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2,821,144

FLUID PUMP WITH FLUID RETURNED PISTONS

Howard M. Purcell, Mount Gilead, Ohio, assignor, by mesne assignments, to Koehring Company, Milwaukee, Wis., a corporation of Wisconsin

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8 Claims. (Cl. 103—162)

The invention relates in general to fluid pumps and more particularly to fluid pumps having pump pistons which are actuated on an intake stroke by fluid means responsive to the fluid pressure in the discharge passageway of the pump and first valve means for maintaining a predetermined positive pressure in the discharge end of the pump and second valve means for insuring that only a predetermined pressure is communicated from the discharge passageway to the fluid means for returning the pump pistons.

An object of the invention is to provide a fluid pump with valve means whereby a predetermined pressure will be present in the discharge passageway of the pump regardless of whether the pump is running or stopped.

Another object of the invention is to provide a fluid pump having fluid extendible means actuated by fluid pressure from the discharge passageway of the pump with a valve member for regulating the fluid pressure from the discharge passageway to the fluid extendible means.

Another object of the invention is to provide a fluid pump, wherein pump pistons are actuated on a high pressure discharge stroke in one direction by cam means and actuated on an intake stroke by fluid extendible means which fluid extendible means are in fluid communication with the high pressure discharge passageway and are actuated thereby, with valve means for maintaining a positive pressure in the discharge passageway whereby the fluid extendible means are actuated whether the pump is running or stopped and also to provide a valve member which is responsive to the fluid pressure in the discharge passageway and which will close off the communication between the discharge passageway and the fluid extendible means upon the building up of a predetermined pressure in the discharge passageway and thus prevent damage to the fluid extendible means or undue resistance to the movement of the pump pistons on their discharge stroke.

Figure 1 is a side elevation view in section of a fluid pump incorporating the principles of the invention;

Figure 2 is a view taken along the line 2—2 of Figure 1;

Figure 3 is a fragmentary view in section taken generally along the line 3—3 of Figure 2.

The fluid pump of this invention is indicated generally by the reference numeral 10 and includes a housing 11 and an insert member 12 located within the housing. A rotor 15 which has a plurality of pump cylinders 16 is mounted about and surrounds the insert members 12. The pump cylinders in the accompanying drawings have all been identified with the reference numeral 16. The pump cylinders 16 are located about the periphery of the rotor 15 and extend generally axially within the rotor. A first and a second pump piston 20 and 21 respectively are mounted within each of the pump cylinders 16. Cam means 23 which include cam members 24 and 25 are mounted on the inner walls of the housing 11. The cam means 23 are engageable with the first and second pump pistons 20 and 21 respectively which are located

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in each of the pump cylinders 16 and as the rotor rotates about the insert member 12 the cam means move the first and second pump pistons toward each other on a discharge stroke. An intake passageway 30 and first and second discharge passageways 31 and 32 respectively are located within the insert member 12. Port means 33 extend from the pump cylinders 16 for providing alternate communication of the pump cylinders 16 with the intake and discharge passageway. The first and second discharge passageways 31 and 32 respectively extend from the central portion of the insert member 12 as separate passageways and are joined together at an end portion of the insert member and flow from the discharge side of the pump in a single passageway 34.

Fluid means or fluid extendible means indicated generally by the reference numeral 37 are provided for returning the pump pistons 20 and 21 on an intake stroke so that these pump pistons will be maintained in engagement with the cam means 23. The fluid extendible means 37 includes a fluid chamber 38 within the first pump piston 20 in each of the pump cylinders 16 and a piston rod 39 in each of the pump cylinders 16. The piston rod 39 in each of the pump cylinders 16 has a first and a second end portion 40 and 41 respectively. The piston rods 39 extend axially within each of the pump cylinders 16 with the first end portion 40 slidably communicating with the fluid chamber 38 through an opening 42 within an end portion of the first pump piston 20. The second end portion 41 is engageable with or may be fixedly attached to the second pump piston 21. Conduit means indicated generally by the reference numeral 47 connect the discharge passageway 31 and 32 respectively and the fluid chambers 38 which are located in each of the first pump pistons 20 together and as a result will provide the fluid chambers 38 with fluid pressure from these discharge passageways. This fluid pressure within the fluid chamber in the first pump pistons acts upon an end face 43 of the piston rod 39 and upon an end wall 44 of the fluid chamber 38 which is located opposite of the face 43 of the piston rod 39 for maintaining the first and second pump pistons in each pump cylinder in engagement with the first and second cam members 24 and 25 respectively. The conduit means 47 includes a conduit 48 which extends from the discharge passageway through the insert member 12 and into an annular space 49 within the rotor member 15. The annular space 49 is in turn connected to the fluid chamber 38 in each of the first pump pistons 20 by means of passageways 50. A drive shaft 54 extends through the housing 11 and is mounted upon suitable bearings 55 and 56 for rotation thereon. This driver shaft may be driven from any suitable power source. The drive shaft 45 is connected to the rotor 15 for rotating the rotor about the insert member 12 by means of a connection member 57.

It will be noted that when there is fluid pressure at the discharge end of the pump that there will also be fluid pressure communicated to the fluid chambers 38 by way of the conduit means 47. When the pump is stopped, however the pressure in the discharge end of the pump would normally drop down to atmospheric pressure which would result in the same pressure in the fluid chambers 38. As a result the first and second pump pistons 20 and 21 in each of the pump cylinders 16 would tend to collapse or stay in the position in which they will be located at the end of the discharge stroke. This position is best illustrated in Figure 1. Figure 3 shows the rotor 15 rotated 90 degrees with respect to the position shown in Figure 1. To obviate this possibility a first valve means 60 has been provided to cooperate with the discharge end of the pump and includes a check valve 61 which is urged toward a closed position by a spring 62. This spring 62

may be of any predetermined value and provides that a certain fluid pressure will be maintained at the discharge end of the pump at all times and hence will maintain fluid pressure in the fluid chamber 38 at all times and as a result the first and second pump pistons will be maintained in engagement with the cam means 23 for all operating conditions of the pump. For example, if the pump was normally to operate to deliver fluid at 2,000 pounds per square inch pressure the spring 62 could be set as to always maintain a fluid pressure in the discharge end of the pump of 100 pounds per square inch. This means that there would be 100 pounds per square inch pressure in the fluid chambers 38 at all times insuring that the pump pistons will always be positively maintained against the cam means 23.

Another problem which must be guarded against is that of undue fluid pressure from the discharge end of the pump entering the fluid chambers 38 by way of the conduit means 47. If too much pressure is communicated to the fluid chambers 38 the fluid extendible means could be severely damaged. In addition to that, if a large amount of pressure is communicated to these chambers a great amount of opposition will be encountered by the cam means 23 trying to move the pump pistons on the discharge stroke. As a result of these problems second valve means 66 have been provided for cooperating with the conduit means 47 for opening and closing the conduit means. The second valve means 66 includes a bore 67 and a valve member 68 located therein. The valve member 68 has a first and a second face 69 and 70 respectively. The valve member 68 also has an opening 71 which extends from the first face 69 and communicates with an annular slot 72 about the outer periphery of the valve member 68. This annular slot 72 in turn communicates with the conduit means 47 which leads on through to the fluid chambers 38. A spring 73 as best shown in Figure 1 normally biases the valve member 68 to the left in an open or first position whereby the fluid pressure from the discharge passageway is communicated through to the fluid chambers 38. The first face 69 of the valve member 68 communicates with the fluid pressure in the discharge passageway and is responsive thereto. In other words when a sufficient predetermined fluid pressure has been built up in the discharge passageway this fluid pressure acting on the first face 69 overcomes the force of the spring 73 and subsequently moves the valve member to the right from the position which it is in as seen in Figure 1. As the valve member 68 moves to the right the annular slot 72 moves to a second position which is out of communication with the conduit means 47 which leads from the valve member to the fluid chamber 38. As a result of this movement to the second or closed position by the valve member 68 further fluid pressure is prevented from passing from the discharge passageway to the fluid chambers 38 and as a result none of the herein above mentioned difficulties will be encountered. The spring loaded valve 74 provides communication between the passageways 50 and the interior of the pump housing 11. This spring loaded valve member 74 insures that upon a predetermined pressure build up it will open and vent the pressure to the housing 11. This insures that excessive pressure build up will not be allowed in either of the chambers 38 or the passageways 50.

It will therefore be readily apparent that a unique and novel means has been provided for positively maintaining fluid pressure in the discharge passageway of the pump, therefore always maintaining the pump pistons in engagement with the cam means. The pump pistons will therefore always be in a position to pump fluid upon rotation of the rotor by means of the driver shaft 54. The additional provision of the second valve means within this type of pump always provides that undue pressure from the discharge passageways will not be communicated to

the fluid extendible means which assist in maintaining the pump pistons positively against the cam means.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. In a fluid pump including a housing, an insert member within said housing, a rotor having a plurality of pump cylinders and surrounding said insert member, a first and a second pump piston mounted within each said pump cylinder, cam means engageable with said first and second pump pistons for moving said first and second pump pistons toward each other on a discharge stroke, an intake and a discharge passageway located within said insert member, port means extending from each said pump cylinder for alternate communication with said intake and discharge passageways, said first pump piston in each said pump cylinders having a fluid chamber therein, a piston rod in each said pump cylinder and having a first and a second end portion, each said piston rod extending axially within each said cylinder with said first end portion communicating with said fluid chamber in telescoping relationship thereto and said second end portion engaging said second pump piston, conduit means connecting said discharge passageway and each said fluid chamber together thereby providing said fluid chambers with fluid pressure from said discharge passageway whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means on an intake stroke, a spring loaded check valve cooperating with said discharge passageway for maintaining a predetermined fluid pressure in said discharge passageway at all times and hence maintaining fluid pressure in said fluid chambers whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means at all times, a valve member cooperating with said conduit means and movable between a first and a second position for opening and closing said conduit means, spring means normally maintaining said valve member in said first position thereby providing fluid communication between said discharge passageway and said fluid chambers, said valve member responsive to fluid pressure within said discharge passageway whereby upon sufficient pressure build up within said discharge passageway said spring means is overcome and said valve member moves to said second position shutting off fluid communication between said discharge passageway and said fluid chambers.

2. In a fluid pump including a housing, an insert member within said housing, a rotor having a pump cylinder and surrounding said insert member, a first and a second pump piston mounted within said pump cylinder, cam means engageable with said first and second pump pistons for moving said first and second pump pistons on a discharge stroke, an intake and a discharge passageway in the housing, port means in said rotor extending from said pump cylinder for alternate communication with said intake and discharge passageways incident to the rotation of the rotor, said first pump piston having a fluid chamber therein, a piston rod having a first and a second portion, said first end portion of said piston rod communicating with said fluid chamber in telescoping relationship thereto and said second end portion of said piston rod engageable with said second pump piston, conduit means connecting said discharge passageway and said fluid chamber together thereby providing said fluid chamber with fluid pressure from said discharge passageway whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means, discharge passageway valve means

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cooperating with said discharge passageway for maintaining fluid pressure in said discharge passageway and hence maintaining fluid pressure in said fluid chambers whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means, conduit valve means cooperating with said conduit means and movable between a first and a second position for opening and closing said conduit means, means normally maintaining said conduit valve means in said first position thereby providing fluid communication between said discharge passageway and said fluid chamber, said conduit valve means responsive to fluid pressure within said discharge passageway whereby upon sufficient pressure build up within said discharge passageway said means which normally maintain said conduit valve means in said first position is overcome and said conduit valve means moves to said second position shutting off fluid communication between said discharge passageway and said fluid chamber.

3. In a fluid pump including a housing, an insert member within said housing, a rotor having a plurality of pump cylinders, a first and a second pump piston mounted within each said pump cylinder, cam means engageable with said first and second pump pistons for moving said first and second pump pistons toward each other on a discharge stroke, an intake and a discharge passageway in the housing, port means in said rotor extending from each said pump cylinder for alternate communication with said intake and discharge passageways in the rotation of said rotor, said first pump piston in each said pump cylinders having a fluid chamber therein, a piston rod in each said pump cylinder and having a first and a second end portion, each said piston rod extending axially within each said cylinder with said first end portion communicating with said fluid chamber in telescoping relationship thereto and said second end portion engageable with said second pump piston, conduit means connecting said discharge passageway and each said fluid chamber together thereby providing said fluid chambers with fluid pressure from said discharge passageway whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means, discharge passageway valve means cooperating with said discharge passageway for maintaining fluid pressure in said discharge passageway and hence maintaining fluid pressure in said fluid chambers whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means.

4. In a fluid pump including a housing, an insert member within said housing, a rotor having a plurality of pump cylinders and surrounding said insert member, a first and a second pump piston mounted within each said pump cylinder, cam means engageable with said first and second pump pistons for moving said first and second pump pistons toward each other on a discharge stroke, an intake and a discharge passageway located within said insert member, port means extending from each said pump cylinder for alternate communication with said intake and discharge passageways, said first pump piston in each said pump cylinders having a fluid chamber therein, a piston rod in each said pump cylinder and having a first and a second end portion, each said piston rod extending axially within each said cylinder with said first end portion communicating with said fluid chamber in telescoping relationship thereto and said second end portion engaging said second pump piston, conduit means connecting said discharge passageway and each said fluid chamber together thereby providing said fluid chambers with fluid pressure from said discharge passageway whereby said first and second pump pistons in each said pump cylinder are maintained in engagement with said cam means, conduit valve means cooperating with said conduit means and movable between a first and a second position for opening and closing

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said conduit means, urging means normally maintaining said conduit valve means in said first position thereby providing fluid communication between said discharge passageway and said fluid chambers, said conduit valve means responsive to fluid pressure within said discharge passageway whereby upon sufficient pressure build up within said discharge passageway said urging means is overcome and said conduit valve means moves to said second position shutting off fluid communication between said discharge passageway and said fluid chambers.

5. In a fluid pump having first and second pump pistons movable axially within a pump cylinder on a discharge stroke by cam means to discharge fluid to a discharge passageway at a higher pressure than which it is received within the pump cylinder; means for maintaining said first and second pump pistons in engagement with said cam means at all times operatively interposed between said first and second pump pistons in said cylinder and comprising a fluid chamber within said first pump piston, a piston rod at one end thereof communicating with said chamber in telescoping relationship thereto, said piston rod being abutable with said second pump piston at the other end thereof, conduit means connecting said fluid chamber and said discharge passageway together whereby fluid pressure from said discharge passageway is communicated to said fluid chamber, and discharge passageway valve means in said discharge passageway to provide a predetermined fluid pressure at all times in said discharge passageway and hence a fluid pressure in said fluid chamber at all times.

6. In a fluid pump having first and second pump pistons movable axially within a pump cylinder on a discharge stroke by cam means to discharge fluid to a discharge passageway at a higher pressure than which it is received within the pump cylinder; means for maintaining said first and second pump pistons in engagement with said cam means at all times operatively interposed between said first and second pump pistons in said cylinder and comprising a fluid chamber within said first pump piston, a piston rod at one end thereof communicating with said chamber in telescoping relationship thereto, said piston rod being abutable with said second pump piston at the other end thereof, conduit means connecting said fluid chamber and said discharge passageway together whereby fluid pressure from said discharge passageway is communicated to said fluid chamber, and conduit valve means in said conduit means and movable between a first and a second position for alternatively permitting and prohibiting fluid communication between said discharge passageway and said fluid chamber.

7. In a fluid pump having first and second pump pistons movable within a pump cylinder on a discharge stroke by cam means to discharge fluid to a discharge passageway at a higher pressure than which is received within the pump cylinder; means for maintaining said first and second pump pistons in engagement with said cam means operatively interposed between said first and second pump pistons in said pump cylinder and comprising a fluid chamber within said first pump piston, a piston rod at one end portion thereof communicating with said fluid chamber in telescoping relationship thereto, said piston rod being abutable with said second pump piston at the other end portion thereof, conduit means connecting said fluid chamber and said discharge passageway together whereby fluid pressure from said discharge passageway is communicated to said fluid chamber, discharge passageway valve means cooperating with said discharge passageway to provide a predetermined fluid pressure in said discharge passageway and hence a fluid pressure in said fluid chamber, and conduit valve means cooperating with said conduit means to alternatively permit and prohibit fluid communication between said discharge passageway and said fluid chamber.

8. In a fluid pump having pump piston means movable

within a pump cylinder on a discharge stroke by cam means to discharge fluid to a discharge passageway at a higher pressure than which it is received within the pump cylinder; means for maintaining said pump piston means in engagement with said cam means at all times operatively disposed adjacent said piston means in said pump cylinder and comprising fluid extendible means including a fluid chamber formed in said pump piston means, a piston rod having one end disposed in telescoping relationship within said chamber and adapted to be projected endwise therefrom relative to the piston upon introduction of pressure fluid into said chamber, discharge passageway together whereby fluid pressure from said discharge passageway is communicated to said fluid chamber, and discharge passageway valve means in said discharge passageway to provide a predetermined fluid

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pressure in said discharge passageway and hence a fluid pressure in said fluid chamber at all times.

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U. S. DEPARTMENT OF COMMERCE

PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,821,144

January 28, 1958

Howard M. Purcell

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 9, after "set" insert -- so --; column 4, line 66, before "portion", first occurrence, insert -- end --.

Signed and sealed this 1st day of April 1958.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents