



(11)

EP 1 669 598 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

14.06.2006 Bulletin 2006/24

(51) Int Cl.:

F04B 9/04 (2006.01)

(21) Application number: **05425875.1**

(22) Date of filing: **09.12.2005**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

Designated Extension States:

AL BA HR MK YU

(30) Priority: **10.12.2004 IT RM20040604**

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(54) Improved fluid pump

(57) The present invention relates to an improved fluid pump (1), characterised in that it comprises a substantially cylindrical body (2), having a first end (5') and a second end (5''), a first and a second outer elements (6, 7), having each one a cavity (13) and a lateral through hole (14), respectively for inlet and outlet of the fluid, said cavities of said first and second elements (6, 7) coupling outside respectively with said first and second ends (5', 5''), said first end (5') providing a zone realising a notch (15) between said cavity and said first end (5'), said body (2) providing a channel (9) extending along its own axis, wherein a one-way valve is inserted, permitting the passage of said fluid from said first end (5') to said second end (5''), and motion driving means (3, 12), realising a roto-reciprocating motion of said body (2) along its own axis between said two outer elements (6, 7), alternatively permitting the realisation of a volume between said ends (5', 5'') and said cavities of said outer elements (6, 7); said fluid entering within said inlet hole (13) when the volume within said cavity of said first element (6) expands and said groove (15) is in correspondence of said inlet hole (13), and substantially at the same time said fluid exiting from said outlet hole (14) due to the compression of the volume of the cavity of said second element (7), during part of the rotation of said body (2), and said fluid passing from said first element (6) cavity compressed volume to the expansion volume of said second element (9) cavity through said channel and said valve, during part of the rotation of said body (2).

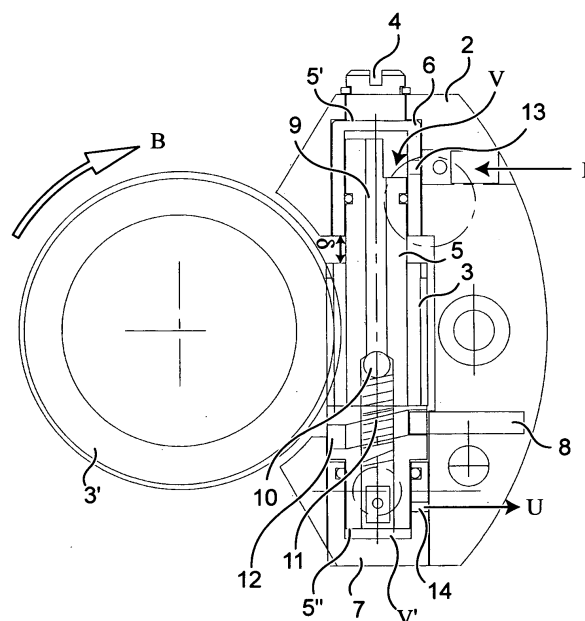


Fig. 2

Description

[0001] The present invention relates to an improved fluid pump, particularly an oil pump.

[0002] More specifically, the invention concerns a pump permitting obtaining a high pressure maintaining small dimensions, along with a high sturdiness.

[0003] In the following, the specification will be addressed to the oil pumping for electric motors or internal-combustion engines, but it is well evident that the same specification must not be considered limited to this specific use.

[0004] As it is well known, at present oleo-dynamic pumps are provided in motors, for lubricating mechanical parts of the same motors. Basic variables in designing this kind of devices are a high intake capacity, possibility of adjusting flow rate, efficient and with uniform performances, a silent operation and easy installation and adjustment. It is well evident that these features are not always easily obtainable at the design level.

[0005] At present, pumps are available on the market that are realised by bearing valve systems. These pumps, notwithstanding their high strength, do not permit a high power adjustment unless their dimensions are noticeably increased.

[0006] Object of the present invention is therefore that of suggesting a pump, preferably an oleodinamica pump, suitable to deliver a high pressure and having reduced dimensions.

[0007] Another object of the invention is that of designing an adjustable pump.

[0008] It is therefore specific object of the present invention an improved fluid pump, characterised in that it comprises a substantially cylindrical body, having a first end and a second end, a first and a second outer elements, having each one a cavity and a lateral through hole, respectively for inlet and outlet of the fluid, said cavities of said first and second elements coupling outside respectively with said first and second ends, said first end providing a zone realising a notch between said cavity and said first end, said body providing a channel extending along its own axis, wherein a one-way valve is inserted, permitting the passage of said fluid from said first end to said second end, and motion driving means, realising a roto-reciprocating motion of said body along its own axis between said two outer elements, alternatively permitting the realisation of a volume between said ends and said cavities of said outer elements; said fluid entering within said inlet hole when the volume within said cavity of said first element expands and said groove is in correspondence of said inlet hole, and substantially at the same time said fluid exiting from said outlet hole due to the compression of the volume of the cavity of said second element, during part of the rotation of said body, and said fluid passing from said first element cavity compressed volume to the expansion volume of said second element cavity through said channel and said valve, during part of the rotation of said body.

[0009] Always according to the invention, said motion driving means can comprise a fixed pin, provided outside said body, and an eccentric groove, provided outside said body, and within which said pin is coupled.

5 **[0010]** Still according to the invention, said motion driving means can comprise a toothing, preferably provided on the lateral surface of said body and/or a pulley.

[0011] Furthermore, according to the invention, said motion driving means can be coupled with outer motion generation means.

10 **[0012]** Preferably, according to the invention, said outer motion generation means can comprise a gear and/or a belt.

15 **[0013]** Always according to the invention, said valve can comprise a spring and a ball suitable to close said channel, said spring being further applied between said ball and the inner surface of said second element cavity.

[0014] Still according to the invention, said channel can have a bigger section close to said second end of the body.

20 **[0015]** Preferably, according to the invention, said body can comprise sealing gaskets close to the ends.

25 **[0016]** Always according to the invention, said pump can comprise flow rate adjustment means, that can vary the position with respect to said outlet hole with respect to said eccentric groove and with respect to said notch.

[0017] Advantageously, according to the invention, said adjustment means can provide a cut on the top of said first element.

30 **[0018]** Preferably, according to the invention, a tube can be provided on said outlet hole, to remote ducting the pumped fluid.

[0019] Always according to the invention, said fluid can be oil.

35 **[0020]** Still according to the invention, said pump can comprise the following operation steps:

a. intake - exhaust, wherein:

- 40
- said first end comes out from said first element;
 - said notch is overlapped to said inlet hole;
 - fluid enter through said inlet hole within the compressed volume between said second element and said second end of the body;

b. transfer, wherein:

- 45
- said first end enters within said first element;
 - said notch is not overlapped with said inlet hole;
 - fluid passes through said channel and said valve from the compressed volume between said first element and said first end of the body to the expansion volume between said second element and said second end of the body.
- 50

55 **[0021]** Preferably, according to the invention, two further steps can be provided between said intake - exhaust step and said transfer step, said step or flat zone step

providing a free rotation of said body, said intake - exhaust step and said transfer step corresponding, respectively, to a body rotation angle of $150,04^\circ$ and said free rotation steps or flat zone steps corresponding to a body rotation angle of $29,96^\circ$.

[0022] The present invention will be now described, for illustrative but not limitative purposes, according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 shows a lateral view of an improved pump according to the invention provided on a support;
figure 2 shows a lateral section view of the improved pump provided on a support according to figure 1;
figure 3 shows a diagram of the operation steps of the pump according to the present invention; and
figure 4 shows a top section view of the improved pump provided on a pruner coupled with a bush-cutter.

[0023] Making reference to figure 1, it is possible observing pump 1 according to the invention, inserted within a support 2. Said pump 1 has a substantially cylindrical shape, and a toothing 3 on its lateral surface, said toothing being meshed with a shaft 3'. Motion of said shaft 3' is provided by the electric motor or by the internal-combustion engine of the device providing the pump 1.

[0024] Said pump 1 also provides an upper screw 4 for adjustment of the oil flow rate, that will be described in greater detail in the following, said oil exiting according to the U direction.

[0025] Observing now in greater detail figure 2, it is possible understanding the operation of the pump 1. Particularly, said pump 1 is comprised of four main parts, a central body 5, a first containment element 6, a second containment element 7 and a pin 8.

[0026] Central body 5, besides having the toothing 3, substantially at the half of the height of its lateral surface, provides (according to the orientation of the figure) an upper end 5' and a lower end 5". Furthermore, said central body 5 is hollow, and particularly it provides an axial channel 9, flared, thus increasing its section. Said channel has its larger section for about the half of its length. A valve is provided in correspondence of the section where the channel section increases, said valve being comprised of a ball 10 closing the section of said channel 9 by the action of a preloaded spring 11.

[0027] On the lateral lower surface of said central body it is provided a cam 12. Pin 8 is placed on the channel of said cam 12. Cam 12 transforms the rotatory movement according to direction B of shaft 3' into a reciprocating movement of the central body 5, with respect to the containment support 2, the oscillation amplitude of said central body 5 being equal to δ , as shown in the figure.

[0028] Upper end 5' is inserted within the first containment element 6, while the lower one is inserted within a second containment element 7.

[0029] Said first and second containment elements 6 and 7 are fixed with respect to said containment support 2, and they have a cylindrical section.

[0030] Obviously, also said ends 5', 5" make a reciprocating motion within said first containment element 6 and within said second containment element 7.

[0031] Said first containment element 6 provides a lateral hole 13 and said second containment element 7 provides a lateral hole 14. said upper end 5' of the body provides a notch 15, overlapping with said lateral hole 13 for part of the rotation of said central body 5.

[0032] Oil enters according to direction I, possibly by a tube (not shown in the figures), passing through the lateral hole 13, and exits through the lateral hole 14, according to the direction U, possibly through a further tube (not shown in the figures), passing through the channel 9.

[0033] In order to fully describe the operation of the pump 1, it will be described according to four different steps, taking into consideration that, under steady state, channel 9 is full of oil.

Intake and exhaust

[0034] During this step, oil enters, as already said, by a tube, according to the direction I. Central body 5 is placed with respect to said first containment element 6 in such a way that, when the upper end 5' enters within said element 6, notch 15 faces on said lateral hole 13. Due to the rotation of said central body 5 (even 8000 rpm) a depression is created within the volume V between notch 15 and the inner (lateral and upper) walls of said first containment element 6, permitting intake of oil within said volume V. Meanwhile, ball 10 keeps the channel 9 closed thanks to the preloaded spring 11.

[0035] This phase occurs in the present embodiment during a rotation of $150,04^\circ$ of the central body 5. During said step, the lower end 5" enters within the second containment element 7, compressing oil within volume V', delimited by the surface of said lower end 5" and the inner surface of said second containment element 7. Said oil is therefore ducted in the lateral hole 14 according to the U direction of the outlet tube (not shown in the figure), not being possible flowing within the channel 9 due to the presence of the ball 10 closing the same.

Flat Step

[0036] During this step, central body 5 makes a rotation of $29,96^\circ$ with respect to its own axis. Notch 15 is not facing on hole 13. Thus, connection between volume V and hole 13 is closed, thus preventing oil feeding.

Transfer phase

[0037] Said phase occurs during a further rotation of the central body 5 of $150,04^\circ$.

[0038] During said rotation, central body 5 moves vertically, thanks to the action of the cam 12, so that the

upper end 5' enters within the inner volume of the first containment element 6. Oil within volume V, while said volume reduces, is pushed within the channel 9, not being it possible for the same going back within the inlet duct through the hole 13 that cannot be reached any more. Pressure of said oil passes the mechanical resistance of the spring 11, making the ball 10 descending and freeing the channel 9. this permits transfer of said oil from volume V to volume V'.

Flat Step

[0039] During this step, as in the previous one, central body 5 makes a rotation of 29,96° with respect to its own axis.

[0040] During said rotation, notch 15 recovers the position with respect to hole 13, before that a new intake step occurs, during which volume V will increase, while notch is faced on hole 13. Volume 13' will tend to diminish due to the downward motion of the central body 5, pushing again the oil according to the direction U.

[0041] Screw 4 makes it possible adjustment of positioning of said first containment element 6 with respect to central body 5, and therefore also of hole 13 with respect to notch 15. It is possible reducing or increasing angle where notch 15 overlaps with hole 13, and dimension of volume V available during said angle. This permits adjusting the amount of oil intaken during the "intake and exhaust step", and consequently pressure of pump 1.

[0042] From figure 4 it is possible observing the installation of pump 1 in a pruner 16 for a bush-cutter. It can be clearly seen pump 1 connected with pin 8 by cam 12. Toothing 3 is mechanically coupled with output shaft 3' of the pruner 16 axis.

[0043] Containment elements 6 and 7 are integral with pruner 16 chassis. Finally, flow rate adjustment screw can be observed.

[0044] On the basis of the above specification, it can be noted that the basic feature of the present invention is the fact that a high oil pressure can be delivered.

[0045] An advantage of the present invention is the fact that oil can be ducted within a tube and injected in a point different with respect to the position of the pump.

[0046] A further advantage of the present invention is that oil flow rate can be modified.

[0047] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Improved fluid pump, **characterised in that** it comprises a substantially cylindrical body, having a first end and a second end, a first and a second outer

elements, having each one a cavity and a lateral through hole, respectively for inlet and outlet of the fluid, said cavities of said first and second elements coupling outside respectively with said first and second ends, said first end providing a zone realising a notch between said cavity and said first end, said body providing a channel extending along its own axis, wherein a one-way valve is inserted, permitting the passage of said fluid from said first end to said second end, and motion driving means, realising a roto-reciprocating motion of said body along its own axis between said two outer elements, alternatively permitting the realisation of a volume between said ends and said cavities of said outer elements; said fluid entering within said inlet hole when the volume within said cavity of said first element expands and said groove is in correspondence of said inlet hole, and substantially at the same time said fluid exiting from said outlet hole due to the compression of the volume of the cavity of said second element, during part of the rotation of said body, and said fluid passing from said first element cavity compressed volume to the expansion volume of said second element cavity through said channel and said valve, during part of the rotation of said body.

2. Pump according to claim 1, **characterised in that** said motion driving means comprise a fixed pin, provided outside said body, and an eccentric groove, provided outside said body, and within which said pin is coupled.
3. Pump according to one of the preceding claims, **characterised in that** said motion driving means comprise a tothing, preferably provided on the lateral surface of said body and/or a pulley.
4. Pump according to one of the preceding claims, **characterised in that** said motion driving means are coupled with outer motion generation means.
5. Pump according to one of the preceding claims, **characterised in that** said outer motion generation means comprise a gear and/or a belt.
6. Pump according to one of the preceding claims, **characterised in that** said valve comprises a spring and a ball suitable to close said channel.
7. Pump according to claim 6, **characterised in that** said spring is applied between said ball and the inner surface of said second element cavity.
8. Pump according to one of the preceding claims, **characterised in that** said channel has a bigger section close to said second end of the body.
9. Pump according to one of the preceding claims,

characterised in that said body comprises sealing gaskets close to the ends.

steps correspond to a body rotation angle of 29,96°.

10. Pump according to one of the preceding claims, **characterised in that** said pump comprises flow rate adjustment means. 5
11. Pump according to claim 10, **characterised in that** said adjustment means vary the position with respect to said outlet hole with respect to said eccentric groove and with respect to said notch. 10
12. Pump according to claim 10 or 11, **characterised in that** said adjustment means provide a cut on the top of said first element. 15
13. Pump according to one of the preceding claims, **characterised in that** a tube is provided on said outlet hole, to remote ducting the pumped fluid. 20
14. Pump according to one of the preceding claims, **characterised in that** said fluid is oil.
15. Pump according to one of the preceding claims, **characterised in that** it comprises the following operation steps: 25
 - a. intake - exhaust, wherein:
 - said first end comes out from said first element; 30
 - said notch is overlapped to said inlet hole;
 - fluid enter through said inlet hole within the compressed volume between said second element and said second end of the body; 35
 - b. transfer, wherein:
 - said first end enters within said first element; 40
 - said notch is not overlapped with said inlet hole;
 - fluid passes through said channel and said valve from the compressed volume between said first element and said first end of the body to the expansion volume between said second element and said second end of the body. 45
16. Pump according to claim 15, **characterised in that** two further steps are provided between said intake - exhaust step and said transfer step, said step or flat zone step providing a free rotation of said body. 50
17. Pump according to claim 15 or 16, **characterised in that**, said intake - exhaust step and said transfer step correspond, respectively, to a body rotation angle of 150,04° and said free rotation steps or flat zone 55

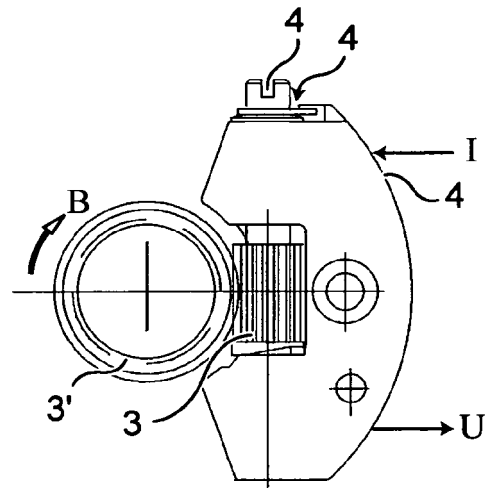


Fig. 1

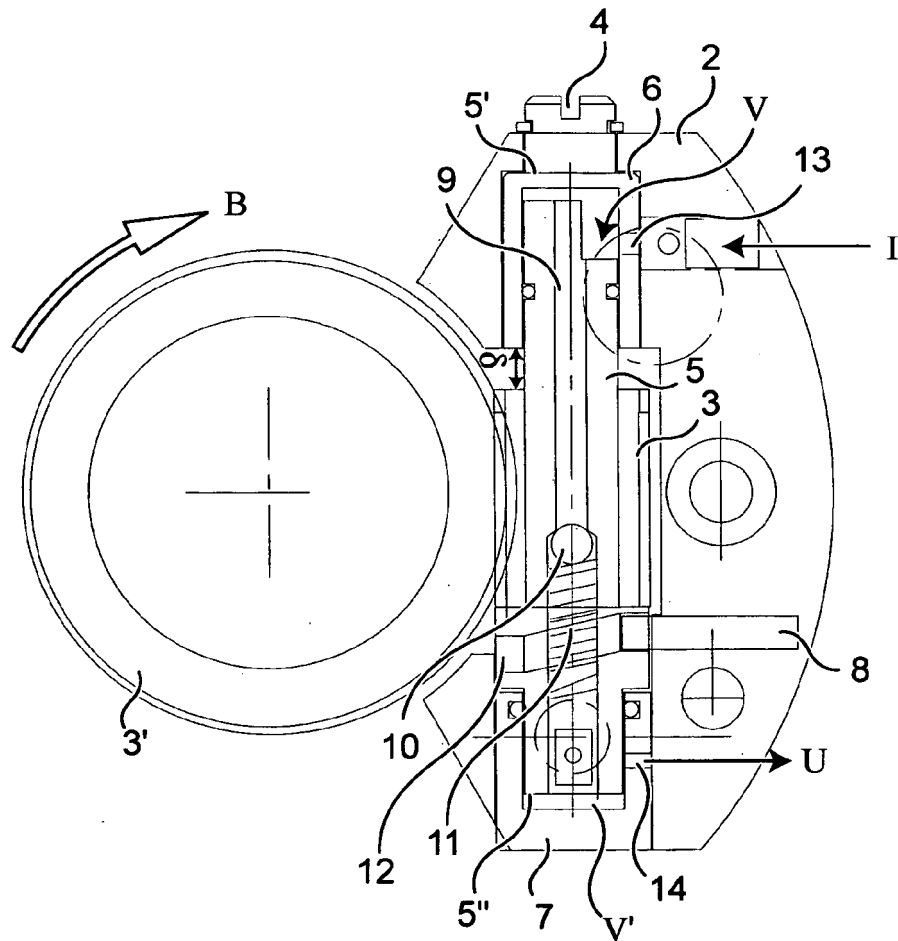


Fig. 2

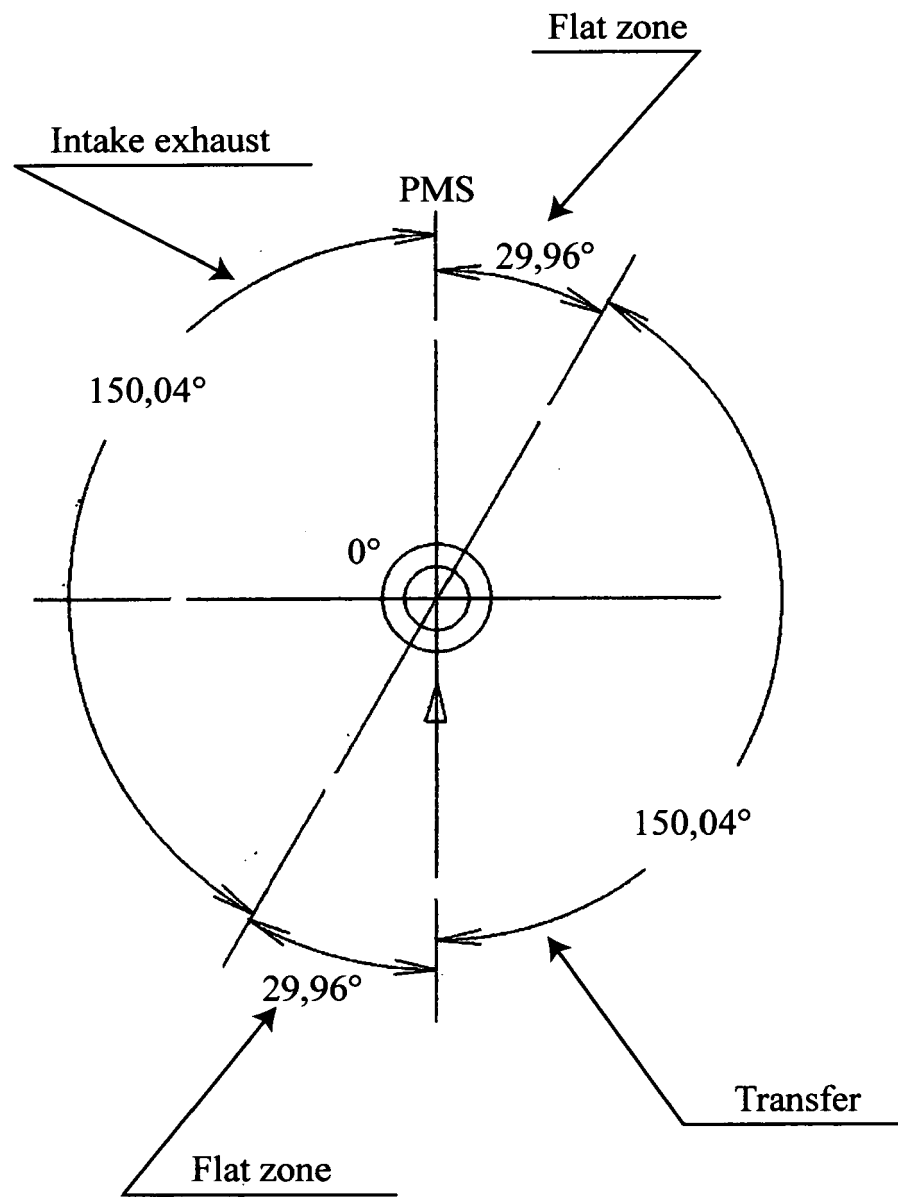


Fig. 3

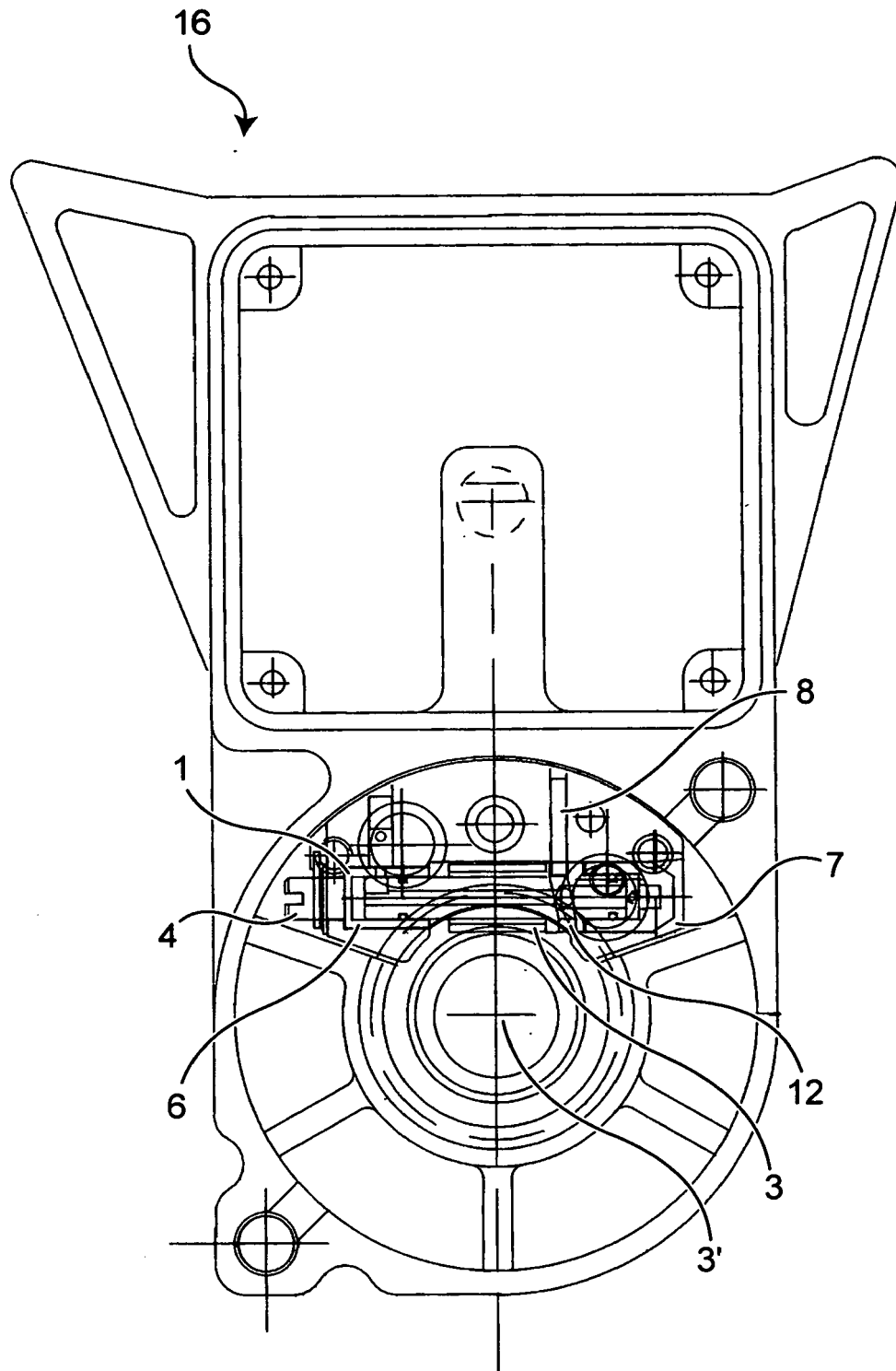


Fig. 4