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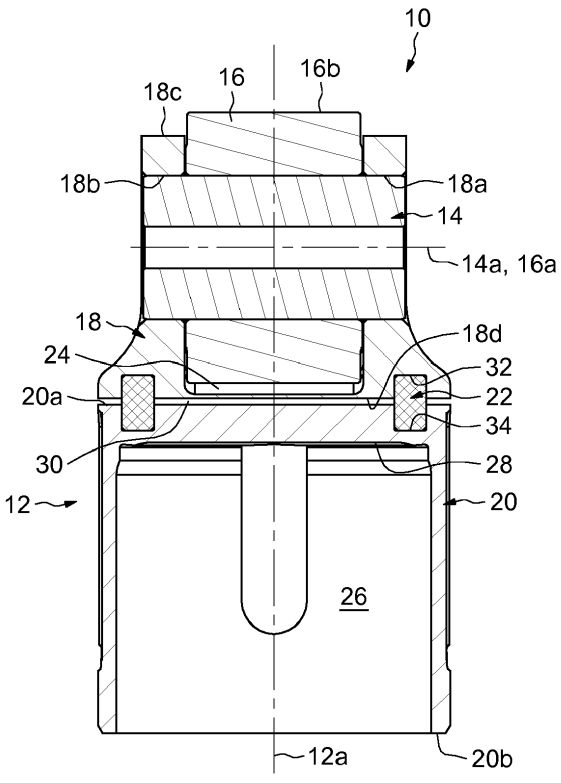
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(54) CAM FOLLOWER ROLLER DEVICE WITH TAPPET BODY MADE IN TWO PARTS

(57) The cam follower roller device for a pump piston of a fuel injection pump comprises a tappet body 12, a pin 14 mounted on said tapped body and a roller 16 mounted on said pin. The tappet body 12 comprises separate first and second parts 18, 20, the first part 18 supporting the pin 14 and the second part 20 delimiting an abutment surface 28 for the pump piston.

The device further comprises at least one deformable coupling member 22 interposed between said first and second parts 18, 20 of the tappet body to couple together said parts.

FIG.1



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Description

[0001] The present invention relates to the field of cam follower roller devices used in automotive or industrial applications.

[0002] One advantageous application of the invention is the use of the cam follower roller device in a fuel injection pump intended for an internal combustion engine, in particular of a motor vehicle.

[0003] Such a cam follower roller device generally comprises an outer tappet body, a pin mounted on the tappet body and a roller movable in rotation relative to the pin around its axis. When the cam follower roller device is in service in a fuel injection pump, the roller collaborates with a cam synchronized with the internal combustion engine camshaft or crankshaft. The rotation of the camshaft, or crankshaft, leads to a periodic displacement of a piston of the pump that rests against the tappet body, to allow fuel to be delivered.

[0004] In operation, the device is intended to slide back and forth into a pump housing. Generally, there is an angular misalignment between the axis of the tappet body and the axis of the pump housing. Accordingly, edge stresses may occur at the ends of the roller of the device with the contact against the cam. Accordingly, in operation, the pressure contact between the roller and the cam may be increased.

[0005] One aim of the present invention is to overcome these drawbacks.

[0006] It is a particular object of the present invention to provide a cam follower roller device having a design adapted to reduce edge stresses on the roller in operation.

[0007] In one embodiment, the cam follower roller device for a pump piston of a fuel injection pump comprises a tappet body, a pin mounted on said tapped body, and a roller mounted on said pin. The tappet body comprises separate first and second parts. The first part supports the pin and the second part delimits an abutment surface for the pump piston.

[0008] The device further comprises at least one deformable coupling member interposed between said first and second parts of the tappet body to couple together said parts.

[0009] The tappet body is in at least two parts which are coupled together via the deformable coupling member to flexibly couple said parts together. The contact between the first and second parts of the tappet body is achieved only via the deformable coupling member. There is no direct contact between the first and second parts of the tappet body.

[0010] With the provision of the deformable coupling member, the first part of the tappet body supporting the pin may tilt relative to the second part. Accordingly, an angular tilting of the axis of the pin relative to the abutment surface of the second part of the tappet body may be obtained.

[0011] The first part, which supports the pin and the roller, is able to move angularly relative to the second part to accommodate angular misalignment between the axis of the tappet body and the axis of the pump housing. When such a tilting occurs, the coupling member is deformed. The edge stresses that may occur at the ends of the roller with the contact against the associated cam is reduced. Accordingly, in operation, the pressure contact between the roller and the cam may be reduced.

[0012] Preferably, an axial gap is provided between said first and second parts of the tappet body, said deformable coupling member extending at least partly inside said gap. Said axial gap may be delimited between a lower end face of the first part of the tappet body and an upper end face of the second part of said tappet body, said end faces facing each other.

[0013] In one embodiment, said deformable coupling member is made from deformable material, preferably elastically deformable material. Said deformable coupling member may be made from synthetic material such as plastic material or elastomer or nitrile rubber or polyurethane. Each of the first and second parts of the tappet body may be made from at least a rigid material such as metal. Preferably, the first part of the tappet body comprises two facing through-holes into which is mounted the pin.

[0014] Advantageously, said deformable coupling member is secured to each of the first and second parts of the tappet body.

[0015] The first part of the tappet body may delimit at least partly a cavity inside which is located the roller.

[0016] In one embodiment, said deformable coupling member comprises an annular ring. Each of the first and second parts of the tappet body may comprise a groove into which is mounted said annular ring.

[0017] In another embodiment, said deformable coupling member comprises at least a layer. In a particular embodiment, said deformable coupling member further comprises retaining means connected to the layer and cooperating with the abutment surface of the second part to axially retain said second part relative to the first part. The retaining means may comprise hooks in axial contact with the abutment surface.

[0018] The present invention and its advantages will be better understood by studying the detailed description of specific embodiments given by way of non-limiting examples and illustrated by the appended drawings on which:

- Figure 1 is a cross-section of a cam follower roller device according to a first example of the invention,
- Figure 2 is a side view of the device of Figure 1,
- Figure 3 is a cross-section of a cam follower roller device according to a second example of the invention,
- Figure 4 is a cross-section of a cam follower roller device according to a third example of the invention,
- Figure 5 is a section on V-V of Figure 4, and
- Figure 6 is a cross-section of a cam follower roller

device according to a fourth example of the invention.

[0019] As shown on Figures 1 and 2, a cam follower roller device 10 comprises a tappet housing or body 12 extending along an axis 12a, a shaft or pin 14 extending along an axis 14a perpendicular to the axis 12a, and a roller 16, with an axis 16a coaxial with the axis 14a, mounted on the pin and movable in rotation relative to said pin. In the disclosed embodiment, the roller 16 is directly mounted on the pin 14. Alternatively, a rolling bearing or a plain bearing may be radially interposed. The roller 16 comprises an axial cylindrical outer surface (not referenced) which forms a contact surface intended to bear against the associated cam of the internal combustion engine, and two opposite radial frontal end faces (not referenced) axially delimiting said outer surface.

[0020] The pin 14 is mounted on the tappet body 12. The tappet body 12 supports the pin 14. The pin 14 comprises two opposite pin ends and a central portion (not referenced) extending between said pin ends. The central portion of the pin delimits a cylindrical outer bearing seat for the roller 16. The portion of the pin 14 left free by the tappet body 12 delimits the central portion. The pin ends extend axially on either side of the roller 16.

[0021] The tappet body 12 is formed of first and second separate parts 18, 20. As will be described later, the device 10 further comprises one deformable coupling ring 22 interposed between the first and second parts 18, 20 of the tappet body to couple together said parts.

[0022] Each part 18, 20 of the tappet body may be made from a rigid material, such as metal or PA. In the disclosed example, the first part 18 of the tappet body is made in one part. The first part 18 extends along the axis 12a. The first part 18 supports the pin 14. The first part 18 comprises through-holes 18a, 18b inside which are mounted the pin ends of the pin. Said through-holes 18a, 18b face one another. The pin ends may be fixed into said through-holes 18a, 18b for example by caulking. Alternatively, it could be possible to fix each pin end on the first part 18 of the tappet body 12 by any other appropriate means, for example with a washer inserted into the associated through-hole.

[0023] The first part 18 of the tappet body delimits an open cavity 24 inside which is located the roller 16. The roller 16 is mounted inside the cavity 24. The through-holes 18a, 18b open into the cavity 24. The roller 16 axially protrudes outwards with respect to an upper face 18c of the first part 18 of the tappet body. The first part 18 also comprises a lower face 18d which delimits axially together with the upper face 18c said first part.

[0024] In the disclosed example, the second part 20 of the tappet body is made in one part. The second part 20 extends along the axis 12a. The second part 20 also delimits an open cavity 26 oriented axially on the side opposite to the cavity 24. A piston of a fuel injection pump is intended to extend into the cavity 26 and to axially bear against a rear abutment surface 28 of the tappet body. Said rear abutment surface 28 is oriented axially on the side opposite to the roller 16. The rear abutment surface 28 is planar and extends radially. The cavity 26 is axially delimited by the rear abutment surface 28. The second part 20 comprises an upper face 20a and an opposite lower face 20b which delimits axially together with said upper face said second part. The upper face 20a axially faces the lower face 18d of the first part of the tappet body.

[0025] The first and second parts 18, 20 of the tappet body are axially spaced apart one from another with respect to the axis 12a. An axial gap 30 is provided between the first and second parts 18, 20. The axial gap 30 is formed between the lower face 18d of the first part and the upper face 20a of the second part.

[0026] The deformable coupling ring 22 is axially interposed between the first and second parts 18, 20 of the tappet body. The coupling ring 22 is axially interposed between the lower face 18d of the first part and the upper face 20a of the second part. The coupling ring 22 extends inside the axial gap 30. The coupling ring 22 is in contact with the first part 18 on one side and in contact with the second part 20 on the other side. The coupling ring 22 is secured to each of the first and second parts 18, 20.

[0027] In the disclosed example, an annular groove 32, respectively 34, is formed on the lower face 18d of the first part, respectively on the upper face 20a of the second part. The grooves 32, 34 axially face each other. The coupling ring 22 is mounted into each of the grooves 32, 34. For example, the coupling ring 22 may be press-fitted into said grooves. Alternatively, the ring 22 may be secured into each groove 32, 34 by any appropriate means, for example by gluing.

[0028] The coupling ring 22 has an annular form. The coupling ring 22 is made from deformable flexible material, for example elastically deformable material. The coupling ring 22 may be made from synthetic material such as plastic material or elastomer or nitrile rubber or polyurethane.

[0029] With the interposition of the deformable coupling ring 22 between the two parts 18, 20 of the tappet body, a flexible connection is provided between said parts. Accordingly, an angular tilting of the first part 18 supporting the pin 14 relative to the second part 20 of the tappet body may be obtained. The axis 14a of the pin may tilt angularly relative to the abutment surface 28 of the second part 20. The coupling ring 22 is locally compressed in this case.

[0030] When the device 10 is mounted into the pump housing, the first part 18 of the tappet body supporting the pin 14 is able to move angularly relative to the second part 20 to accommodate angular misalignment between the axis of the housing and the axis 12a of the tappet body. With a contact between the roller 16 of the device and the cam of the internal combustion engine, said roller supported by the pin 14 may tilt angularly relative to the second part 20 of the tappet housing. This has the effect of reducing the edge stresses that may occur at the ends of the roller 16. Accordingly, in operation, the pressure

contact between the roller 16 and the cam may be reduced.

[0031] The example illustrated on Figure 3, in which identical parts are given identical references, only differs from the previous example in that the first and second parts 18, 20 of the tappet body delimit together the cavity 24 inside which is located the roller 16. A groove 36 is formed on the upper face 20a of the second part and receives a part of the roller 16. A gap is provided between each frontal surface of the roller and a facing lateral wall of the groove 36 to allow the tilting of the first part 18 of the housing relative to the second part 20.

[0032] The example illustrated on Figures 4 and 5, in which identical parts are given identical references, differs from the first example in that the device comprises one deformable coupling layer 40 axially interposed between the first and second parts 18, 20 of the tappet body. The coupling layer 40 is in axial contact with the first part 18 on one side and in axial contact with the second part 20 on the other side. The coupling layer 40 is axially interposed between the lower face 18d of the first part and the upper face 20a of the second part. The axial gap (not referenced) provided between these faces 18d, 20a is filled by the coupling layer 40.

[0033] The coupling layer 40 is secured to each of the first and second parts 18, 20. The coupling layer 40 is secured to the lower face 18d of the first part and to the upper face 20a of the second part by any appropriate means, for example by gluing. The coupling layer 40 forms a flat band. Similarly to the first example, the coupling layer 40 is made from deformable flexible material, for example elastically deformable material. The coupling layer 40 may be made from synthetic material such as plastic material or elastomer or nitrile rubber or polyurethane.

[0034] In the example illustrated on Figure 6, in which identical parts are given identical references, the device comprises a deformable coupling member 42 interposed between the first and second parts 18, 20 of the tappet body. The coupling member 42 is made in one part. In this example, the coupling member 42 is overmoulded on the first part 18 of the tappet body. Similarly to the previous examples, the coupling member 42 is made from deformable flexible material, for example elastically deformable material. The coupling member 42 may be made from synthetic material such as plastic material or elastomer or nitrile rubber or polyurethane.

[0035] The coupling member 42 comprises a layer 44 axially interposed between the lower face 18d of the first part and the upper face 20a of the second part, and an anchorage portion 46 extending from said layer and disposed into a stepped through-hole 18e made into the thickness of said first part. The through-hole 18e extends from the lower end face 18d of the first part and opens into the cavity 24.

[0036] The coupling member 42 also comprises a plurality of studs 48 extending from the layer 44 axially on the side opposite to the anchorage portion 46. Each stud 48 is disposed into a through-hole 20c made into the thickness of the second part 20 of the tappet body. Each through-hole 20c extends from the upper end face 20a of the second part and opens into the cavity 26. The coupling member 42 further comprises lugs 50 extending from each stud and into the associated through-hole 20c. Each lug 50 is provided with a radial hook 52 in axial contact against the abutment surface 28 of the second part 20. The hooks form axial retaining means to axially retain the second part 20 of the tappet body relative to the first part 18. The second part 20 may be secured to the first part 18 equipped with the coupling member 42 by axial pushing.

[0037] In the illustrated examples, each deformable coupling member of the device is made from an elastically deformable material. Alternatively, each deformable coupling member may be made from a plastically deformable material.

Claims

1. Cam follower roller device for a pump piston of a fuel injection pump comprising a tappet body (12), a pin (14) mounted on said tapped body and a roller (16) mounted on said pin, **characterized in that** the tappet body (12) comprises separate first and second parts (18, 20), the first part (18) supporting the pin (14) and the second part (20) delimiting an abutment surface (28) for the pump piston, the device further comprising at least one deformable coupling member (22; 40; 42) interposed between said first and second parts (18, 20) of the tappet body to couple together said parts.

2. Device according to claim 1, wherein an axial gap (30) is provided between said first and second parts (18, 20) of the tappet body, said deformable coupling member (22; 40; 42) extending at least partly inside said gap.

3. Device according to claim 2, wherein said axial gap (30) is delimited between a lower end face (18d) of the first part of the tappet body and an upper end face (20a) of the second part of said tappet body, said end faces facing each other.

4. Device according to any of the preceding claims, wherein said deformable coupling member (22; 40; 42) is made from deformable material.

5. Device according to claim 4, wherein said deformable coupling member (22; 40; 42) is made from elastically deformable material.

6. Device according to any of the preceding claims, wherein each of the first and second parts (18, 20) of the tappet body is made from at least a rigid ma-

terial.

7. Device according to claim 6, wherein each of the first and second parts (18, 20) of the tappet body is made from metal.

8. Device according to any of the preceding claims, wherein the first part (18) of the tappet body comprises two facing through-holes into which is mounted the pin (14).

9. Device according to any of the preceding claims, wherein said deformable coupling member (22; 40; 42) is secured to each of the first and second parts (18, 20) of the tappet body.

10. Device according to any of the preceding claims, wherein the first part (18) of the tappet body delimits at least partly a cavity (24) inside which is located the roller (16).

11. Device according to any of the preceding claims, wherein said deformable coupling member (22) comprises an annular ring.

12. Device according to claim 11, wherein each of the first and second parts (18, 20) of the tappet body comprise a groove (32, 34) into which is mounted said annular ring.

13. Device according to any of the preceding claims 1 to 10, wherein said deformable coupling member (40; 42) comprises at least a layer.

14. Device according to claim 13, wherein said deformable coupling member (42) further comprises retaining means (52) connected to the layer and cooperating with the abutment surface (28) of the second part to axially retain said second part relative to the first part.

15. Device according to claim 14, wherein the retaining means comprise hooks in axial contact with the abutment surface (28).

FIG.2

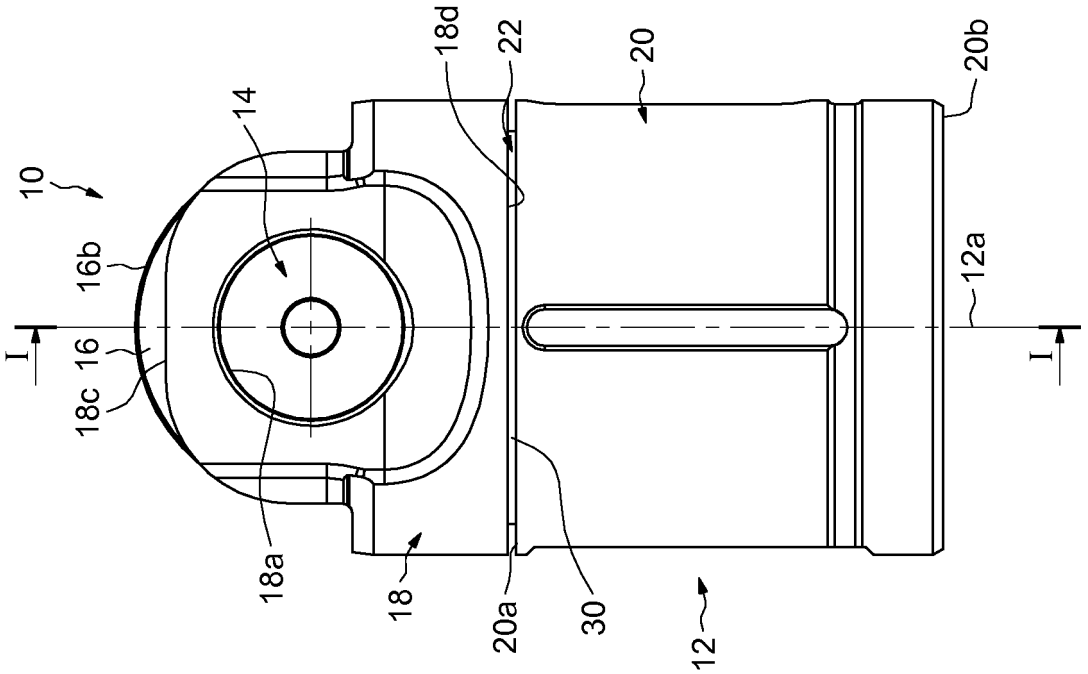

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16b
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18c
I
14
18a
18
18d
22
20
20a
30
12
20b
12a
I

FIG.1

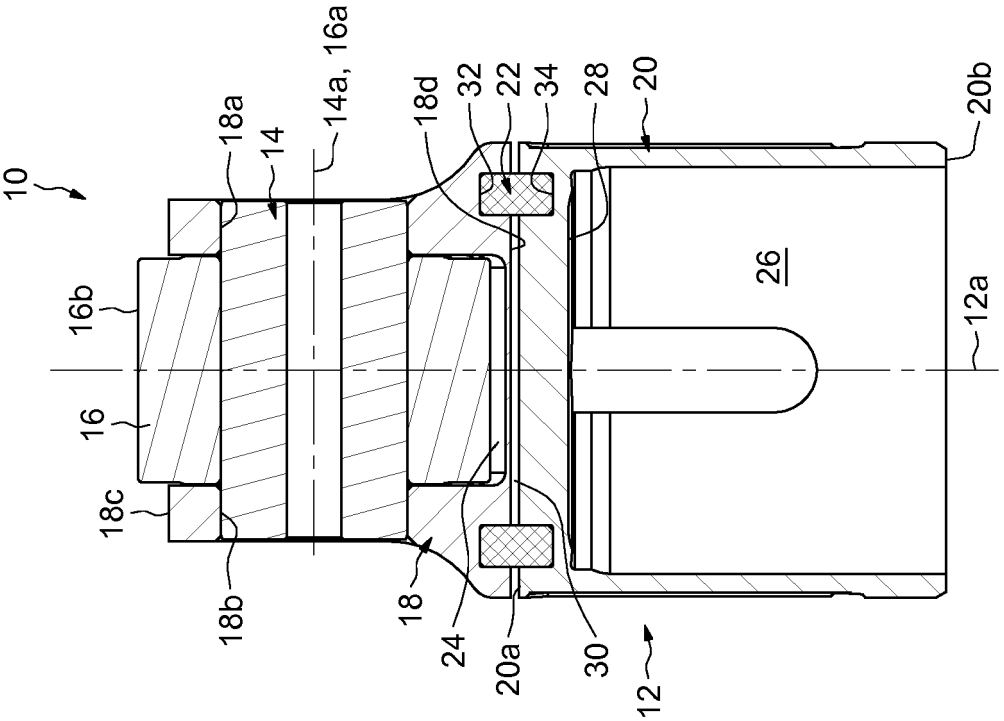

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16b
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18c
18b
18a
14
14a, 16a
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18d
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20a
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26
20b
12a

FIG.3

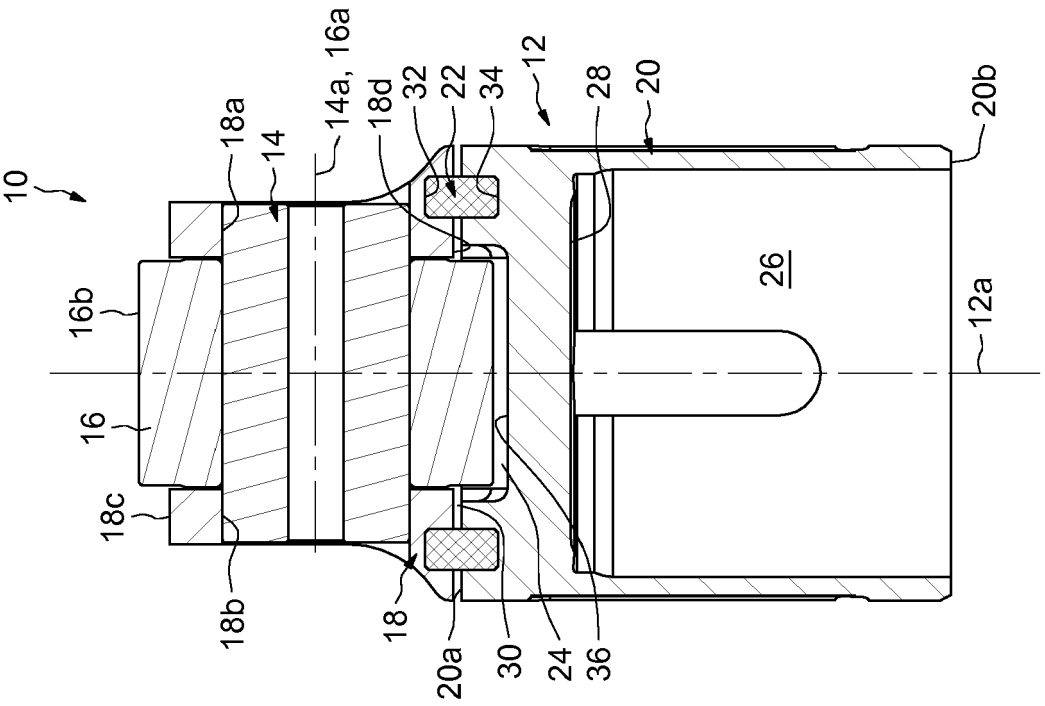

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18c
18b
18a
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14a, 16a
18d
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20a
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20b
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12a

FIG.5

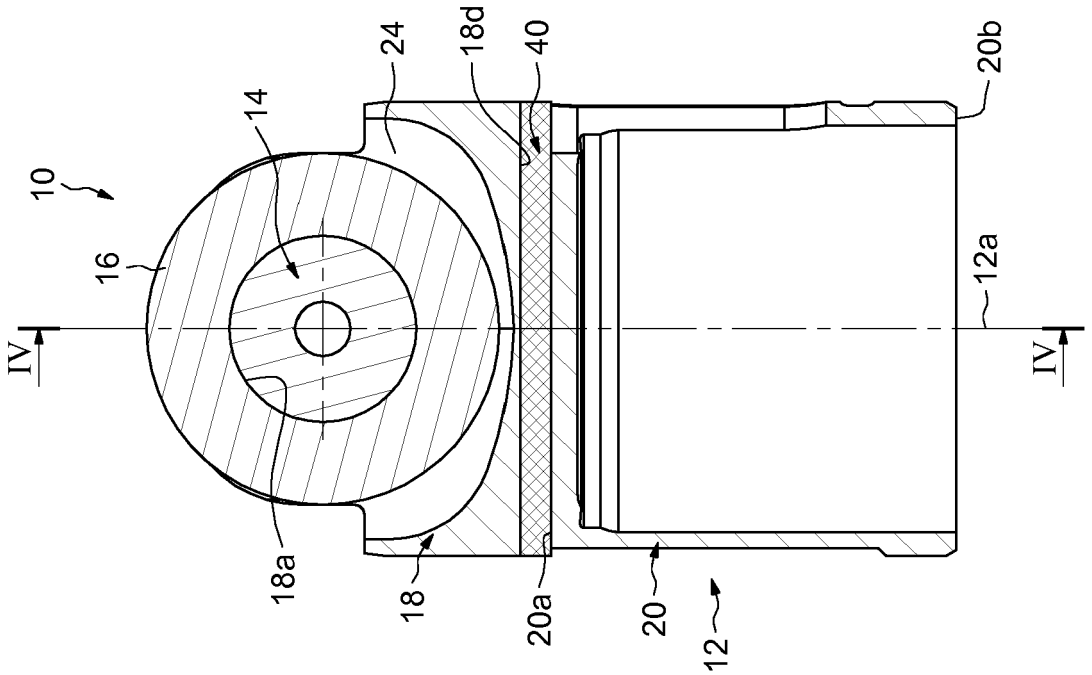

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IV
14
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18d
40
20b
12a
IV
18a
18
20a
20
12

FIG.4

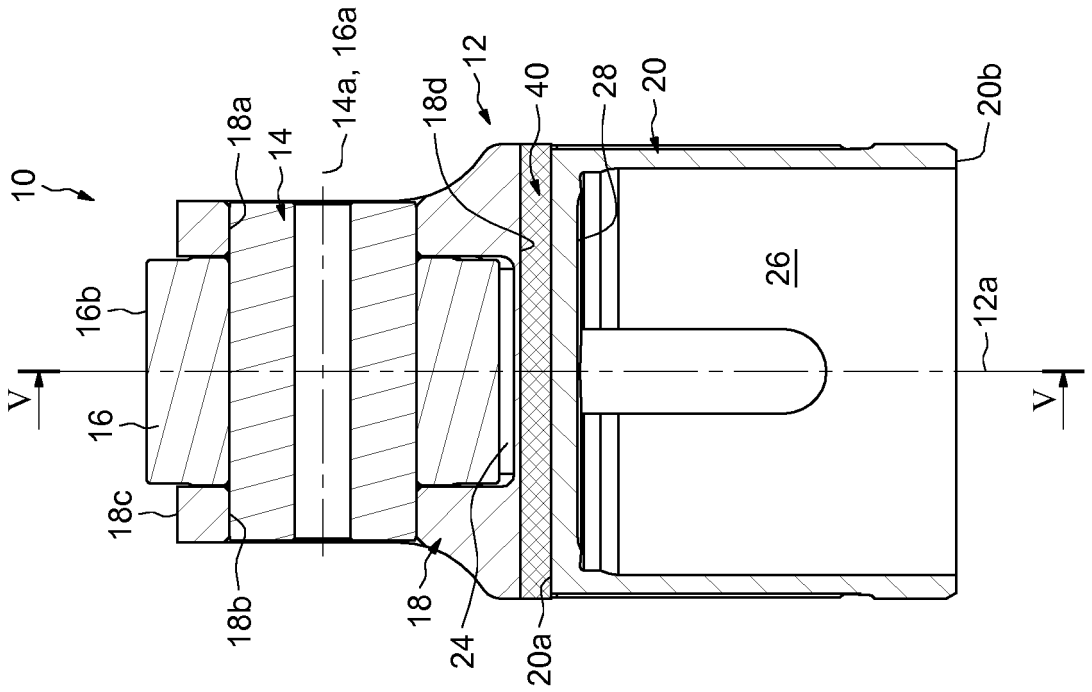
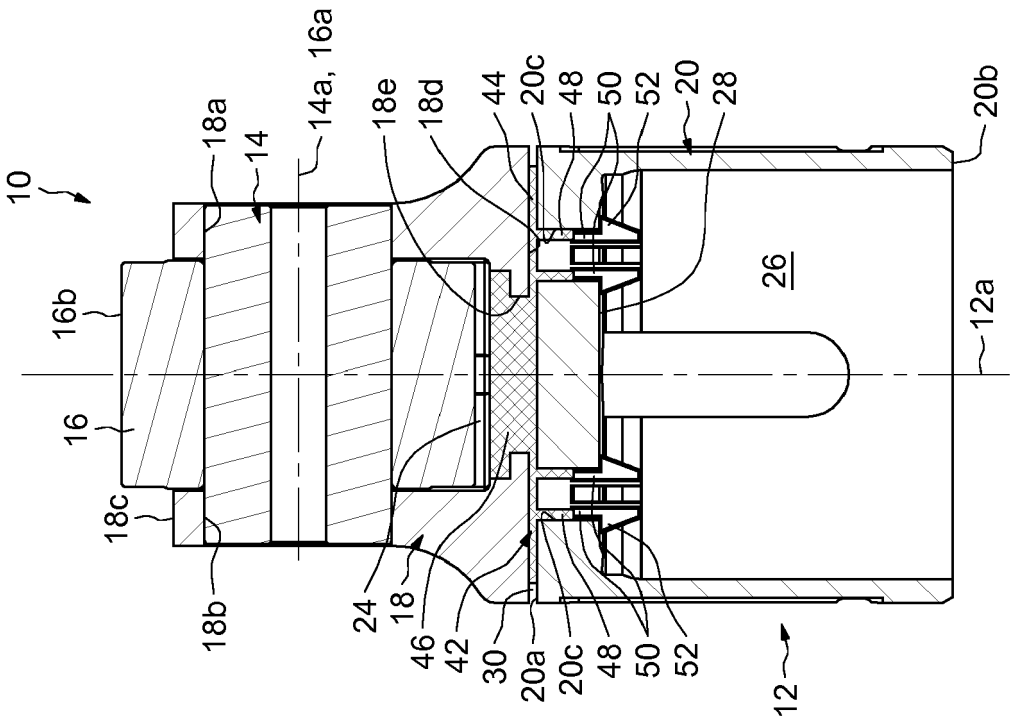

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V
16b
16
18c
18b
18a
14
14a, 16a
18
24
18d
12
40
28
20
20a
26
20b
12a
V

FIG.6


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16b
16
18c
18b
18a
14
14a, 16a
18e
18d
44
20c
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52
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20b
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12a
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20a
20c
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12

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EUROPEAN SEARCH REPORT

Application Number
EP 15 30 7044

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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