

Nov. 24, 1959

H. M. PURCELL
FLUID PUMP HAVING PUMP PISTONS AND MEANS
FOR COLLAPSING THE PUMP PISTONS

2,913,994

Filed Nov. 16, 1955

3 Sheets-Sheet 1

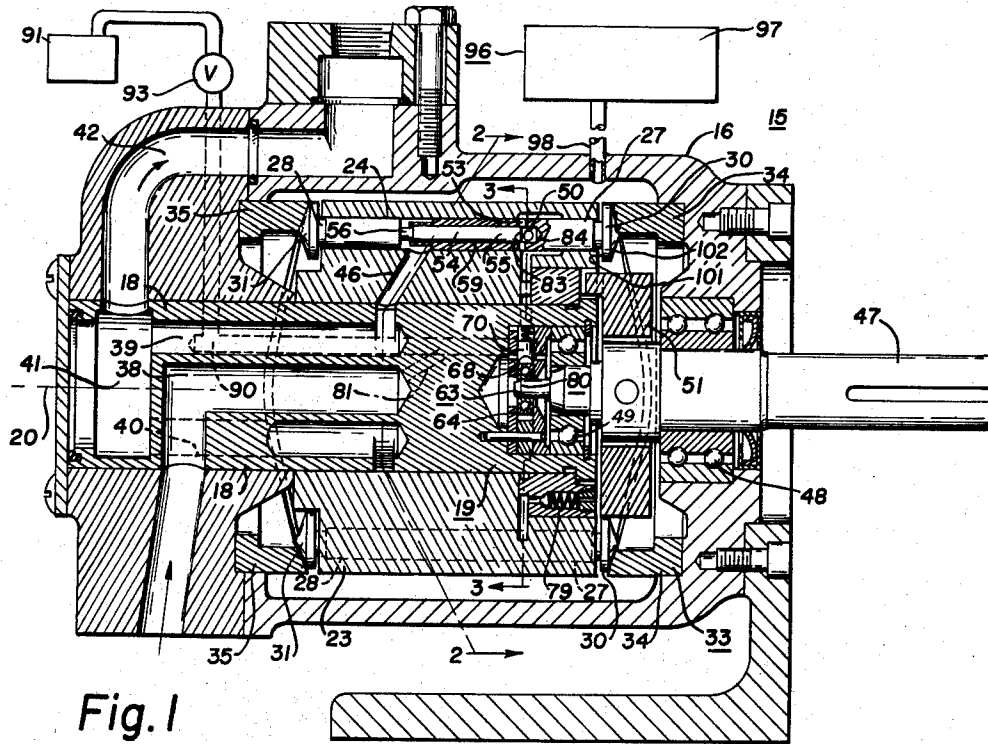


Fig. 1

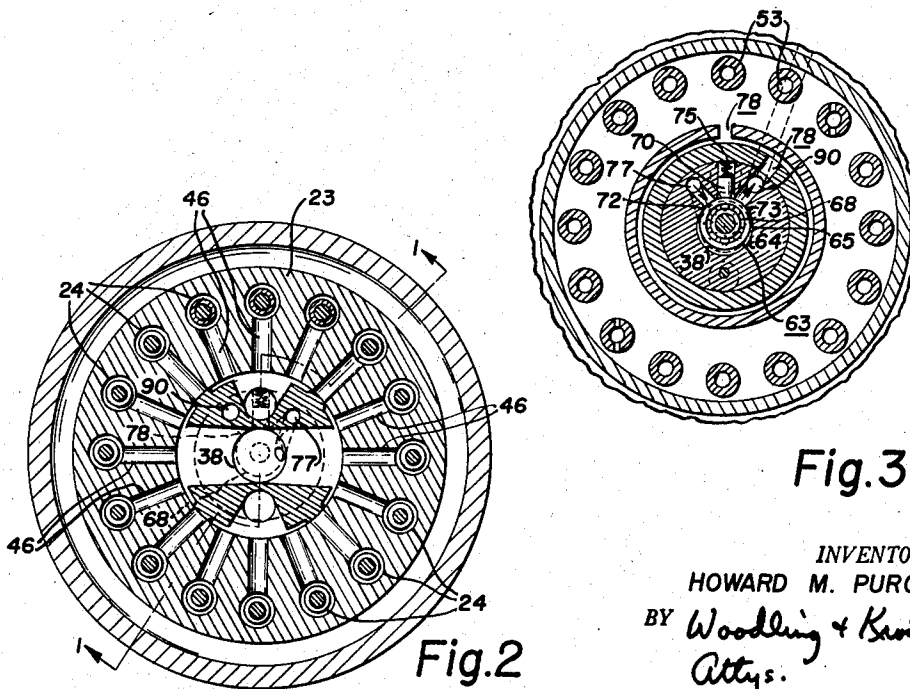


Fig. 2

Fig. 3

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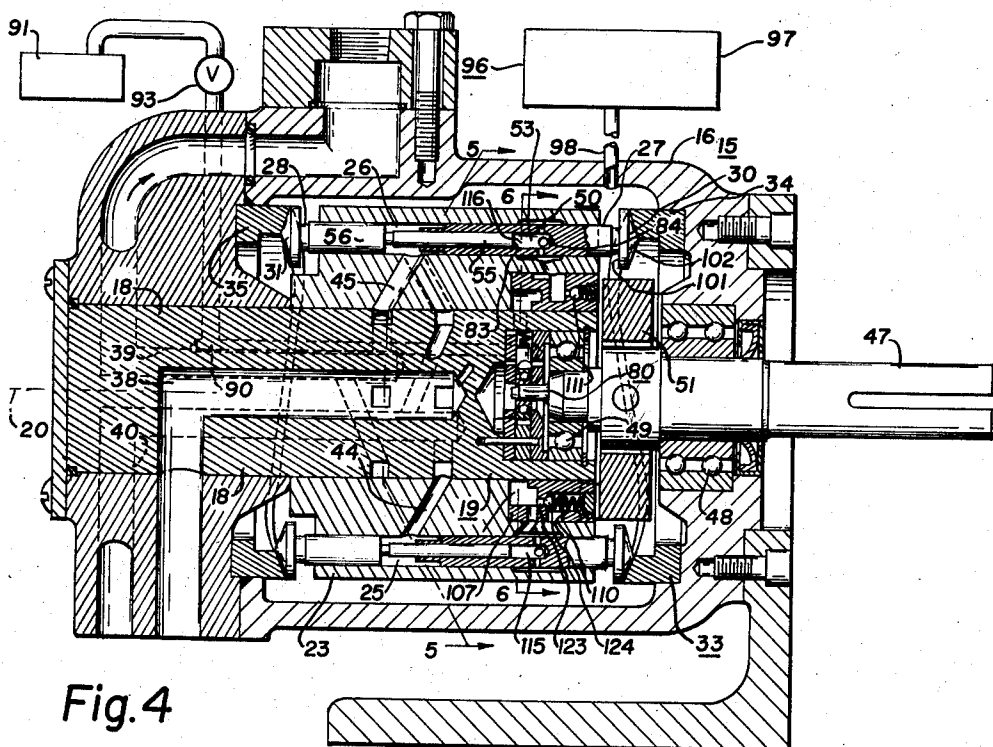


Fig. 4

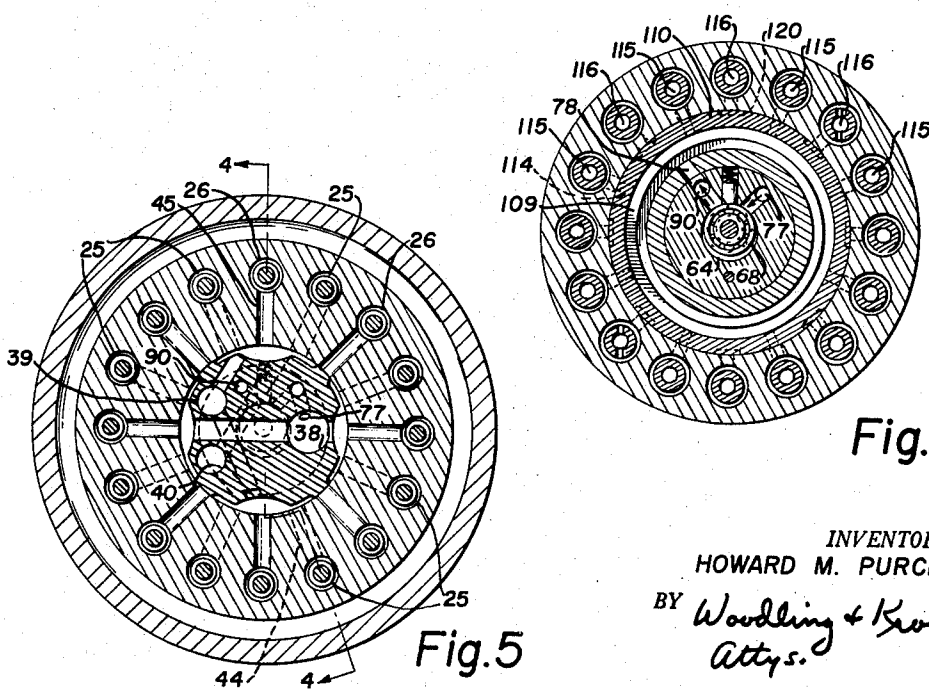


Fig. 5

Fig. 6

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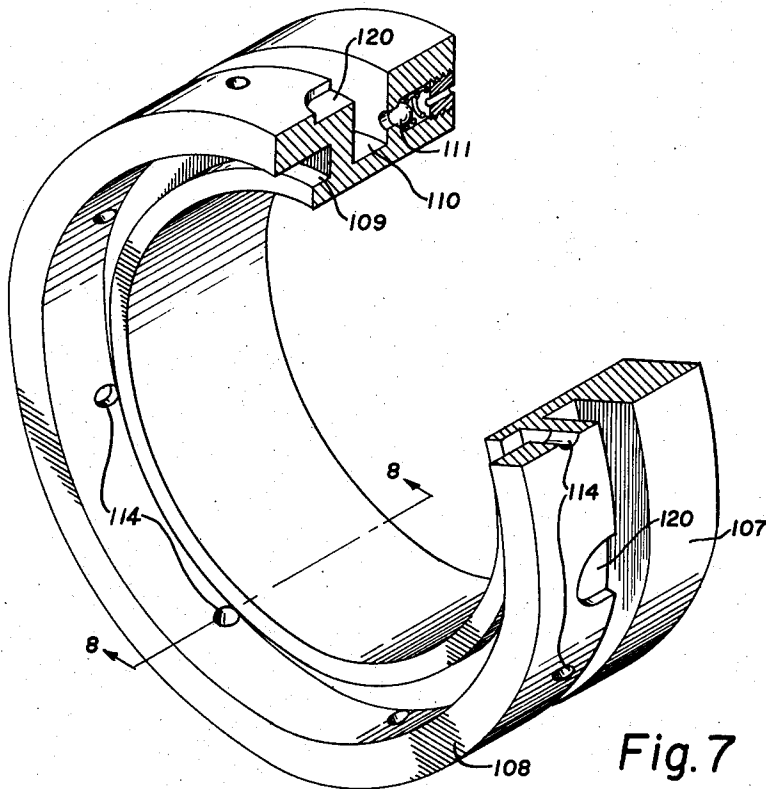


Fig. 7

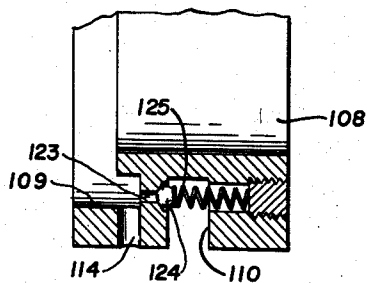


Fig. 8

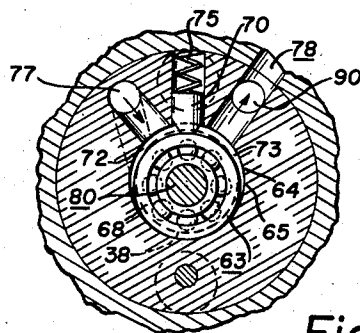


Fig. 9

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FLUID PUMP HAVING PUMP PISTONS AND MEANS FOR COLLAPSING THE PUMP PISTONS

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6 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 extendible means responsive to a fluid pressure which is produced by a secondary pump and to means for collapsing all or a portion of the pump pistons thereby enabling the pump to be driven and selectively operated to pump fluid under pressure or to idle without pumping fluid under pressure.

An object of the invention is to provide a fluid pump having pump pistons actuated on a discharge stroke by cam means with a means for collapsing or rendering the pump pistons ineffective to perform the pumping operation.

Another object of the invention is to provide a fluid pump driven by a power or drive source which will selectively deliver fluid under pressure or run without delivering fluid under pressure without interrupting the power or drive source.

Another object of the invention is to provide a fluid pump having pump pistons with a means for collapsing the pump piston thereby rendering the pump ineffective to perform the pumping operation without interrupting or disconnecting the source of power driving the pump.

Another object of the invention is to provide a primary fluid pump having fluid extendible means for maintaining the pump pistons in engagement with cam means, with a secondary control pump for actuating the fluid extendible means which secondary control pump is located within the primary fluid pump housing.

Another object of the invention is to provide a primary fluid pump having fluid extendible means actuated by fluid delivered by a secondary control pump, with piston collapsing means and valve means for selectively delivering the fluid delivered by the secondary control pump to the fluid extendible means and to a low pressure area whereby the fluid extendible means may be selectively actuated and de-actuated.

Another object of the invention is to provide a means for pressurizing the casing of a fluid pump whereby pump pistons of the fluid pump will be positively held in a collapsed position when the fluid extendible means are de-actuated.

Another object of the invention is to provide a fluid pump having a plurality of pump pistons with a valving ring wherein a portion of the pump pistons may be collapsed and rendered ineffective to perform the pumping operation and the remainder of the pump pistons will still be effective to perform the pumping operation.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims taken in combination with the accompanying drawings in which:

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

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

Figure 3 is a view taken along the line 3—3 of Figure 1;

Figure 4 is a side elevation view in section of a pump

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similar to that which is shown in Figure 1 but illustrating a modification of the pump of Figure 1;

Figure 5 is a view taken along the line 5—5 of Figure 4;

Figure 6 is a view taken along the line 6—6 of Figure 4;

Figure 7 is an isometric view with a portion thereof cut away showing the details of a valving ring which is used in conjunction with the fluid pump of Figure 4;

Figure 8 is a view taken along the line 8—8 of Figure 7; and

Figure 9 is an enlarged fragmentary view taken along the same line as Figure 3 and showing the secondary pump which is shown in Figure 3 in more detail and in a slightly different position.

The fluid pump of the invention is indicated generally by the reference numeral 15. The pump 15 comprises a primary housing 16 having a cylindrically shaped insert member 18 extending therein. The insert member 18 has an end portion 19 and a central axis indicated by the dot-dash lines 20. A rotor 23 surrounds the insert member 18 and has a plurality of axially extending pump cylinders therein. All of the pump cylinders within the rotor 23 have been designated by the same reference numeral 24. The rotor 23 is adapted for rotation about the insert member 18 and hence about the central axis 20 of the insert member 18. Each of the pump cylinders 24 is provided with a first and a second pump piston 27 and 28, respectively. Each of the first pump pistons 27 has a first cam follower 30 on an end portion thereof and each of the second pump pistons 28 has a second cam follower 31 attached to an end portion. Each of the cam followers 30 and 31 are in communication with the interconfines of the primary housing 16. Cam means 33 which include a first and a second cam member 34 and 35, respectively, are engageable with the first and second cam followers 30 and 31, respectively, of each of the first and second pump pistons 27 and 28, for urging the pump pistons inwardly toward each other on a discharge stroke. The insert member 18 is provided with an intake passageway 38 which provides the fluid pump 15 with low pressure fluid and a first and a second discharge passageway 39 and 40, respectively, which provide for the exit of high pressure fluid from the fluid pump. As will be noted in Figure 1 the first and second discharge passageway 39 and 40, respectively, join together at an end portion of the insert member 18 in a chamber 41 and thereafter fluid travels from the pump in a single discharge conduit 42. Port means 46 are provided within the rotor 23 for providing alternate communication between each of the pump cylinders 24 and the intake and discharge passageways. A drive shaft 47 mounted on bearings 48 and 49 and driven by any suitable power source, not shown herein, is operably connected to the rotor 23 by means of a connection member 51 for rotating the rotor 23 about the central axis 20.

Fluid extendible means or fluid means 50 are provided within each of the pumping cylinders 24 for maintaining the cam followers 30 and 31, respectively on each of the pump pistons in engagement with the first and second cam members 34 and 35, respectively, during the intake stroke of each of the first and second pump pistons 27 and 28, respectively. The fluid extendible means 50 include a fluid chamber 53 within each of the first pump pistons 27 in each of the pump cylinders 24 and a piston rod 54 in each of the pump cylinders 24. The piston rod 54 has a first and a second end portion 55 and 56, respectively. The first end portion communicates with the fluid chamber 53 in each of the first pump pistons by way of an aperture 59 in each of the first pump pistons. The piston rod 54 slidably resides in the aperture 59 and extends axially within the pump cylinder 24 and the second end portion 56 thereof is engageable with or may be fixedly attached

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to the second pump piston 28 in each of the pump cylinders 24.

A secondary control pump 63 shown in Figures 1, 3 and 9 is located within the end portion 19 of the insert member 18. The secondary control pump 63 includes wall means 64 which define a cylindrically shaped secondary control pumping housing 65. The secondary control pump housing is located coaxially with the insert member 18. A cylindrically shaped secondary control pump member 63 is mounted eccentrically within the secondary control pump housing 65 for rotation therein. A chamber forming member 70 extends from the wall means 64 and engages the secondary control pump member 68 thereby forming an input and an exhaust chamber 72 and 73, respectively, within the secondary pump. A spring 75 urges the chamber forming member 70 into engagement with the secondary control pump member 68 thereby forming the input and exhaust chambers at all times within the secondary control pump 63. Figure 9 is enlarged to better show the details of the secondary control pump 63 and shows the secondary control pump member 68 moved angularly approximately 180 degrees from the position in Figure 3. Input conduit means 77 connect the input chamber 72 of the secondary control pump 63 and the intake passageway 38 which is located within the insert member 18. The input conduit means 77 are best seen in Figures 2 and 3 but in Figure 1 the position of the input conduit means as it connects with the intake passageway 38 is indicated by the dot-dash lines 81. This provides a means for supplying fluid to the secondary control pump. In actual operation and practice, however, the secondary pump 63 may operate without the input conduit means 77. It is possible to supply fluid to the secondary control pump by the normal leakage and slippage of fluid from the discharge passageways 39 and 40 which leak into the primary housing 16 along the innerface of the various mating surfaces such as the surface between the insert member 18 and the rotor 23. Exhaust conduit means 78 connect the exhaust chamber 73 of the secondary control pump 63 and the fluid chamber 53 in each of the first pump pistons 27 which are located in each of the pump cylinders 24. A relief pressure valve 79 selectively connects the exhaust conduit means 78 to the interior of the primary housing 16 so as to prevent excessive pressure build up in the exhaust conduit means 78. Connection means 80 which include an extension of the drive shaft 47 are provided for connecting the secondary control pump member 68 to the same source of power that drives the rotor 23. Upon actuation of the drive shaft 47 in addition to rotating the rotor 23 the secondary control pump member 68 is rotated eccentrically within the secondary housing 65 whereby fluid under pressure is delivered by way of the exhaust conduit means 78 to the fluid chamber 53 in each of the first pump pistons 27. This fluid pressure within the fluid chamber 53 acts upon an end face 83 of the piston rod 54 and against an end wall 84 of the fluid chamber 53 whereby the first and second pump pistons 27 and 28 in each of the pump cylinders 24 are urged axially outwardly and the cam followers 30 and 31 are maintained in engagement with the first and second cam members 34 and 35, respectively, on the intake stroke of the pump pistons.

Piston collapsing conduit means 90 are provided within the pump and connects the exhaust conduit means 78 to a low pressure system 91. The low pressure system 91 is preferably any suitable sump which may be at normal atmospheric pressure. In any event the low pressure system is at a lower pressure than the pressure at which the secondary pump 63 delivers fluid therefrom. Valve means 93 are interposed within the piston collapsing conduit means 90 and cooperate therewith. The valve means 93 are movable between a first and a second position. The valve means in the first position permits fluid communication between the exhaust conduit means 78 and the low pressure system 91 whereby fluid which is de-

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livered by the secondary control pump 63 is exhausted to the low pressure area 91. In this position the fluid pressure within the fluid chamber 53 is greatly lessened if not completely reduced and the fluid extendible means 50 are prevented from accomplishing their normal function. As a result the pump pistons in each of the pump cylinders are collapsed from engagement with the cam means 33. The collapsed position is when the first and second pump pistons have reached the end of their discharge stroke. In the position indicated in Figure 1 the first and second pump pistons 27 and 28 are at the end of their discharge stroke and ready to start their intake stroke. The end of the intake stroke will come about when the rotor has rotated 90 degrees from the position shown in Figure 1. When the valve means 93 are in the second position they prevent fluid communication between the exhaust conduit means 78 or the second control pump 63 and low pressure system 91. In this position the fluid pressure which is produced by the secondary pump is communicated to the fluid chambers 53 in each of the first pump pistons 27 and as a result the fluid extendible means 50 are actuated and the first and second pump pistons are maintained in engagement with the cam means 33. The relief pressure valve 79 insures that the pressure in the fluid extendible means does not build up to a pressure greater than that at which valve 79 is set. It will therefore be seen that the drive shaft 47 may be kept operating and by merely actuating the valve means 93 between the first and second position the primary pump will either idle or deliver fluid at high pressure from the discharge passageways 39 and 40, respectively.

Pressurizing means 96 for pressurizing the interior confines of the primary housing 16 have been provided. The pressurizing means 96 which have been herein disclosed includes a tank 97 connected to the interior of the primary housing by way of a pipe 98. The tank 97 may be filled with any type of fluid but preferably the particular fluid which the pump 15 is pumping and the pressure within the housing will depend on the height of the tank 97 above the pump 15. Since fluid pressure acts equally in all directions there will be a force exerted against a first surface 101 on the cam followers 30 and 31, respectively, tending to move the cam followers against the cam means 33 and also an equal force per unit area acting upon a second surface 102 of the cam followers 30 and 31, respectively, tending to move the pump pistons inwardly toward each other. The resultant force will be a force inwardly on the pump pistons because the second surface area 102 is greater than the first surface area 101. Therefore when the valve means 93 are in the first position which renders the fluid extendible means ineffective the resultant force on the pump pistons caused by pressurizing the primary housing will tend to hold the first and second pump pistons positively in the collapsed position.

It will thus be seen that while the drive shaft 47 is driving the rotor 23 and the secondary control pump 63 the pump pistons may be collapsed or rendered ineffective to accomplish the pumping operation by merely moving the valve means 93 to the first condition. This transfers the fluid delivered by the secondary pump 63 to the low pressure system 91 thus reducing the fluid pressure on the fluid extendible means 50. All this of course is accomplished without stopping the drive shaft 47 thus obviating the necessity of shutting off the main power source and stopping the drive shaft 47. This results in a great saving in power and much freedom in the operation of the pump.

With reference to Figures 4, 5, 6, 7 and 8, these figures illustrate a modification of the invention which has hereinabove been described in detail. The same reference numerals have been applied in Figures 4, 5 and 6 as have been used in Figures 1, 2 and 3 where no changes in structure have occurred and as a result the forthcoming description will deal solely with the improvements and modifications which have been made. A valving ring 107 best seen in Figures 7 and 8 has been incor-

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porated within the pump 15 as shown in Figures 4 and 6. The valving ring 107 is mounted coaxial with the insert member 18 and is located within the rotor 23 and is adapted for movement with the rotor. The valving ring comprises an annular member 108 which has first and second annular channels 109 and 110, respectively, located therein. As best noted in Figure 4 the valving ring 107 is located between the secondary control pump 63 and the fluid extendible means 50. The first annular channel 109 is provided with first valve ports 114 which first valve ports communicate with alternate fluid chambers 115 in the first pump pistons 27. The fluid chambers which are included within the fluid extendible means 50 have been separated into two groups. The first group of alternate fluid chambers has been indicated by the reference numeral 115 and the second group of fluid chambers has been indicated by the reference numeral 116. The second annular channel 110 is provided with second valve ports 120 which second valve ports communicate with the second group of alternate fluid chambers 116 which fluid chambers are located in the first pump pistons 27 other than the fluid chambers which the first valve ports 114 communicate with. In other words the first valve ports 114 provide fluid communication between the first annular channel 109 and the fluid chambers 115 which reside within the first pump pistons 27 and the second valve ports 120 provide fluid communication between the second annular channel 110 and the second group of fluid chambers 116 or the remainder of the fluid chambers which are located within the remaining first pump pistons 27. A channel connecting passageway 123 best seen in Figure 8 extends between the first and second annular channels 109 and 110, respectively, for providing fluid communication therebetween. A spring loaded valve member 124 resides within the channel passageway 123 and is movable between a first and a second position. The spring loaded valve member 124 when in the first position permits passage of fluid from the first annular channel 109 to the second annular channel 110, and in the second position as shown in Figure 8 the spring loaded valve member 124 prohibits passage of fluid from the first to the second annular channel. A relief pressure valve 111, similar to the valve 79 shown in Figure 1 is provided to prevent undue pressure build up in the second annular channel 110. When this valve 111 is forced open by fluid pressure the fluid is transmitted to the primary housing 16. The exhaust conduit means 78 used in conjunction with the pump shown in Figures 4, 5 and 6 connects the exhaust chamber 73 of the secondary pump 63 and the first annular channel 109 in the valving ring 107 whereby the fluid pumped by the secondary pump 63 is delivered initially to the first annular channel 109. The fluid under pressure thereafter travels into the channel connecting passageway 123 and overcomes the spring loaded valve member 124 thereby moving this valve member to the first position and thus delivering fluid under pressure to the second annular channel 110. The fluid under pressure thereafter travels from the first annular channel 109 through the first valve ports 114 to the first group of alternate fluid chambers 115 and the fluid under pressure in the second annular channel travels through the second valve ports 120 into the second group of fluid chambers 116. As a result of the fluid pressure communicated to the fluid chambers 115 and 116 the fluid extendible means 50 are actuated and the first and second pump pistons 27 and 28, respectively, in all of the pump cylinders are maintained in engagement with the cam means 33.

The pump cylinders in the pump of Figures 4, 5 and 6 which correspond to the pump cylinders 24 of the pump shown in Figures 1, 2 and 3 have been divided into two groups of pump cylinders indicated by the reference numerals 25 and 26, respectively. The pump cylinders 25 carry the first pistons 27 which have the chambers 115

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therein and the pump cylinders 26 carry the pistons 27 which have the chambers 116 therein.

As will be noted in the pump of Figure 4 the two discharge passageways 39 and 40 are not connected together and the pump therefore provides two sources of fluid supply under pressure. Port means 44 are located in the rotor 23 for providing alternate communication between the pump cylinders 25 and the discharge and intake passageways, 40 and 38, respectively, and port means 45 are located in the rotor 23 for providing alternate communication between the pump cylinders 26 and the discharge and intake passageways, 39 and 38, respectively. The port means 44 slope toward the right end of the pump and the port means 45 slope toward the left end of the pump as seen in Figure 4.

The piston collapsing conduit means 90 is connected to the exhaust conduit means 78 of the secondary pump 63 and connects the same to a low pressure system 91. When the valve means 93 is in the first position fluid communication between the exhaust conduit means 78 and the low pressure system 91 is permitted whereby fluid which is delivered by the secondary control pump 63 is exhausted to the low pressure area 91 and the fluid pressure in the first group of fluid chambers 115 is reduced. The fluid pressure in the second annular channel 110 along with the force of the spring 125 serves to maintain and hold the spring loaded valve 124 in the second position whereby fluid pressure is prevented from escaping back to the first annular channel 109 through the channel connecting passageway 123 and therefore fluid pressure is maintained in the second group of fluid chambers 116. In the event that there is normal leakage from the second annular channel 110 the pressure therein will be maintained by the normal leakage of high pressure fluid from the pump cylinders 26 into the chambers 116 and hence down into the channel 110. This pressure will be prevented from exceeding a predetermined valve by the spring loaded valve 111 which opens up to discharge into the pump housing. It will thus be seen that by utilizing the valve ring 107 in combination with the pump 15 which has been herein disclosed, that the first and second pump pistons 27 and 28 in the pump cylinders 25 may be collapsed or rendered ineffective for pumping purposes by merely actuating the valve means 93 to the first position. If it is deemed desirable to operate the pump utilizing all of the first and second pump pistons in all of the pump cylinders 25 and 26 it is merely necessary to move the valve means 93 to the second condition whereby all of the pump pistons will be effective for the pumping operation.

It will be readily observed from the description of this latter pump that two fluid requirements may be supplied by this pump since neither of the discharge passageways are connected together. This same principle may be utilized to supply more than two fluid requirements. It would also be possible to connect both of the discharge passageways together to supply a single fluid requirement but in this case it would be necessary to provide a check valve or something similar in the discharge passageway which would be rendered ineffective when a portion of the pump pistons are collapsed, so that high pressure fluid from the other discharge passageway would not leak back up into the cylinders and force the collapsed pistons back out against the cams. It is also possible to vary the volume and pressure output of the pump by varying the size of the pump cylinders and the stroke of the pump pistons. As a consequence the pump shown in Figure 4 may deliver different volumes and pressures of oil from each of the separate discharge passageways.

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 comprising a housing having an insert member therein, a rotor surrounding said insert member, said rotor having a pump cylinder therein, said pump cylinder having a first and a second pump piston, said first and second pump pistons movable on an intake and a discharge stroke, said insert member having an intake and a discharge passageway extending therein, port means providing alternate communication between said pump cylinder and said intake and discharge passageways, cam means engageable with said first and second pump pistons for moving said pump pistons on said discharge stroke, fluid extendible means for maintaining said first and second pump pistons in engagement with said cam means and including a fluid chamber within said first pump piston, a piston rod member having a first and a second end portion, said first end portion of said piston rod communicating with said fluid chamber and said second end portion engageable with said second pump piston, a drive shaft cooperating with said rotor for rotating said rotor about said insert member, a secondary pump located coaxial with said insert member, said drive shaft operably connected to said secondary pump for driving said secondary pump, exhaust conduit means connecting said secondary pump and said fluid chamber of said first pump piston whereby fluid delivered by said secondary pump is transmitted to said fluid chamber and said first and second pump pistons are maintained in engagement with said cam means, means defining a low pressure system, piston collapsing conduit means connecting said exhaust conduit means to said low pressure system, valve means in said piston collapsing conduit means movable between a first and a second position, said valve means in said first position causing fluid delivered by said secondary pump to be transmitted to said low pressure system and said valve means in said second position prohibiting fluid from being transmitted to said low pressure system, means for pressurizing the interior of said housing whereby a force is exerted on said end portions of said first and second pump pistons tending to move said first and second pump pistons out of engagement with said cam means.

2. In a fluid pump comprising a housing having an insert member therein, a rotor surrounding said insert member, said rotor having a pump cylinder therein, said pump cylinder having a first and a second pump piston, each said first and second pump pistons communicating with the interior of said housing, said first and second pump pistons movable on an intake and a discharge stroke, said insert member having an intake and a discharge passageway extending therein, port means providing alternate communication between said pump cylinder and said intake and discharge passageways, means engageable with said first and second pistons for moving said pump pistons on said discharge stroke, fluid extendible means including a fluid chamber within said first pump piston, a piston rod member having a first and a second end portion, said first end portion of said piston rod communicating with said fluid chamber and said second end portion engageable with said second pump piston, a secondary pump located within said housing, exhaust conduit means connecting said secondary pump and said fluid chamber with said first pump piston whereby fluid delivered by said secondary pump is transmitted to said fluid chamber, means defining a low pressure system, piston collapsing conduit means connecting said exhaust conduit means to said low pressure system, valve means in said piston collapsing conduit means movable between a first and a second position, said valve means in said first position allowing fluid delivered by said secondary pump to be transmitted to said low pressure system and said valve means in said second position prohibit-

ing fluid from being transmitted to said low pressure system, means for pressurizing the interior of said housing whereby a force is exerted on said first and second pump pistons tending to move said first and second pump pistons in the direction of said discharge stroke.

3. In a fluid pump comprising a primary housing having an insert member therein, a rotor surrounding said insert member and having first and second pump cylinders therein, said rotor adapted for rotation about said insert member, each said pump cylinder having first and second pump pistons therein, cam means engageable with said first and second pump pistons in each said pump cylinder for urging said pump pistons on a discharge stroke, an intake and a discharge passageway extending within said insert member, port means for providing alternate communication between each said pump cylinder and said intake and discharge passageways, fluid extendible means within each said pump cylinder for maintaining said pump pistons in each said pump cylinder in engagement with said cam means, a secondary control pump enclosed in said primary housing, a valving member supported adjacent said secondary pump, said valving member having first and second annular channels, said first annular channel having a first valve port communicating with said fluid extendible means in said first pump cylinder, said second annular channel having a second valve port communicating with said fluid extendible means in said second pump cylinder, a channel connecting passageway extending between said first and second annular channel, a valve member cooperating with said channel connecting passageway and movable between a first and a second position, said valve member in said first position permitting passage of fluid from said first to said second channel and in said second position prohibiting passage of fluid from said first to said second channel, exhaust conduit means connecting said secondary pump and said first annular channel of said valving ring, means defining a low pressure system, piston collapsing conduit means connecting said exhaust conduit means to said low pressure system, valve means interposed in said piston collapsing conduit means, said valve means in a first position permitting fluid communication between said exhaust conduit means and said low pressure system whereby fluid delivered by said secondary control pump is exhausted to said low pressure system, said valve means in a second position preventing fluid communication between said exhaust conduit means and said low pressure system, whereby fluid pressure produced by said secondary pump is communicated to said first and second annular channel of said valving member.

4. In a fluid pump comprising a housing having an insert member therein, a rotor surrounding said insert member and having first and second pump cylinders therein, said rotor adapted for rotation about said insert member, each said pump cylinder having first and second pump pistons therein, cam means engageable with said first and second pump pistons in each said pump cylinders for urging said pump pistons on a discharge stroke incident to the rotation of said rotor, a first and a second discharge and an intake passageway extending within said insert member, first port means providing alternate communication between said first pump cylinders, and said intake and first discharge passageways, second port means providing alternate communication between said second pump cylinders, and said intake and second discharge passageways, first fluid chambers within said first pump pistons which reside within said first pump cylinders, second fluid chambers within said first pump pistons which reside within said second pump cylinders, fluid extendible means in each of said first and second pump cylinders for maintaining said first and second pump pistons in engagement with said cam means on an intake stroke, a secondary control pump located within said housing, a valving member connected to receive fluid under pressure from said secondary control

pump, separate conduit means connecting said valving member to said first and second fluid chambers and normally operative to convey pressure fluid thereto whereby all of said first and second pump pistons are maintained in engagement with said cam means on said intake stroke of said pump, and valve means operable to by-pass the fluid from the conduit means connecting to said second fluid chambers thereby collapsing said first and second pump pistons within said second pump cylinders.

5. In a pump, in combination, a cylinder block having a series of through bores disposed concentrically about a central axis, a pair of cams supported adjacent opposite ends of said block, power driven means for relatively rotating said cams and said block about said central axis, a pair of pistons reciprocable in each cylinder, pressure fluid operated means for urging said pistons outwardly against the respective cams, said cams being shaped to force the pistons inwardly simultaneously in a pressure stroke and then release them for a return stroke by said fluid operated means incident to the relative rotation of the cylinder block and cams, said pressure fluid operating means comprising a cylindrical recess formed in one of the pistons in each cylinder, a plunger having one end slidable in said recess and the other end engageable with the companion piston, a secondary pump mounted within said cylinder block operative in response to the relative rotation of the cylinder block and cams to deliver fluid under pressure through an exhaust conduit, passages in said cylinder block connecting said exhaust conduit to said piston recesses in succession incident to said relative rotation, conduit means for venting fluid from said exhaust conduit, and valve means in said venting conduit operable to initiate or interrupt the venting of the pressure fluid from said exhaust conduit to stop or start the operation of the pump.

6. In a pump, in combination, a cylinder block having a series of through bores disposed concentrically about a central axis, a pair of cams supported adjacent opposite ends of said block, power driven means for relatively rotating said cams and said block about said central axis, a pair of pistons reciprocable in each cylinder, pressure fluid operated means for urging said pistons outwardly against the respective cams, said cams being shaped to force the pistons inwardly simultaneously in a pressure stroke and then release them for a return stroke by said fluid operated means incident to the relative rotation of the cylinder block and cams, said pressure fluid operating means comprising a cylindrical recess formed in one of the pistons in each cylinder, a plunger having one end slidable in said recess and the other end engageable with the companion piston, a secondary pump mounted within said cylinder block operative in response to the relative rotation of the cylinder block and cams to deliver fluid under pressure through an exhaust conduit, passages in said cylinder block connecting said exhaust conduit to said piston recesses in succession incident to said relative rotation, and means for directing pressure fluid against the outer ends of said pistons to prevent their return stroke and thereby condition the pump for running idle without pumping fluid.

References Cited in the file of this patent

UNITED STATES PATENTS

2,377,227	Griswold	May 29, 1945
2,437,887	Mott	Mar. 16, 1948
2,439,668	Mercer	Apr. 13, 1948
2,459,786	Beaman et al.	Jan. 25, 1949
2,577,242	Grad	Dec. 4, 1951
2,617,360	Barker	Nov. 11, 1952
2,675,830	Vuillemin	Apr. 20, 1954