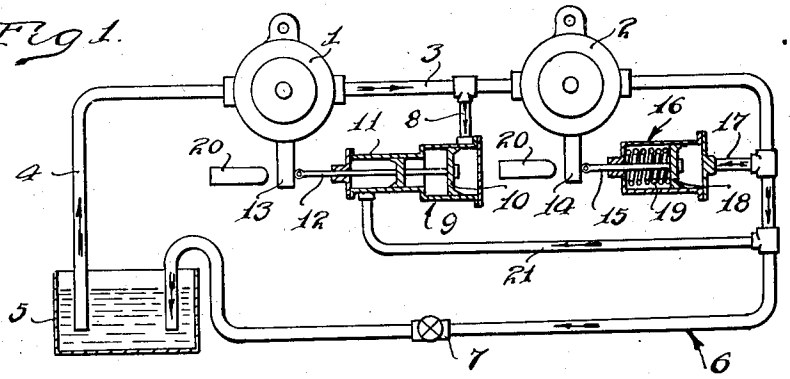
Sept. 13, 1932. H. F. VICKERS 1,877,091

VARIABLE VOLUME PUMP

Filed Oct. 19, 1931

Fig 1.



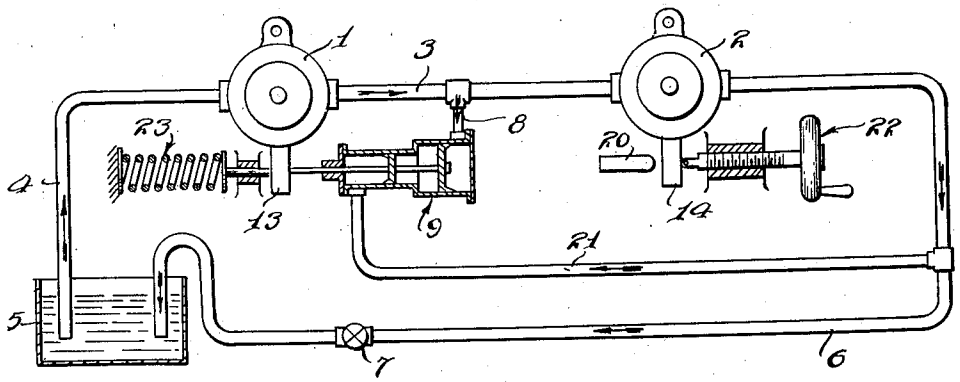


Fig. 2.

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VARIABLE VOLUME PUMP

Application filed October 19, 1931. Serial No. 569,611.

This invention relates to variable volume pumps, and more particularly to a novel manner of compounding a plurality of variable volume pumps in series.

The present invention contemplates the connecting up of a plurality of variable volume pumps in series and in its preferred embodiment has to do with novel means for maintaining a constant pressure in the main hydraulic line and additional means for automatically varying the volume of one pump and maintaining the pressure of such pump at a certain relative proportion to the pressure in the main line.

Other features of this compound hook-up will be more clearly brought out in the specification and claims.

In the drawing:

Fig. 1 is a diagrammatic view illustrating the manner of connecting two variable volume pumps in a circulating system whereby to produce a constant pressure and variable volume.

Fig. 2 illustrates a diagrammatic circulating system somewhat similar to Fig. 1 but embodying a manual control whereby to produce both a variable pressure and variable volume.

It will be understood that the hydraulic circulating system forming a part of the present invention may be connected into a hydraulic motor or hydraulic operating unit of any type or design, as the present invention has to do with the circulating system rather than with the means to be operated.

In the embodiment illustrated in Fig. 1, two variable volume pumps 1 and 2, of any standard type, are connected together in series by means of a conduit 3. A common lead-in conduit 4 is connected to a liquid source of supply 5 and a common power conduit 6 is shown as passing through a valve 7 to the source of supply 5. This valve 7 may be taken to represent any hydraulic motor or operating unit which will tend to create the pressure in the line.

A branch conduit 8 leads from the connecting conduit 3 into a differential piston control unit 9, the large area 10 and the small area 11 of this unit being connected to a common piston rod 12 to the variable volume control lever 13. It will be seen from this arrangement that pressure in the conduit 3 against the large area 10 will tend to decrease the discharge of the pump and the pressure against the small area 11 will tend to increase with the discharge of the pump.

The variable lever 14 of No. 2 pump is connected by means of the piston rod 15 to a pressure control unit 16. The pressure control unit is connected to the main conduit by means of a branch conduit 17 with the result that the piston in the control unit 16 is subject to the pressure in the main conduit, which pressure will tend to decrease the discharge from the pump 2. The piston 18 is opposed by any suitable means such as by spring 10. Each of the control levers 13 and 14 are provided with suitable stops 20.

In operation, a restriction of the valve 7 will cause pressure to build up in No. 2 pump, which pressure will actuate the piston 18 to in turn move the lever 14 and reduce the delivery from pump 2. This action in turn builds up pressure in pump 1 and the connecting conduit 3 whereby the volume of pump No. 1 will be decreased by the action of the increased pressure against the piston 10. Inasmuch as the working face of the piston 11 is connected to the pressure in the main conduit by means of the auxiliary conduit 21, it will be seen that the resulting pressure in line 3 will always be proportionate to the pressure in the main line 6, and if the differential piston 10 is twice the area of the piston 11, it will be seen that the pressure in the line 3 will be equal to one-half the pressure in the line 6.

In the modification shown in Fig. 2, I have replaced the pressure control unit with an external or manual control unit 22 and have balanced the differential piston control unit 9 with a spring member 23. In the operation of this modified arrangement the external control may be adjusted to obtain any desired discharge from the pump 2. If the discharge from pump No. 2 is increased, the discharge from pump No. 1 will automatically be increased and the pressure will be proportionately divided between the two or more pumps.

By using a coil spring 23, it will be seen that the control lever 13 will always tend to move towards open position regardless of the initial pressure in the main line 6.

What I claim is:

1. A constant pressure variable volume liquid circulating system, comprising a plurality of variable volume pumps connected in series, pressure control means actuated by the main operating pressure for controlling the volume of one pump, and means controlling the volumetric discharge of another pump actuated by the pressure existing in between two adjacent pumps.

2. A constant pressure variable volume liquid circulating system, comprising a plurality of variable volume pumps connected in series, pressure control means actuated by the main operating pressure for controlling the volume of one pump, and differential piston control means controlling the volumetric discharge of another pump actuated by the pressure existing in between two adjacent pumps.

3. A liquid circulating system comprising a source of supply, a main liquid operating conduit and a plurality of variable volume pumps connected in series for feeding liquid under pressure from said source of supply to said main conduit, and means connecting the main conduit with a conduit in between two pumps in series and arranged to automatically vary the volume of the pump farthest away from the main conduit to maintain predetermined proportionate pressures in the conduit connecting the two pumps and the main conduit.

4. A liquid circulating system comprising a source of supply, a main liquid operating conduit and a plurality of variable volume pumps connected in series for feeding liquid under pressure from said source of supply to said main conduit, and differential piston control means connecting the main conduit with a conduit in between two pumps in series and arranged to automatically vary the volume of the pump farthest away from the main conduit to maintain predetermined proportionate pressures in the conduit connecting the two pumps and the main conduit.

5. A liquid circulating system, comprising a source of supply, a main liquid operating conduit and a plurality of variable volume pumps connected in series for feeding liquid under pressure from said source of supply to said main conduit, means connecting the main conduit with a conduit in between two pumps in series and arranged to automatically vary the volume of the pump farthest away from the main conduit to maintain predetermined proportionate pressures in the conduit connecting the two pumps and the main conduit, and pressure control means connecting the main control conduit with the variable volume control of another pump whereby to vary the volume of said pump in proportion to any pressure change in the system.

6. A liquid circulating system, comprising a source of supply, a main liquid operating conduit and a plurality of variable volume pumps connected in series for feeding liquid under pressure from said source of supply to said main conduit, differential piston control means connecting the main conduit with a conduit in between two pumps in series and arranged to automatically vary the volume of the pump farthest away from the main conduit to maintain predetermined proportionate pressures in the conduit connecting the two pumps and the main conduit, and pressure control means connecting the main control conduit with the variable volume control of another pump whereby to vary the volume of said pump in proportion to any pressure change in the system.

7. A liquid circulating system, comprising a source of supply, a main liquid operating conduit and a plurality of variable volume pumps connected in series for feeding liquid under pressure from said source of supply to said main conduit, differential piston control means connecting the main conduit with a conduit in between two pumps in series and arranged to automatically vary the volume of the pump farthest away from the main conduit to maintain predetermined proportionate pressures in the conduit connecting the two pumps and the main conduit, and means for varying the discharge in the pump closest adjacent the main pressure pump.

In testimony whereof I affix my signature.

HARRY F. VICKERS.