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(54) **PUMP TESTING SYSTEM WITH ENERGY RECOVERY**

(57) The invention relates to a pump testing system with energy recovery which provides saving on electric energy required for the pump tests such as quality control and performance life test which are compulsory for the manufacturers and repairmen to conduct. Said system comprises a tank (1) in which the oil to be drawn by the test pump (7) to be tested therein is provided and an electric motor (10) to which said test pump (7) is connected. The oil drawn from the tank (1) by the test pump (7) with the operation of said electric motor (10) is transferred to the shaft of the electric motor (10) by a transmission element or to the hydraulic motor (9) connected to the extended back shaft. The oil pressure is increased to an extent allowed by the electronically controlled proportional pressure relief valve (5) in the hydraulic motor (9) output line and upon opening of the pressure relief valve (5), the pressure oil drives the hydraulic motor (9) coupled with said electric motor (10). Thus, energy recovery is achieved by re-supply of the torque generated in the hydraulic motor (9) to the system. Said system comprises control blocks (6) controlling the system with the information received from the measuring devices such as flow meter, torque meter, tachometer, and pressure transmitter measuring the data such as flow rate, pressure, and torque in the system.

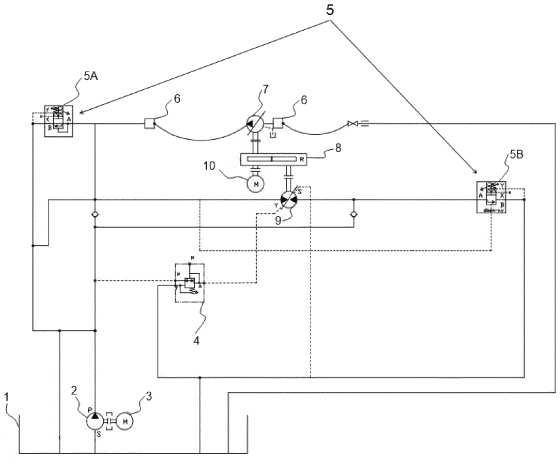

Fig. 1

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Description

Technical Field

[0001] The invention relates to a pump testing system with energy recovery which provides saving on investment costs by reducing the installation power (transformer capacity) and on electric energy required for pump tests such as quality control and performance life test which are compulsory for the manufacturers and repairmen to conduct.

State of the Art

[0002] Pumps are the equipment which supplies energy to the liquid by transferring the mechanical energy received from a drive motor to the liquid passing therethrough. Pumps increase the pressure and the total energy of the liquid and converts this energy into work by means of hydraulic cylinder or hydro-motor.

[0003] The pump tests are conducted for reasons such as detecting the performance of the newly designed pumps, controlling the performance in mass production, detecting the effect of the special materials on the pump performance, testing the performance after the repair, quality control, and life test.

[0004] However, high energy is needed during the large scale pumps being subjected to test. This results in high costs.

[0005] Moreover, because investment is made in line with the installation power (transformer capacity) and the electric current according to the maximum power to be needed as power gain is not achieved in the existing test systems, high costs are encountered.

[0006] Another disadvantage in the existing systems is that the oil pumped with the pump is pressurized to a high level with the resistance formed by the relief valve and is directly discharged to the oil tank, which results in excessive heating of the test fluid and consuming extra energy for cooling the oil.

[0007] In conclusion, a development is deemed necessary to be made in the related technical field due to the aforementioned problems and the inadequacy of the existing solutions.

Objects of the Invention

[0008] The present invention relates a pump testing system with energy recovery which is developed to eliminate the aforementioned disadvantages and to offer new advantages to the related technical field.

[0009] The object of the pump testing system according to the invention is to save on energy by allowing any size of the pump to be tested with lower energy than it needs. With this system, energy saving beyond 60% is achieved when compared to the systems used in the existing systems.

[0010] Another object of the invention is to reduce the investment costs by lowering the installation power (transformer capacity) needed.

[0011] Another advantage of the pump testing system according to the invention is to prevent the excessive heating of the hydraulic fluid (oil) and to reduce the energy required for cooling to a great extent.

[0012] To achieve the aforementioned objects, the present invention relates to a pump testing system with energy recovery comprising a tank in which the oil to be drawn by the test pump to be tested is provided therein and an electric motor to which said test pump is connected. The oil drawn from the tank by the test pump with the operation of the electric motor in the system is transferred to the hydraulic motor which is connected directly or by a transmission element to the extended back shaft of the electric motor. The oil pressure is increased to an extent allowed by the electronically controlled proportional pressure relief valves in the hydraulic motor output line and upon opening of the pressure relief valve, the pressure oil drives the hydraulic motor coupled with said electric motor. Thus, energy recovery is achieved by re-supply of the torque generated in the hydraulic motor to the system. Control blocks are provided which control the system with the information received from the measuring devices such as pressure transmitter, flow meter, torque meter and tachometer measuring the data such as flow rate, pressure, and torque in the system.

[0013] In another preferred embodiment of the invention, in case the test pump does not pump oil due to any reason, a gear pump transferring the oil to the system and a motor to which said gear pump is connected are provided. Thus, the system (hydraulic motor) is prevented from breaking down due to not being supplied with oil.

[0014] In another preferred embodiment of the invention, a pressure reducing valve which controls the pressure of the oil flowing for greasing said hydraulic motor body is provided.

Figures for a Better Understanding of the Invention

[0015] Figure 1. The schematic view of the circuit diagram and equipment of the pump testing system with energy recovery according to the invention.

Description of the Part References

[0016]

1. Tank
2. Gear pump
3. Motor
4. Pressure reducing valve
5. Pressure relief valve

5A. First pressure relief valve

5B. Second pressure relief valve

6. Block
7. Test pump
8. Transmission element

9. Hydraulic motor
10. Electric motor

Detailed Description of the Invention

[0017] In this detailed description, the preferred alternatives of the pump testing system with energy recovery according to the invention are described only for a better understanding of the subject without any limiting effect.

[0018] The schematic view of the circuit diagram and equipment of the pump testing system with energy recovery according to the invention is given in Figure 1. In the system, the test pump (7) to be tested is connected to the special design electric motor (10) which can be operated at high torque values. A hydraulic motor (9) which operates in the same direction with the shaft of the electric motor (10) is coupled thereto by means of a transmission element (8). The object of the connection of this hydraulic motor (9) is to provide the power gain in the system. As soon as the electric motor (10) is started to operate, the test pump (7) to be tested draws oil from the oil tank (1). The oil drawn from the tank (1) forms resistance in the pressure relief valves (5). This resistance is primarily generated in the first pressure relief valve (5A) and then is increased in the second pressure relief valve (5B).

[0019] As the required pressure is obtained, the second pressure relief valve (5B) at the output of the hydraulic motor (9) is opened and the oil is discharged to the tank (1). The oil, the pressure of which is increased, rotates hydraulic motor (9) to an extent allowed by the pressure relief valve (5) and the resulting power is supplied to the electric motor (10) by means of the transmission element (8) and the torque meter. Thus, the system loss only results from the energy which cannot be recovered during these operations (friction, internal leakages). Apart from that, all the energy can be recovered. The net power remaining after said loss is transferred to the electric motor (10) in the form of torque and reused in the test system.

[0020] Gear pump (2), the other pump in the system, is driven by the electric motor (3). The task of said gear pump (2) is prevent the oil-free operation of the system and to provide the required cooling and filtration. In case the test pump (7) to be tested cannot pump oil due to any reason, said gear pump (2) keeps the required low pressure oil ready for preventing the system from burning due to remaining oil free and supplies it to the input and output lines of the hydraulic motor (9) when needed, thereby preventing the dry operation of the motor and thus the breakdown of the system. Pressure of the oil sent to the hydraulic motor (9) is controlled by the pressure reducing valve (4).

[0021] The control blocks (6) disposed in the system control the system and send signals to the circuit elements for adjustment, said signals especially making the displacement of the hydraulic motor (9) according to the pumped oil suitable, and thereby the energy can be retransferred to the system. Said control blocks (6) are the elements controlling the system with the information received from the measuring devices such as flow meter, torque meter, tachometer, and pressure transmitter measuring the data such as flow rate, pressure, and torque.

[0022] The control blocks (6) and the electronic control and computer system integrated therewith are the electric and electronic components and the required software measuring the flow rate of the pumped oil and coordinating all these systems with the flow meter which commands the coil of the proportional mechanism adjusting the displacement of the hydraulic motor (9) and power card and computer controlling said software; "torque meter" and the cards thereof measuring the torque transferred to the test pump (7); flow meters measuring the leakages in the test pump (7) and the motor; additional "torque meter" and the card thereof measuring the torque transferred to the system by the hydraulic motor (9) with the tachometers.

[0023] In the system the circuit diagram of which is given as an example in Figure 1, test pump (7) is an axial piston pump which can be manually adjusted to 0- 250 cm^3 displacement and up to 350 bar pressure. Hydraulic motor (9) is, on the other hand, an axial piston motor, the flow rate of which can be adjusted in a variable and electronic manner up to 215 cm3/rev. Thus, the pump in the capacity from 15 to 225 $cm^{3/rev}$ can be tested up to 350 bar pressure. Still, it should be stated that transmission element (8) which is required for the torque transmission will not be needed in a mechanism which is convenient for connecting the hydraulic motor (9) to the shaft of the electric motor (10).

Claims

1. A pump testing system with energy recovery which comprises the following so as to provide saving on electric energy required for the pump tests such as quality control and performance life test which are compulsory for the manufacturers and repairmen to conduct;

    - a tank (1) in which the oil to be drawn by the test pump (7) to be tested therein is provided,
    - an electric motor (10) to which said test pump (7) is connected,
    - and at least one proportional-control pressure relief valve (5) which receives the oil drawn from the tank (1) by said test pump (7) with the operation of said electric motor (10), **characterized in** comprising
    - a hydraulic motor (9) to which the pressure oil is transmitted when the pressure relief valve (5) is opened with said oil pressure being increased to an extent allowed by said proportional-control pressure relief valve (5) and which is coupled

with said electric motor (10),
• control blocks (6) controlling the system with the information received from the measuring devices such as flow meter, torque meter, tachometer, and pressure transmitter measuring the data such as flow rate, pressure, and torque in the system.

2. The pump testing system with energy recovery as in Claim 1, **characterized in** comprising a first pressure relief valve (5A) and a second pressure relief valve (5B) which respectively receive the oil drawn by the test pump (7) from said tank (1).

3. The pump testing system with energy recovery as in Claim 1, **characterized in** comprising a gear pump (2) transferring the oil to the system in case the test pump (7) does not pump oil due to any reason and a motor (3) to which said gear pump (2) is connected.

4. The pump testing system with energy recovery as in Claim 1, **characterized in** comprising a pressure reducing valve (4) which controls the pressure of the oil flowing to said hydraulic motor (9) body.

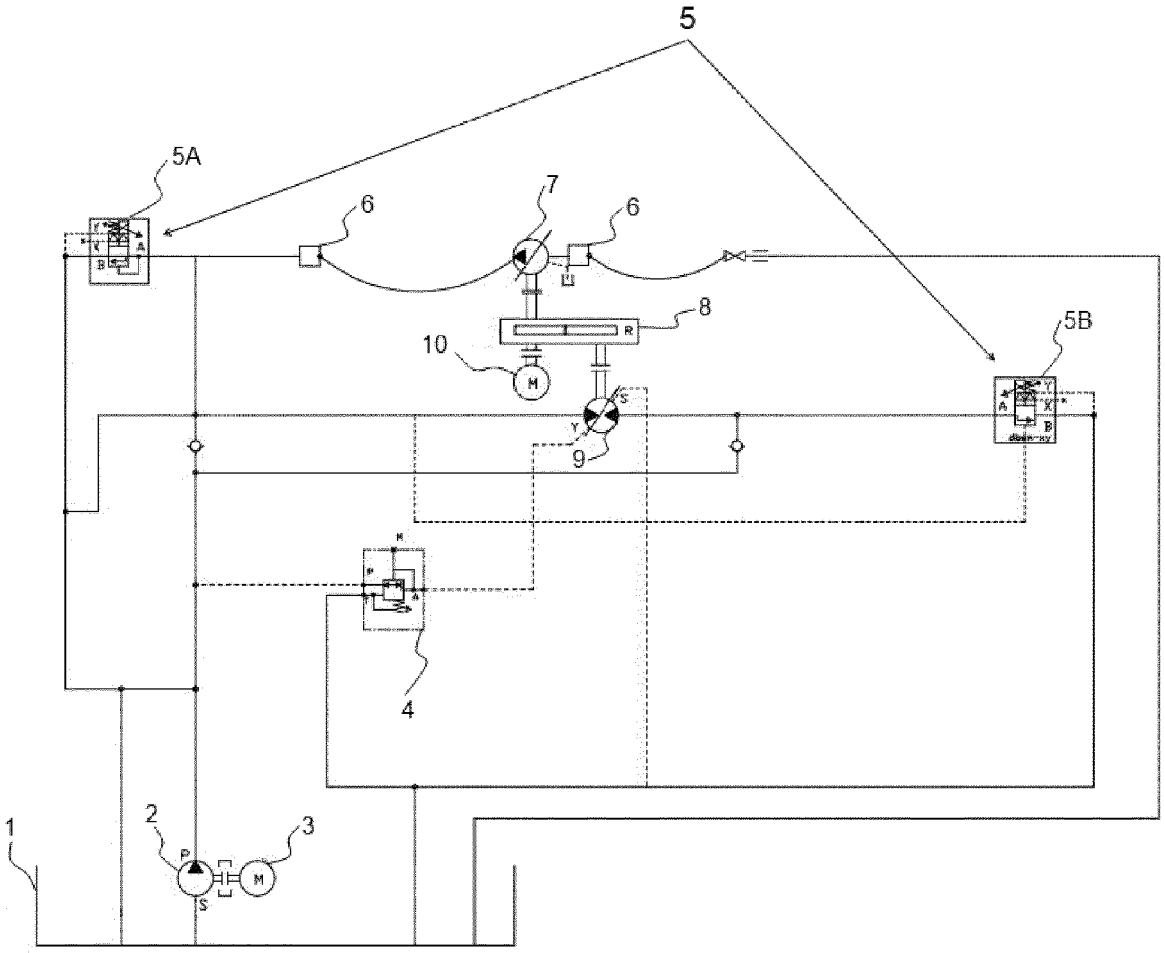

Fig. 1

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EUROPEAN SEARCH REPORT

Application Number
EP 15 16 0969

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 368 638 A (DEERE & COMPANY [US]) 18 January 1983 (1983-01-18) * figure 1 * * column 1, line 6 - line 23 * * column 2, line 35 - column 3, line 42 * -----	1-4	INV. F04B51/00 F04D15/00 F15B19/00
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A	US 6 318 167 B1 (PARKER HANNIFIN CORPORATION [US]) 20 November 2001 (2001-11-20) * figures 1, 3 * * column 2, line 33 - column 3, line 57 * -----	1-4	
A	DE 41 04 708 A1 (BECHTOLD, GUENTER [DE]) 5 September 1991 (1991-09-05) * Pump testing system. * * the whole document * -----	1-4	
A	WO 88/08524 A1 (GRUMMAN AEROSPACE CORPORATION [US]) 3 November 1988 (1988-11-03) * Automated equipment for testing hydraulic pumps. * * the whole document * -----	1	TECHNICAL FIELDS SEARCHED (IPC) F04B F04D F15B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 September 2015	Gnüchtel, Frank

CATEGORY OF CITED DOCUMENTS

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02-09-2015

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