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(54) Variable output pump device

(57) A variable output pump device, comprising a movable component capable of displacing a liquid fluid, said movable component being driven at constant speed by a motor, a similar actuating means or a means of transmitting movement, said movable component being mounted in a chamber of a housing comprising a supply passage or orifice and an outlet passage, the output of the pump device being variable according to the temperature of the liquid fluid aspirated and delivered by said device, at least within a certain temperature range.

The pump device (1) also comprises a heat-sensitive component (8) mounted in the supply passage or orifice (6) or in the outlet passage (7), the apparent surface in a projection plane perpendicular to the direction of the fluid flow of said heat-sensitive component (8) being a function of the temperature of said fluid with which it is in direct contact.

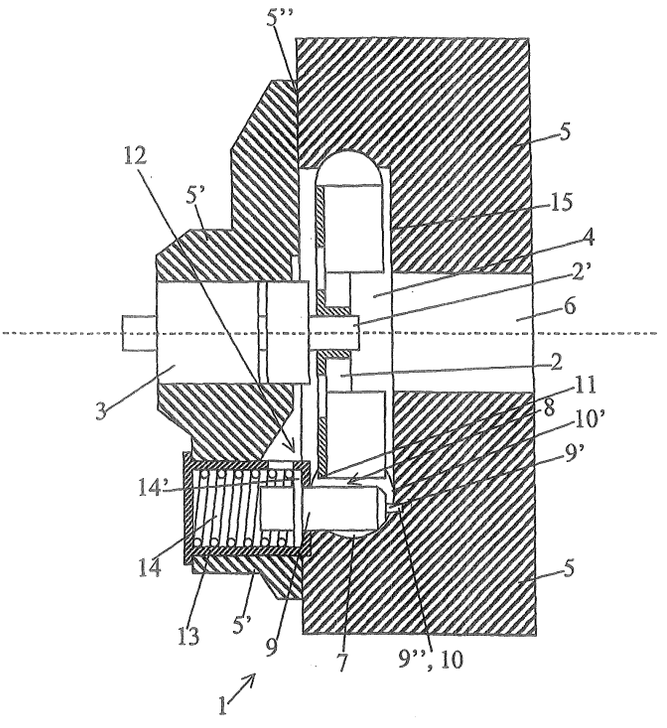

Fig. 1

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Description

[0001] The present invention relates to the field of regulation, more particularly the regulation of the output of a liquid or viscous fluid, in relation to the use of a device for circulating said fluid, such as a pump or similar.

[0002] The object of the present invention is a pump device of which the output is a function of the temperature of the fluid delivered, at least within a predetermined temperature range.

[0003] There are already numerous embodiments of pump devices or the like in which the output is regulated according to several parameters, including in particular the temperature of the fluid aspirated and delivered.

[0004] A first known solution consists of measuring the temperature of the fluid by a suitable sensor and varying the speed of the motor driving the active component of the pump depending on the measured temperature, after processing the measured values.

[0005] A second known solution consists of measuring the temperature of the fluid by a suitable sensor and displacing or positioning an obstruction element depending on the measured temperature, to modify the pump's inlet and/or outlet section, to modify the useful surface of the active component, or to modify the characteristics of the chamber of the housing of said pump, it then being possible for the speed of the active component and its actuating means to remain constant.

[0006] However, both these two known solutions are complex and costly, and cannot be considered in applications with a low manufacturing cost.

[0007] The object of the present invention in particular is to overcome the aforementioned drawbacks.

[0008] Accordingly, the present invention relates to a variable output pump device, comprising a movable component capable of displacing a liquid fluid, said movable component being driven at a constant speed by a motor, a similar actuating means or a means of transmitting movement, said movable component being mounted in a chamber of a housing comprising a supply passage or orifice and an outlet passage, the output of the pump device being variable depending on the temperature of the liquid fluid aspirated and delivered by said device, at least within a certain temperature range, a pump device characterised in that it also comprises a heat-sensitive component mounted in the supply passage or orifice or in the outlet passage, the apparent surface in a projection plane perpendicular to the direction of the fluid flow of said heat-sensitive component being a function of the temperature of said fluid with which it is in direct contact.

[0009] The invention will be better understood, using the description that follows, which relates to preferred embodiments, given as non-limiting examples, and explained with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 is a view in section of a pump device according to a first variant of an advantageous embodiment of the invention;

Fig. 2 is a view in section of a pump device according to a second variant of the advantageous embodiment of the invention;

Fig. 3 is an exploded view in section of the pump device in Fig. 2, before assembly of the two constituent preassembled parts, and,

Fig. 4 is a view in section of a pump device according to a third variant of the advantageous embodiment of the invention.

[0010] As shown in the figures of the accompanying drawings, the variable output pump device 1 comprises a housing 5, 5' and a movable component 2 capable of displacing a liquid fluid, said movable component being driven at a constant speed by a motor 3, a similar actuating means or a means of movement transmission, said movable component 2 being mounted in a chamber 4 of the housing comprising a supply passage or orifice 6 and an outlet passage 7, the output of the pump device 1 being variable depending on the temperature of the liquid fluid aspirated and delivered by said device, at least within a certain temperature range.

[0011] According to the invention, said pump device 1 also comprises a heat-sensitive component 8 mounted in the supply passage or orifice 6 or in the outlet passage 7, the apparent surface in a projection plane perpendicular to the fluid flow direction of said heat-sensitive component 8 being a function of the temperature of said fluid with which it is in direct contact.

[0012] Thus, an embodiment of a variable output pump is achieved with an extremely simple structure (that is to say only slightly more complex than a constant output pump and that could possibly be manufactured easily from a constant output pump) and that does not require a variable actuator, the heat-sensitive component 8 fulfilling simultaneously the function of sensor, transducer and output regulating component.

[0013] For the heat-sensitive component, existing standard components are favoured, advantageously those of simple design and low manufacturing cost, capable of directly transforming temperature variations into variations of position or form, according to a predetermined function, and that can possibly be adjusted according to the application envisaged and the variations desired.

[0014] Modification of the apparent surface of the heat-sensitive component 8, exposed to the fluid flow, may be achieved by different physical variations, namely variation of position (pivoting a plate round a spindle), variation of external form (greater or lesser deployment of constituent parts), variation of volume (greater or lesser inflation), variation of internal form (greater or lesser restriction in the region of a traversing orifice ar-

ranged in the heat-sensitive component).

[0015] Thus, according to a first embodiment of the invention, not illustrated in the accompanying drawings, the heat-sensitive component 8 may comprise a body 9 forming an envelope or box, of which the external form changes depending on variations in the temperature of the fluid flow to which said component 8 is directly exposed, in particular the area of its apparent surface exposed to the fluid flow or obtained by projection in a plane perpendicular to the direction of said flow.

[0016] According to a second embodiment, illustrated in the accompanying drawings, the heat-sensitive component 8 may comprise a body 9 forming an envelope or box of which the external form is such that its apparent surface exposed to the fluid flow or obtained by projection in a plane perpendicular to the direction of said flow varies if there is a displacement of said body 9 generated by and a function of a variation in temperature of said fluid to which said component 8 is directly exposed.

[0017] According to a first embodiment, not illustrated in the accompanying drawings, the heat-sensitive component 8 may comprise a part 9, if applicable a body 9 forming an envelope or box, for example of non-regular, non-symmetrical structure or provided with excrescence(s), mounted moving round a spindle, the degree of pivoting or the position in rotation round said spindle being a function of the temperature of the fluid to which said heat-sensitive component 8 is directly exposed.

[0018] According to a second advantageous embodiment of the invention, illustrated in Figs. 1 to 4 of the accompanying drawings, provision can be made for the heat-sensitive component to be basically composed of at least two parts 9 and 9' of different section and assembled together telescopically, said component 8 being mounted transversally in the outlet passage 7 and the telescopic structure forming it being retracted for low temperatures, with maximum obstruction of the outlet passage 7 by the part 9 of larger section, and deployed for higher temperatures, with total or partial displacement of the part 9 of greater section outside said passage 7 and exposure to the fluid flow traversing said passage 7 of the part(s) 9' of smaller section.

[0019] Preferably, and with a view to being able to guarantee a particular state if the heat-sensitive component 8 malfunctions, the telescopic structure of the heat-sensitive component 8 is subject to an elastic constraint loading it in its state of maximum retraction, the temperature-sensitive actuating means of the component 8 (for example wax) acting positively against said elastic constraint with a magnitude corresponding to the magnitude of the rise in temperature.

[0020] According to a practical advantageous embodiment of the invention, the component 8 may consist of a wax actuator, also known currently as a thermostatic element or wax plug, comprising, on the one hand, a cylindrical box body 9 enclosing a predetermined quantity of wax forming the temperature-sensitive actuating means of which the melting temperature is substantially equal to the lower temperature of the active regulation range and, on the other hand, a spindle 9' mounted moving in translation in said box body 9, between a position of maximum retraction and a position of maximum extension, and of which the position in translation is determined by the condition of the wax.

[0021] Said wax actuator 8 is mounted in said outlet passage 7 of the chamber 4 of the pump device 1 with the free end 9" of the spindle 9' mounted fixed in a side recess 10 of the wall 10' of said passage 7 and its box body 9 mounted sliding in a bearing 11 of the housing, said box body 9 being subject to an elastic load in the direction of the free end 9" of the spindle 9'.

[0022] To facilitate assembly and manufacture, the pump device 1 may comprise a preassembled module 12 incorporating a box 13 comprising a compression spring 14 applying an elastic load to the box body 9 of the heat-sensitive component 8, or to a drive or support part 14' integral therewith, mounted sliding and coming to a stop in the position of maximum displacement in the action direction of the spring 14 and in that said module 12 is received sealed in a suitable recess arranged in the housing 5, 5' of the pump device 1.

[0023] As shown in the accompanying drawings, provision is advantageously made for a movable component 2 to consist of a finned wheel mounted on a rotating drive spindle 2' and for the housing to be formed principally of two complementary parts 5 and 5' assembled together and sealed in the region of a joint plane 5", the first part 5 having a totally or at least partly discoid cavity 15 in which the supply passage 6 and the outlet passage 7 open out and the second part 5' in the form of a cover closing said cavity 15 to delimit the chamber 4 and forming directly or indirectly a support for the rotating spindle 2' on which is mounted projecting the finned wheel 2, the supply passage 6 opening into the chamber 4 in the direction of the rotating spindle 2' and facing that spindle and the outlet passage 7 extending tangentially from the circular periphery of said chamber.

[0024] According to a first variant embodiment of the invention, illustrated in Fig. 1 of the accompanying drawings, the outlet passage 7 is formed in the first constituent part 5 of the housing and the preassembled module 12 is mounted sealed by its box 5 in the second constituent part 5' forming a cover and by the end 9" of its spindle 9' movable in translation in a recess 10 of the wall 10' delimiting the outlet passage 7 of the first constituent part 5.

[0025] According to a second variant embodiment of the invention, illustrated in Figs. 2 and 3 of the accompanying drawings, the outlet passage 7 is at least partially formed in a structural extension 16 of the second part 5' constituting the housing, which is nested and sealed in a corresponding reception recess 16' of the first constituent part 5, so as to delimit in part the chamber 4. The preassembled module 12 is then mounted sealed by its box 13 in the second constituent part 5' and by the end 9" of its spindle 9' movable in translation

in a recess 10 of the wall 10' delimiting the outlet passage 7 and forming part of said structural extension 16, the wax actuator 8 being thus permanently in contact over the whole of its external surface with the fluid.

[0026] Fig. 4 of the accompanying drawings shows a hybrid variant of the two aforementioned variants.

[0027] The driving of the spindle 2' of the movable component 2 may be produced by a belt, a chain or similar means of transmitting a rotating movement.

[0028] In a variant, and as illustrated in Figs. 1 to 3, an electric motor 3, which may or may not be of variable speed, is mounted in the second part 5' forming a cover, its spindle 2' carrying the movable component 2 mounted fixed in rotation on this spindle.

[0029] According to another embodiment of the invention, not illustrated in the accompanying figures, but that can be easily deduced therefrom, the heat-sensitive component 8 consists of a shape-memorising part, mounted transversally in the supply 6 or outlet 7 passage and of which the apparent surface exposed to the flow of fluid varies, by changing the orientation or form of said part, depending on the temperature of said fluid in contact with it, at least within a predetermined temperature range.

[0030] Of course, the invention is not limited to the embodiments described and illustrated in the accompanying drawings. Modifications are possible, particularly from the point of view of the composition of the various elements or by substitution of technical equivalents, without departing thereby from the scope of protection of the invention.

Claims

1. Variable output pump device, comprising a movable component capable of displacing a liquid fluid, said movable component being driven at a constant speed by a motor, a similar actuating means or a means of transmitting movement, said movable component being mounted in a chamber of a housing comprising a supply passage or orifice and an outlet passage, the output of the pump device being variable depending on the temperature of the liquid fluid aspirated and delivered by said device, at least within a certain temperature range, a pump device (1) **characterised in that** it also comprises a heat-sensitive component (8) mounted in the supply passage or orifice (6) or in the outlet passage (7), the apparent surface in a projection plane perpendicular to the direction of the fluid flow of said heat-sensitive component (8) being a function of the temperature of said fluid with which it is in direct contact.

2. Device according to claim 1, **characterised in that** the heat-sensitive component (8) comprises a body (9) forming an envelope or box, of which the external form changes depending on variations in the temperature of the fluid flow to which said component (8) is directly exposed, in particular the area of its apparent surface exposed to the fluid flow or obtained by projection in a plane perpendicular to the direction of said flow.

3. Device according to claim 1, **characterised in that** the heat-sensitive component (8) comprises a body (9) forming an envelope or box of which the external form is such that its apparent surface exposed to the fluid flow or obtained by projection in a plane perpendicular to the direction of said flow varies if there is a displacement of said body (9) generated by and a function of a variation in temperature of said fluid to which said component (8) is directly exposed.

4. Device according to claim 1 or claim 3, **characterised in that** the heat-sensitive component (8) comprises a part (9), if applicable a body (9) forming an envelope or box, for example of non-regular, non-symmetrical structure or provided with excrescence (s), mounted moving round a spindle, the degree of pivoting or the position in rotation round said spindle being a function of the temperature of the fluid to which said heat-sensitive component (8) is directly exposed.

5. Pump device according to claim 1 or claim 3, **characterised in that** the heat-sensitive component (8) is basically composed of at least two parts (9 and 9') of different section and assembled together telescopically, said component (8) being mounted transversally in the outlet passage (7) and the telescopic structure forming it being retracted for low temperatures, with maximum obstruction of the outlet passage (7) by the part (9) of larger section, and deployed for higher temperatures, with total or partial displacement of the part (9) of greater section outside said passage (7) and exposure to the fluid flow traversing said passage (7) of the part(s) (9') of smaller section.

6. Pump device according to claim 5, **characterised in that** the telescopic structure of the heat-sensitive component (8) is subject to an elastic constraint loading it in its state of maximum retraction, the temperature-sensitive actuating means of the component (8) acting positively against said elastic constraint with a magnitude corresponding to the magnitude of the rise in temperature.

7. Pump device according to any one of claims 5 and 6, **characterised in that** the heat-sensitive component (8) consists of a wax actuator comprising, on the one hand, a cylindrical box body (9) enclosing a predetermined quantity of wax forming the temperature-sensitive actuating means of which the

melting temperature is substantially equal to the lower temperature of the active regulation range and, on the other hand, a spindle (9') mounted moving in translation in said box body (9), between a position of maximum retraction and a position of maximum extension, and of which the position in translation is determined by the condition of the wax, and **in that** the wax actuator (8) is mounted in said outlet passage (7) of the chamber (4) of the pump device (1) with the free end (9") of the spindle (9') mounted fixed in a side recess (10) of the wall (10') of said passage (7) and its box body (9) mounted sliding in a bearing (11) of the housing, said box body (9) being subject to an elastic load in the direction of the free end (9") of the spindle (9').

8. Pump device according to claim 7, **characterised in that** it comprises a preassembled module (12) incorporating a box (13) comprising a compression spring (14) applying an elastic load to the box body (9) of the heat-sensitive component (8), or to a drive or support part (14') integral therewith, mounted sliding and coming to a stop in the position of maximum displacement in the action direction of the spring (14) and **in that** said module (12) is received sealed in a suitable recess arranged in the housing (5, 5') of the pump device (1).

9. Pump device according to any one of claims 1 to 8, **characterised in that** the movable component (2) consists of a finned wheel mounted on a rotating drive spindle (2') and **in that** the housing is formed principally of two complementary parts (5 and 5') assembled together and sealed in the region of a joint plane (5"), the first part (5) having a totally or at least partly discoid cavity (15) in which the supply passage (6) and the outlet passage (7) open out and the second part (5') in the form of a cover closing said cavity (15) to delimit the chamber (4) and forming directly or indirectly a support for the rotating spindle (2') on which is mounted projecting the finned wheel (2), the supply passage (6) opening into the chamber (4) in the direction of the rotating spindle (2') and facing that spindle and the outlet passage (7) extending tangentially from the circular periphery of that chamber.

10. Pump device according to claims 8 and 9, **characterised in that** the outlet passage (7) is formed in the first constituent part (5) of the housing and **in that** the preassembled module (12) is mounted sealed by its box (5) in the second constituent part (5') forming a cover and by the end (9") of its spindle (9') movable in translation in a recess (10) of the wall (10') delimiting the outlet passage (7) in the first constituent part (5).

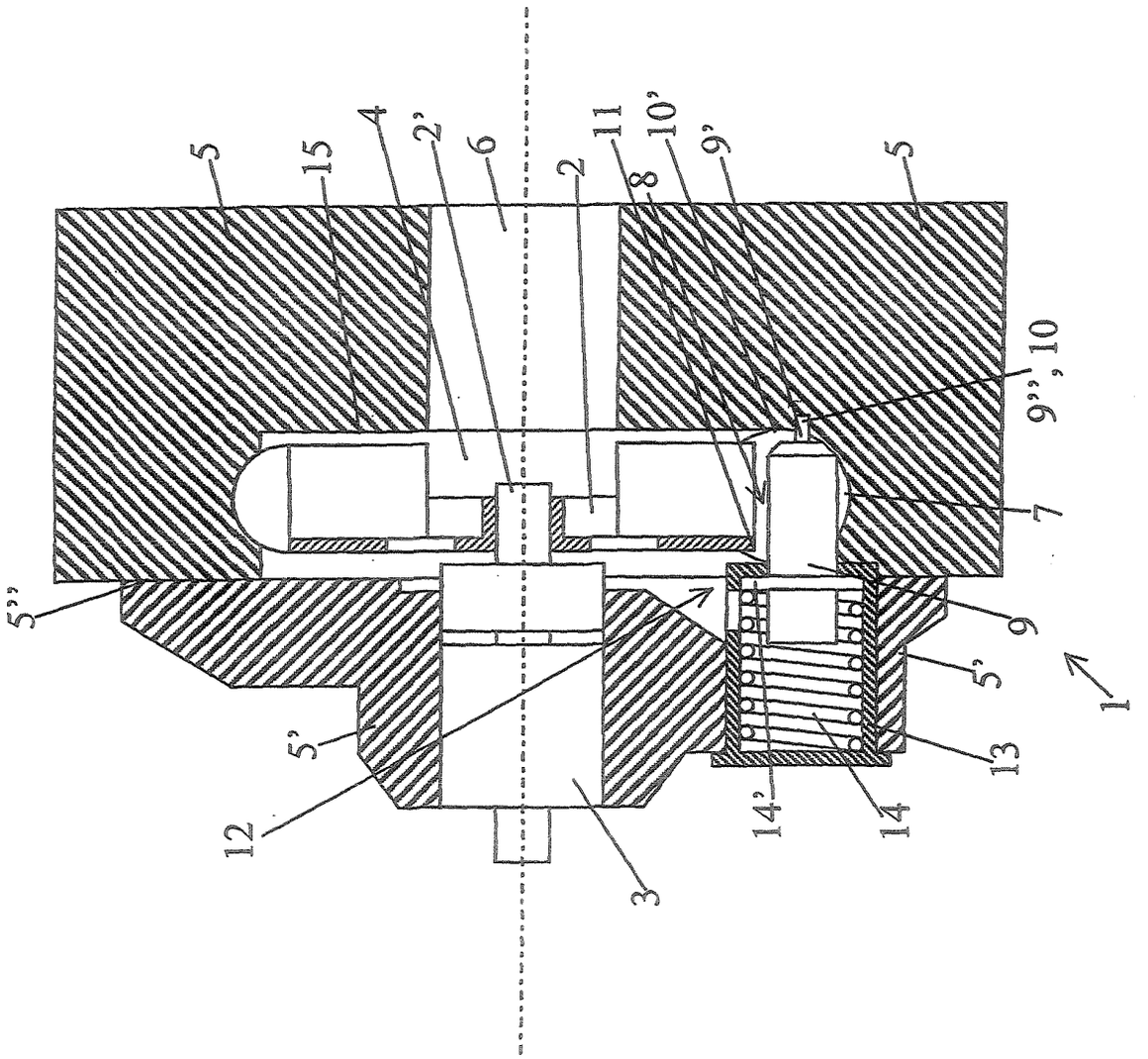
11. Pump device according to claims 8 and 9, **characterised in that** the outlet passage (7) is at least partially formed in a structural extension (16) of the second part (5') constituting the housing, which is nested and sealed in a corresponding reception recess (16') of the first constituent part (5), so as to delimit in part the chamber (4), and **in that** the preassembled module (12) is mounted sealed by its box (13) in the second constituent part (5') and by the end (9") of its spindle (9') movable in translation in a recess (10) of the wall (10') delimiting the outlet passage (7) and forming part of said structural extension (16).

12. Pump device according to any one of claims 10 and 11, **characterised in that** the internal volume of the box (13) of the preassembled module (12) is open towards the chamber (4) receiving the movable component (2) and is exposed to the fluid flow circulating through this chamber (4).

13. Pump device according to any one of claims 9 to 12, **characterised in that** an electric motor (3), of constant speed or not, is mounted in the second part (5') forming a cover, its spindle (2') carrying the movable component (2) mounted fixed in rotation on this spindle.

14. Pump device according to any one of claims 1 to 3 or claim 6 insofar as it relates to claim 1, **characterised in that** the heat-sensitive component (8) consists of a shape-memorising part, mounted transversally in the supply (6) or outlet (7) passage and of which the apparent surface exposed to the flow of fluid varies, by changing the orientation or form of said part, depending on the temperature of said fluid in contact with it, at least within a predetermined temperature range.

Fig. 1



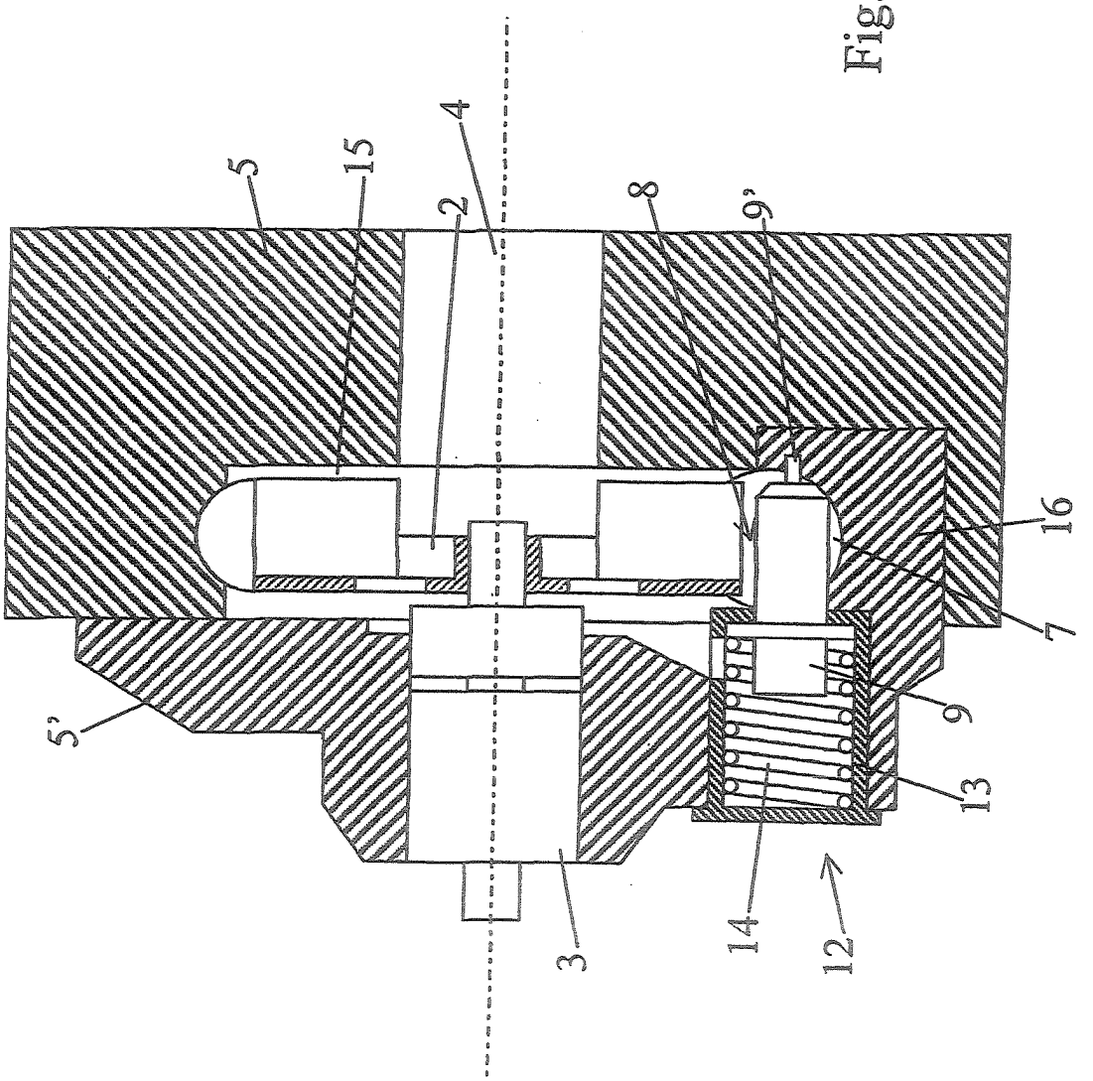


Fig. 2

Fig. 3

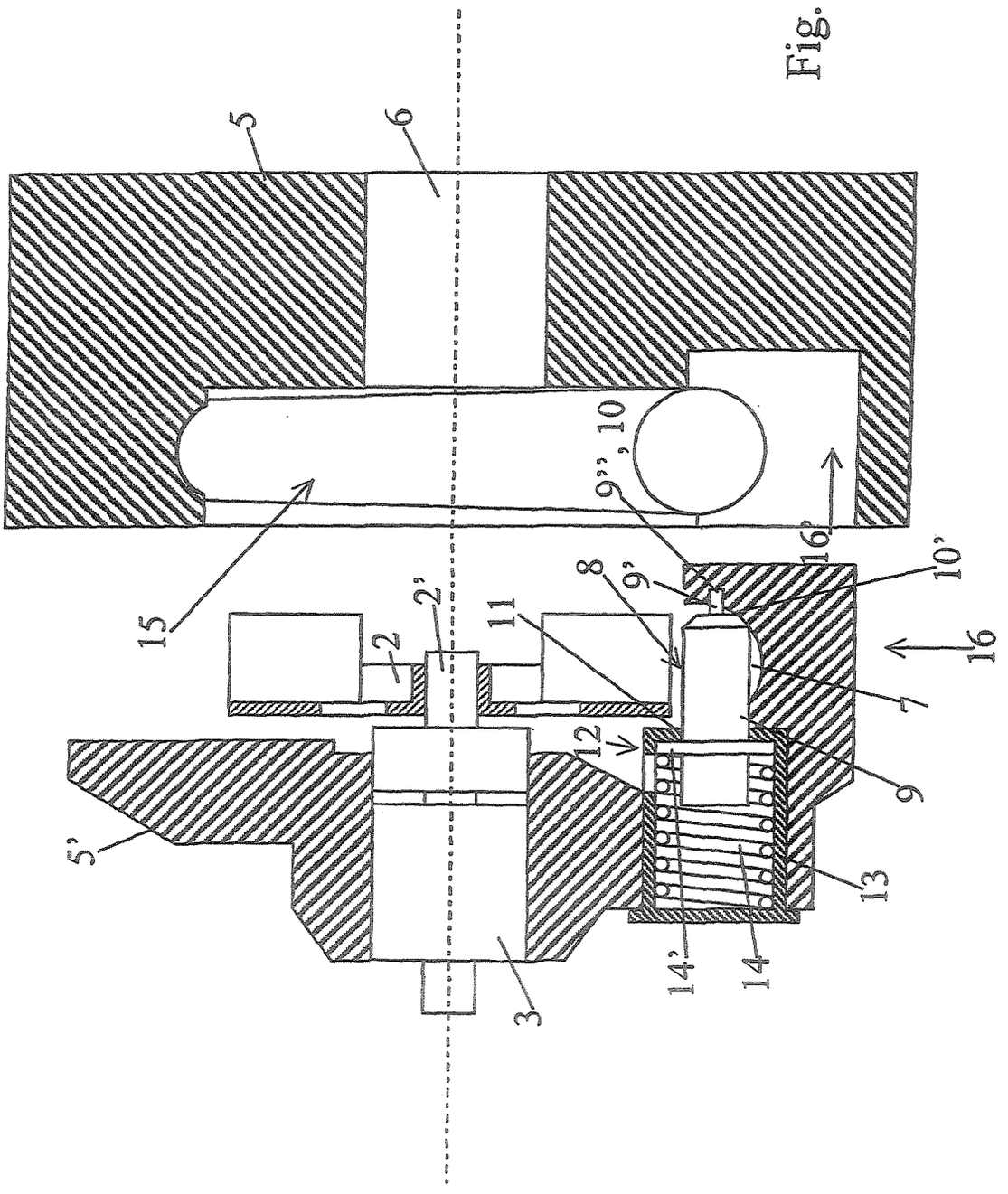
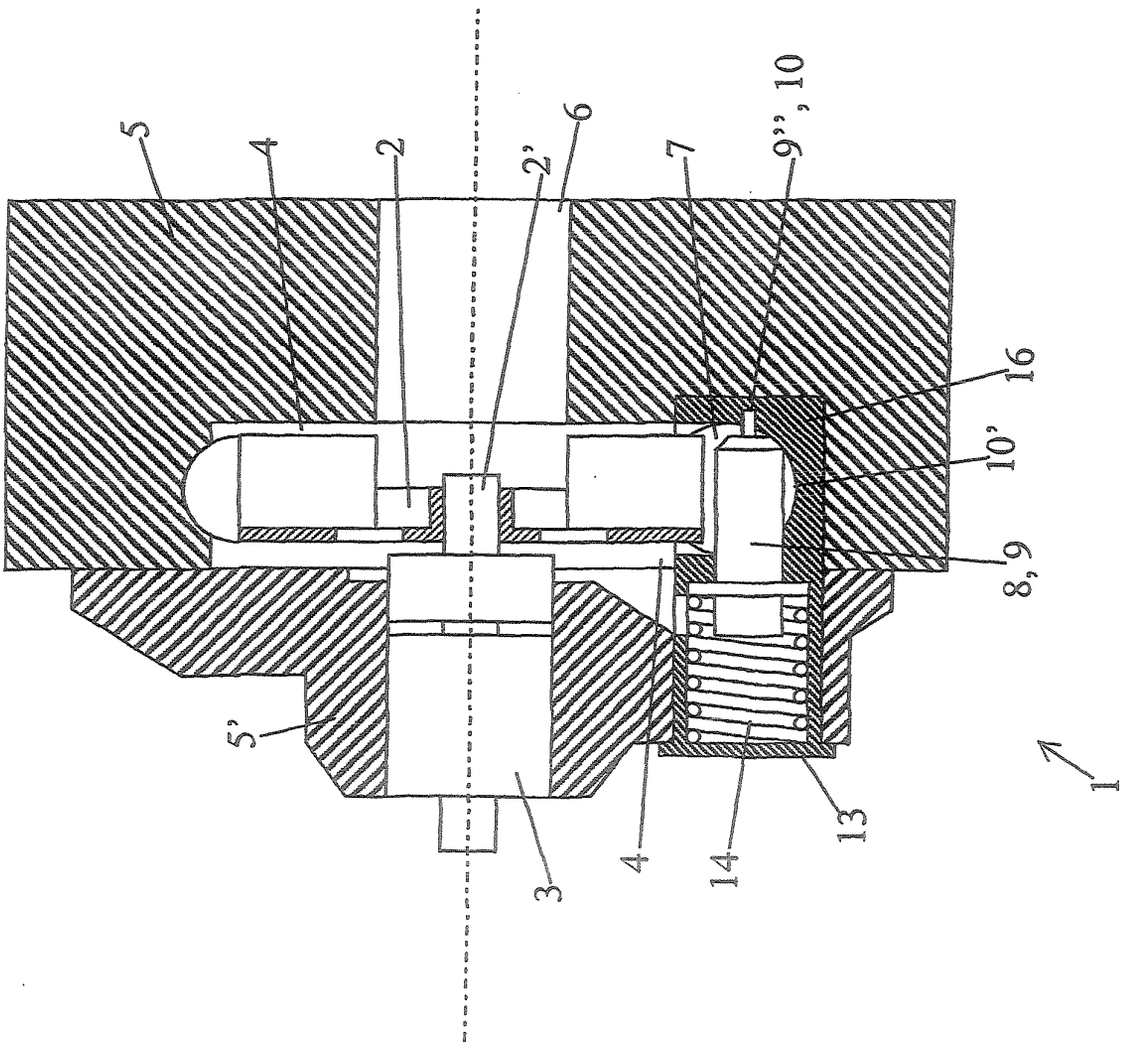


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 3251

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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X	US 6 260 515 B1 (HARADA MAKOTO ET AL) 17 July 2001 (2001-07-17) * abstract * * column 12, lines 30-51 * * column 12, lines 57-64 * * column 13, lines 30-47 * * figure 14 *	1-6	
X	FR 2 738 203 A (VALEO SYSTEMES ESSUYAGE) 7 March 1997 (1997-03-07) * the whole document *	1	
A	FR 2 681 906 A (RENAULT VEHICULES IND) 2 April 1993 (1993-04-02) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F04D
F16K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 August 2005	Giorgini, G

CATEGORY OF CITED DOCUMENTS

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