a pin 52 provided with a head 53 which has a spherical surface 53a resting on corresponding support elements 54 which are fixed to the casing 1 so that the head 53 itself forms a ball joint; the shank 52a of the pin 52 supports a cylindrical body 55 having a diameter such that its side surface 55a makes contact with the inner side surface of the piston 12 and its radially outer front surface 55b is arranged underneath an annular tooth 12c of the cylinder 12 projecting towards the inside thereof. Resilient means in the form of a spring 16 are arranged between the cylindrical body 55 and the said annular tooth 12c so as to ensure constant relative contact between the sliding surfaces 12b,1a during the various working phases of the propulsion member 10; the piston 12 also carries an end-of-travel element 50 for preventing the spring 16 from being stressed beyond its yield point.

[0020] As shown in Figs. 3 and 4 which show a motor according to the present invention, it is envisaged that said means for retaining the piston 12 against the sliding surface are composed of an anchoring pin formed as one piece and having:

- a head 101 for engagement with the cover 104 of the motor;
- a shank 102 with a diameter smaller than that of the head;
- a radially inner disk 103 with an outer diameter smaller than the inner diameter of the piston 12 and designed to make axial contact against an inwardly projecting annular edge 12a formed on the radially outer end of the said piston 12, the disk being suitably connected in the axial direction Y-Y to the shank 102.

[0021] Correspondingly the cover 104 of the motor has (Fig. 4):

-) a sliding surface 104b against which the radially outer end of the piston 12 must be sealingly retained;
-) a keyed cavity 105 comprising a first radially inner seat 105a of suitable diameter designed to receive radially the head 101 of the pin 100;
-) a second radially outer seat 105b with an internal constriction 105c designed to receive the head 101 and prevent it from coming out in the radial direction;
-) a third seat 106 (Fig, 5a) connecting together the first inner seat 105a and the second outer seat 105b.

[0022] As shown in Fig. 4, the third connecting seat 106 allows the head 101 of the retaining pin 100 to pass from the first radially inner seat 105a to the second radially outer seat 105b, inside which the head remains trapped.

[0023] In greater detail and as shown in said Fig. 12, the assembly sequence involves:

--) insertion of the retaining pin 100 inside the piston 12 until frontal contact of the disk 103 against the annular edge 12c occurs;

--) inclination of the piston 12 and the pin 100 with the associated retaining head 101 at a suitable angle until the retaining head 101 comes into alignment with the third connecting seat 106;

--) insertion of the retaining head along the connection seat 106 until the head 101 enters inside the second outer seat 105b drawing the piston 12 along with it;

--) counter-inclination of the piston 12 and the head 101 in the opposite direction so as to bring back into coaxial alignment the cover, the piston and the associated retaining head, which is now trapped inside the second outer seat 105b, ready for use, and is designed to pull and keep the end 12a of the piston 12 against the sliding surface 104b during operation of the motor.

[0024] An internal spring 13 for pushing the associated ends against the corresponding sliding surfaces is arranged between the opposite ends of the piston 12 and the cylinder 11.

[0025] It is therefore clear how the motor according to the invention results in a significant reduction in the parts required for operation thereof and also in a substantial simplification of the machining operations which must be carried out on the single parts and the assembly operations; the formation of the convex and concave spherical surfaces on the respective covers and projections of the casing, piston and cover may in fact be easily realized during production of the two components and does not require additional machining and/or handling during assembly of the motor.

[0026] Taking into account that a hydraulic motor on average has a ring of five propulsion members, but also in some cases two rings of five propulsion members in pairs, it has been estimated that, owing to the particular constructional form of the retaining element designed as one piece and the corresponding particular form of the cover 104 of the motor, a reduction of between 20% and 35% in the time required for preparation of the motor may

be achieved.

[0027] Although described in connection with an embodiment of the radial type, it is understood that the solution according to the present invention may also be applied to motors which are of the axial type and/or have inclined propulsion members.

[0028] The scope of the present invention also includes the equivalent configuration of the propulsion member inverted with an inner cylinder and outer piston.

[0029] Although described in connection with a number of embodiments and a number of preferred examples of embodiment of the invention, it is understood that the scope of protection of the present patent is determined solely by the claims below.

Claims

1. Fluid-column hydraulic motor comprising a casing (1) which internally seats the drive shaft (2) provided with an eccentric cam (3) against which a plurality of propulsion members (10) act, said propulsion members being closed inside the casing (1) by a respective cover (104) which is fastened to the casing (1) by respective fixing means, each propulsion member (10) comprising an outer cylinder (11), one of the two end edges (11a) of which rests on the outer surface (3a) of the said eccentric cam (3), and a piston (12), telescopically slidable in the radial direction inside the cylinder (11) and having one of the two end edges making bearing contact against a respective sliding surface (104b) of the cover (104); means for sealingly retaining the piston (12) against the sliding surface (104b) of the cover (104).
characterized in that:

said retaining means comprising an anchoring pin (100) formed as one piece and provided with:

- a head (101) for engagement with the cover (104) of the motor;
- a shank (102) with a diameter smaller than that of the head;
- a radially inner disk (103) with an outer diameter smaller than the inner diameter of the piston (12) and designed to make axial contact against an inwardly projecting annular edge (12a) formed on the radially outer end of the said piston (12)

and **in that**
correspondingly the cover (104) of the motor has:

-) a radially inner keyed cavity (105) comprising a first radially inner seat (105a) of suitable diameter designed to receive the head (101) of the pin (100) in the radial direction;
-) a second radially outer seat (105b) with an internal constriction (105c) designed to receive the head (101) and prevent it from coming out in the radial direction;
-) a third seat (106) connecting together the first inner seat (105a) and the second outer seat (105b).

2. Motor according to Claim 1, **characterized in that** an internal spring (13) providing a thrust against the respective sliding surfaces (104b,3a) is arranged between the opposite ends of the piston (12) and the cylinder (11).

3. Motor according to Claim 1, **characterized in that** it is of the type with radial propulsion members.

4. Motor according to Claim 1, **characterized in that** it is of the type with axial propulsion members.

5. Motor according to Claim 1, **characterized in that** it is of the type with inclined propulsion members.

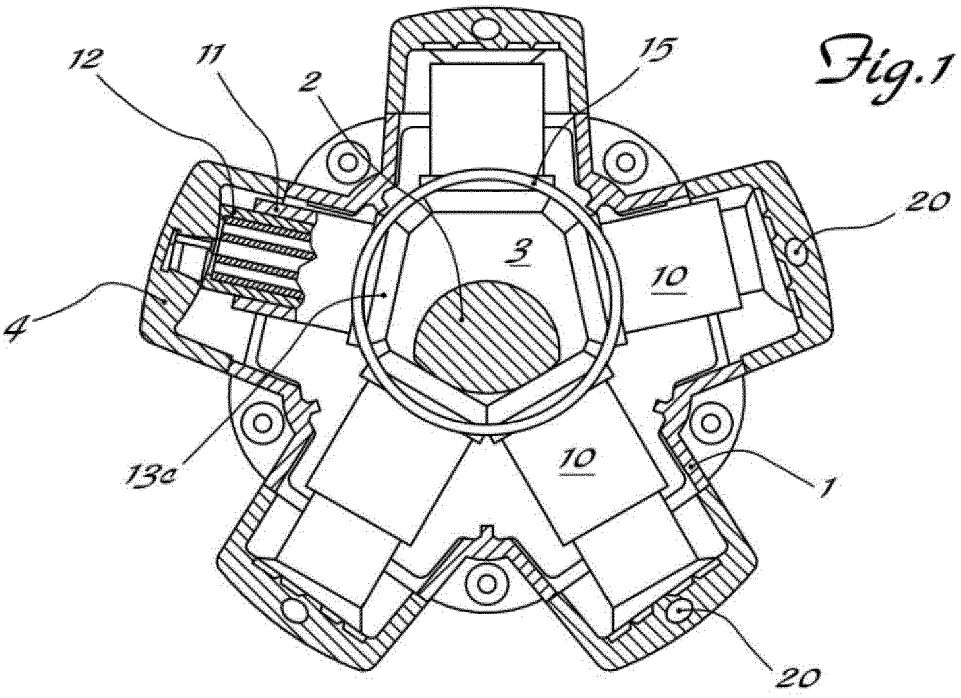


Fig.1

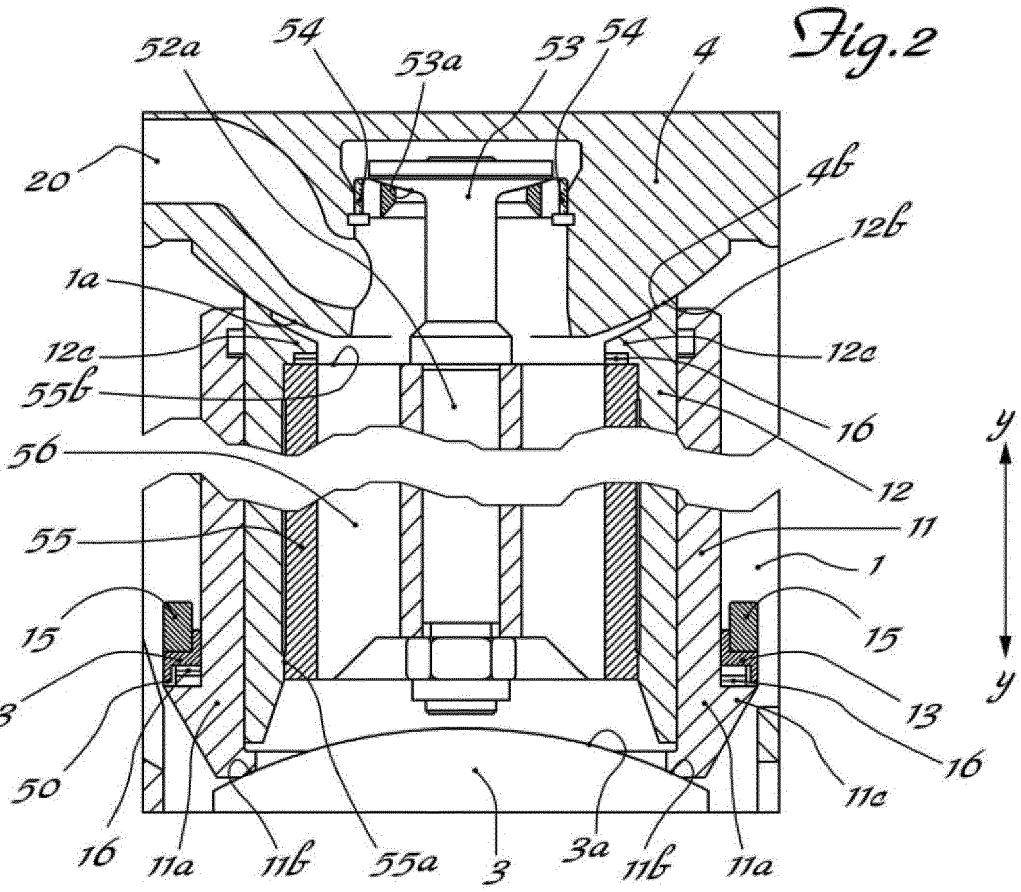
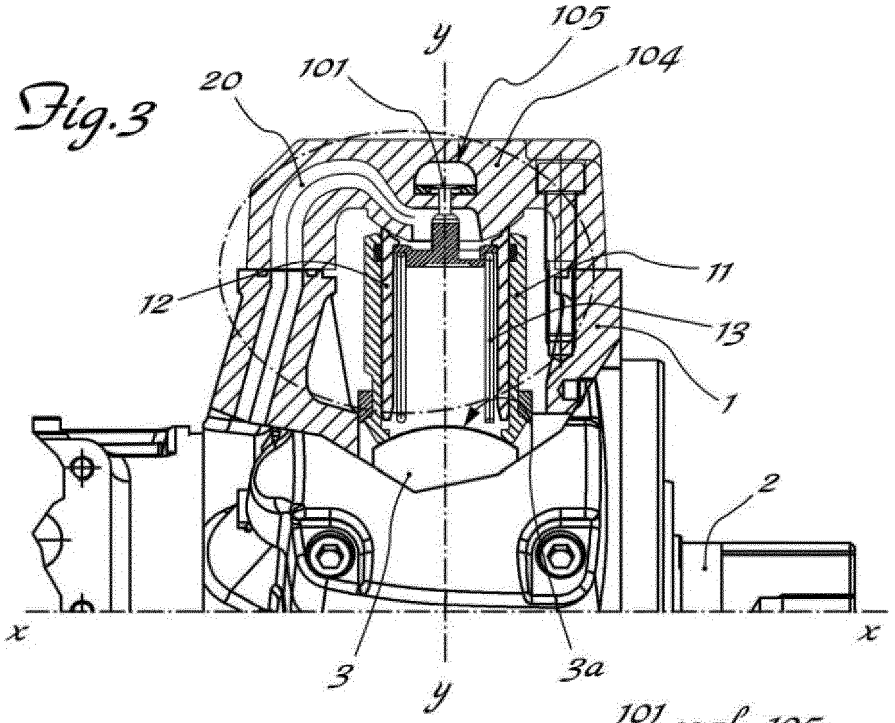


Fig.2

PRIOR ART

Fig.3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105
104
101
20
11
12
13
1
2
x
x
3
3a
y

Fig.4

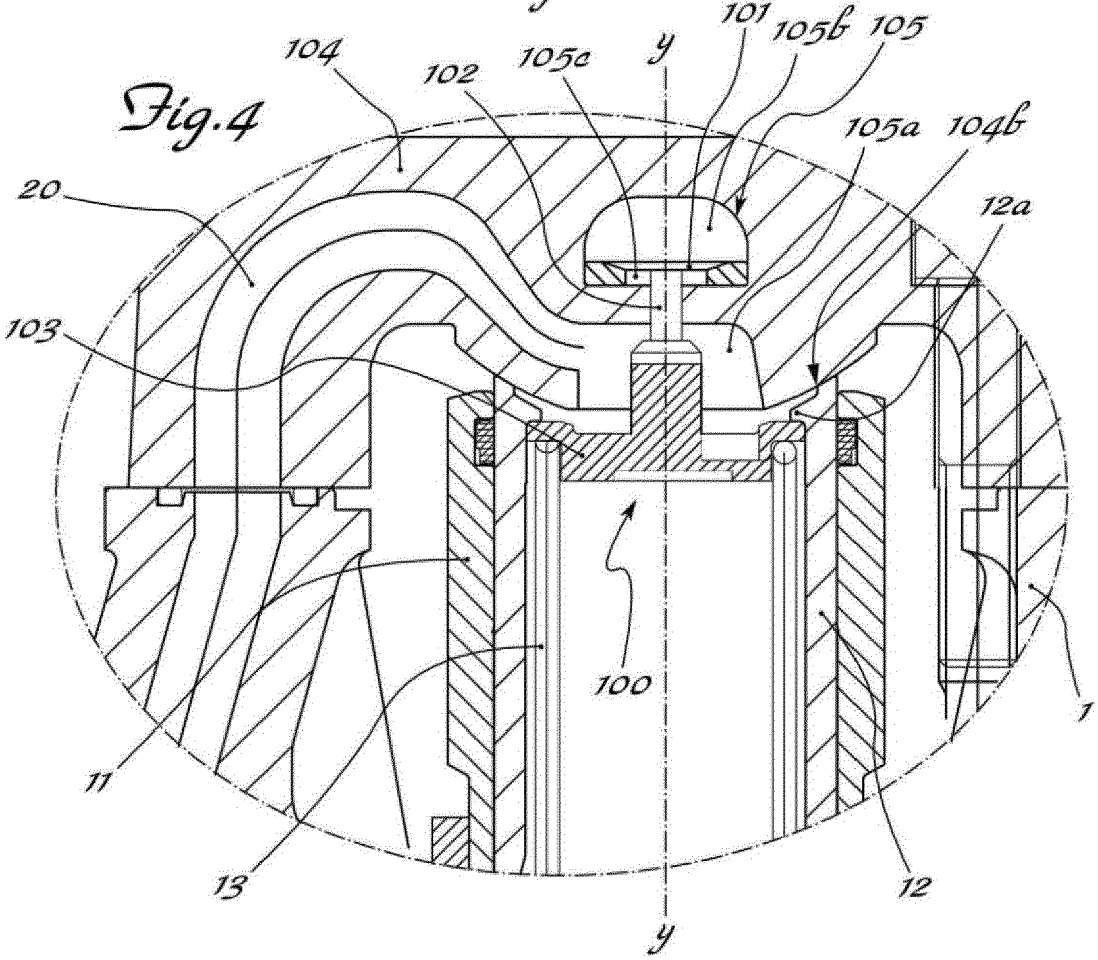
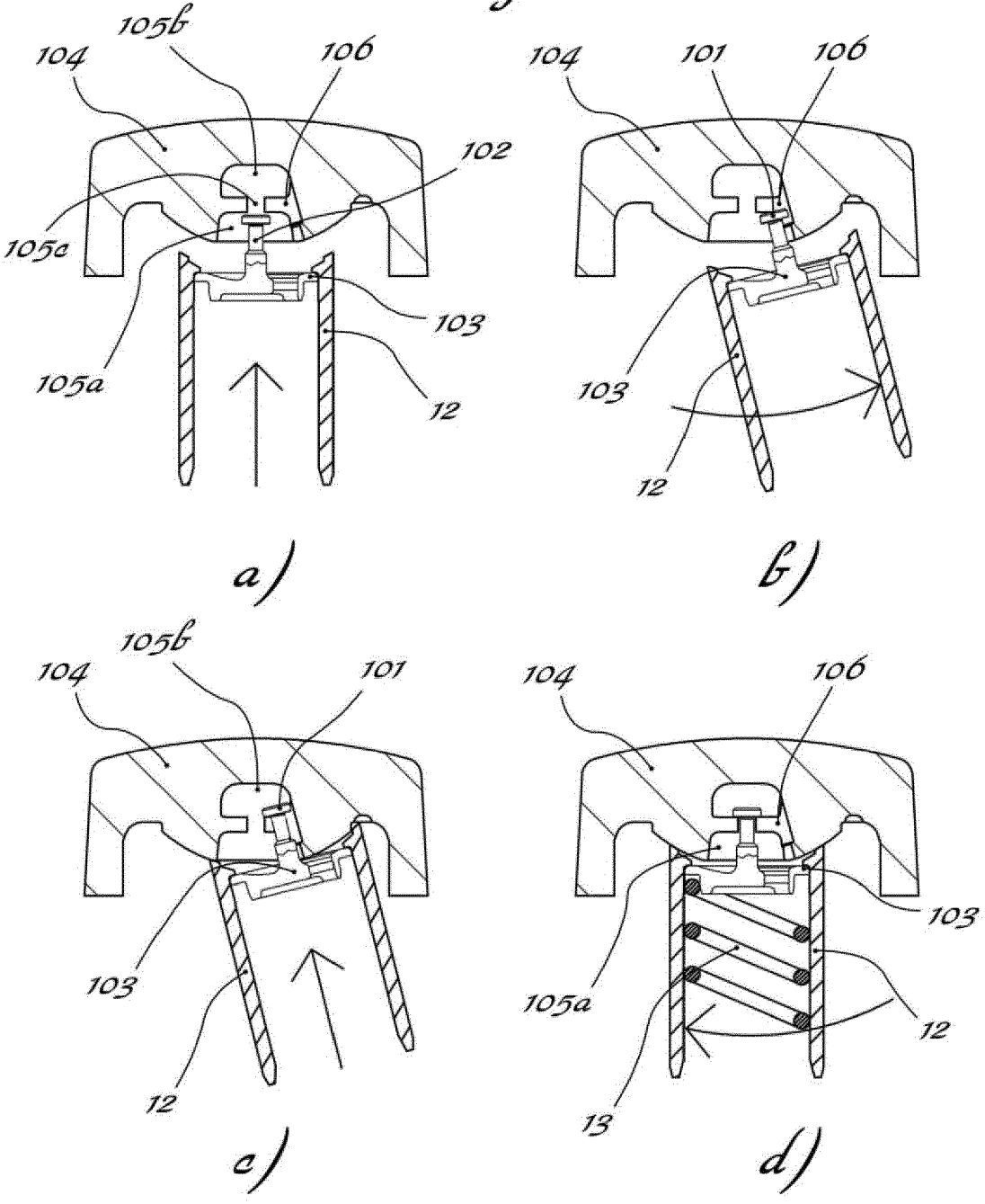

104
102
105c
y
101
105b
105
105a
104b
12a
20
103
100
1
11
13
12
y

Fig.5


105b
104
106
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105c
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105a
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a)
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105a
12
13
d)

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EUROPEAN SEARCH REPORT

Application Number
EP 15 19 3044

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F04B
F03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2016	Ziegler, Hans-Jürgen

CATEGORY OF CITED DOCUMENTS

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