

(19)



(11)

EP 3 207 254 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

21.04.2021 Bulletin 2021/16

(51) Int Cl.:

F04C 14/22 ^(2006.01)

F04C 2/344 ^(2006.01)

(86) International application number:

PCT/IB2015/057147

(21) Application number: **15775819.4**

(22) Date of filing: **17.09.2015**

(87) International publication number:

WO 2016/059490 (21.04.2016 Gazette 2016/16)

(54) CONTROL SYSTEM AND METHOD FOR CONTROLLING A POSITIVE DISPLACEMENT PUMP

**STEUERUNGSSYSTEM UND VERFAHREN ZUR STEUERUNG EINER POSITIVEN
VERDRÄNGERPUMPE**

SYSTÈME ET PROCÉDÉ DE COMMANDE POUR COMMANDER UNE POMPE VOLUMÉTRIQUE

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

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(30) Priority: **15.10.2014 IT PR20140069**

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(43) Date of publication of application:

23.08.2017 Bulletin 2017/34

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Description

Technical field

[0001] The object of the present invention is a control system and method for controlling a variable volume positive displacement rotary pump.

Background art

[0002] There are known variable displacement pumps for circulation of the lubrication oil in an internal combustion engine and any possible auxiliaries.

[0003] Variable displacement makes it possible to regulate the flow rate of the lubrication oil, optimizing it based on the operating mode of the engine. In fact, in the case of a fixed displacement pump, the flow rate should be such as to ensure adequate lubrication at low speeds, but this would determine an excessive flow rate at higher speeds (therefore requiring greater consumption by the engine to ensure circulation of the lubricant and imposing higher pressures and thus greater stress on the circuit).

[0004] An example of a variable displacement pump for circulation of lubrication oil is found in patent WO 2007/087704. In this case, two chambers are shown that move a stator, inside of which a vane rotor rotates. The movement of the stator determines a variation in the output of the pump. Access to at least one of the two thrust chambers is regulated by a valve controlled by an electronic control unit. In this specific case, the two thrust chambers act jointly to counter the force exerted by a spring. The spring exerts a force that pushes the stator to a position of maximum displacement. By virtue of the oil pressure in the two thrust chambers, the displacement of the pump can thus be regulated

[0005] A further example of a variable displacement pump is disclosed in document US 2014/0219847 A1.

[0006] The Applicant has verified that when the variable displacement pump is utilized on mid-range/high-powered engines for heavy vehicles there is a problem consisting of a marked delay in the increase in flow rate/pressure of the oil needed for quickly activating the actuator of the engine brake and for protecting the internal members of the engine from stress.

Object of the invention

[0007] In this context, the technical task underlying the present invention is to offer a control system and method for controlling a pump that make it possible to overcome the drawbacks described hereinabove. In particular, an aim of the present invention is to offer a control system and method for controlling a pump that make better lubrication of a load possible, regardless of the operating conditions.

[0008] The defined technical task and the specified aims are substantially achieved by a control system and method for controlling a pump, comprising the technical

characteristics set forth in one or more of the appended claims.

Brief description of drawings

[0009] Further characteristics and advantages of the present invention will become more apparent from the approximate and thus non-limiting description of a preferred, but not exclusive, embodiment of a control system and method for controlling a pump, as illustrated in the accompanying drawings, of which:

- Figure 1 is a schematic view of an application of a control system for controlling a pump according to the present invention (operating in a first configuration);
- Figure 2 is a schematic view of the system appearing in Figure 1 operating in a second configuration.

Detailed description of preferred embodiments of the invention

[0010] In the accompanying figures, a control system for controlling a positive displacement pump is indicated by the reference number 1.

[0011] This system comprises the positive displacement pump 2, which is of the variable volume rotary type.

[0012] As explained above, variable displacement makes it possible to optimize operation under different operating conditions.

[0013] The pump 2 comprises a stator 20 that is movable so as to determine a variation in the volume of the pump 2. The stator 20 is conveniently hollow and a rotor 200, typically a vane rotor, is present inside the stator. Relative movement of the stator 20 with respect to the axis of rotation of the rotor 200 allows for variation in the volume of the pump 2. Movement of the stator 20 can be of various types, for example it could be a tilting, rotational, or translational type of movement. In the solution exemplified in the figures, the movement of the stator 20 is of the rotational type where a first, a second and a third arc are indicated by reference numbers 203, 204, 205, with a common centre, on which the stator 20 rotates. The pump 2 further comprises a first thrust chamber 214 for thrusting the stator 20. This first thrust chamber 21 is designed to be filled with a fluid processed by the pump. In this manner, it is possible to bring about movement of the stator 20 and a variation in the volume of the pump 2. The fluid processed by the pump 2 is a liquid, typically oil. Therefore, this fluid is not compressible.

[0014] In the solution exemplified in the accompanying figures, the first chamber 21 is defined by the fluid dynamic seal realized with the contribution of the third arc 205, the first arc 203 and the gasket 201.

[0015] The system 1 comprises a supply line 3 for supplying the fluid processed by the pump 2 to a load. In the accompanying figures, the load is generally indicated by the reference letter "C", for example the lubrication sys-

tem of an endothermic engine.

[0016] The supply line 3 extends downstream of a delivery side of the pump 2; it preferably starts precisely from the delivery side of the pump 2.

[0017] The system 1 conveniently comprises an element 4 that defines a localized pressure drop. This element 4 is located along the supply line 3. It is located before the load.

[0018] The element 4 that defines a localized pressure drop advantageously consists in a filter 40 for the fluid in transit in said supply line 3. The filter 40 determines a pressure drop that can amount to as much as 2-3 bars, based on temperature, flow rate and blockage. The filter 40 lies along the supply line 3.

[0019] As an alternative, the element 4 could also consist in a component of another type that determines an abrupt localized type of pressure loss.

[0020] The system 1 also comprises control means 5 for controlling the flow of the fluid supplying said first chamber 21. During operation, the control means 5 is able to assume at least a first and a second configuration.

[0021] The system 1 further comprises a first branch 31, which, in the first configuration of the control means 5, allows for collecting the fluid (pressure) to be directed into the first thrust chamber 21, from said supply line 3 downstream of said element 4 (see Figure 1).

[0022] The system 1 further comprises a second branch 32, which, in the second configuration of the control means 5, allows for collecting the fluid (pressure) to be directed into the first thrust chamber 21, from said supply line 3 upstream of said element 4 (see Figure 2). Only the contour of the stator 20 is illustrated in the schematic view of Figure 1 and the rotor 200 is visible only in Figure 2.

[0023] With respect to the first configuration, the second configuration enables a more demanding functioning of the load (for example this can involve operating conditions in which the engine brake is activated or mid-range/high-powered engines are operating on heavy vehicles).

[0024] The second branch 32 is conveniently connected to a maximum pressure safety valve 511. In the case of excess pressure, this valve 511 enables the fluid to be discharged into a collection system (which is, in turn, operatively connected to the suction of the pump 2).

[0025] In the first configuration (Figure 1), the control means 5 conveniently enables passage of the fluid from said first branch 31 towards the first thrust chamber 21, blocking passage of the fluid from said second branch 32 towards the first thrust chamber 21. The movement of the fluid in the first configuration of the control means is illustrated in Figure 1.

[0026] In the second configuration (Figure 2), the control means 5 enables passage of the fluid from said second branch 32 towards the first thrust chamber 21, blocking passage of the fluid from said first branch 31 towards the first thrust chamber 21. The movement of the fluid in the second configuration of the control means is illustrated

ed in Figure 2.

[0027] The control means 5 for controlling the flow of the fluid comprises a three-way valve 50 that alternatively has the first or second branch 31, 32 as inlets. This three-way valve 50 is typically responsible for the occurrence of the first or second configuration of the control means 5.

[0028] The system 1 conveniently comprises an electronic control unit 6 for commanding the flow control means 5, said electronic control unit 6 determining the switching between the first and the second configuration.

[0029] The control means 5 for controlling the flow comprises a modulating valve 51 for modulating the entrance of fluid into the first thrust chamber 21. The valve 51 could consist of a spool valve. Advantageously, the outlet of said three-way valve 50 supplies the inlet of the spool valve.

[0030] The modulating valve 51 (the spool valve) comprises piston that moves in a compartment. In a first position of the piston, the modulating valve 51 enables the first chamber 21 to be filled. In a second position of the piston, the regulating valve enables the first chamber 21 to be emptied. Conveniently, in the second position of the piston, the fluid present in the first chamber 21 is re-directed towards the suction of the pump 2. The modulating valve 51 is controlled by the electronic control unit 6.

[0031] The system 1 conveniently comprises a second thrust chamber 22. In both the first and second configuration, the second chamber 22 is found (is supplied) downstream of said element 4, with respect to the direction of travel of the fluid in the supply line 3. The second thrust chamber 22 is supplied by a third branch 33 located downstream of said element 4. The third branch 33 conveniently extends from the supply line 3. In particular, the third branch 33 extends upstream of the load C that is supplied by the line 3. In the exemplary solution of the accompanying figures, the fluid present in the second thrust chamber 22 exerts an opposite thrust on the stator 20 with respect to the fluid present in the first thrust chamber 21. The pump 2 comprises elastic means 23 that exerts an action jointly with the fluid present in the first thrust chamber 21 so as to position the stator 20 in the maximum volume configuration. The elastic means 23 comprises for example a compression spring. Leaving the condition of maximum volume, the spring is compressed. In this manner, even in the case where there is a breakdown in the electronics management of the control system of the pump 2, the latter progresses towards a situation of maximum volume, minimizing the risk of "seizing".

[0032] In both the first and the second configuration, the third branch 33 conveniently keeps the second chamber 22 pressurized.

[0033] In the solution illustrated in the accompanying figures, the second chamber 22 is defined by the fluid dynamic sealing realized with the contribution of the third arc 205, the second arc 204 and the gasket 202.

[0034] The object of the present invention is also a

method for controlling the operation of a variable volume positive displacement rotary pump. The control method is conveniently implemented by a control system 1 that has one or more of the characteristics described hereinabove. The method of operation of the system 1 shall thus be illustrated by way of example below.

[0035] The method comprises the stage of conveying a fluid exiting from the delivery side 24 of the pump 2 along a supply line 3 for supplying a load C, having it pass through at least one filter 40. The load C typically comprises a lubrication system for an internal combustion engine. This filter 40 determines a drop in pressure that can amount to as much as 2-3 bars.

[0036] The method further comprises the stage of positioning the control means 5 for controlling the flow of fluid in a first configuration in such a manner as to collect part of the fluid in transit along said supply line 3, downstream of the filter 40, and convey it into a first thrust chamber 21 for thrusting a stator 20 (see Figure 1). The stage of positioning the control means 5 for controlling the flow of fluid in a first configuration comprises positioning a three-way valve 50 so that part of the fluid in transit along said supply line 3 is collected downstream of the filter 40 (Figure 1). The stage of positioning the control means 5 in the first configuration further comprises having the fluid exiting the three-way valve 50 pass through a spool valve 51 that regulates/modulates access of the fluid into the first chamber 21.

[0037] The method conveniently comprises the stage of conveying part of the fluid that has passed from the delivery side of the pump 2 into a second chamber 22. In the preferred solution, the pressure exerted on the stator 20 by the fluid in the first chamber 21 is opposite the pressure exerted on the stator 20 by the fluid present in the second chamber 22. Advantageously, the method comprises exerting, by means of the elastic means 23, a force on the stator 20 that opposes the distancing of the stator 20 from a position associated with the maximum volume of the pump 2.

[0038] The position of the stator 20 is conveniently defined by the equilibrium at least of the following stresses:

- the pressure exerted on the stator 20 by the fluid present in the first chamber 21;
- the pressure exerted on the stator 20 by the fluid present in the second chamber 22;
- the force exerted on the stator 20 by the elastic means 23.

[0039] In the preferred, but non-limiting solution shown in the accompanying figures, the pressure exerted on the stator 20 by the fluid present in the first chamber 21 is opposite the force exerted on the stator 20 by the elastic means 23.

[0040] The method further comprises the stage of changing the configuration of the flow control means 5 so as to pass from the first configuration to a second configuration. Passage from the first to the second con-

figuration is associated with a configuration for more demanding functioning (for example, but not necessarily, frequent recourse to the engine brake). Conveniently, passage from the first to the second configuration is determined by a command coming from an electronic control unit based on the detection of certain input signals (for example through sensors or an explicit user command).

[0041] In the second configuration of the control means 5, the method comprises the stage of collecting a working fluid between the delivery side 24 of the pump 2 and the filter 40 and directing it to the first thrust chamber 21 (see Figure 2).

[0042] The passage from the first to the second configuration determines a movement of the stator 20 accompanied by a rapid increase in the volume of the pump 2. In said second configuration, the pressure that is available and that can be modulated for said first chamber 21 is higher than in the first configuration.

[0043] The stage of changing the configuration of the control means 5 so as to pass from the first to the second configuration advantageously comprises changing the configuration of the three-way valve 50 so that a fluid passes through it, the fluid being the fluid that is collected from the supply line 3 supplying the load downstream of the delivery side of the pump 2, but before the filter 40.

[0044] The invention thus conceived makes it possible to achieve multiple advantages.

[0045] First of all, it makes it possible to change the configuration of the fluid dynamic circuit so that the first thrust chamber 21 can be supplied by a fluid collected upstream of the filter (and therefore upstream of the pressure drop associated with the presence of the filter).

[0046] In this manner, the stator 20 can progress towards a position with which the maximum volume of the pump 2 is associated, thus ensuring a greater fluid flow rate so as to meet more demanding functioning needs.

[0047] Moreover, in this situation in which the second thrust chamber 22 is acting in opposition to the first thrust chamber 21, the latter can exert greater pressure with respect to the second thrust chamber (and this makes the passage of the stator into the maximum volume configuration faster, preventing, among other things, vibrations or undesired reactions).

[0048] The invention thus conceived is susceptible to numerous modifications and variants, all of which falling within the scope of the inventive concept characterizing the invention. Moreover, all details may be replaced with other technically equivalent elements. All the materials used, as well as the dimensions, may in practice be of any type, according to needs.

Claims

1. A control system comprising:

- a variable volume positive displacement rotary

pump (2), in turn comprising:

- i) a stator (20) that is movable so as to determine a variation in the volume of the pump (2);
 - ii) a first thrust chamber (21) for thrusting the stator (20) and designed to be filled with a fluid processed by the pump so as to determine a movement of the stator (20) and a variation in the volume of the pump (2);
 - a supply line (3) for supplying the fluid processed by the pump (2) to a load;
 - an element (4) that defines a localized pressure drop, said element (4) being located along said supply line (3);
 - control means (5) for controlling the flow of the fluid supplying said first chamber (21), said control means (5) being able to assume at least a first and a second configuration;
 - a first branch (31), which, in the first configuration of the control means (5), allows for directing the fluid, collected from said supply line (3) downstream of said element (4), into the first thrust chamber (21);
 - a second branch (32), which, in the second configuration of the control means (5), allows for directing the fluid, collected from said supply line (3) upstream of said element (4), into the first thrust chamber (21); with respect to the first configuration, said second configuration enabling functioning of the load under more demanding conditions.
2. The system according to claim 1, **characterized in that** said element (4) that defines a localized pressure drop consists in a filter (40) for the fluid in transit in said supply line (3).
 3. The system according to claim 1 or 2, **characterized in that** the control means (5):
 - in the first configuration, enables passage of the fluid from said first branch (31) towards the first thrust chamber (21), blocking passage of the fluid from said second branch (32) towards the first thrust chamber (21);
 - in the second configuration, enables passage of the fluid from said second branch (32) towards the first thrust chamber (21), blocking passage of the fluid from said first branch (31) towards the first thrust chamber (21).
 4. The system according to any one of the preceding claims, **characterized in that** said control means (5) for controlling the flow of the fluid comprises a three-way valve (50) that alternatively has the first or second branch (31, 32) as inlets.
 5. The system according to any one of the preceding claims, **characterized in that** it comprises an electronic control unit (6) for commanding the flow control means (5), said electronic control unit (6) determining the switching between the first and the second configuration.
 6. The system according to claim 5, **characterized in that** the control means (5) for controlling the flow comprises a modulating valve (51) for modulating the introduction of fluid in the first thrust chamber (21), and that is controlled by the electronic control unit (6).
 7. The system according to any one of the preceding claims, **characterized in that** it comprises a second thrust chamber (22); in both the first and the second configuration of the control means (5), said second thrust chamber (22) being downstream of said element (4), with respect to the direction of travel of the fluid in the supply line (3).
 8. The system according to any one of the preceding claims, **characterized in that** the fluid present in the second thrust chamber (22) exerts an opposite thrust with respect to the fluid present in the first thrust chamber (21); said pump (2) comprising elastic means (23) that exerts an action jointly with the fluid present in the first thrust chamber (21) so as to position the stator (20) in the maximum volume configuration.
 9. A method for controlling the operation of a variable volume positive displacement rotary pump, comprising the stages of:
 - conveying a fluid exiting from the delivery side (24) of the pump (2) along a supply line (3) for supplying a load, having said fluid pass through at least one filter (40);
 - positioning the control means (5) for controlling the flow of fluid in a first configuration in such a manner as to collect, downstream of the filter (40), part of the fluid in transit along said supply line (3) and convey it into a first thrust chamber (21) for thrusting a stator (20);
 - changing the configuration of the control means (5) for controlling the flow of the fluid so as to pass from the first configuration to a second configuration so as to enable collection of a working fluid between the delivery side (24) of the pump (2) and the filter (40) and direct it into the first thrust chamber (21), this determining a movement of the stator (20), accompanied by an increase in the volume of the pump (2), and with respect to the first configuration, said second configuration enabling more demanding functioning of the load.

10. The method according to claim 9, **characterized in that** at least in the first configuration of the control means (5), a second thrust chamber (22) exerting a pressure on the stator (20) that is opposite the pressure of the first thrust chamber (21) is supplied downstream of said filter (40).

Patentansprüche

1. Steuersystem, umfassend:

- eine Verdrängerkreiselpumpe (2) mit variablem Volumen, die wiederum umfasst:

I) einen Stator (20), der derart beweglich ist, dass eine Schwankung des Volumens der Pumpe (2) bestimmt wird,
 II) eine erste Schubkammer (21), um den Stator (20) vorzudrücken und dafür gestaltet, mit einem Fluid gefüllt zu werden, das von der Pumpe verarbeitet wird, so dass eine Bewegung des Stators (20) und eine Schwankung des Volumens der Pumpe (2) bestimmt wird,

- eine Speiseleitung (3) zum Speisen des Fluids, das von der Pumpe (2) verarbeitet wird, zu einer Last,
- ein Element (4), das einen lokalisierten Druckabfall definiert, wobei sich das Element (4) entlang der Zufuhrleitung (3) befindet,
- ein Steuermittel (5) zum Steuern des Strömens des Fluids, das die erste Kammer (21) speist, wobei das Steuermittel (5) in der Lage ist, mindestens eine erste und eine zweite Gestaltung einzunehmen,

eine erste Abzweigung (31), die in der ersten Gestaltung des Steuermittels (5) ermöglicht, das Fluid, das aus der Speiseleitung (3) stromabwärts des Elements (4) gesammelt wird, in die erste Schubkammer (21) zu lenken,
 eine zweite Abzweigung (32), die in der zweiten Gestaltung des Steuermittels (5) ermöglicht, das Fluid, das aus der Speiseleitung (3) stromaufwärts des Elements (4) gesammelt wird, in die erste Schubkammer (21) zu lenken, wobei die zweite Gestaltung im Verhältnis zur ersten Gestaltung das Funktionieren der Last unter anspruchsvolleren Bedingungen ermöglicht.

2. System nach Anspruch 1, **dadurch gekennzeichnet, dass** das Element (4), das einen lokalisierten Druckabfall definiert, aus einem Filter (40) für das Fluid beim Durchqueren der Speiseleitung (3) besteht.

3. System nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Steuermittel (5):

- in der ersten Gestaltung das Hindurchtreten des Fluids von der ersten Abzweigung (31) zur ersten Schubkammer (21) ermöglicht und dabei das Hindurchtreten des Fluids von der zweiten Abzweigung (32) zur ersten Schubkammer (21) blockiert,
- in der zweiten Gestaltung das Hindurchtreten des Fluids von der zweiten Abzweigung (32) zur ersten Schubkammer (21) ermöglicht und dabei das Hindurchtreten des Fluids von der ersten Abzweigung (31) zur ersten Schubkammer (21) blockiert.

4. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Steuermittel (5) zum Steuern des Strömens des Fluids ein Dreiwegeventil (50) umfasst, das alternativ die erste oder die zweite Abzweigung (31, 32) als Einlass aufweist.

5. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** es eine elektronische Steuereinheit (6) zum Beherrschen des Strömungssteuermittels (5) umfasst, wobei die elektronische Steuereinheit (6) das Umschalten zwischen der ersten und der zweiten Gestaltung bestimmt.

6. System nach Anspruch 5, **dadurch gekennzeichnet, dass** das Steuermittel (5) zum Steuern der Strömung ein modulierendes Ventil (51) zum Modulieren des Einführens von Fluid in die erste Schubkammer (21) umfasst und das durch die elektronische Steuereinheit (6) gesteuert wird.

7. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** es eine zweite Schubkammer (22) umfasst, wobei die zweite Schubkammer (22) sowohl in der ersten als auch der zweiten Gestaltung des Steuermittels (5) im Verhältnis zur Bewegungsrichtung des Fluids in der Speiseleitung (3) stromabwärts des Elements (4) liegt.

8. System nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Fluid, das in der zweiten Schubkammer (22) vorhanden ist, einen im Verhältnis zu dem Fluid, das in der ersten Schubkammer (21) vorhanden ist, entgegengesetzten Schub ausübt, wobei die Pumpe (2) ein elastisches Mittel (23) umfasst, das gemeinsam mit dem Fluid, das in der ersten Schubkammer (21) vorhanden ist, eine Wirkung ausübt, so dass der Stator (20) in der Maximalvolumengestaltung positioniert wird.

9. Verfahren zum Steuern des Betriebes einer Verdrängerkreiselpumpe mit variablem Volumen, die folgenden Schritte umfassend:

- Befördern eines Fluids, das aus der Zufuhrseite (24) der Pumpe (2) austritt, entlang einer Speiseleitung (3) zum Speisen einer Last, wobei man das Fluid durch mindestens einen Filter (40) hindurchtreten lässt, 5
 - Positionieren des Steuermittels (5) zum Steuern der Strömung von Fluid in einer ersten Gestaltung derart, dass stromabwärts des Filters (40) ein Teil des Fluids beim Durchqueren entlang der Speiseleitung (3) gesammelt und in eine erste Schubkammer (21) befördert wird, um einen Stator (20) vorzudrücken, 10
 - Wechseln der Gestaltung des Steuermittels (5) zum Steuern der Strömung des Fluids derart, dass es von der ersten Gestaltung in eine zweite Gestaltung übergeht, so dass ein Sammeln eines Arbeitsfluids zwischen der Zufuhrseite (24) der Pumpe (2) und dem Filter (40) und das Lenken desselben in die erste Schubkammer (21) ermöglicht wird, wobei dies eine Bewegung des Stators (20) bestimmt, die von einer Zunahme des Volumens der Pumpe (2) begleitet wird, und im Verhältnis zu ersten Gestaltung die zweite Gestaltung das Funktionieren der Last unter anspruchsvolleren Bedingungen ermöglicht. 15 20 25

10. Verfahren nach Anspruch 9, **dadurch gekennzeichnet, dass** mindestens in der ersten Gestaltung des Steuermittels (5) eine zweite Schubkammer (22), die einen Druck auf den Stator (20) ausübt, der dem Druck der ersten Schubkammer (21) entgegengesetzt ist, stromabwärts des Filters (40) gespeist wird. 30 35

Revendications 40

1. Système de commande, comprenant :

- une pompe rotative volumétrique à volume variable (2), comprenant à son tour : 45
 i) un stator (20) qui est mobile afin de déterminer une variation du volume de la pompe (2) ;
 ii) une première chambre de poussée (21) 50 pour pousser le stator (20) et conçue pour être remplie avec un fluide traité par la pompe afin de déterminer un mouvement du stator (20) et une variation du volume de la pompe (2) ; 55
 - une conduite d'alimentation (3) pour effectuer l'alimentation en le fluide traité par la pompe (2)

à une charge ;

- un élément (4) qui définit une chute de pression localisée, ledit élément (4) étant situé le long de ladite conduite d'alimentation (3) ;
 - un moyen de commande (5) pour commander l'écoulement du fluide alimentant ladite première chambre (21), ledit moyen de commande (5) étant capable d'adopter au moins une première et une seconde configuration ;
 - une première branche (31), qui, dans la première configuration du moyen de commande (5), permet de diriger le fluide, collecté à partir de ladite conduite d'alimentation (3) en aval dudit élément (4), dans la première chambre de poussée (21) ;
 - une seconde branche (32), qui, dans la seconde configuration du moyen de commande (5), permet de diriger le fluide, collecté à partir de ladite conduite d'alimentation (3) en amont dudit élément (4), dans la première chambre de poussée (21) ; par rapport à la première configuration, ladite seconde configuration permettant le fonctionnement de la charge dans des conditions plus contraignantes.

2. Système selon la revendication 1, **caractérisé en ce que** ledit élément (4) qui définit une chute de pression localisée est constitué en un filtre (40) pour le fluide en transit dans ladite conduite d'alimentation (3). 30

3. Système selon la revendication 1 ou 2, **caractérisé en ce que** le moyen de commande (5) :

- dans la première configuration, permet le passage du fluide à partir de ladite première branche (31) vers la première chambre de poussée (21), bloquant le passage du fluide à partir de ladite seconde branche (32) vers la première chambre de poussée (21) ;
 - dans la seconde configuration, permet le passage du fluide à partir de ladite seconde branche (32) vers la première chambre de poussée (21), bloquant le passage du fluide à partir de ladite première branche (31) vers la première chambre de poussée (21). 35 40

4. Système selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit moyen de commande (5) pour commander l'écoulement du fluide comprend une valve à trois voies (50) qui a de façon alternée la première ou seconde branche (31, 32) en tant qu'entrées. 50

5. Système selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend une unité de commande électronique (6) pour commander le moyen de commande d'écoulement (5), ladite 55

unité de commande électronique (6) déterminant la permutation entre la première et la seconde configuration.

6. Système selon la revendication 5, **caractérisé en ce que** le moyen de commande (5) pour commander l'écoulement comprend une valve de modulation (51) pour moduler l'introduction de fluide dans la première chambre de poussée (21), et qui est commandée par l'unité de commande électronique (6). 10

7. Système selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** comprend une seconde chambre de poussée (22) ; dans la première ainsi que dans la seconde configuration du moyen de commande (5), ladite seconde chambre de poussée (22) étant en aval dudit élément (4), par rapport à la direction de déplacement du fluide dans la conduite d'alimentation (3). 15
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8. Système selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le fluide présent dans la seconde chambre de poussée (22) exerce une poussée opposée par rapport au fluide présent dans la première chambre de poussée (21) ; ladite pompe (2) comprenant un moyen élastique (23) qui exerce une action conjointement avec le fluide présent dans la première chambre de poussée (21) afin de positionner le stator (20) dans la configuration de volume maximum. 25
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9. Procédé pour commander le fonctionnement d'une pompe rotative volumétrique à volume variable, comprenant les stades de : 35
 - le transport d'un fluide sortant du côté refoulement (24) de la pompe (2) le long d'une conduite d'alimentation (3) pour alimenter une charge, faisant en sorte que ledit fluide passe à travers au moins un filtre (40) ; 40
 - le positionnement du moyen de commande (5) pour commander l'écoulement de fluide dans une première configuration de manière telle à collecter, en aval du filtre (40), une partie du fluide en transit le long de ladite conduite d'alimentation (3) et le transporter dans une première chambre de poussée (21) pour pousser un stator (20) ; 45
 - le changement de la configuration du moyen de commande (5) pour commander l'écoulement du fluide afin de passer de la première configuration à une seconde configuration afin de permettre la collection d'un fluide actif entre le coté refoulement (24) de la pompe (2) et le filtre (40) et le diriger dans la première chambre de poussée (21), ceci déterminant un mouvement du stator (20), accompagné par une augmentation du volume de la pompe (2), et par rapport 50
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à la première configuration, ladite seconde configuration permettant un fonctionnement plus contraignant de la charge.

10. Procédé selon la revendication 9, **caractérisé en ce qu'au moins** dans la première configuration du moyen de commande (5), une seconde chambre de poussée (22) exerçant une pression sur le stator (20) qui est opposée à la pression de la première chambre de poussée (21) est prévue en aval dudit filtre (40).

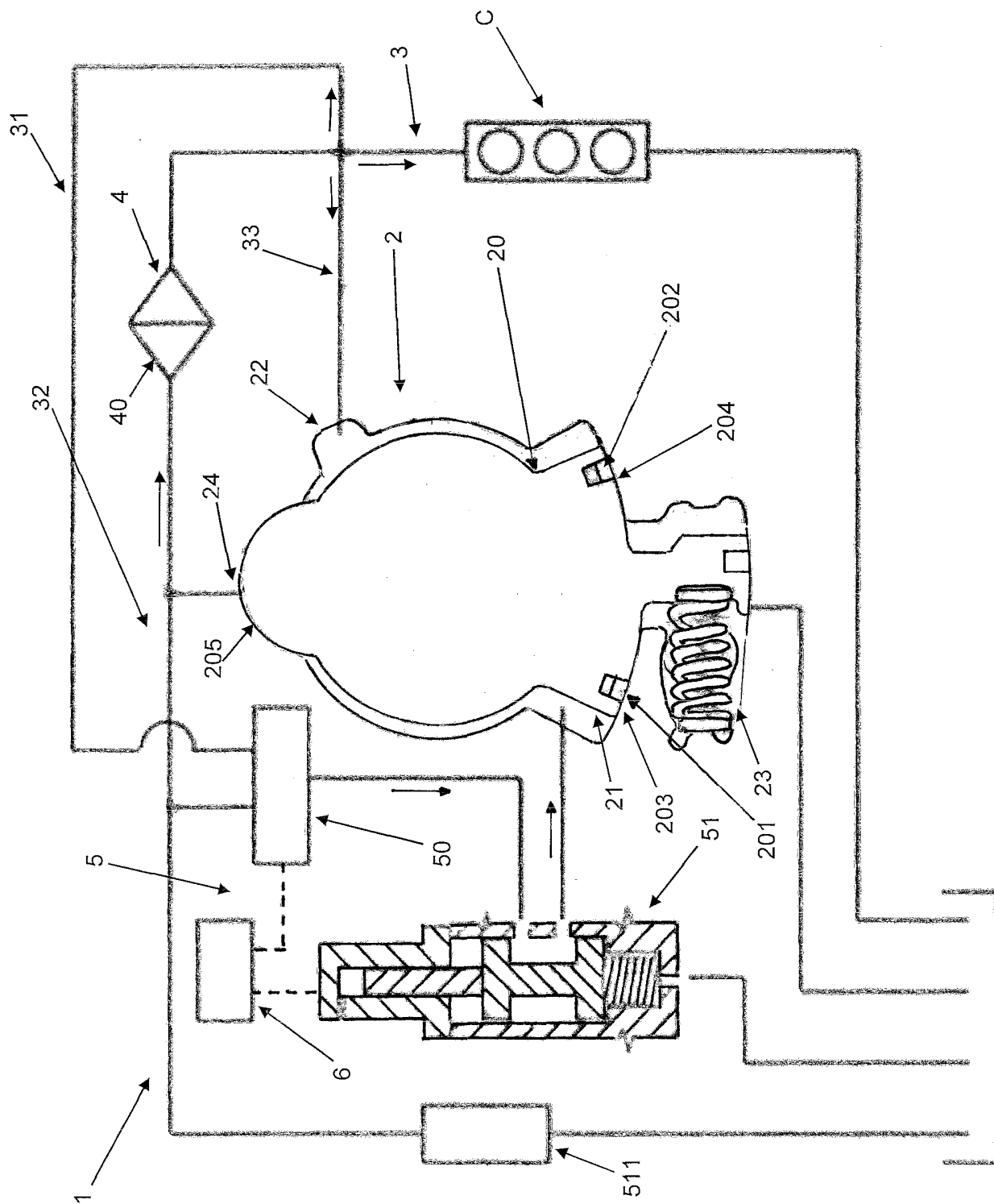


FIG. 1

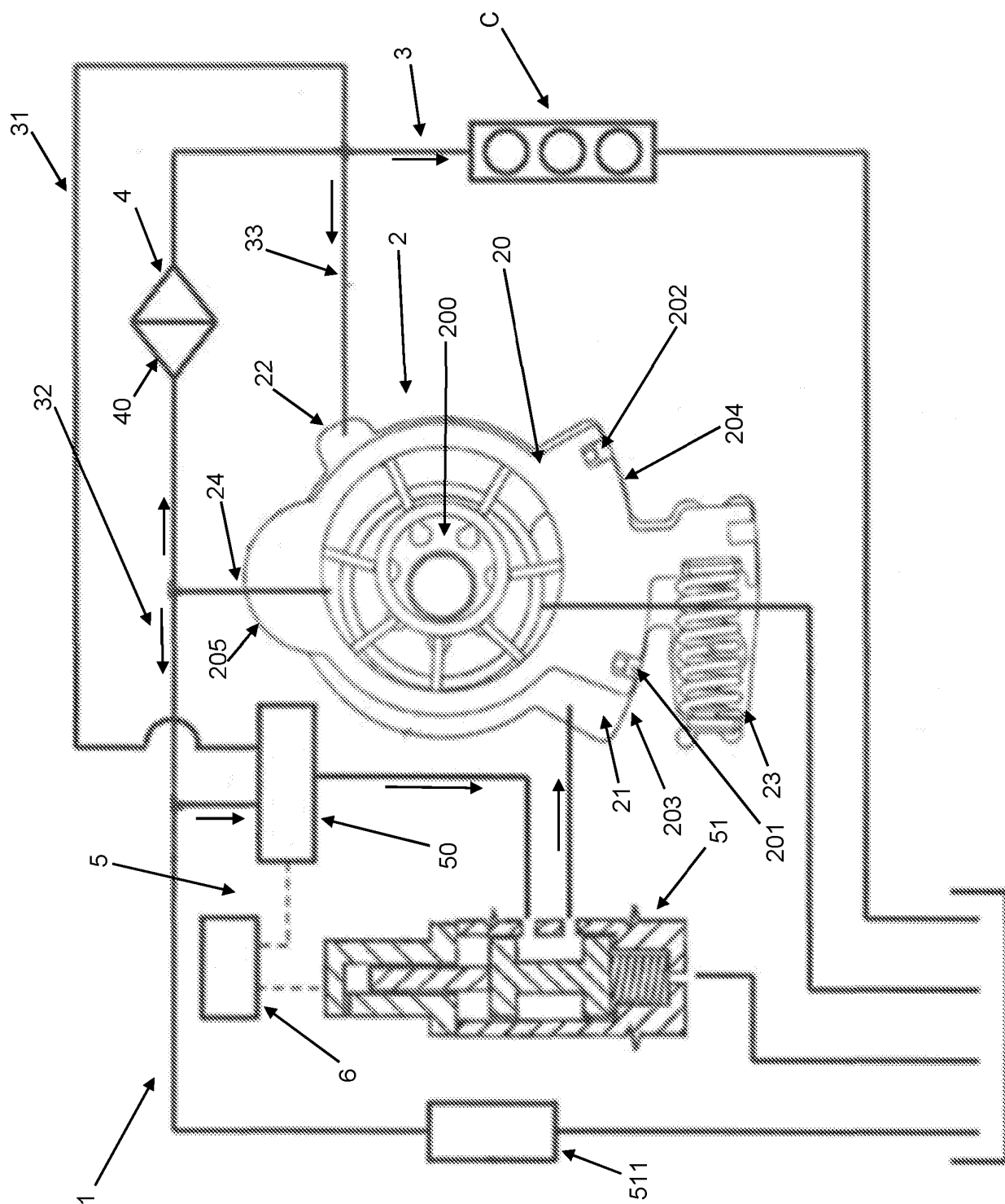


FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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