Aug. 21, 1951 G. B. KITCHEL 2,565,374

COMPOUNDING OF RECIPROCATING PUMPS

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FIG. 2

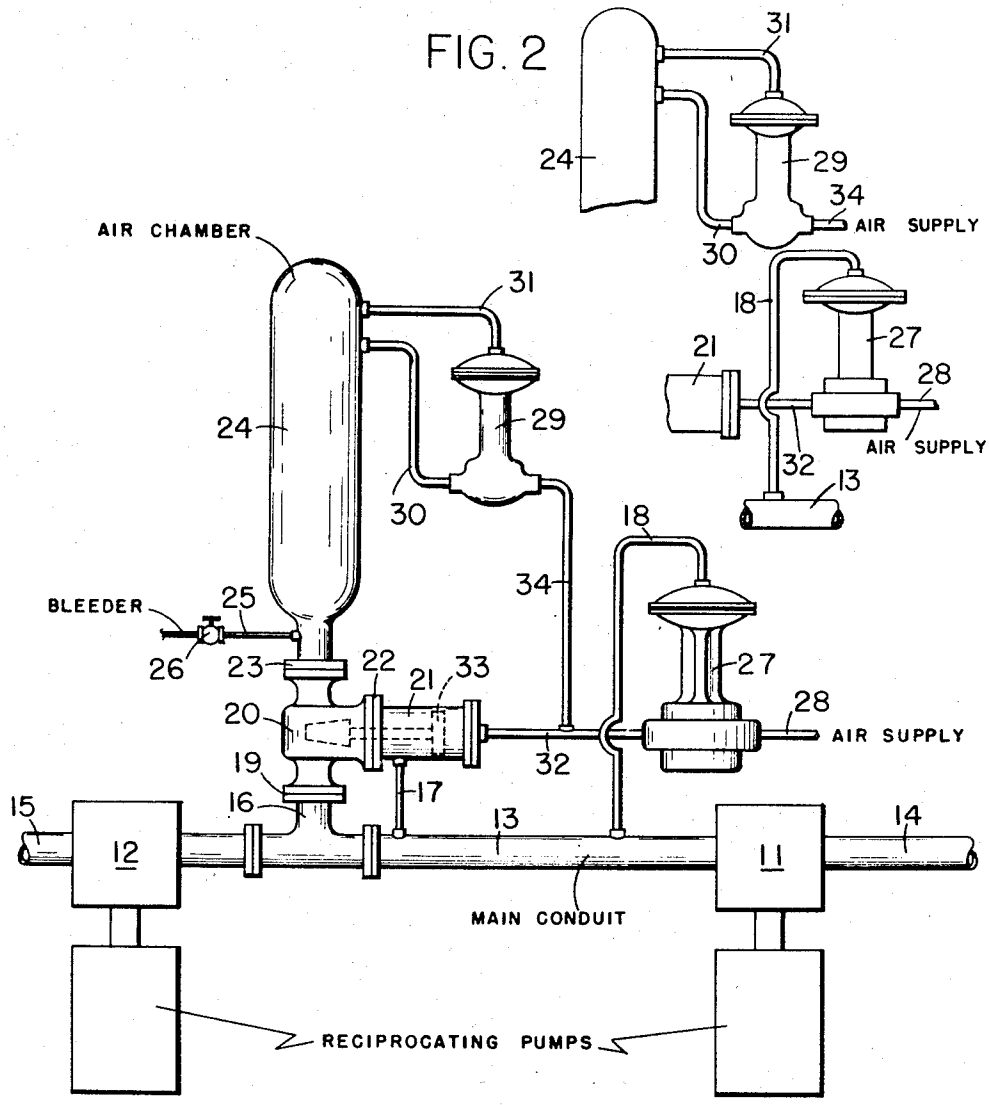


FIG. 1

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COMPOUNDING OF RECIPROCATING PUMPS

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12 Claims. (Cl. 103—223)

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The present invention is directed to apparatus for compounding reciprocating pumps. More particularly, the invention is directed to apparatus suitable for employment with at least two reciprocating pumps. In its more specific aspects, the invention is directed to apparatus for compounding reciprocating pumps employed in pumping drilling mud and other similar suspensions.

It is the main object of the present invention to provide apparatus which will allow at least two reciprocating power pumps to be compounded and which will compensate for the difference in displacement between the pick up and the discharge pumps.

A still further object of the present invention is to provide apparatus in which at least two reciprocating pumps are compounded in which an air chamber maintained between the two pumps is preloaded at a first pressure.

A still further object of the present invention is to provide an attachment for two reciprocating power pumps including a surge chamber and means for absorbing peak pressures and compensating for differences in displacement between the pumps.

The principal parts of the apparatus of the present invention include at least two reciprocating pumps which are interconnected by a conduit into which is fluidly connected a surge chamber which is provided with means for regulating fluid pressure thereto and means for connecting and disconnecting the conduit between the two pumps to the surge chamber.

The apparatus will be further illustrated by reference to the drawing in which Fgure 1 is an elevational view of a preferred embodiment thereof; and Fig. 2 is a modification of the apparatus of Fig. 1 showing separate sources of air for the fluid regulating means.

Referring now to the drawing, number 11 designates a first reciprocating pump which may be employed to pump mud or other drilling fluid and numeral 12 designates a second reciprocating power pump, the intake of which is connected by main conduit 13 with the discharge of first mud pump 11. Pump 11 is arranged to pick up drilling fluid or mud from a mud pit or tank, not shown, by intake line 14 and pump 12 is provided with a discharge line 15 which may be connected to another reciprocating pump or may be connected into the well drilling apparatus to provide drilling fluid therefor.

Main mud conduit 13 is provided with a first lateral conduit 16, a second lateral conduit 17 and a third lateral conduit 18.

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First lateral conduit 16 is connected by a flanged connection 19 to a valve 20 provided with a fluid responsive element 21 which is connected thereto by flanged connection 22. Valve 20 is connected by a suitable flange 23 to an air surge chamber 24. Air surge chamber 24 is provided at its lower end thereof with a conduit 25 and a bleeder valve 26.

The apparatus of the present invention includes a first fluid regulating means 27 which may be a diaphragm actuated regulator valve connected by air inlet line 28 to a source of air maintained at a constant pressure. First fluid regulating means 27 is connected to the main conduit 13 by third lateral conduit 18 so that it is responsive to changes in pressure therein.

Chamber 24 is provided with a second fluid regulating means 29 which is connected thereto by a fourth lateral conduit 30. Second regulating means 29 is actuated through a conduit 31 which connects into the upper end of chamber 24.

The fluid responsive element 21 of valve 20 is shown in the drawing as a piston operated valve and this valve is connected by fifth lateral conduit 32 to first fluid regulating means 27 and receives, by air inlet line 28 and conduit 32, the air delivered to the regulating means 27.

A sixth lateral conduit 34 interconnects fifth lateral conduit 32 and second fluid regulating means 29 thus allowing the air supplied by conduit 32 to fluid responsive element 21 also to be supplied to second fluid regulating means 29.

Although first and second fluid regulating means 27 and 29 respectively have been shown to be diaphragm actuated valves, it is within the spirit and purview of this invention to use equivalents thereof and these diaphragm actuated valves may be hydraulically operated valves. Similarly, the fluid responsive element 21 of valve 20 is shown as a piston operated device actuated by air supplied through conduit 32. This element may be substituted by an equivalent operated hydraulically.

The device of the present invention is suitably employed with at least two reciprocating power pumps with one end of the main conduit attached to the discharge of the first of said conduits and a second end attached to the intake of the second end of said pumps.

To compensate for peak pressures and compensate for the differences in displacement between the equivalents of pumps 11 and 12 it is desirable to employ an air chamber similar to chamber 24. However, it would be necessary ordinarily, without the apparatus of the present in-

vention, to make air chamber 24 of an exceedingly large size to take care of all variations in pressures and differences in displacement. In accordance with the present invention the air chamber 24 is preloaded as regard to air pressure by supplying air to regulator 27 at a constant value, say of about 100 pounds per square inch. Thus, to preload the air chamber 24 and maintain the air supply therein when the mud line pressure in conduit 13 between pumps 11 and 12 drops below the preloading pressure, the pressure operated piston valve 20 is closed by the air supplied by conduit 32 working against the piston 33, closing valve 20. Thus, the air supply in chamber 24 is maintained since air may be supplied thereto through regulator 29 connected to line 32 by conduit 34 which discharges into chamber 24 by line 30. When the pressure builds up in chamber 24 the regulator 29 is shut off by virtue of line 31 connecting into the diaphragm regulating valve 29.

When the mud line pressure increases as the pumps are again put in motion the pressure operated valve 20 is opened by mud pressure supplied by conduit 17 against the opposite side of piston 33 from that contacted by air supplied by conduit 32. This valve remains open until the mud line pressure again falls below the preload pressure and the cycle is repeated as described.

A small amount of mud may remain in chamber 24 when valve 20 is closed. This may be bled off through line 25 controlled by valve 26 which may connect back into the main mud conduit 13 at a desired point where the pressure is lower than that in chamber 24 or it may be discharged back into the main mud pit.

Although it may be preferred to connect conduit 34 to the conduit 32 which connects valve 27 with valve 29 and to the control means 21 of valve 20, it is possible to have conduit 34 connecting to a source of pressure separate from that leading into valve 27 as shown in Fig. 2. Under these conditions, it will be necessary to control carefully the pressure supply to valves 27 and 29 to allow proper functioning of my invention. In the latter event, conduit 32 would connect into control means 21 but would not be connected to conduit 34.

It will be seen from the foregoing description of the drawing that the apparatus of the present invention allows the practical operation and compounding of at least two reciprocating power pumps. Since pumps used in pumping drilling fluid, such as mud and other suspensions, are frequently stopped as often as every five minutes, it will be apparent that the present apparatus contributes to the functioning of compounded pumps by allowing them to operate efficiently to absorb the peak pressures and compensate for differences in displacement between the pumps. Furthermore, the apparatus of the present invention allows the size of the air chamber conventionally employed in connection with such reciprocating power pumps to be reduced materially.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and obtain by Letters Patent is:

1. A device suitable for compounding at least two reciprocating pumps which comprises, in combination, a main conduit adapted to be connected at first and second ends thereof, respectively, to a discharge of one of said pumps and to an intake of a second of said pumps, a chamber, a first lateral conduit fluidly connecting said chamber with said main conduit, a valve comprising a fluid responsive element interposed in said first lateral conduit between said chamber and said main conduit, a second lateral conduit operatively connecting said main conduit with said fluid responsive element and adapted to cause opening of said valve, a first fluid regulating means adapted to be connected to a source of fluid pressure, a third lateral conduit operatively connecting said first fluid regulating means with said main conduit, a second fluid regulating means, a fourth lateral conduit operatively connecting said second fluid regulating means with said chamber, a fifth lateral conduit operatively connecting said first regulating means with said fluid responsive element and adapted to cause closing of said valve, and a sixth lateral conduit fluidly connecting said fifth lateral conduit with said fluid chamber, said second fluid regulating means being arranged in said sixth conduit and adapted to supply fluid to said chamber.

2. A device in accordance with claim 1 in which the chamber is provided with means for releasing fluid therefrom at a lower end thereof.

3. A device in accordance with claim 1 in which the fluid responsive element is a piston cylinder.

4. A device in accordance with claim 1 in which the first and second fluid regulating means are diaphragm actuated air regulator valves.

5. A device suitable for compounding at least two reciprocating pumps which comprises a main conduit adapted to be connected at first and second ends thereof, respectively, to a discharge of one of said pumps and to an intake of a second of said pumps, an air chamber, a first lateral conduit fluidly connecting said chamber with said main conduit, a valve including a piston cylinder interposed in said first lateral conduit between said chamber and said main conduit, means for releasing fluid from said chamber at a lower end thereof, a second lateral conduit operatively connecting said main conduit with said piston cylinder and adapted to cause opening of said valve, a first air regulating means adapted to be connected to a source of air pressure, a third lateral conduit operatively connecting said first air regulating means with said main conduit, a second air regulating means, a fourth lateral conduit operatively connecting said second air regulating means with said chamber, a fifth lateral conduit operatively connecting said first regulating means with said piston cylinder and adapted to cause closing of said valve, and a sixth lateral conduit fluidly connecting said fifth lateral conduit with said air chamber, said second air regulating means being arranged in said sixth conduit and adapted to supply air to said chamber.

6. In combination with at least two reciprocating pumps, a main conduit connected at a first end to the discharge of the first of said pumps and connected at a second end to the intake of a second of said pumps, an air chamber, a first lateral conduit fluidly connecting said chamber with said main conduit, a valve including a piston cylinder interposed in said first lateral conduit between said chamber and said main conduit, a second lateral conduit operatively connecting said main conduit with said piston cylinder and adapted to cause opening of said valve, a first fluid regulating means adapted to be connected to a source of pressure, a third lateral

conduit operatively connecting said first fluid regulating means with said main conduit, a second fluid regulating means, a fourth lateral conduit operatively connecting said second fluid regulating means with said chamber, a fifth lateral conduit operatively connecting said first fluid regulating means with said piston cylinder and adapted to cause closing of said valve, and a sixth lateral conduit fluidly connecting said fifth lateral conduit with said chamber, said second fluid regulating means being arranged in said sixth conduit and adapted to supply fluid to said chamber.

7. A device in accordance with claim 6 in which the chamber is provided with means at a lower end thereof for releasing fluid therefrom.

8. A device in accordance with claim 6 in which the first and second regulating means are diaphragm actuated air regulator valves.

9. A system for reducing pressure surges when compounding mud pumps comprising, in combination, a mud line adapted to be connected with the discharge side of one mud pump and with the inlet side of another mud pump, an air chamber, a conduit provided with a liquid valve connecting the lower end of the air chamber with the mud line, a pressure actuated control means for the liquid valve, a first gas valve provided with a control means, a second gas valve provided with a control means, conduits connecting the outlet side and the control means of the second gas valve with the upper end of the air chamber, conduits connecting the outlet side of the first gas valve with the inlet side of the second gas valve and with the control means for the liquid valve, and conduits connecting the mud line with the control means for the liquid valve and the control means of the first air valve.

10. A system for reducing pressure surges when compounding mud pumps comprising, in combination, a mud line adapted to be connected with the discharge side of one mud pump and with the inlet side of another mud pump, an air chamber, a conduit provided with a first valve connecting the lower end of the air chamber with the mud line, a pressure actuated control means for the first valve, a second valve provided with a control means, a third valve provided with a control means, conduits connecting the outlet side and the control means of the second valve with

the upper end of the air chamber, a conduit connecting the outlet side of the third valve with the control means of the first valve, conduits connecting the mud line with the control means for the first valve and the control means of the third valve, and conduits adapted to connect the inlet sides of said second and third valves to separate sources of pressure.

11. In combination with at least two reciprocating pumps, a mud line connected at a first end to the discharge of the first of said pumps and connected at a second end to the intake of a second of said pumps, an air chamber, a conduit provided with a liquid valve connecting the lower end of the air chamber with the mud line, a pressure actuated control means for the liquid valve, a first gas valve provided with a control means, a second gas valve provided with a control means, conduits connecting the outlet side and the control means of the second gas valve with the upper end of the air chamber, conduits connecting the outlet side of the first gas valve with the inlet side of the second gas valve and with the control means for the liquid valve, and conduits connecting the mud line with the control means for the liquid valve and the control means of the first air valve.

12. In combination with at least two reciprocating pumps, a mud line connected at a first end to the discharge of the first of said pumps and connected at a second end to the intake of a second of said pumps, an air chamber, a conduit provided with a first valve connecting the lower end of the air chamber with the mud line, a pressure actuated control means for the first valve, a second valve provided with a control means, a third valve provided with a control means, conduits connecting the outlet side and the control means of the second valve with the upper end of the air chamber, a conduit connecting the outlet side of the third valve with the control means of the first valve, conduits connecting the mud line with the control means for the first valve and the control means of the third valve, and conduits adapted to connect the inlet sides of said second and third valves to separate sources of pressure.

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No references cited.