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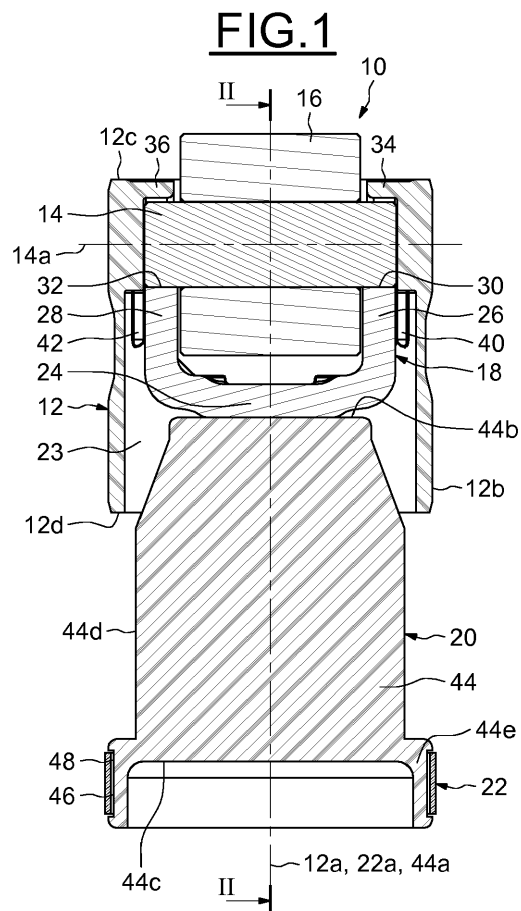
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(54)

CAM FOLLOWER ROLLER DEVICE WITH SPACER AND IMPROVED WEAR RESISTANCE

(57) The cam follower roller device comprises a tappet body (12) extending along an axis, a pin (14) mounted into said tappet body and a roller (16) mounted on said pin. The device further comprises a spacer (20) provided with a main body (44) extending along an axis, mounted into the tappet body (12) and axially protruding outwards relative to said body. The device also comprises at least one anti-friction and/or wear resistance ring (22) mounted on an outer surface of the main body of the spacer, said ring being mounted freely tiltable with respect to said body.



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. Another advantageous application of the invention is the use of the device in a rocker system intended for controlling valves of an internal combustion piston engine.

[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] It is also known to provide the cam follower roller device with an insert as a stroke-transmission part mounted in the tappet body. EP-A1-2 853 738 describes a device comprising such an insert supporting the pin while the tappet body supports said insert.

[0005] A cam follower roller device is generally delivered as a preassembled unit to a motor vehicle manufacturer or system supplier. The axial length of the device may be adapted according to the application and the specification of the manufacturers or system suppliers. It is known to design a forged tappet body with adapted given dimensions for each application and for each manufacturer or system supplier.

[0006] One aim of the present invention is to provide a cam follower roller device with an adaptive and cost-saving design.

[0007] It is a particular object of the present invention to provide a cam follower roller device having a limited wear in operation.

[0008] In one embodiment, the cam follower roller device comprises a tappet body extending along an axis, an insert mounted in the tappet body, a pin mounted at least on said insert, and a roller mounted on said pin. The device comprises a spacer provided with a main body extending along an axis, mounted into the tappet body and axially protruding outwards relative to said body.

[0009] The device further comprises at least one anti-friction and/or wear resistance ring mounted on an outer surface of the main body of the spacer, or on an outer surface of the tappet body, and radially protruding outwards relative to said outer surface. Said anti-friction and/or wear resistance ring is mounted freely tiltable with respect to said body so as to allow an angular tilting of an axis of the said ring relative to the axis of said body.

[0010] The tappet body can have a standardized de-

sign for each application and for each manufacturer or system supplier. The length of the spacer is the only feature of the device to be adapted for the different applications and manufacturers or system suppliers. This leads to a reduction of the manufacturing costs.

[0011] Otherwise, when the device slides into a housing, such as a pump housing, the wear and/or the friction due to this sliding is limited with the provision of the said anti-friction and/or wear resistance ring. Besides, since said ring is freely movable angularly relative to the associated body, said ring may handle misalignment between the axis of said body and the axis of the housing in operation. Said ring acts as a self-aligning ring in order that the axis of said ring may be coaxial to the axis of the housing. Accordingly, in operation, the pressure contact between the roller of the device and the cam is reduced.

[0012] Preferably, said anti-friction and/or wear resistance ring is mounted into a groove formed on the outer surface of said body. Alternatively, said outer surface may be deprived of such groove.

[0013] In one embodiment, said anti-friction and/or wear resistance ring has an annular shape. Said ring may be made of metal or plastic material.

[0014] In one embodiment, the device comprises at least two anti-friction and/or wear resistance rings, one of the said rings being mounted on the main body of the spacer while the other ring being mounted on the tappet body.

[0015] With such a device comprising the tappet body and the spacer separate from one another, the density of the material of the main body of said spacer may advantageously be smaller than that of the material of said tappet body. Accordingly, the weight of the device can be limited.

[0016] In one embodiment, the device may further comprise an insert mounted in the tappet body, the pin being mounted at least on said insert. The main body of the spacer may be mounted axially against the insert on the side opposite to the pin and the roller. Preferably, the insert comprises a central core and at least two side tabs each comprising a receiving housing into which is mounted an end of the pin. The body of the spacer may be mounted into axial contact with the central core of the insert. The tappet body may comprise axial blocking means for maintaining the pin into the receiving housings.

[0017] In another embodiment, the pin is mounted on the tappet body.

[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 section on II-II of Figure 1,
- Figure 3 is a cross-section of a cam follower roller device according to a second example of the inven-

tion, and

- Figure 4 is a cross-section of a cam follower roller device according to a third example of the invention.

[0019] As shown on Figures 1 and 2, a cam follower roller device 10 comprises an outer 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, a roller 16 mounted on the pin and movable in rotation relative to said pin, and a stroke-transmission part or insert 18 mounted in said tappet body. The insert 18 supports the pin 14. 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.

[0020] As will be described later, the device 10 further comprises a spacer 20 mounted axially against the insert 18 on the side opposite to the roller 16, and an outer anti-friction and/or wear resistance ring 22 mounted on said spacer.

[0021] The tappet body 12 is made in one part. In the disclosed example, the body 12 has a tubular form. The tappet body 12 comprises a cylindrical axial outer surface 12b and a cylindrical axial inner surface or bore (not referenced). Said inner bore delimits a cavity 23 inside which are located the insert 18 and the pin 14. The roller 16 axially protrudes outwards with respect to an upper edge 12c of the tappet body 12. In the disclosed example, the tappet body 12 is deprived of any through-hole extending between the outer surface 12a and the bore for mounting the pin 14.

[0022] The insert 18 is made in one part. The insert 18 may preferably be made of metal, by example steel, or be made of plastic material. The insert 18 is distinct from the tappet body 12. In the disclosed example, the insert 18 is entirely housed inside the cavity 23 delimited by the tappet body 12.

[0023] The insert 18 comprises a base part or a central core 24 and two side parts or lateral tabs 26, 28 extending from said core and facing each other. The tabs 26, 28 of the insert extend from the core 24 towards the upper edge 12c of the tappet body. The insert 18 has in cross-section a U-shape. The roller 16 is disposed between the tabs 26, 28. A concave recess 30, 32 is provided at the free end of each tab to receive the pin 14. Both recesses 30, 32 extend through the tabs 26, 28 along the axis 14a and have the same diameter. Recesses 30, 32 form receiving housings adapted to receive the ends of the pin 14. Each end of said pin 14 is supported by one of the two tabs 26, 28. The pin 14 is supported by the insert 18.

[0024] The tappet body 12 further comprises means 34, 36 for axially blocking the pin 14 and the roller 16 relative to said body. The axial blocking means 34, 36 block the translation of pin 14 in a direction from a lower edge 12d of the tappet towards the upper edge 12c. The axial blocking means 34, 36 are integrally formed with the tappet body 12. In the illustrated example, these means 34, 36 are provided on the bore of the tappet body

at the upper edge 12c. The axial blocking means 34, 36 delimit receiving housings each facing one of the receiving housings 30, 32 of the insert to delimit together cylindrical bores for the ends of the pin 14. Alternatively, it could be possible to provide a spacer comprising cylindrical through-holes made into the thickness of the lateral tabs and facing one another, the ends of the pin 14 being fixed in said through-holes. In the illustrated example, the tappet body 12 is made from synthetic material, such as polyamide for example. The tappet body 12 is advantageously formed by moulding. Alternatively, the tappet body 12 may be made of metal, for example in an economic way by cutting, stamping and folding.

[0025] The tappet body 12 also comprises two pairs of two axial ribs 40, 42 provided on the bore of said body and which radially protrude inwards. The ribs 40, respectively 42, extend axially the axial blocking means 34, respectively 36. The ribs 40 are symmetrical to the ribs 42 with respect to a transverse axial plane passing through the centre of the roller 16. The ribs 40, 42 of each pair are spaced apart one relative to another to delimit a space into which is located one of the tabs 26, 28 of the insert. Accordingly, each tab 26, 28 is located circumferentially between the two ribs 40, 42 of one pair. Each tab 26, 28 abuts in the circumferential direction against one of the ribs 40, 42 of one pair on one side, and abuts against the other rib of said pair on the other side. The ribs 40, 42 cooperate with the tabs 26, 28 to prevent the insert 18 from moving in the circumferential direction relative to the tappet body 12.

[0026] The spacer 20 axially bears against the insert 18 on the side opposite to the roller 16 and the pin 14. The spacer 20 axially bears against the core 24 of the insert. The spacer 20 extends into the cavity 23 delimited by the tappet body 12 and protrudes axially outwards with respect to the lower edge 12d of said body. The lower edge 12d and the upper edge 12c delimit axially the tappet body 12.

[0027] The spacer 20 comprises a main body 44 extending along an axis 44a which is coaxial with the axis 12a of the tappet body. The main body 44 is provided with an upper frontal radial surface 44b in axial contact with the insert 18, and more precisely with the core 24 of said insert. The upper radial surface 44b is mounted axially against a lower surface of the core 24. The body 44 also comprises a lower radial frontal surface 44c intended to come into contact with a movable element (not shown), such as a piston of a fuel injection pump. In the disclosed example, the body 44 has substantially a cylindrical form. Alternatively, the body 44 may have different shape, for example a U-shape.

[0028] The main body 44 of the spacer 20 may preferably be made of plastic material, for instance PA 6.6, or be made of metallic material such as aluminium. In the disclosed example, the main body 44 of the spacer 20 is formed in one part by moulding. Preferably, the density of the material of the main body 44 is smaller than that of the material of the tappet body 12 in order to limit the

weight of the device 10. In the disclosed example, the spacer 20 is made in one part. Alternatively, the spacer 20 may comprise two or more parts.

[0029] The anti-friction and/or wear resistance ring 22, with an axis 22a, is mounted on a cylindrical outer surface 44d of the main body of the spacer. The material of the ring 22 is adapted to improve friction properties and/or wear-resistance of the device 10 which is intended to slide back and forth into a housing (not represented), such as a pump housing. The ring 22 may be made of a material harder than that of the housing. For example, the ring 22 may be made of metal, by example a hardened steel. In one variant, it is also possible to provide a coating on an outer surface of the ring 22 such as coatings with dry-lubricants, nitrocarburation, tungsten carbide, diamond-like carbon, black oxide or tungsten disulfide. Alternatively, the ring 22 may be made of plastic material such as PEEK, PEAK or PPA and may be reinforced with fibers. In a preferred embodiment, the ring 22 is not reinforced with fibers. An anti-friction coating, such as PTFE or MoS₂, may also be provided on the plastic ring 22.

[0030] Preferably, the ring 22 is mounted on the main body 44 of the spacer where the friction between its outer surface 44d and the housing is the highest. In the disclosed example, the ring 22 is mounted on a flange 44e provided on the outer surface 44d. The ring 22 radially protrudes outwards with respect to the outer surface 44d. In the disclosed example, the ring 22 is mounted into an annular groove 46 formed on the outer surface 44d. The ring 22 has an annular shape. The ring 22 has a cylindrical form. Alternatively, the ring 22 may be open in the circumferential direction for easy mounting.

[0031] The ring 22 is mounted freely tiltable relative to the main body 44 of the spacer. A radial gap 48 is provided between the ring 22 and the groove 46. The gap 48 is provided between a bore of the ring 22 and the bottom of the outer surface 44d. In a neutral position of the device 10, for example before mounting into the associated housing, the axis 22a of the ring is coaxial with the axes 12a, 44a of the tappet body and the main body 44 of the spacer.

[0032] When the device 10 is mounted into the associated housing, the ring 22 is able to move angularly relative to the main body 44 of the spacer to accommodate angular misalignment between the axis of the housing and the axis 44a of the main body of the spacer. With a contact between the housing and the ring 22, said ring may tilt angularly relative to the main body 44a of the spacer so that its axis 22a is aligned with the axis of the housing. Such a tilting may be obtained since the radial gap 48 is provided between the ring 22 and the outer surface 44d.

[0033] In the first disclosed example, the device comprises only one anti-friction and/or wear resistance ring 22 mounted on the body 44 of the spacer. In the second example illustrated on Figure 3, in which identical parts are given identical references, the device 10 further comprises an additional outer anti-friction and/or wear resist-

ance ring 50 mounted on the body 44 of the spacer. Similarly to the ring 22, the ring 50, with an axis 50a, is mounted on the outer surface 44d of the main body of the spacer and is freely tiltable so as to allow an angular tilting of the axis 50a relative to the axis 44a of the main body.

[0034] The ring 50 radially protrudes outwards with respect to the outer surface 44d of the main body 44. In the disclosed example, the ring 50 is mounted into an annular groove 50 formed on the outer surface 44d. A radial gap 54 is provided between the ring 50 and the groove 52. The gap 54 is provided between a bore of the ring 50 and the bottom of the groove 52. In the disclosed example, the ring 50 is mounted on a flange 44f provided on the outer surface 44d near to the tappet body.

[0035] In the previous examples, the anti-friction and/or wear resistance rings 22, 50 of the device are mounted on the spacer 20. In the example illustrated on Figure 4, in which identical parts are given identical references, the device 10 comprises outer anti-friction and/or wear resistance rings 56, 58 mounted on the tappet body 12. Each ring 56, 58, with an axis 56a, 58a, is mounted on the outer surface 12b of the tappet body. Preferably, the rings 56, 58 are mounted on the tappet body 12 where the friction between the outer surface 12b of the said body and the associated housing is the highest. In the disclosed example, the ring 56 is mounted near to the lower edge 12d of the tappet body 12 while the ring 58 is mounted near to the upper edge 12c.

[0036] Each ring 56, 58 radially protrudes outwards with respect to the outer surface 12b of the tappet body. In the disclosed example, each ring 56, 58 is mounted into an annular groove 60, 62 formed on the outer surface 12b. A radial gap 64, respectively 66, is provided between the ring 56, respectively 58, and the groove 60, respectively 62. Said gap is provided between a bore of the ring and the bottom of the associated groove. Similarly to the first and second examples, each ring 56, 58 is freely tiltable relative to the tappet body 12 so as to allow an angular tilting of the axis 56a, 58a relative to the axis 12a of the tappet body.

[0037] In another non-shown embodiment, it could also be possible to foresee a device provided with at least one anti-friction and/or wear resistance ring disposed on the tappet body 12 and at least one anti-friction and/or wear resistance disposed on the main body 44 of the spacer.

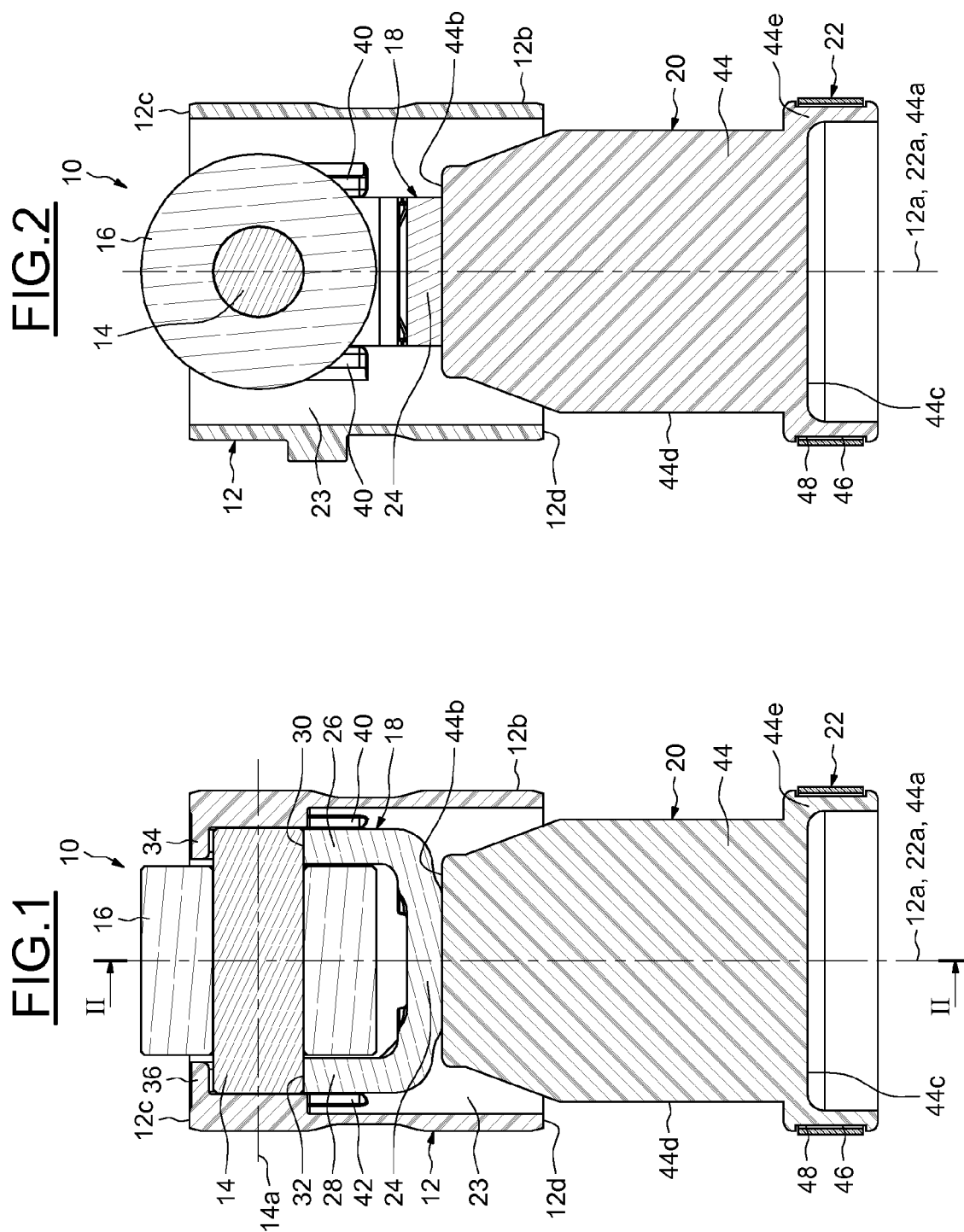
[0038] In the illustrated example, the spacer is mounted in simple axial contact with the insert without any fixation. Alternatively, the spacer may comprise retaining means cooperating with the insert, or with the tappet body, for fixing said spacer to said insert, or to said tappet body, in order to obtain a unitary assembly.

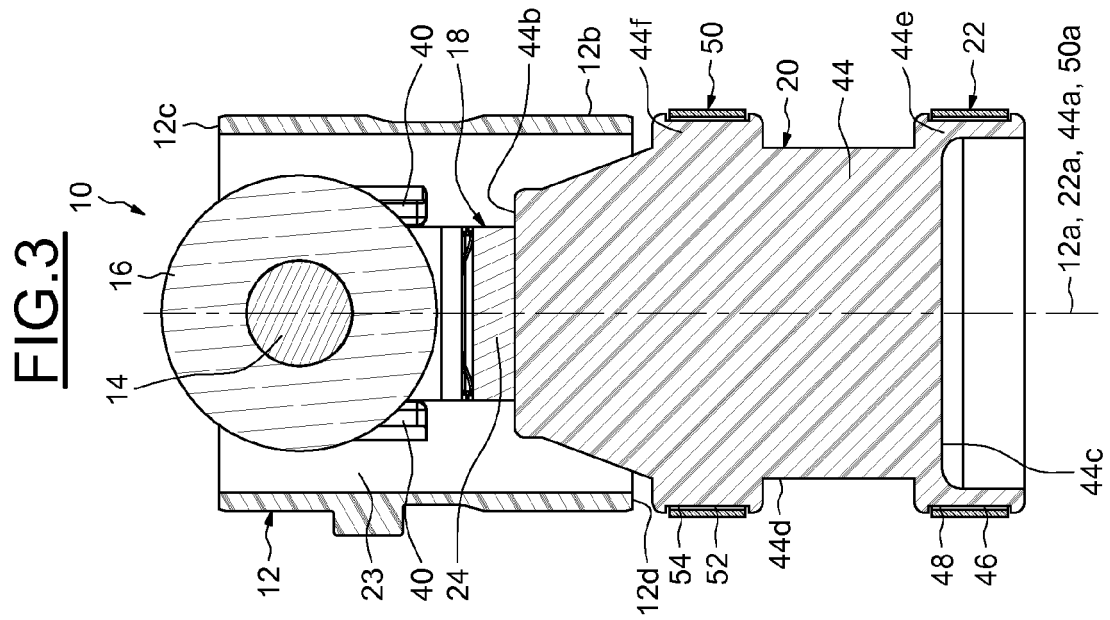
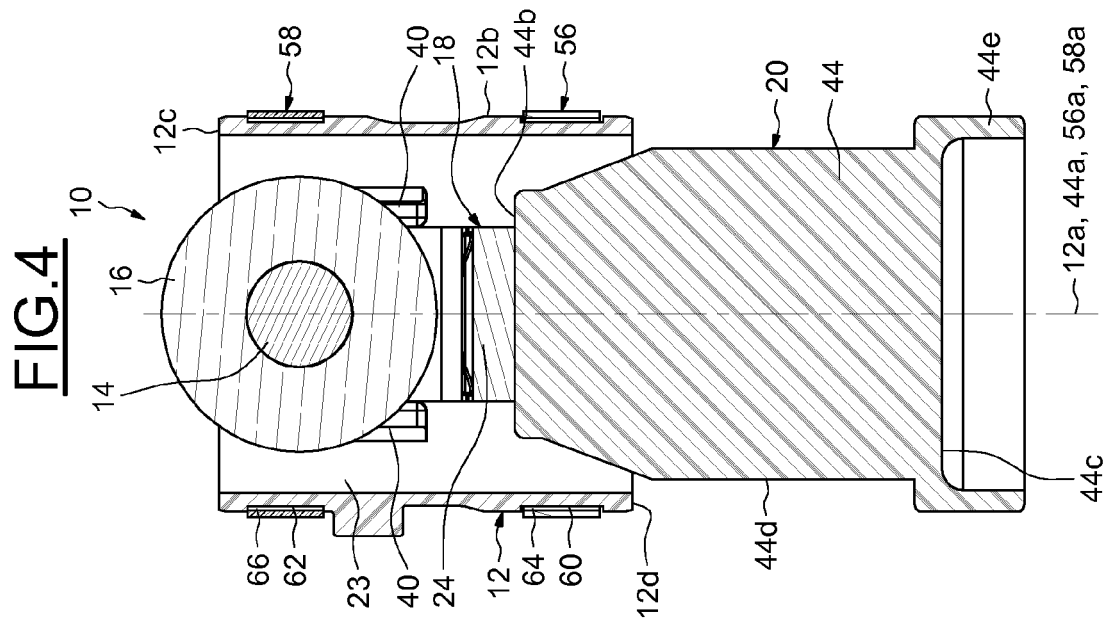
[0039] The invention has been illustrated on the basis of a cam follower roller device comprising an insert mounted into the tappet body and supporting the pin. Alternatively, it could be possible to directly mount the pin on the tappet body, for example by providing through-holes into the thickness of said body. In this case, the

device is deprived of such insert.

Claims

1. Cam follower roller device comprising a tappet body (12) extending along an axis, a pin (14) mounted into said tappet body and a roller (16) mounted on said pin, **characterized in that** the device comprises a spacer (20) provided with a main body (44) extending along an axis, mounted into the tappet body (12) and axially protruding outwards relative to said body, the device further comprising at least one anti-friction and/or wear resistance ring (22, 56) mounted on an outer surface of the main body (44) of the spacer, or on an outer surface of the tappet body (12), and radially protruding outwards relative to said outer surface, said anti-friction and/or wear resistance ring (22, 56) being mounted freely tiltable with respect to said body (12, 44) so as to allow an angular tilting of an axis of the said ring relative to the axis of said body. 5 10 15 20
2. Device according to claim 1, wherein said anti-friction and/or wear resistance ring (22, 56) is mounted into a groove (46, 60) formed on the outer surface of said body (20, 44). 25
3. Device according to claim 1 or 2, wherein said anti-friction and/or wear resistance ring (22, 56) has an annular shape. 30
4. Device according to any of the preceding claims, wherein said anti-friction and/or wear resistance ring (22, 56) is made of metal or plastic material. 35
5. Device according to any of the preceding claims, wherein the device comprises at least two anti-friction and/or wear resistance rings (22, 56), one of the said rings being mounted on the main body (44) of the spacer while the other ring being mounted on the tappet body (12). 40
6. Device according to any of the preceding claims, wherein the density of the material of the main body (44) of the spacer is smaller than that of the material of the tappet body (12). 45
7. Device according to any of the preceding claims, further comprising an insert (18) mounted in the tappet body (12), the pin (14) being mounted at least on said insert. 50
8. Device according to claim 7, wherein the main body (44) of the spacer is mounted axially against the insert (18) on the side opposite to the pin (14) and the roller (16). 55
9. Device according to claim 7 or 8, wherein the insert (18) comprises a central core (24) and at least two side tabs (26, 28) each comprising a receiving housing (30, 32) into which is mounted an end of the pin (14). 5
10. Device according to claim 9, wherein the main body (44) of the spacer is mounted into axial contact with the central core (24) of the insert. 10
11. Device according to claim 9 or 10, wherein the tappet body (12) comprises axial blocking means (34, 36) for maintaining the pin (14) into the receiving housings (30, 32). 15







EUROPEAN SEARCH REPORT

Application Number
EP 15 30 6921

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 May 2016	Examiner Paquay, Jeannot
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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