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(54) **PISTON PUMP DRIVE AND CONTROL PNEUMATIC OSCILLATING SYSTEM USED IN MEDICAL RESEARCH**

(57) The piston pump drive and control pneumatic oscillating system consisting of an air preparation unit 3, a pneumatic directional control valve 2, a discharge throttle 1 with variable orifice and a distribution and oscillation slide valve 4 which pneumatically actuates the piston and the valves distribution 5 of a pump, enabling the flow of

working fluid to be supplied by moving the working piston along a stroke (c) correlated with the pneumatic control frequency obtained by varying of the supply flow of the distribution and oscillation slide valve or by varying the flow section of the discharge throttle.

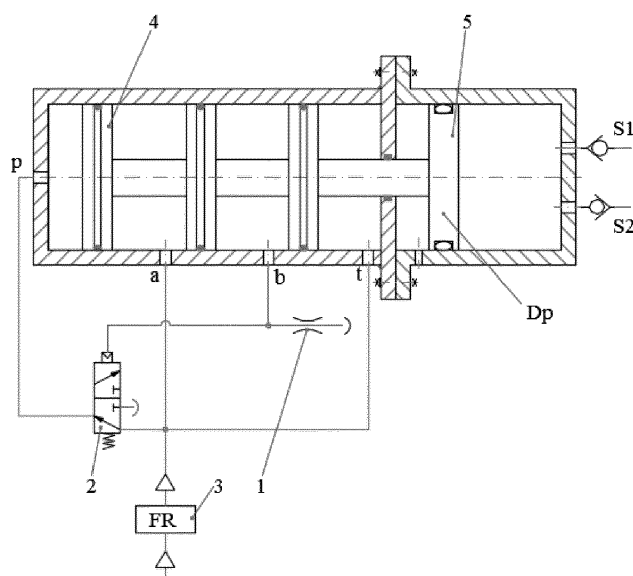


Fig.1

Description

Technical Field

[0001] The drive and control oscillating pneumatic system is used to actuate a piston pump used in medical applications such as heart pulsations to ensure a working fluid flow by moving the piston on a stroke correlated with the control frequency of the pneumatic oscillating system that may vary.

[0002] The invention can also be used in the food industry, chemical industry, etc., in which applications of the kind already mentioned can be identified.

Background Art

[0003] There are known classic systems for drive and control of hydraulic pumps, consisting of flow and pressure distribution and control devices that use hydraulic oil as a working fluid, and in case of a breakdown the oil can seriously contaminate the working environment, which is not allowed in certain areas.

[0004] In the patent document DE3228109 "Linearantrieb zum Erzeugen impulsartiger schneller Stossbewegungen" a pneumatic oscillating system for actuating a pump piston is also presented. The limitations of this system consist in the limited possibilities of adjusting the amplitude and frequency of the piston movement.

Summary of invention

[0005] The technical problem that the invention solves is the conveyance, in wide ranges of frequency and amplitude, of a working fluid used mainly in medical applications, but also in food industry applications, chemical industry applications and similar, with fixed or variable flow rate, in a sterile environment or one which should not be contaminated with other substances, by eliminating conventional hydraulic drives.

[0006] The drive and control pneumatic system according to the invention is made of a piston pump that can carry special fluids, actuated by a pneumatic oscillating circuit, which allows one to easily adjust, in wide ranges, both the amplitude of the piston working stroke and the frequency of oscillations, without electrical - electronic control intervention. The following advantages are obtained by using the piston pump drive and control pneumatic oscillating system:

- Working environment is not contaminated with hydraulic oil;
- Cost price of the facility decreases by eliminating conventional hydraulic drives;
- Energy losses and residual heat generated in hydraulic drives are eliminated;- Maintenance costs are eliminated;
- Noise decreases.

Brief description of drawings

[0007] The following is an example of embodiment of the invention related to Fig. 1 which depicts the functional block diagram of the drive and control pneumatic oscillating system.

Description of embodiments

[0008] According to it, the system consists of an air preparation unit *FR* 3, a pneumatic directional control valve 2, a discharge throttle 1, a distribution and oscillation slide valve 4 and a piston with valves distribution for pumping the working fluid 5.

[0009] Operation of the system is as follows:

From the air preparation unit 3 the cylinder chambers connected through the orifices "l" and "a" are permanently supplied; by means of the directional control valve 2, when the spring force overcomes the pneumatic control force, the chamber connected through the orifice "p" is also supplied.

[0010] In this state the pneumatic cylinder moves to the right, until, near the end of the stroke, the connection between the orifice "a" and the orifice "b" is set, and thus the control of the directional control valve 2 is supplied.

[0011] When the force generated by the pressure in the control circuit overcomes the force of the directional control valve spring, the directional control valve shifts to the other distribution chamber which discharges the pressure in the orifice "p" to the atmosphere.

[0012] At this moment, the pneumatic cylinder, as it is supplied only to the orifice "l", starts to move to the left and breaks the connection between "a" and "b". The control circuit of the pneumatic directional control valve begins to slowly lose pressure through the throttle 1 and when the spring overcomes the pneumatic control, the directional control valve shifts to the initial distribution chamber, supplying pressure to the orifice "p", and discharges to the atmosphere through the throttle 1.

[0013] At this point, the movement to the right of the pneumatic cylinder is resumed until nearly reaching the end of the stroke, at which moment the connection between the orifices "a" and "b" is restored, and the cycle starts again from the beginning.

[0014] The speed of unloading the control pressure through the throttle 1 controls the amplitude of the leftward cylinder stroke, and the flow rate received from the source 3 controls the frequency of the movement of the pneumatic cylinder.

[0015] All these oscillations are taken over by the pump piston D_p to ensure the transfer of the working fluid through the valves S_1 and S_2 .

[0016] The system according to the invention works optimally under the conditions of the functional characteristics of the piston pump framing in the value ranges of $p = 4 \div 10$ bar; $f = 0.5 \div 10$ Hz, $D_p = 20,63$ mm, and the pneumatic oscillating system framing in the value ranges of 0.5-3 bar, air flow 90-1500 l / min and a distance of

25-60 mm between the orifices "a" and "b".

Claims

1. Piston pump drive and control pneumatic oscillating system **characterized in that** it consists of an air preparation unit **(3)**, a pneumatic directional control valve **(2)** with a maximum frequency of 10 Hz, a discharge throttle **(1)** with variable orifice, a distribution and oscillation slide valve **(4)**, which pneumatically actuates the piston and the valves distribution **(5)** of a pump that conveys working fluid. 5
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2. Pneumatic oscillating system according to claim 1, **characterized in that** it is supplied from a max. 10 bar pneumatic network and it operates automatically without the intervention of a control panel or an electrical - electronic control unit 15
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3. Pneumatic oscillating system according to claim 1, **characterized in that** the simple performing of the working stroke is done with no control equipment only by choosing two preset orifices that determine the displacement limits. 25
4. Pneumatic oscillating system according to claim 1, **characterized in that** the control of working stroke amplitude (c) is achieved by varying the flow section of the throttle **(1)**, and by varying the supply flow provided by the regulator in the air preparation unit (FR) **(3)** oscillation frequency is adjusted. 30
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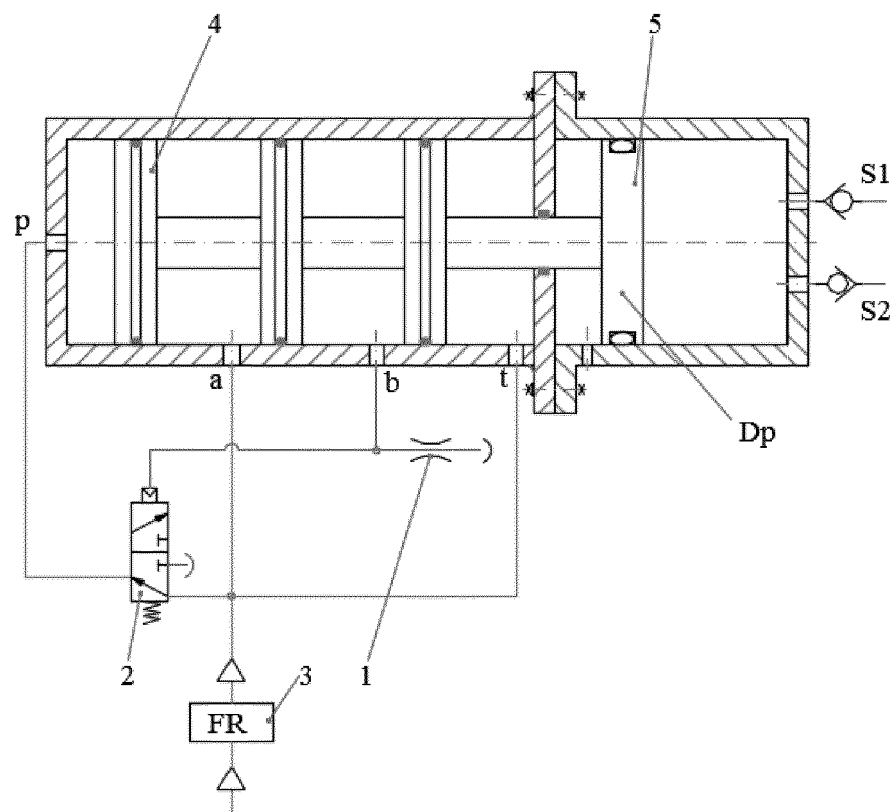


Fig.1



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 Application Number
 EP 19 02 0605

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EPO FORM 1503 03.82 (P04C01)

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X	DE 15 28 482 A1 (MASCHF AUGSBURG NUERNBERG AG) 21 August 1969 (1969-08-21) * figure 1 * * page 3, line 13 - page 6, line 1 * -----	1-3 4	ADD. F04B15/02
A	US 5 862 828 A (DOERFLER ERICH N [DE]) 26 January 1999 (1999-01-26) * figures 1-2 * * column 3, line 49 - column 4, line 60 * -----	1-4	
A	US 4 780 065 A (SAYERS WILLIAM [US]) 25 October 1988 (1988-10-25) * figure 2 * * column 2, line 45 - column 4, line 23 * -----	1-4	
A	US 3 721 091 A (TOMINAGA H ET AL) 20 March 1973 (1973-03-20) * figures 1-2 * * column 2, line 19 - column 6, line 41 * -----	1-4	TECHNICAL FIELDS SEARCHED (IPC) F04B
A	US 9 816 535 B2 (TOX PRESSOTECHNIK GMBH [DE]) 14 November 2017 (2017-11-14) * figure 2 * * column 5, line 61 - column 9, line 30 * -----	1-4	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 22 January 2020	Examiner Ricci, Saverio
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document 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			

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 19 02 0605

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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

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