

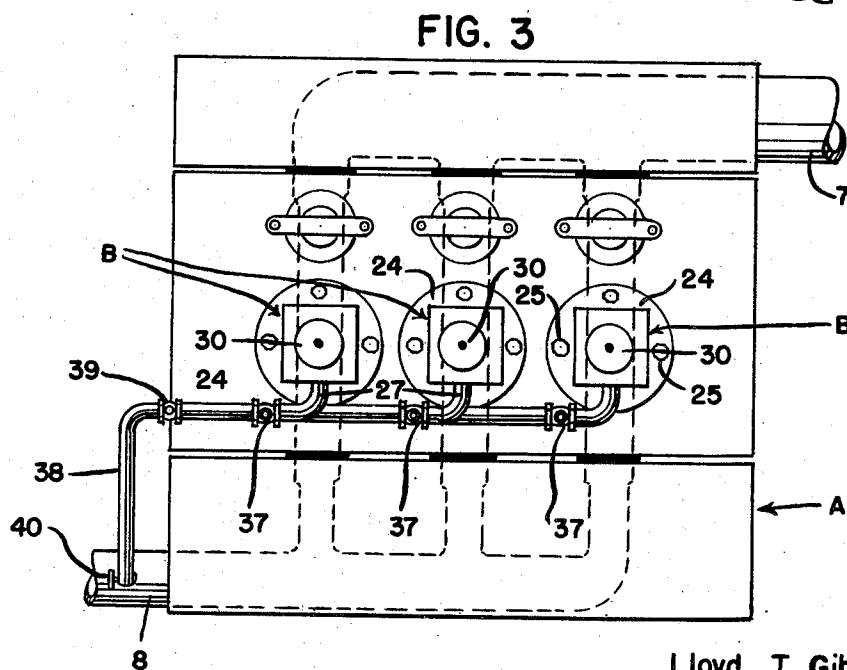
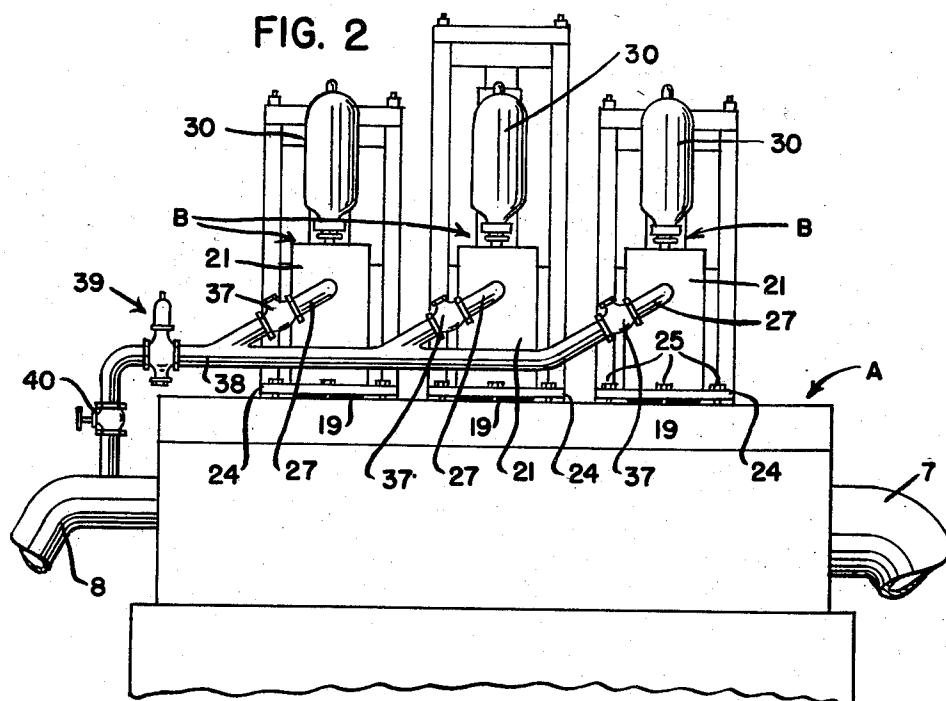
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VARIABLE CAPACITY PUMP

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1

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VARIABLE CAPACITY PUMP

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5 Claims. (Cl. 103—37)

This invention relates to variable capacity pumps.

An important object of the invention is to provide new means, for association with such pumps, for operating the pumps at constant speeds.

Another important object is to provide means for operating a variable capacity pump at a constant speed, and employing a valve, operatively connected with the passageway or space between the suction and discharge valves of the pump and a second chamber surrounding the valve member and seat of the valve and communicating with another chamber, so that the proper volumes of fluids within the chambers, but separated from each other, will be automatically maintained in the chambers, other elements of the means including a conventional check valve and pressure regulator.

A further important object of the invention is to provide a simple, substantially automatic means for operating a variable capacity pump at constant speed and employing a minimum of parts.

Other objects and advantages of the invention will be apparent during the course of the following detailed description of the invention, taken in connection with the accompanying drawings, forming a portion of this disclosure, and in which drawings:

Figure 1 is a view of a conventional variable capacity triplex pump, partly in elevation and partly in vertical section, upon which the new means for operating the pump at constant speeds is mounted and shown mostly in vertical section.

Figure 2 is a side elevation of the upper portion of the triplex pump, with three of the new means mounted thereon.

Figure 3 is a top plan of the showing in Figure 1.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of the invention, the letter A generally designates a variable capacity pump and the letter B, the new constant speed operating means associated therewith.

The variable capacity pump A is shown, by way of illustration, as a conventional triplex pump, including a working barrel 5 provided with suitable major fluid-carrying passageways 6 extending between the suction manifold 7 and the discharge manifold 8, with lateral passageways 9 extending therefrom and plunger stuffing boxes 10 for plungers 11 operatively connected at their outer ends with cross-heads. There is also a conventional pump suction valve 12 and discharge valve 13 for each passageway 6. At the outer mouth of each lateral passageway 9 where it opens to the exterior of the working barrel, there may be provided a circumferential groove 14 for a valve seat to be described.

The new constant speed operating means B includes a reciprocating valve structure 15, having a reciprocating valve member 16 which may comprise a cylindrical wall 17, an end wall 18 joined thereto, and an opposite open end, with the end wall 18 adapted to seat snugly upon a valve seat 19 which preferably is ring-shaped and of compressible material. The valve member 16 and seat 19 are contained in the chamber 20 of a housing 21 which housing preferably has a cylindrical side wall 22, an outer end wall 23 joined to the wall 22 and an outwardly-ex-

2

tending flange 24 at the end of the wall 22 opposite the wall 23. Means to secure the housing 21 and valve seat 19 to the pump working barrel 5 so that the opening in the seat is in communication with the lateral passageway 9, may comprise suitable screws 25 with their shanks extending through openings in the flange 24 and screwed into screw-threaded sockets in the pump working barrel 5, and since the flange bears upon the outer portions of the seat 19, the latter is suitably compressed against the walls of the circumferential groove 14 in the outer face of the pump housing portion, thus securing the housing 21 and seat to the working barrel 5.

Preferably there should be a reasonable close sliding fit of the outer face of the side wall 17 with the inner face of the wall 22, so that co-mingling of the fluids in the chamber 20 and the lateral passageway 9 will be reduced to a minimum. The valve member 16 is of such size that a reasonable maximum lift of the valve member may be obtained when the pump A is operating full speed but not pumping fluid through the main line. This lift is preferably in the order of $\frac{1}{2}$ ", but reasonable changes in size are, of course, sometimes desirable.

Opening through the side wall 22 is a minor passageway 26 of a conduit 27, with the passageway 26 in communication with the chamber 20 above the valve member 16. Above the mouth of the passageway 26 where it opens into the chamber 20 is a port 28 of a suitable tubular member 29 upon which may be mounted a suitable accumulator 30 of fluid under pressure as, for example only, that described in United States Patent 2,331,921 (Serial Number 272,791) granted to Jean Mercier, October 19, 1943. In this patent a rigid container, designated in Figure 1 of my application as 31, encloses a suitable, substantially fluid-tight movable barrier, as a flexible, elastic bag 32, thus dividing the container into inner and outer chambers 33 and 34 and the inner chamber 33 may be filled with a suitable medium, as gas, introduced through a valved opening 35 extending through the walls of the container 31 and bag 32. Fluid may enter the outer chamber 34 through an opening adapted to be closed by a valve and communicating with the port 28.

Interposed in the conduit 27 is a conventional check valve 37, and the passageway 26 of each conduit 27 may open into the passageway of a major conduit 38 to form a manifold, as, for example, in Figures 2 and 3, with a conventional adjustable pressure regulator 39 interposed in the conduit 38 outwardly of the juncture of all of the conduits 27 with the conduit 38.

A suitable fluid is introduced into the chamber 20 in any conventional way. This fluid may be the same as that being pumped, such as crude oil, petroleum products, fresh water, salt water, hydraulic oils and the like. However, it may be advantageous, at times, to have this fluid a heavier oil than an oil being pumped. For example, in this case, the fluid introduced into the chamber 20 may be machine castor oil or lube oil, while the fluid being pumped may be propane or butane. This fluid in chamber 20 is brought, by any conventional step, to the desired controlled pressure whereupon a second fluid, preferably a gas or mixture of gases, such as nitrogen or air, is introduced into the chamber 33 at substantially the same pressure.

The operation of the new means B will be explained as to one of the three means B illustrated, since each operates in unison. As the plungers 11 move in their power stroke (downwardly in the example illustrated) and when the line pressure rises slightly above the pressure of the fluid in chamber 20, the valve member 16 will unseat and the extent of the lift of valve member 16 will depend upon this line pressure. In the event the line pressure rises high enough, no fluid will be pumped and the lift of the valve member will be such that all the fluid moved by

the plunger will flow into that portion of the chamber 20 then between the end wall 18 of the valve member 16 and the valve seat 19. On the upstrokes of the plunger 11, this fluid will return to the lateral passageway 9 and fluid passageway 8 and transmit pressure against the inner end of the plunger 11, whereby very little loss of operating efficiency will occur.

It will be readily seen that there will be very little mingling of fluid in the chamber 20 and the passageways 8 and 9, because there is very little pressure differential (this differential being only the pressure necessary to move the valve member 16).

Of course, the gaseous fluid in chamber 33 will compress according to Boyle's law ($PV=K$; P being pressure, V being volume, and K being a constant).

It is essential to the accurate operation of the means B, that the volume and pressure of the fluid in chamber 20 remain at the predetermined constant for any given minimum line pressure at which control is desired and, to this end, the check valve 37 is employed and interposed in the conduit 27 and the pressure regulator 39 employed as described.

The fluid pressure in the inner chamber 33 is so adjusted that when the predetermined control pressure on the fluid in chamber 20 is established, fluid will rise above the valved opening 35 in a volume sufficient so that the outer chamber 34 will, under all working conditions, be partially filled with this fluid. The critical point is that where the valve member of the structure 15 seats, whereby the fluid in the chamber 20 is at a minimum level, and the fluid in chamber 33 is at a maximum expansion.

Before passing to specific examples of the operation of the new means B, it should be pointed out that when the valve member 16 seats, it is a positive seating due to suction. When the plunger 11 opens the suction valve 12 there is a considerable difference of pressure between the fluid in chamber 20 and that in the working barrel 5.

As an example of operation, if the suction at the suction valve 12 is, in one case, zero or, in another case, 100 p. s. i., and the discharge is 1000 p. s. i., the differential in pressure across the valve 15 will be 1000 p. s. i. or 900 p. s. i., as the case may be but, due to the operation of the means B, at the time this occurs, the valve member 16 seats and no leakage occurs; at all other times, when the valve member 16 unseats, the only difference in pressure across the valve 15 is that necessary to move the valve member 16 and there is no incentive for any great volume of leakage. When any leakage does occur, the pressure upon the fluid in chamber 20 drops slightly and the pressure regulator 39 permits the flow of extra fluid to maintain the desired pressure. This extra fluid normally will enter the chamber 20 through opening of the check valve 37 when the valve member 16 is seated, because the volume of fluid in the housing 5 is then greater and the pressure of the fluid in the inner chamber 33 follows the workings of Boyle's law (inasmuch as the volume remains essentially the same, minus a small leakage volume, the pressure P will drop in order to maintain K as a constant).

Assuming a 2½" diameter x 5" stroke, single acting pump in operation, each plunger will deliver 0.1407 gallon of fluid per effective stroke (total volume when the pump is in operation but not delivering). In such a case, a valve member 16 having an effective area of substantially 33 square inches, would move substantially 1" in order to accommodate 0.14 gallon per stroke. This would call for a valve member with a diameter of substantially 6½".

If the main line is adjusted to operate at 1000 p. s. i. and, for some reason, the pressure tends to climb to 1100 p. s. i., for example, and reaches this point, the reduction in capacity delivered into the main line will be approximately 47%, so that full automatic control can be secured with minor changes of the main line pressure.

Various changes may be made to the form of the in-

vention herein shown and described without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. A pressure control for a pump provided with suction and discharge valves, a pumped fluid discharge passageway, and a major fluid-carrying passageway communicating between said valves, said control including walls defining a first chamber in communication with said major fluid passageway; valve means in said chamber to open and close communication between said major fluid passageway and chamber including a valve member; walls defining a second chamber in communication with said first chamber; walls defining a third chamber; a substantially fluid-tight movable barrier between said second and third chambers; means providing a minor fluid passageway between said first chamber and said discharge passageway, with said minor fluid passageway having a mouth opening into said first chamber and said mouth spaced from said valve member when said valve member is seated; an expansible fluid filling said third chamber; a fluid under pressure within said first and second chambers, means causing the fluid pressure of the fluid in said first chamber to substantially equal the fluid pressure in said major fluid-carrying passageway, comprising adjustable pressure regulator interposed in said minor fluid passageway; and a check valve interposed in said minor fluid passageway between said pressure regulator means and said first chamber.

2. A pressure control according to claim 1 in which said valve member is a reciprocating valve member, there is a single communication between said major passageway and said first chamber, and said communication is normally closed by said valve member.

3. A pressure control according to claim 1 in which said valve member is a freely reciprocating valve member, there is a single communication between said major passageway and said first chamber, and said communication is normally closed by said valve member and retained closed by gravity and suction.

4. A pressure control for a pump provided with suction and discharge valves, a pumped fluid discharge passageway, and a major fluid-carrying passageway communicating between said valves, said control including walls defining a first chamber in communication with said major fluid passageway; valve means in said chamber to open and close communication between said major fluid passageway and chamber including a valve member; accumulator means in communication with said chamber at a location spaced from said valve member when said valve member is seated, including a container and an expansible fluid within a portion of said container; means providing a minor fluid passageway between said chamber and said discharge passageway, with said minor fluid passageway having a mouth opening into said chamber at a location spaced from said valve member when said valve member is seated; a fluid under pressure within said chamber and another portion of said container; adjustable pressure regulator means interposed in said minor fluid passageway to substantially equalize the pressure of said fluid under pressure with the pressure of fluid within said major fluid-carrying passageway; and a check valve interposed in said minor fluid passageway between said pressure regulator means and said mouth.

5. A pressure control according to claim 4 in which said expansible fluid is a gas and said fluid under pressure is a liquid.

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