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(54) PUMPING SYSTEM EMPLOYING A VARIABLE-DISPLACEMENT VANE PUMP

EINE FLÜGELZELLENPUMPE MIT VARIABLER VERDRÄNGUNG EINSETZENDES PUMPSYSTEM

SYSTÈME DE POMPAGE UTILISANT UNE POMPE À PALETTES À CYLINDRÉE VARIABLE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a variable-displacement vane pump comprising a main body having a cavity, in which is movable a ring containing a rotor rotating about a fixed axis. The rotor has a number of vanes, one end of each of which rests on the inner surface of the ring during rotation.

[0002] Means are also provided which, depending on a control pressure, move the ring between a centred position with respect to the rotation axis of the rotor, in which no pumping action takes place, and a predetermined eccentric position with respect to the rotation axis of the rotor.

BACKGROUND ART

[0003] Vane pumps of the above type are currently used to pump various fluids, such as oil in an internal combustion engine.

[0004] As is known, in pumps of the above type, at high rotation speeds of the shaft connected to the rotor, the gaps between adjacent vanes on the pump fail to fill completely, thus resulting in forces impairing operation of the pump.

[0005] To counteract the increase in such forces, counteracting springs are traditionally used, but are extremely rigid and therefore do not deform easily.

[0006] FR 2 195 271 (PEUGEOT & RENAULT) discloses a pumping system comprising a variable-delivery vane pump; the system also comprising a user device (not shown) connected to the pump by a delivery conduit, and pressure regulating means for adjusting the eccentricity of a ring with respect to a rotor, both forming part of the pump, so that the pump assumes a balanced configuration such as to supply the oil flow requested by said user device; and wherein the pressure regulating means comprise hydraulic dissipating means for imparting to the oil inside a regulating chamber forming part of the pump a pressure lower than a control pressure. However, in such a document the dissipating means are located in series with the control device. The position of the dissipating means with regard to the discharging valve does not permit a fine control of the pressure in the control chamber.

[0007] In DE 32 14 212 (TEVES) a pressure control device for vane cell pumps is described. Such a control device has a servo piston cylinder unit and a control piston cylinder unit, the cylinder chambers of which are connected to a consumer pressure line of the pump and the pistons of which act on opposite sides of a servo element influencing the pump delivery, the control piston having a larger piston surface than the servo piston and being spring-loaded into the position of maximum delivery of the servo element, and a pressure limiting valve which is arranged in a line leading to an unpressurised vessel.

In order to simplify the construction of the pressure control device and in order to reduce the leakage points without resorting to spring-loaded valve slides, it is proposed that in the pressure line section leading to the control piston cylinder unit a diaphragm be arranged and that the pressure limiting valve be connected between the diaphragm and the control piston cylinder unit.

[0008] In such a document the diaphragm constitutes the dissipating means. However, the pressure limiting valve does not feel the pressure in the delivery conduit. Therefore, the pressure control into the control piston cylinder unit is not precise.

[0009] In WO 02/052155 (INAGUMA YOSHIHARU et al.) a vane pump is described. Such pump has a cam ring mounted in an adapter and made movable in the radial directions, and an internal pressure and a loading pressure, which are introduced into action chambers formed on the two sides of the cam ring, between the upstream and downstream of a variable orifice are controlled by a differential pressure control valve to control the discharge flow rate in response to the pump rotation speed. The differential pressure control valve is activated by the internal pressure and the loading pressure, which are introduced into action chambers formed on the two end sides, and by a valve pushing spring for biasing the differential pressure control valve to the internal pressure action chamber, and this biasing force by the valve pushing spring is increased/decreased according to the increase/decrease in the loading pressure. This increase/decrease is caused, for example, by a loading pressure responding piston which is biased by a piston pushing spring so that its leading end comes into the internal pressure action chamber and abuts against the differential pressure control valve. However, in such a document no precise pressure control is achieved.

DISCLOSURE OF INVENTION

[0010] It is therefore an object of the present invention to provide for hydraulic control of a variable-delivery vane pump, particularly at high speed.

[0011] According to the present invention, there is provided a pumping system employing a variable-displacement vane pump, as claimed in Claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a first embodiment of the present invention;

Figure 2 shows a first configuration of a second embodiment;

Figure 3 shows a second configuration of the second embodiment in Figure 2;

Figure 4 shows a first configuration of a detail of the

second embodiment in Figures 2 and 3;
Figure 5 shows a second configuration of the Figure 4 detail;

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] Number 10 in Figure 1 indicates a variable-delivery vane pump forming part of a pumping system 100 in accordance with the present invention.

[0014] Pump 10 comprises, in known manner, a main body 11 having a cavity 12 in which a ring 13 translates as described in detail later on.

[0015] Ring 13 houses a rotor 14 having a number of vanes 15, which move radially inside respective radial slits 16 formed in rotor 14, which is rotated in the direction indicated by arrow W (see below).

[0016] Main body 11 is closed by a cover not shown in the drawings.

[0017] In known manner, rotor 14 houses a shaft 17 connected mechanically to rotor 14; and a floating ring 18 surrounding shaft 17, and on which the other ends of vanes 15 rest.

[0018] Shaft 17 therefore has a centre P1 which is fixed at all times; and ring 13 has a centre P2.

[0019] The distance P1P2 represents the eccentricity E of pump 10.

[0020] As is known, by varying eccentricity E, the delivery of pump 10 can be varied as required by a user device UT downstream from pump 10 (see below).

[0021] User device UT may be defined, for example, by an internal combustion engine (not shown).

[0022] As shown in Figure 1, ring 13 has a projection 19 housed partly in a chamber 20; and a projection 21 housed partly in a chamber 22. Projections 19 and 21 are located on opposite sides of centre P2 of ring 13, and have respective front surfaces A1 and A2 facing chambers 20 and 22 respectively. For reasons explained in detail later on, surface A2 is larger than surface A1. More specifically, tests and calculations have shown surface A2 must be 1.4 to 1.7 times larger than surface A1.

[0023] A spring 22a inside chamber 22 exerts a small force on surface A2 to restore the system to a condition of maximum eccentricity E when system 100 is idle.

[0024] In the Figure 1 embodiment, chambers 20 and 22 are formed in main body 11 of pump 10.

[0025] Main body 11 also comprises an intake port 23 for drawing oil from a tank 24; and a delivery port 25 for feeding oil to user device UT.

[0026] A delivery conduit 26 extends from delivery port 25 to feed user device UT.

[0027] As shown in Figure 1, a first portion of the oil supplied to user device UT is diverted to chamber 20 by a conduit 27, and a second portion of the oil is fed to chamber 22 by a conduit 28.

[0028] More specifically, the second portion of the oil in conduit 28 is almost all fed to chamber 22 by a conduit 28a via a dissipating device 29, in which a calibrated pressure loss occurs as the oil actually flows through it.

[0029] Conduit 28 is connected to a valve 30 by a conduit 28b.

[0030] Valve 30 comprises a cylinder 31 housing a piston 32.

5 **[0031]** More specifically, as shown in Figure 1, piston 32 comprises a first portion 32a and a second portion 32b connected to each other by a rod 32c.

[0032] Portions 32a and 32b are equal in cross section to cylinder 31, whereas rod 32c is smaller in cross section than cylinder 31.

[0033] Cylinder 31 has a port 33 connected hydraulically to chamber 22 by a conduit 34.

[0034] Conduit 28b substantially provides for picking up a delivery pressure signal in conduit 28, so as to act on the front surface A3 of portion 32a of piston 32.

10 **[0035]** The dash line in Figure 1 shows the situation in which port 33 is closed by second portion 32b.

[0036] As described in more detail later on, as the delivery pressure (p1) increases alongside an increase in the operating speed of pump 10, greater force is exerted on surface A3 and, on reaching the preload value of a spring 36, moves piston 32 to allow oil flow from conduit 34 through port 33 and along a conduit 35 into tank 24.

20 **[0037]** At the start of conduit 35, the oil is at atmospheric pressure (p0).

[0038] Piston 32 is stressed elastically by a suitably sized spring 36 designed to generate a force which only permits movement of piston 32 when the delivery pressure (p1) on surface A3 reaches a given value.

25 **[0039]** A return conduit 37 from user device UT to tank 24 completes pumping system 100.

[0040] In the known art, eccentricity E is normally regulated by diverting a portion of the oil supply into a chamber, in which the delivery pressure acts directly on the ring; and an elastic counteracting force, generated by a spring, acts on the opposite side of the ring, so that the pump is set to an eccentricity E value ensuring the oil pressure and flow requested by the user device.

30 **[0041]** As stated, however, at high rotation speed of the shaft, and therefore of the rotor and vanes, the gaps between adjacent vanes fail to fill completely, thus resulting in undesired forces which, in addition to high rotation speed of the rotor, also depend on the temperature and chemical-physical characteristics of the oil.

35 **[0042]** Incomplete fill has the side effect of generating a force acting in the direction indicated by arrow F1 in Figure 1.

[0043] Consequently, the user device fails to obtain the required delivery pressure, on account of this undesired force which, as stated, is substantially caused by incomplete oil fill of the gaps between the vanes.

40 **[0044]** By way of a solution to the problem, an attempt has been made to disassociate control from the above negative internal forces by providing for so-called "hydraulic control".

45 **[0045]** With reference to Figure 1, since, as stated, surface A2 is larger (preferably 1.4 to 1.7 times larger) than surface A1, it follows that, if the delivery pressure (p1)

were present in both chambers 20 and 22, a force would be generated in the direction indicated by arrow F2 to compensate the force produced by incomplete fill of gaps 15a, thus resulting in maximum eccentricity E.

[0046] In this case, however, there would be no adjustment. To achieve the desired adjustment, therefore, the oil pressure in chamber 22 must be made lower than in chamber 20.

[0047] Consequently, when the delivery pressure (p_1) reaches a value capable of generating sufficient force on surface A3 of portion 32a to overcome the elastic force of spring 36, piston 32 moves into the configuration shown by the continuous line in Figure 1, in which rod 32c of piston 32 is located at port 33, and so permits oil flow from chamber 22 to conduit 34, and along conduit 35 into tank 24.

[0048] Oil therefore also flows along conduit 28a and through dissipating device 29, so that, as opposed to the delivery pressure (p_1), a lower pressure (p_2) is present in chamber 22.

[0049] In other words, the pressure (p_2) in chamber 22 is lower than the pressure (p_1) in chamber 20, thus dissociating the two pressures to enable ring 13 to move in the direction indicated by arrow F1 to establish a balanced eccentricity E value producing the desired oil flow to user device UT.

[0050] More specifically, as delivery pressure increases to a value (p^*) determined by the characteristics of spring 36, piston 32 begins moving so that part of the oil leaks through port 33. In other words, valve 30 also acts as a pressure dissipating device to assist in creating the desired pressure (p_2) in chamber 22.

[0051] (p_1) and (p^*) are equal at the end of the transient state

[0052] The system has also proved stable.

[0053] That is, adjustment continues for as long as permitted by piston 32, i.e. control is taken over by valve 30, which is regulated solely by delivery pressure (p_1) and totally unaffected by undesired internal forces.

[0054] Conversely, in known regulating systems, when delivery pressure (p_1) increases, it remains constant for a while, and then decreases.

[0055] With the system employed in system 100, on the other hand, on reaching the value required by user device UT, pressure (p_1) remains constant, even at extremely high rotation speeds of rotor 14.

[0056] When delivery pressure reaches pressure value (p^*), substantially determined by the characteristics of spring 36, generation of pressure (p_2) commences, and ring 13 begins moving in the direction of arrow F1 to reduce eccentricity E and therefore the displacement of pump 10. Consequently, delivery pressure falls, and tends to assume a value below (p^*), so that piston 32 moves into an intermediate balance position reducing the size of port 33.

[0057] Displacement remains fixed up to a given pressure value and, as pump speed increases, tends to increase delivery. When a given pressure value (p^*) is

reached, valve 30 opens, and oil flows along conduit 34, through port 33, and along conduit 35 to tank 24, so that the pressure (p_2) in chamber 22 is lower than (p_1), and ring 13 moves in the direction of arrow F1 to reduce displacement and therefore oil flow to user device UT.

[0058] In a second embodiment shown in Figures 2 to 5, dissipating device 29 and valve 30 are replaced by a three-way slide valve 50.

[0059] Valve 50 comprises a cylinder 51 housing a slide 52 stressed by a spring 53.

[0060] As shown more clearly in Figures 4 and 5, slide 52 comprises a first portion 52a, a second portion 52b, and a third portion 52c. Portions 52a and 52b are connected by a rod 52d, and portions 52b and 52c are connected by a rod 52e.

[0061] Cylinder 51 comprises four ports 54, 55, 56, 57. More specifically, port 54 defines the first way of three-way valve 50, ports 56 and 57 together define the second way, and port 55 defines the third way.

[0062] Slide 52 is controlled by delivery pressure (p_1).

[0063] As shown in Figure 4, the value of ϵ_1 , which represents the size of port 56, must be greater than ϵ_2 , i.e. the size of the closed area covered by portion 52b of slide 52.

[0064] As shown in Figures 2 and 4, when delivery pressure (p_1) is below a given value (p^*), the oil pressure in chamber 22 assumes the delivery pressure (p_1) value, pump 10 is set to maximum eccentricity, and no pumping action occurs.

[0065] As delivery pressure (p_1) increases, slide 52 begins moving in the direction of arrow F3, so that oil flows from port 54 to port 56, and from port 57 to port 55 and into tank 24 maintained at atmospheric pressure (p_0) (Figures 3, 5).

[0066] In other words, oil leaks from valve 50, thus resulting in a load loss, so that the pressure (p_2) of the oil in chamber 22 assumes an intermediate value between delivery pressure (p_1) and the atmospheric pressure (p_0) of tank 24.

Claims

1. A pumping system (100) comprising a variable-delivery vane pump (10); the system (100) also comprising a user device (UT) connected to said pump (10) by a delivery conduit (26), and pressure regulating means for adjusting the eccentricity (E) of a ring (13) with respect to a rotor (14), said ring (13) and said rotor (14) forming part of said pump (10), so that said pump (10) assumes a balanced configuration such as to supply the oil flow requested by said user device (UT);
the system (100) being characterized in that said pressure regulating means comprise:

(a) hydraulic dissipating means (29; 54, 56) in a first conduit (28a); and

(b) a valve (30; 50) in a second conduit (28b), said valve (30) being regulated solely by a control pressure (p1);

both said hydraulic dissipating means (29; 54, 56) and said valve (30; 50) are provided for imparting to the oil inside a regulating chamber (22) forming part of said pump (10) a pressure (p2) lower than a control pressure (p1);

and in that

said first conduit (28a) and said second conduit (28b) are two branching off of the same main conduit (28) for feeding oil to said regulating chamber (22).

2. A system (100) as claimed in Claim 1, **characterized in that** said valve (30) comprises a cylinder (31) housing a piston (32) which, in turn, comprises a first portion (32a) and a second portion (32b) connected to each other by a rod (32c); wherein cylinder (31) has a port (33) connected hydraulically to chamber (22) by a third conduit (34) and to a tank (24) by a fourth conduit (35).

3. A system (100) as claimed in Claim 2, **characterized in that** said second conduit (28b) substantially provides for picking up a delivery pressure signal in main conduit (28), so as to act on a front surface (A3) of said first portion (32a) of said piston (32).

4. A system (100) as claimed in Claim 3, **characterized in that**, as the delivery pressure (p1) increases alongside an increase in the operating speed of pump (10), greater force is exerted on said surface (A3) and, on reaching the preload value of a spring (36), moves piston (32) to allow oil flow from third conduit (34) through a port (33) and along said fourth conduit (35) into said tank (24).

5. A system (100) as claimed in Claim 4, **characterized in that** said piston (32) is stressed elastically by said spring (36) designed to generate a force which only permits movement of said piston (32) when the delivery pressure (p1) on said surface (A3) reaches a given value.

6. A system (100) as claimed in Claim 1, **characterized in that** said hydraulic dissipating means comprise a three-way slide valve (50).

7. A system (100) as claimed in Claim 6, **characterized in that** said valve (50) comprises a cylinder (51) housing a slide (52), controlled by delivery pressure (p1), stressed by a spring 53, wherein slide (52) comprises a first portion (52a), a second portion (52b), and a third portion (52c), the first and second portions (52a) and (52b) being connected by a rod (52d), and the second and third portions (52b) and (52c) being connected by a rod (52e).

8. A system (100) as claimed in Claim 7, **characterized in that** said cylinder (51) comprises four ports (54, 55, 56, 57), wherein, more specifically, a first port (54) defines the first way of three-way valve (50), third and fourth ports (56, 57) together define the second way, and second port (55) defines the third way.

9. A system (100) as claimed in Claim 8, **characterized in that** the value of (ϵ_1), which represents the size of said third port (56), is greater than the value of (ϵ_2), which represents the size of the closed area covered by portion (52b) of slide (52).

10. A system (100) as claimed in Claim 9, **characterized in that** when delivery pressure (p1) is below a given value (p*), the oil pressure in said chamber (22) assumes the delivery pressure (p1) value, pump (10) is set to maximum eccentricity, and no pumping action occurs.

11. A system (100) as claimed in Claim 9, **characterized in that** as delivery pressure (p1) increases, said slide (52) begins moving, so that oil flows from said first port (54) to said third port (56), and from said fourth port (57) to said second port (55) and into tank (24) maintained at atmospheric pressure (p0), so that the pressure (p2) of the oil in said chamber (22) assumes an intermediate value between delivery pressure (p1) and the atmospheric pressure (p0) of tank (24).

12. A system (100) as claimed in any one of the foregoing Claims, **characterized in that** a return conduit (37) is provided from user device (UT) to a tank (24).

13. A system (100) as claimed in any one of the foregoing Claims, **characterized in that** said pump (10) comprises a hollow main body (11) having at least one chamber (20, 22); and **in that** said chamber (20, 22) houses a respective projection (19, 21) integral with said ring (13).

14. A system (100) as claimed in Claim 13, **characterized in that** said projection (21) has a first front surface (A2) greater than a second front surface (A1) of said projection (19).

15. A system (100) as claimed in Claim 14, **characterized in that** the size of said first front surface (A2) is 1.4 to 1.7 times said second front surface (A1).

Patentansprüche

1. Pumpsystem (100) mit einer Flügelzellenpumpe (10) mit veränderbarer Fördermenge; wobei das System (100) ferner eine mit der Pumpe (10) durch eine Förderleitung (26) verbundene Nutzvorrichtung (UT)

und Druckregeleinrichtungen zum Einstellen der Exzentrizität (E) eines Rings (13) in Bezug auf einen Rotor (14) aufweist, wobei der Ring (13) und der Rotor (14) Teil der Pumpe sind, so dass die Pumpe (10) ausgeglichene Konfiguration aufweist, um den von der Nutzvorrichtung (UT) benötigten Ölfluss zu liefern;

wobei das System (100) **dadurch gekennzeichnet ist, dass** die Druckregeleinrichtung aufweist:

- (a) hydraulische Abführeinrichtungen (29; 54, 56) in einer ersten Leitung (28a); und
- (b) ein Ventil (30; 50) in einer zweiten Leitung (28b), wobei das Ventil (30) ausschließlich durch einen Steuerdruck (p1) gesteuert ist;

wobei sowohl die hydraulischen Abführeinrichtungen (29; 54, 56), als auch das Ventil (30; 50) dazu vorgesehen sind, das Öl in der Steuerkammer (22), welche Teil der Pumpe (10) ist, mit einem Druck (p2) zu versehen, der niedriger als der Steuerdruck (p1) ist;

und dass die erste Leitung (28a) und die zweite Leitung (28b) zwei Abzweigungen der selben Hauptleitung (28) zum Liefern von Öl an die Steuerkammer (22) sind.

2. System (100) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Ventil (30) einen Zylinder (31) aufweist, der einen Kolben (32) aufnimmt, welcher seinerseits einen ersten Bereich (32a) und einen zweiten Bereich (32b) aufweist, welche miteinander durch eine Stange (32c) verbunden sind; wobei der Zylinder (31) einen Port (33) aufweist, welcher über eine dritte Leitung (34) mit der Kammer (22) und über eine vierte Leitung (35) mit einem Tank (24) hydraulisch verbunden ist.
3. System (100) nach Anspruch 2, **dadurch gekennzeichnet, dass** die zweite Leitung (28b) im Wesentlichen dazu dient, ein Förderdrucksignal in der Hauptleitung (28) zu erfassen, um so auf die Stirnfläche (A3) des ersten Bereichs (32a) des Kolbens (32) einzuwirken.
4. System (100) nach Anspruch 3, **dadurch gekennzeichnet, dass** bei einem mit dem Anstieg der Betriebsgeschwindigkeit der Pumpe (10) einhergehenden Anstieg des Förderdrucks (p1) eine größere Kraft auf die Fläche (A3) aufgebracht wird und bei Erreichen des Vorspannungswerts einer Feder (36) der Kolben (32) bewegt wird, um einen Ölfluss von der dritten Leitung (34) durch einen Port (33) und durch die vierte Leitung (35) in den Tank (24) zu ermöglichen.
5. System (100) nach Anspruch 4, **dadurch gekennzeichnet, dass** der Kolben (32) durch die Feder (36)

elastisch belastet ist, wobei die Feder derart ausgelegt ist, dass sie eine Kraft erzeugt, die eine Bewegung des Kolbens nur dann ermöglicht, wenn der auf die Fläche (A3) wirkende Förderdruck (p1) einen bestimmten Wert erreicht.

6. System (100) nach Anspruch 1, **dadurch gekennzeichnet, dass** die hydraulischen Abführeinrichtungen ein Dreizege-Schieberventil (50) aufweisen.
7. System (100) nach Anspruch 6, **dadurch gekennzeichnet, dass** das Ventil (50) einen Zylinder (51) aufweist, der einen Schieber (52) aufnimmt, welcher durch den Förderdruck (p1) gesteuert und durch eine Feder (53) belastet ist, wobei der Schieber (52) einen ersten Bereich (52a), einen zweiten Bereich (52b) und einen dritten Bereich (52c) aufweist, wobei der ersten und der zweite Bereich (52a) und (52b) durch eine Stange (52d) miteinander verbunden sind, und wobei der zweite und der dritte Bereich (52b) und (52c) durch eine Stange (52e) miteinander verbunden sind.
8. System (100) nach Anspruch 7, **dadurch gekennzeichnet, dass** der Zylinder (51) vier Ports (54, 55, 56, 57) aufweist, wobei insbesondere ein erster Port (54) den ersten Weg des Dreizegeventils (50) bildet, der dritte und der vierte Port (56, 57) zusammen den zweiten Weg bilden und der zweite Port (55) den dritten Weg bildet.
9. System (100) nach Anspruch 8, **dadurch gekennzeichnet, dass** der Wert (ε_1), welcher die Größe des dritten Ports (56) abgibt, größer als der Wert (ε_2) ist, welcher die Größe der von dem Bereich (52b) des Schiebers (52) geschlossenen Fläche angibt.
10. System (100) nach Anspruch 9, **dadurch gekennzeichnet, dass**, wenn der Förderdruck (p1) unter einem bestimmten Wert (p^*) liegt, der Öldruck in der Kammer (22) den Wert des Förderdrucks (p1) annimmt, die Pumpe (10) auf die maximale Exzentrizität eingestellt wird und keine Pumpaktion erfolgt.
11. System (100) nach Anspruch 9, **dadurch gekennzeichnet, dass** mit dem Anstieg des Förderdrucks (p1), der Schieber (52) beginnt, sich zu bewegen, so dass Öl von dem ersten Port (54) zu dem dritten Port (56) und von dem vierten Port (57) zu dem zweiten Port (55) und in den auf Atmosphärendruck (p_0) gehaltenen Tank (24) fließt, so dass der Druck (p2) des Öls in der Kammer (22) einen mittleren Wert zwischen dem Förderdruck (p1) und dem Atmosphärendruck (p_0) des Tanks (24) annimmt.
12. System (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** eine Rücklaufleitung (37) von der Nutzvorrichtung (UT)

zu einem Tank (24) vorgesehen ist.

13. System (100) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Pumpe (10) einen hohlen Hauptkörper (11) mit wenigstens einer Kammer (20, 22) aufweist, und dass die Kammer (20, 22) einen jeweiligen Vorsprung (19, 21) aufnimmt, der einstückig mit dem Ring (13) ausgebildet ist.
14. System (100) nach Anspruch 13, **dadurch gekennzeichnet, dass** der Vorsprung (21) eine erste Stirnfläche (A2) aufweist, die größer als eine zweite Stirnfläche (A1) des Vorsprungs (19) ist.
15. System (100) nach Anspruch 14, **dadurch gekennzeichnet, dass** die Größe der ersten Stirnfläche (A2) dem 1,4- bis 1,7-fachen der zweiten Stirnfläche (A1) entspricht.

Revendications

1. Système de pompage (100) avec une pompe à palettes à débit variable (10); le système (100) également comprenant un dispositif utilisateur (UT) relié à ladite pompe (10) par une conduite de refoulement (26), et des moyens de réglage de pression pour l'ajustage de l'excentricité ϵ d'un anneau (13) par rapport à un rotor (14), ledit anneau (13) et ledit rotor (14) formant partie de la pompe (10) de sorte que la pompe (10) présente une configuration équilibrée afin d'alimenter le flux d'huile demandé par ledit dispositif utilisateur (UT); ledit système (100) étant **caractérisé en ce que** le moyen de réglage de pression comprend:
 - (a) des moyens de dissipation hydraulique (29; 54, 56) dans une première conduite (28a); et
 - (b) une soupape (30; 50) dans une deuxième conduite (28b), ladite soupape (30) étant réglée exclusivement par une pression de commande (p_1);
 tant les moyens de dissipation hydraulique (29; 54, 56) et ladite soupape (30; 50) sont prévus pour donner à l'huile dans une chambre de réglage (22) formant partie de la pompe (10) une pression (p_2) inférieure à une pression de commande (p_1); et **en ce que** ladite première conduite (28a) et ladite deuxième conduite (28b) sont deux branches de la même conduite (28) pour l'alimentation d'huile à ladite chambre de réglage (22).
2. Système (100) selon la revendication 1, **caractérisé en ce que** ladite soupape (30) comprend un cylindre (31) accommodant un piston (32) qui, à son tour, comprend une première partie (32a) et une deuxième partie (32b) reliées entre eux par une tige (32c); le cylindre (31) comprenant une ouverture (33) en communication hydraulique avec ladite chambre (22) par une troisième conduite (34) et avec un réservoir (24) par une quatrième conduite (35).
3. Système (100) selon la revendication 2, **caractérisé en ce que** la deuxième conduite (28b) essentiellement sert à détecter un signal de pression de refoulement dans la conduite principale (28) afin d'agir sur la face frontale (A3) de la première partie (32a) du piston (32).
4. Système (100) selon la revendication 3, **caractérisé en ce que** plus la pression de refoulement (p_1) augmente parallèlement à l'augmentation de la vitesse de marche de la pompe (10), plus grande est la force appliquée sur la face (A3) et, lors la valeur de précontraint d'un ressort (36) est atteinte, le piston (32) est déplacé pour permettre le flux d'huile de s'écouler de la troisième conduite (34) à travers une ouverture (33) et le long de la quatrième conduite (35) dans le réservoir (24).
5. Système (100) selon la revendication 4, **caractérisé en ce que** le piston (32) est précontraint élastiquement par le ressort (36) qui est réalisé pour générer une force qui ne permet le déplacement du piston (32) qu'avant la pression de refoulement (p_1) sur la face (A3) a atteint une valeur prédéterminée.
6. Système (100) selon la revendication 5, **caractérisé en ce que** les moyens de dissipation hydraulique comprennent une vanne à tiroir à trois voies (50).
7. Système (100) selon la revendication 6, **caractérisé en ce que** cette vanne (50) comprend un cylindre (51) recevant un tiroir (52) commandé par la pression de commande (p_1), précontraint par un ressort (53), ledit tiroir (52) ayant une première partie (52a), une deuxième partie (52b) et une troisième partie (52c), la première partie et la deuxième partie (52a) et (52b) étant reliées par une tige (52d), et la deuxième partie et la troisième partie (52b) et (52c) étant reliées par une tige (52e).
8. Système (100) selon la revendication 7, **caractérisé en ce que** le cylindre (51) a quatre ouvertures (54, 55, 56, 57) dont, en particulier, la première ouverture (54) forme la première voie de la vanne à trois voies (50), la troisième ouverture et la quatrième ouverture (56, 57) ensemble forment la deuxième voie, et la deuxième ouverture (55) forme la troisième voie.
9. Système (100) selon la revendication 8, **caractérisé en ce que** la valeur (ϵ_1), qui représente la taille de la troisième ouverture (56), est supérieure à la valeur (ϵ_2), qui représente la taille de la surface fermée re-

couverte par la partie (52b) du tiroir (52).

10. Système (100) selon la revendication 9, **caractérisé en ce que**, si la pression de refoulement (p_1) est inférieure à une valeur prédéterminée (p^*), la pression d'huile dans ladite chambre (22) adopte la valeur de la pression de refoulement (p_1), la pompe (10) est ajustée à l'excentricité maximale, et aucune action de pompage n'est exécutée. 5
11. Système (100) selon la revendication 9, **caractérisé en ce que** lors de l'augmentation de la pression de refoulement (p_1), le tiroir (52) commence à se déplacer de sorte que d'huile s'écoule de la première ouverture (54) vers la troisième ouverture (56) et de la quatrième ouverture (57) vers la deuxième ouverture (55) et dans le réservoir (24) maintenu sous pression atmosphérique (p_0), de sorte que la pression (p_2) de l'huile dans la chambre (22) adopte une valeur intermédiaire entre la pression de refoulement (p_1) et la pression atmosphérique (p_0) du réservoir (24). 10 15 20
12. Système (100) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**une conduite de retour (37) est prévue, s'étendant à partir du dispositif utilisateur (UT) jusqu'au réservoir (24). 25
13. Système (100) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la pompe (10) comprend un corps principal creux (11) avec au moins une chambre (20, 22); et **en ce que** ladite chambre (20, 22) reçoit une saillie respective (19, 21) formée d'un seul tenant avec l'anneau (13). 30 35
14. Système (100) selon la revendication 13, **caractérisé en ce que** la saillie (21) a une première face frontale (A2) plus grande que la deuxième face frontale (A1) de la saillie (19). 40
15. Système (100) selon la revendication 14, **caractérisé en ce que** la taille de la première face frontale (A2) est de 1.4 à 1.7 fois la taille de la deuxième face frontale (A1). 45

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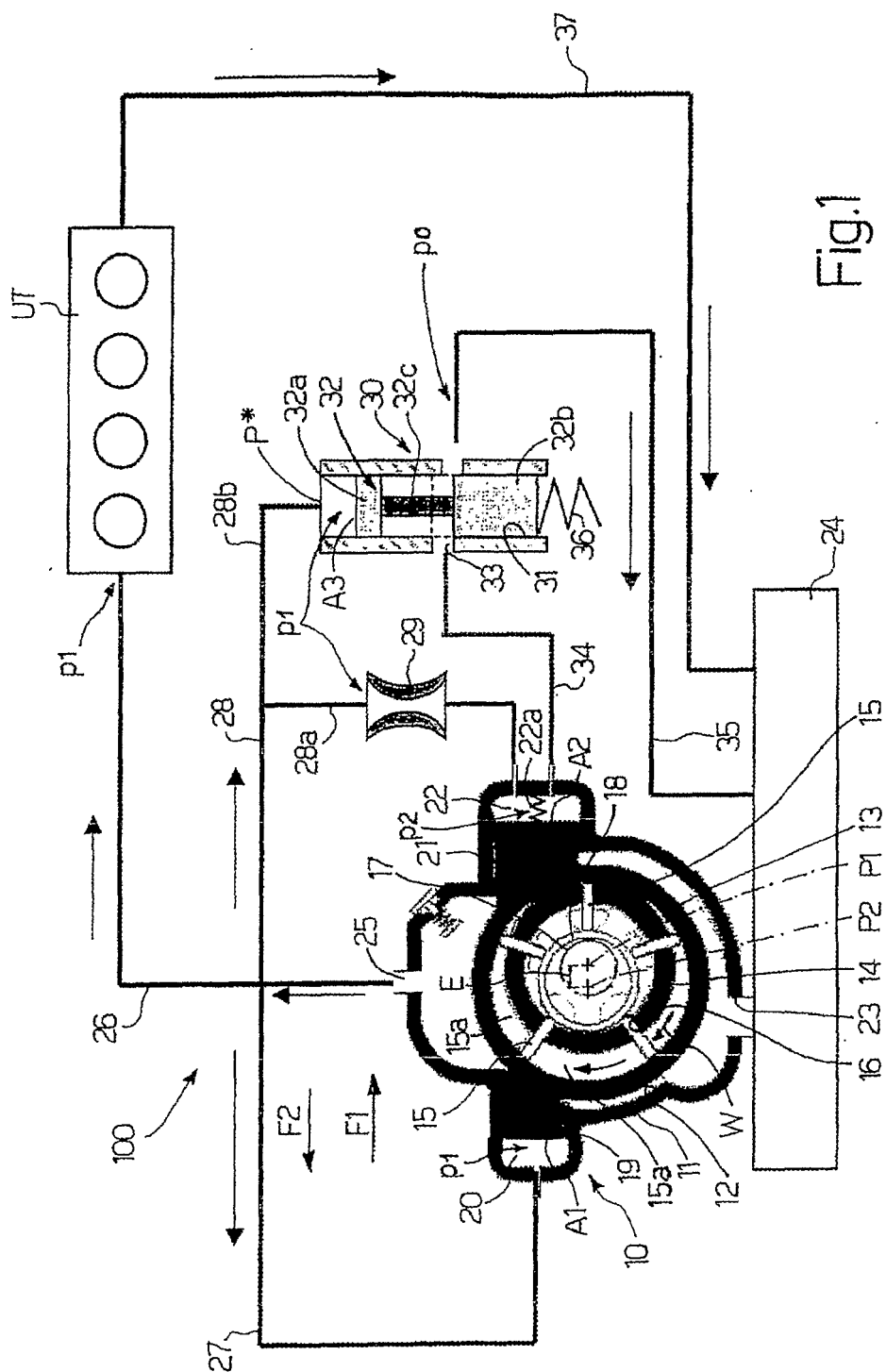


Fig. 1

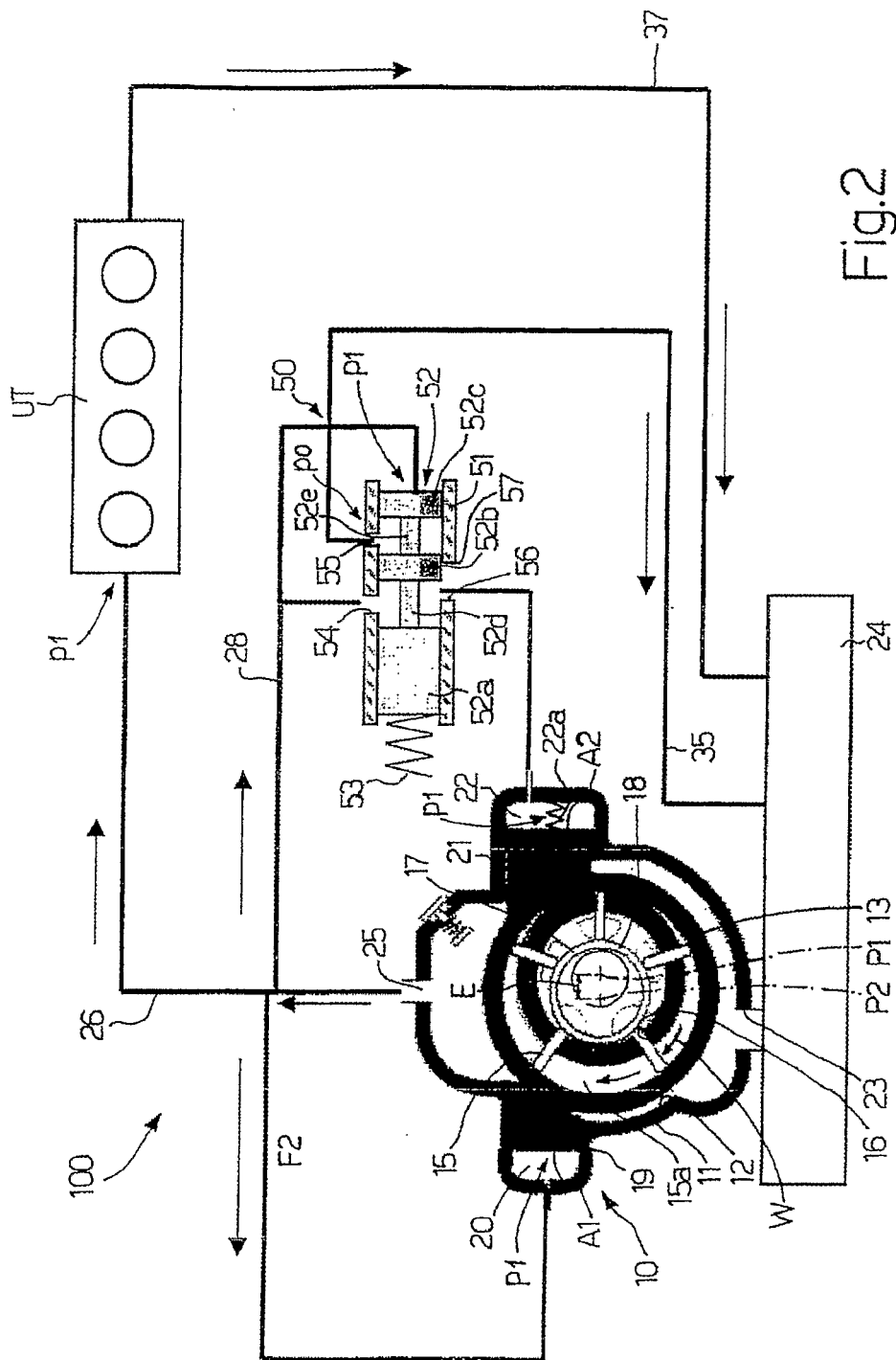


Fig.2

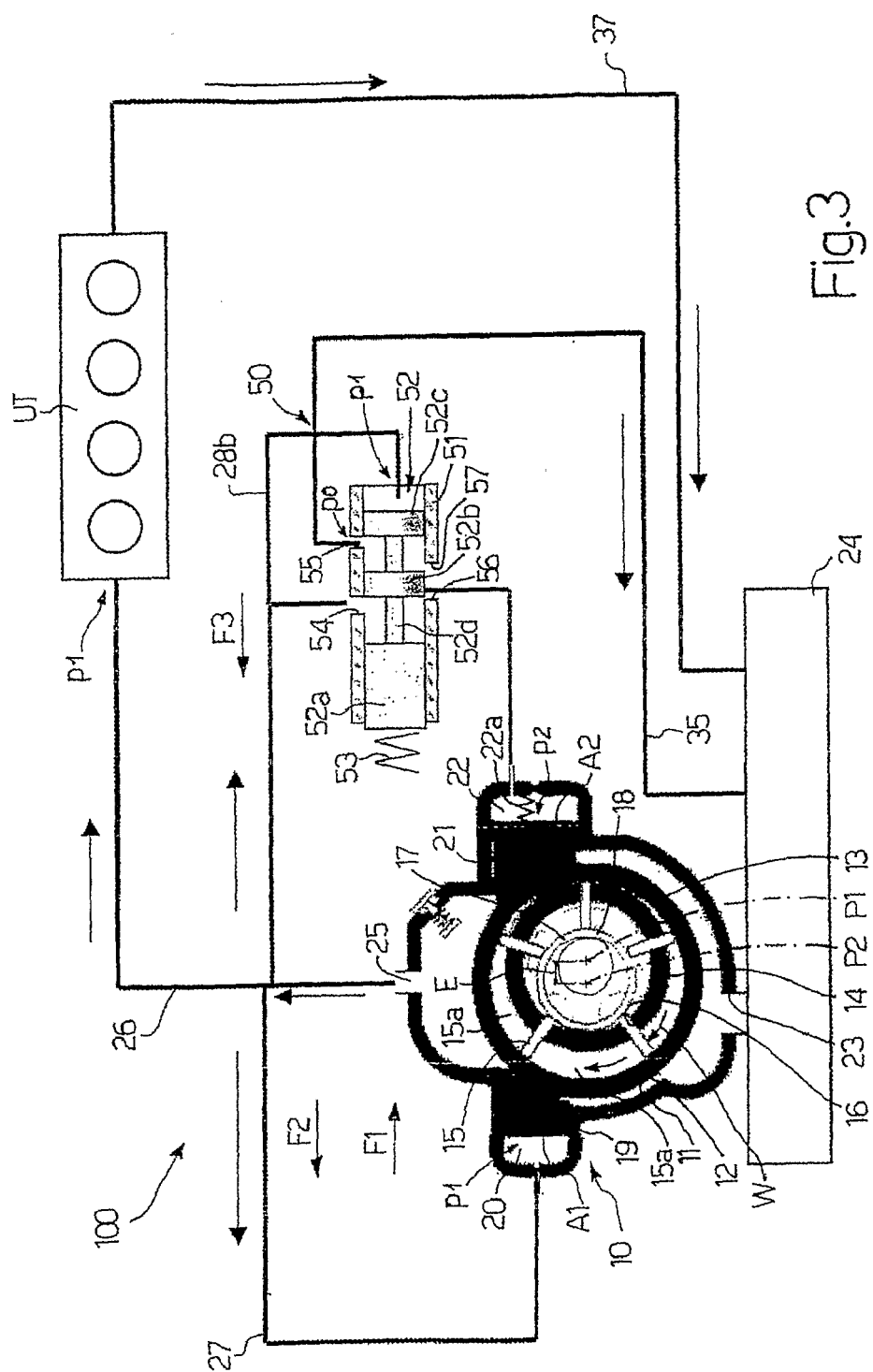
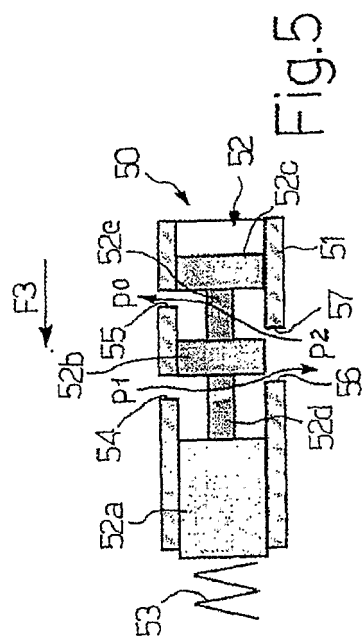
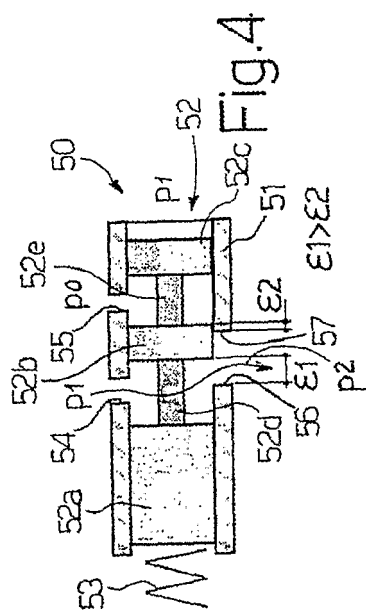


Fig. 3



REFERENCES CITED IN THE DESCRIPTION

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