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(54) **CONSTRUCTIVE ARRANGEMENT APPLIED IN A DUAL-ACTION VALVE**

(57) to be used in high-pressure pumps, particularly in pumping fluids, comprising a valve (V) provided with a double seat (1) of a cylindrical kind and provided with a peripheral sealing ring (2), said double seat (1) has on one side the suction valve (3) and on the other side the pressure valve (4), the latter consisting of a more elongated cylindrical body (5), of smaller diameter, with external sealing rings (6); the double seat (1) receives longitudinal hollow conduits (7) that have one end with an opening (8) for fluid inflow, the opposite ends of said longitudinal hollow conduits (7) having the suction valve (3), on which is supported one end of the compression spring (9), whose opposite end abuts the spring support (10), distinguished by using two compression springs, where the suction valve (3) receives the compression spring (9), whereas the pressure valve (4) receives a pressure spring guide (14) and the compression spring itself (15), which has a smaller diameter than the compression spring (9). The valve also features better sealing features and lower material costs.

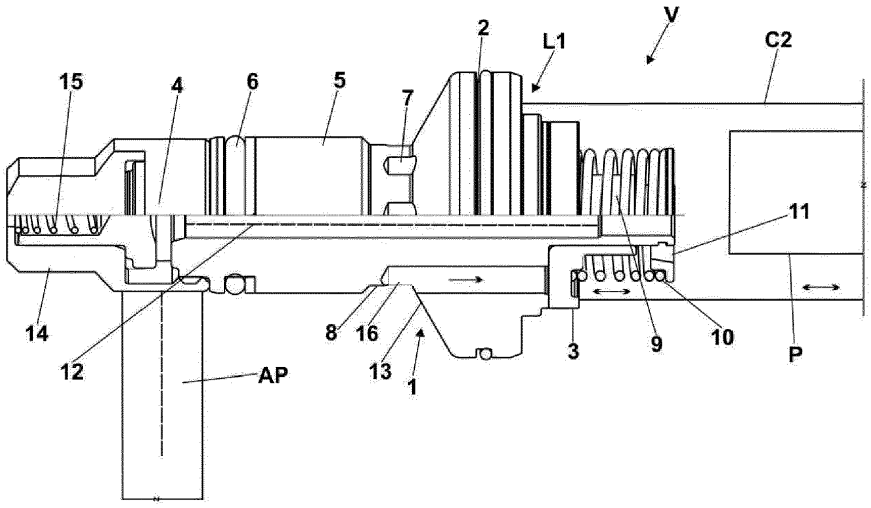

FIG. 01

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Description

FIELD OF THE INVENTION

[0001] This application for a patent of invention relates to a dual-action valve used in high-pressure pumps, particularly for pumping fluids.

BACKGROUND OF THE INVENTION

[0002] So-called dual-action valves are known in the state of the art, and are normally used in high-pressure pumps. These valves are called dual action as they allow fluid to flow in both the forward and return strokes of a piston, for example.

[0003] Although they are widely used in the market, most of these valves possess certain features such as the use of resilient materials next to the seal, generating less stability and a greater incidence of leaks, as well as often presenting stability problems due to a reduced length in relation to the theoretically ideal length; in addition, these known dual-action valves have a diameter that is considered relatively large, thus also running into problems related to material costs. Furthermore, it is normal for the current valves to use a single spring, which reduces the device's useful life, as well as a through shaft seal, which increases resistance to the flow of fluid, resulting in lower efficiency.

STATE OF THE ART

[0004] It is known from the state of the art the document US 6,231,323 of 15/05/2001, relating to a reciprocating high-pressure pump, which has a valve cartridge positioned within a manifold block, and said valve cartridge has a fixed body with a plurality of equally spaced suction openings, in a radial design. According to the above document, a central hole in the fixed body of the valve cartridge has a valve assembly mounted within it, and said valve assembly includes a discharge valve element and an aspiration valve element mounted to slide over the outer surface of the discharge valve member.

[0005] Also, according to the above document, a spring is positioned between the aforesaid discharge valve element and the aspiration valve element, and said spring continually activates the discharge and aspiration valve elements, in relation to the closed portion. In the aspiration process, the aspiration valve element is opened and the fluid enters the pump chamber through the aforesaid radial suction openings. In the power stroke, the fluid is discharged through a central hole and lateral feed channels in the discharge valve element in the open position.

[0006] This state of the art high-pressure valve has a work cycle similar to the valve in this patent application; however, the valve of the above document presents the problems listed above, namely:

- use of a single spring, which causes a reduced useful life;
- sealing angle made from resilient materials, which leads to a higher probability of leaks, and reduced stability;
- a reduced valve length compared to this model, which can lead to stability problems;
- a greatly increased valve diameter compared to the valve of this patent, which leads problems related to material costs;
- the larger valve diameter creates a greater load on the valve due to the increase of the pressurized area;
- a bottleneck in the fluid flow due to the through shaft seal.

OBJECT OF THE INVENTION

[0007] It is the object of this patent application to propose a dual-action valve, for use in high-pressure pumps, which has two compression springs with different dimensional features, one of which works on the suction valve and the other on the pressure valve. With the use of these two springs, the useful life of the valve is increased in relation to state of the art valves, which is a significant technical advantage, given that it directly affects the efficiency of the valve, particularly over time.

[0008] Another object of the invention is to obtain a dual-action valve in which the sealing angle is configured as metal/metal, ensuring greater stability for the assembly and determining a lower incidence of leaks.

[0009] Additional features such as the greater length of the valve and its smaller diameter, when compared visually with the state of the art valves, lead, respectively, to greater stability and a reduction in the final cost of the product.

GENERAL DESCRIPTION OF THE INVENTION

[0010] The CONSTRUCTIVE ARRANGEMENT APPLIED IN A DUAL-ACTION VALVE, the reason for this patent application, is intended preferentially to be used in a head block, and essentially consists of a suction valve and a pressure valve, with a compression spring in each of the aforesaid valves. The compression spring of the suction valve is supported on a spring support, on which a split ring operates, while the compression spring of the pressure valve is housed in a pressure spring guide. The double seat forms the metal/metal seal angle, while the suction valve works within a piston liner, with openings for fluid intake, whereas a longitudinal conduit, when the piston advances, makes the fluid flow into the high-pressure duct within the head.

[0011] As stated, working with two compression springs, the high-pressure fluid feeding operation becomes more efficient, with an increased useful life and without flow variations determined by the problems with a single system spring.

DESCRIPTION OF THE DRAWINGS

[0012] The invention will be explained below through an embodiment thereof and, to facilitate understanding, reference will be made to the attached drawings, which show:

FIG. 1: Side view of the dual-action high pressure valve, partially sectioned lengthwise;
FIG. 2: Side view of the head in section, showing the dual-action high-pressure valve inserted into it.

[0013] The CONSTRUCTIVE ARRANGEMENT APPLIED IN A DUAL-ACTION VALVE, the subject matter of this application for a industrial invention, consists of a valve (V) to be used in high-pressure systems, and, in the example shown in this patent, the aforesaid valve (V) is inserted into a head (C1), showing the fixing elements (E1) and the high-pressure outlet (AP) of the valve (V) to the cited head (C1).

[0014] According to the attached drawings, the valve (V), particularly by means of its suction side (L1), is coupled to the piston liner (C2) which is connected to the crankshaft (not shown).

[0015] The valve (V) itself is provided with a double seat (1) of a cylindrical kind and provided with a peripheral sealing ring (2), and said double seat (1) has on one side the suction valve (3) and on the other side the pressure valve (4). The latter consists of a more elongated cylindrical body (5), of smaller diameter, with external sealing rings (6).

[0016] The double seat (1) receives longitudinal hollow conduits (7) that have one end with an opening (8) for fluid inflow, the opposite ends of said longitudinal hollow conduits (7) having the suction valve (3), on which is supported one end of the compression spring (9), whose opposite end abuts the spring support (10), where is applied a split locking ring (11).

[0017] The double seat (1) is traversed by a longitudinal channel (12) extending from the suction side to the pressure side, to communicate with the high-pressure outlet (AP).

[0018] The dual-action seat (1) has a sealing angle (13) that is made of metal with metal, to ensure greater stability and reduce the incidence of eventual fluid leaks.

[0019] The pressure valve (4) receives a pressure spring guide (14) and the compression spring itself (15), which has a smaller diameter than the compression spring (9).

[0020] Although it is not the object of a patent to give measurements, comparative analysis of the subject matter of the invention with the state of the art document clearly shows, from a simple comparison of the cartridge and the aspiration and discharge valves, that the cartridge diameter is significantly greater than the valves, and the overall length of the assembly is reduced, because in the previous document a single spring is used, which, in addition to the inherent problems of premature wear of the single spring, has a reduced length.

[0021] On the contrary, this valve, by creating a construction to receive two springs, managed to design, with this construction, a dual-action valve of greater length, ensuring greater stability, to reduce the diameter and to save material and, above all, to increase the useful life of the valve, which is a solution that the market wants and expects, because the procedures for preventive and corrective maintenance incur a loss of time and labour and generate costs.

[0022] From the functional perspective, the valve in this patent application is operated by actuating the piston (P) in the retracting direction, in order to create negative pressure inside the liner (C2) and thereby create positive pressure in (16) and allow the flow of fluid to the interior of said liner (C2).

[0023] At the point of maximum retraction of the piston (P), the pressures are equalized, allowing the compression spring (9) to close the suction valve (3), ending the first stage.

[0024] The piston (P), actuated by the crankshaft (not shown), starts moving forward, thus generating an increase in pressure, which makes the fluid flow through the longitudinal channel (12) and pressurize the pressure valve (4), which compresses the compression spring (15) and releases the fluid to flow to the high-pressure duct (AP).

[0025] As can be seen, with the adoption of two springs, the operating cycle of the high-pressure valve occurs efficiently, and achieves a number of useful life cycles which is substantially optimized in relation to the valves that use a single spring.

Claims

1. CONSTRUCTIVE ARRANGEMENT APPLIED IN A DUAL-ACTION VALVE, the valve (V) is provided with a dual-action seat (1) of a cylindrical kind and provided with a peripheral sealing ring (2), said double seat (1) has on one side the suction valve (3) and on the other side the pressure valve (4), the latter consisting of a more elongated cylindrical body (5), of smaller diameter, with external sealing rings (6); the double seat (1) receives longitudinal hollow conduits (7) that have one end with an opening (8) for fluid inflow, the opposite ends of said longitudinal hollow conduits (7) having the suction valve (3), on which is supported one end of the compression spring (9), whose opposite end abuts the spring support (10), where is applied a split locking ring (11); said double seat (1) is traversed by a longitudinal channel (12) extending from the suction side to the pressure side, to communicate with the high pressure outlet (AP); **characterized in that** the suction valve (3) receives the compression spring (9), whereas the pressure valve (4) receives a pressure spring guide (14) and the compression spring itself

(15), which has a smaller diameter than the compression spring (9).

2. CONSTRUCTIVE ARRANGEMENT APPLIED IN A DUAL-ACTION VALVE according to claim 1, **characterized in that** the double seat (1) has a sealing angle (13) that is made of metal with metal.

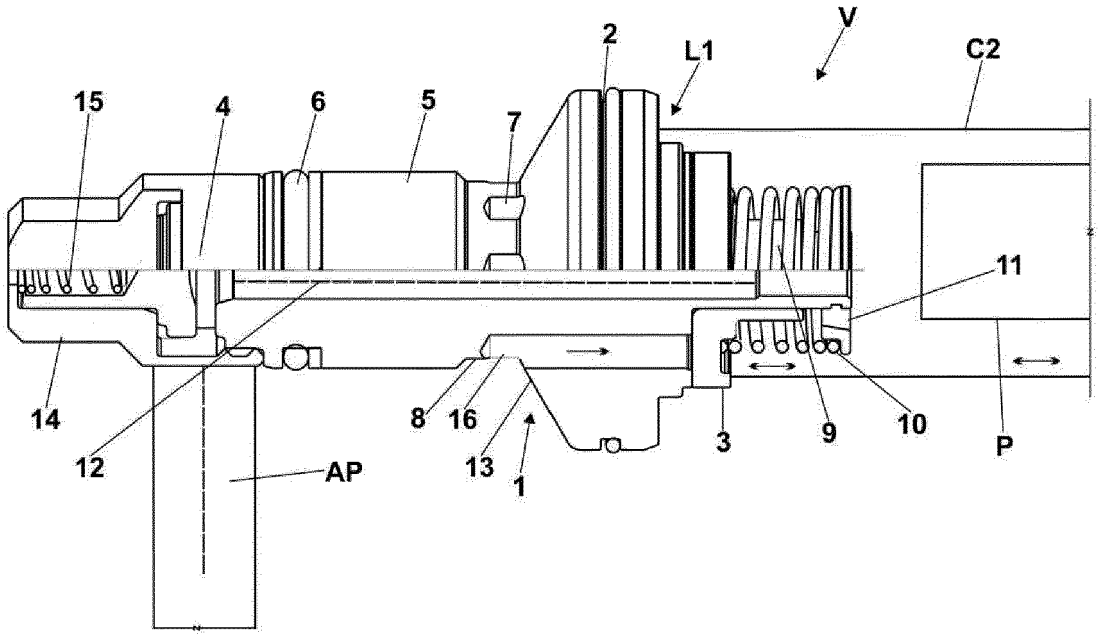

FIG. 01

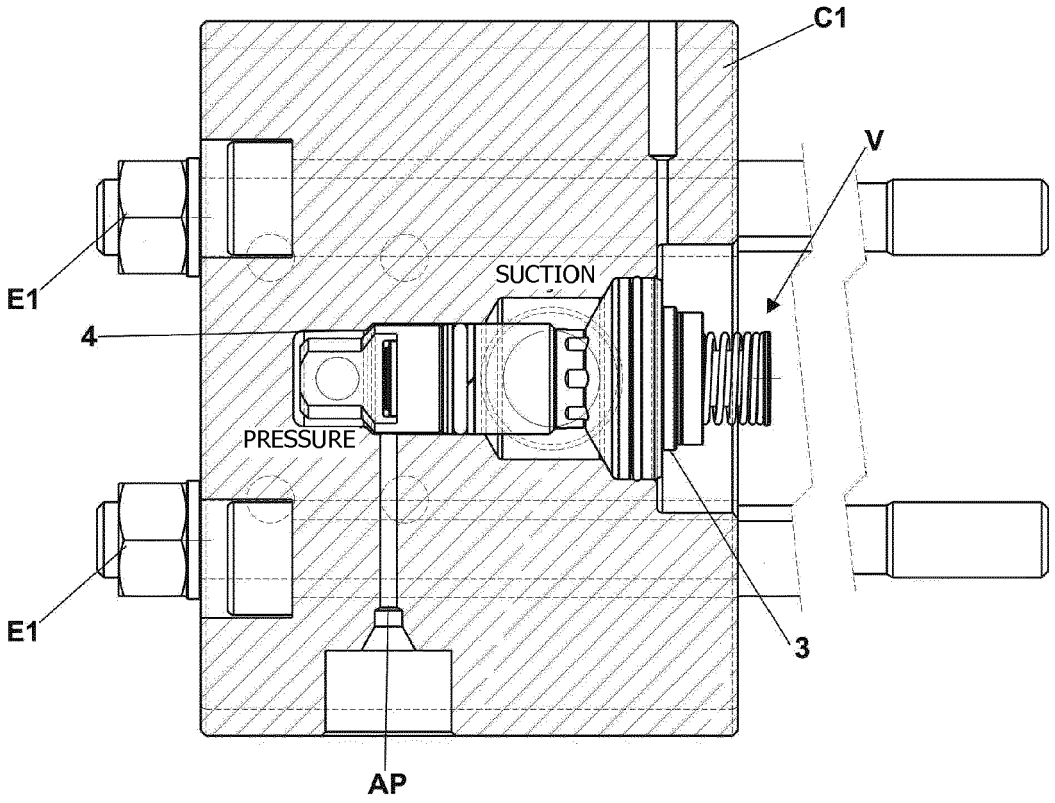

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 4581

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 4 026 322 A (THOMAS BENJAMIN A) 31 May 1977 (1977-05-31) * figures 1,2 * * column 3, line 4 - column 5, line 14 * -----	1 2	INV. F04B53/10
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A	US 2009/194717 A1 (JARCHAU MICHAEL [DE] ET AL) 6 August 2009 (2009-08-06) * figures 1-2 * * paragraph [0021] - paragraph [0026] * -----	1,2	
A	WO 94/20754 A1 (SAURWEIN ALBERT C [US]) 15 September 1994 (1994-09-15) * figure 2 * * page 6, line 31 - page 8, line 25 * -----	1,2	TECHNICAL FIELDS SEARCHED (IPC) F04B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 April 2017	Ricci, Saverio

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 16 20 4581

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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