

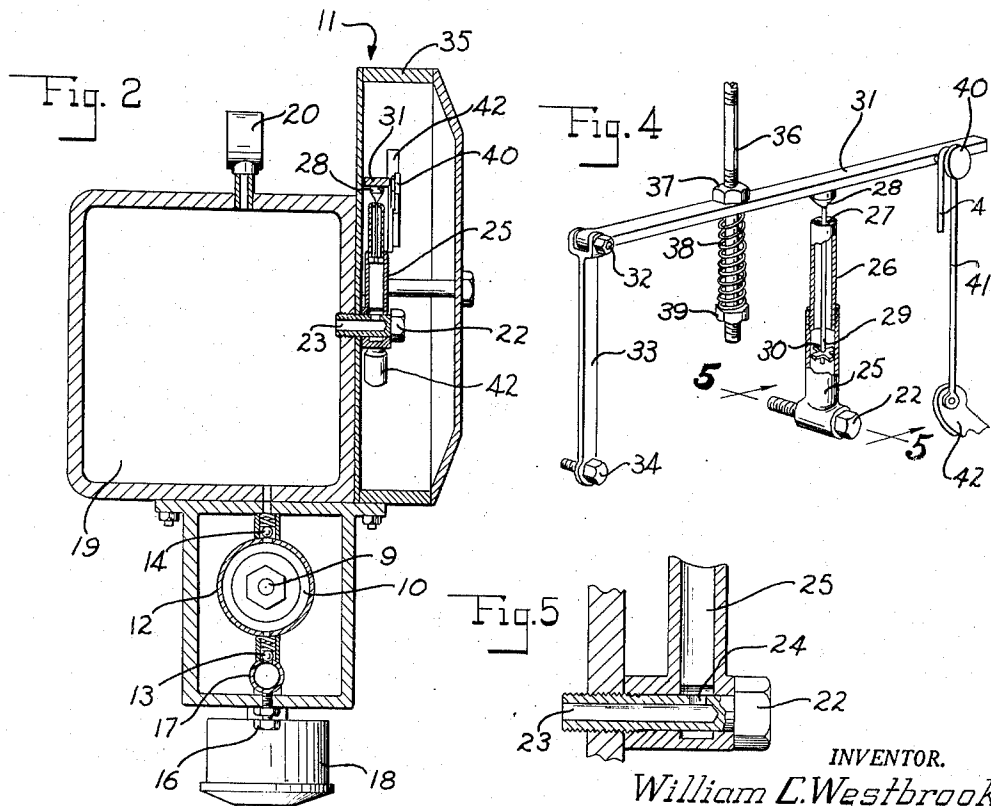
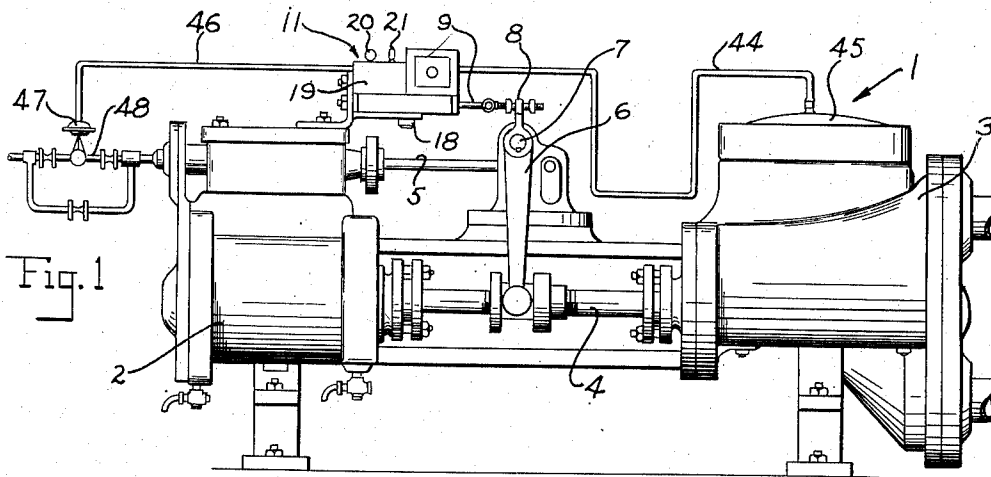
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CONTROL MECHANISM FOR PUMPS

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CONTROL MECHANISM FOR PUMPS

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This invention relates to mechanisms for controlling the speed and pressure of pumps and more particularly of stroke pumps that are operated by steam, air, or natural gas as a motivating pressure fluid.

In the pumping of fluids, such as oil, water or the like with stroke pumps, these pumps generally are operated by steam, air or natural gas as the motivating fluid. Stroke pumps operated by some such motivating fluid have long been in general use in oil fields, refineries, water works and various other industries to which the use of such a pump is adapted.

Heretofore, however, such pumps have required constant attention in order to maintain them at correct operating speed, to maintain an ever-present supply of fluid to be pumped, and to maintain a constant discharge pressure. If one or more of these factors were not properly maintained the results required of the pump were hampered and the equipment damaged.

Various regulators have been proposed heretofore, and when used under favorable conditions, have been reasonably satisfactory, however, few installations can be made under completely satisfactory conditions and therefore the results of their use have not been satisfactory.

The actuating mechanism of the present invention is connected to a control valve within the motivating fluid supply line of a stroke pump, and is designed to operate automatically to meet and maintain the speed and pressure requirements of the pump. It may be set so that the operating speed of the pump will not vary, whether the pump is operating at full capacity or when it is not pumping fluid. Provision is also made for maintaining sufficient speed to sustain a predetermined pressure as long as the fluid being pumped is supplied to the intake. Furthermore, the discharge pressure is controlled to prevent it becoming greater than a predetermined set pressure.

The use of the present control mechanism insures uniform operating speed to the pump even though the fluid being pumped becomes exhausted. The mechanisms in general use heretofore have controlled the speed of the pump by a constant supply of fluid being pumped, but if the fluid being pumped became exhausted, the pump speed often became so great that the pump mechanism would tear itself to pieces.

The present control mechanism for the pump system is connected to a member on the pump which imparts mechanical movement for the operation of an air pump, which pump supplies air

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for controlling the speed of the pump through a diaphragm control valve, as will be more fully described hereinafter. Provision is also made for controlling the maximum speed of the pump in accordance with the pressure of the fluid being pumped.

The primary object of this invention is to provide a device for controlling the maximum speed of a pump and a maximum output pressure thereof.

Another object of this invention is to provide a pump having an auxiliary air pump thereon to supply air pressure independently, for actuating a control valve for controlling the maximum speed and maximum pressure of a pump.

Another object of this invention is to provide a control mechanism for pumps that will control the discharge pressure of the pump within a predetermined limit, and in event of a drop in pressure below the predetermined point, the mechanism will effectively control the speed of the pump and in so doing, prevent excess speed which would result in damage and undue wear to the pump.

A still further object of this invention is to provide a pressure shut-off mechanism that controls the exhaust supply of pressure of the pressure generating system so as to effectively control the operating speed of the pump.

Yet another object of the invention is to provide a regulating system for a stroke pump, the mechanism of which provides for independent adjustment of the speed of the pump and for controlling the discharge pressure thereof.

The present mechanism provides an auxiliary air pump system which is a separate and independent mechanism that is attached to the motivating fluid supply line of a stroke pump, and which generates an independent pressure system for actuating the control valve which directs steam or gas to the motor end of the pump. Furthermore, provision is also made for utilizing the output pressure of the pump for operating a metering device, which device, in turn, causes the pressure from the generating system to actuate the motor control valve to the pump so as to maintain the motivating fluid thereto in accordance with the requirements of the output pressure of the pump and with the motor operating part of the pump.

An embodiment of this invention is illustrated in the accompanying drawings in which:

Fig. 1 is a side elevational view of a stroke pump showing the control mechanism as connected to the motivating fluid line;

Fig. 2 is a sectional view of a pressure generating and control mechanism taken on the line 2—2 of Fig. 3;

Fig. 3 is an elevational view thereof with parts broken away and shown in section to more clearly bring out the details of construction;

Fig. 4 is a fragmentary perspective view of a portion of the control mechanism with parts broken away and shown in section to show details of construction; and

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4, looking in the direction indicated by the arrows and showing a fragmentary portion of the fluid control supply system.

With more detailed reference to the drawing, the numeral 1 designates generally a stroke pump, which pump is usually of the duplex type, that is, having two steam cylinders and two fluid pump cylinders. This pump 1 has a power head 2 at one end and a pump head 3 at the opposite end thereof. The usual power pistons and pump pistons within the respective cylinders are interconnected by pump rods 4, which pump rods operate the usual slide rods 5 by means of arms 6. The arms 6 are connected to a rocker shaft 7 to which a bifurcated arm 8 is attached. The bifurcated, upright arm 8 operates an air pump rod 9, which pump rod 9 carries the conventional cups 10 so as to pump air, as will be more fully described hereinafter.

Secured to the pump 1 is a pressure generating and control unit generally designated at 11, which unit has an air cylinder 12 therein valved with intake valves 13 at either end thereof and exhaust valves 14 at either end thereof. It is preferable to have the air cylinder clamped between heads 15 to prevent endwise movement, and bolts 16 are provided to clamp pipes 17 and cylinder 12 upward against the bottom of control unit 11. This arrangement permits of ready assembly and disassembly of the parts for servicing, maintenance and repair.

The air inlet is provided at 18 to direct air through pipe 17 and valve 13 into cylinder 12. The exhaust valves 14 are provided to permit air to be discharged into reservoir 19, as shown in Figs. 2 and 3. The reservoir 19 is provided with a pressure gauge 20 and a relief valve 21, so the pressure within the reservoir may be quickly and accurately determined, and in event the pressure exceeds a predetermined amount, the relief valve 21 will permit the escape of excess pressure.

A bolt 22 has a passage 23 therein, which passage connects with a transverse passage 24 to direct air pressure into tubular member 25. The tubular member 25 has a valved orifice 27 at the upper end thereof which orifice is adapted to be closed by a valve 28. A guide rod 29 protrudes downward through tubular member 28 to tubular member 25 and has a guide member 30 threadably secured on the lower end thereof.

The upward movement of valve 28 is constrained by an arm 31, which arm is pivoted on bolt 32 at one end. The bolt 32 passes through a link 33 pivoted on bolt 34, which bolt 34 is secured to case 35. The arm 31 is mounted upon a link 33 which allows the arm 31 to move downward about bolt 36 without causing any binding action on the bolt due to the arcuate movement of the arm 31. The arm 31 extends outward from pivot point 32 and has an outstanding pin 38 on one side thereof to which a linkage 41 is attached at its lower end. The linkage 41 is attached to a Bourdon tube 42 and to the pin 40 at the upper end by means of a hook 41'. The Bourdon tube

42 is of the usual construction and is mounted on a hollow bolt 43, which bolt is similar in construction to bolt 22, as shown in Fig. 5. This enables the Bourdon tube 42 to be adjusted to various operating positions around bolt 43 so as to give a correct movement to linkage 41 upon the expansion of Bourdon tube 42, under pressure.

A pipe 44 connects the tube 42 with valve chamber 45 of the first discharge side of the pump. This enables the discharge pressure of the pump to be transmitted to the Bourdon tube 42 to operate the linkage 41, arm 31 and valve 28 to control the flow of air through orifice 27, which operation will be explained more fully hereinafter. A pipe 46 leads from air reservoir 19 to a diaphragm control valve 47 which is positioned within motivating fluid line 48, which valve 47 is controlled in accordance with the pressure within the chamber 19.

The air inlet 18 preferably has a filtering material therein to filter the air of foreign particles before it enters the air system.

In the operation of the control mechanism, the pump 1 is connected to an air, gas or steam pressure line 48 in which a valve 47 is positioned intermediate the pressure supply and the power end of the pump 1. The valve linkage is operated by a connecting rod 5 upon operation of the lever 6, which lever 6 is mounted on shaft 7. Affixed to the shaft 7 is an arm 8 which arm 8 is bifurcated to receive the outer end of piston rod 9. The piston rod 9 is adapted to operate a plunger type air pump within the cylinder 12. The air pump is of the type employing inlet valves 13 and outlet valves 14, which outlet valves discharge air pressure into a reservoir 19. The volume of air which the pump 12 delivers depends upon the speed of the bifurcated arm 8 and the linear travel of the piston 10. The valve 47 is of the character known as a diaphragm valve and is of the direct acting type, that is, as pressure is applied to the diaphragm in the valve 48 the valve would tend to close, which in turn would reduce the amount of pressure motivating fluid to the valve chamber and the power end of the pump, therefore, the pump would be slowed. This slowing of the pump would slow the auxiliary air compressor unit which comprises arm 8, piston rod 9 and piston 10, which in turn, would reduce the air supply to the reservoir 19.

A bleeder valve is provided and connects with reservoir 19, which bleeder valve is normally open, and if additional air is not pumped into the reservoir 19, the pressure will drop. A nut 37 is provided for adjustment on threaded rod 36 to give a maximum opening of the valve 28. This valve 28 is regulated to bleed off air so as to give the maximum desired operating speed to the pump. With this valve open, if pressure is built up, it will be gradually bled out through valve 28 so as to normalize said pressure, when this pressure is reduced sufficiently, the valve 47 opens and causes the pump 1 to operate. An arm 31 is positioned above valve 28 and is adapted to be closed thereby upon downward movement of the link 41, one end of which is connected to arm 31 by pin 40 and the other end of which is connected to Bourdon tube 42. The Bourdon tube 42 being sensitive to pressure, expands, and causes the closing of the valve due to the downward movement of the parts as described.

The Bourdon tube is connected, through pipe

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44, to the fluid head of pump 1, which makes the Bourdon tube 42 responsive to the discharge pressure of the pump.

As long as the pump is running at normal speeds, the spring 38 will hold arm 31 in raised position. This will permit the air pressure within reservoir 19 to lift valve 28 to permit the escape of air therefrom; this will cause a lowering of pressure in the reservoir, the system and the upper surface of the diaphragm which will permit the opening of valve 47 to cause motivating fluid to be directed to the power end of the pump 1. If the pump gains in speed, the pressure of the fluid discharge of the pump will normally increase and in so doing the pressure will be transmitted through pipe 44 to Bourdon tube 42 to draw link 41 downward. The arm 31, which is connected to the link 41, is also drawn downward into contact with valve 28 to close said valve and prevent the escape of too much air from reservoir 19. With the escape of air from reservoir 19 reduced or shut off, the pressure on valve 47 will be built up, which will tend to close the valve 47 and thus reduce the speed of the pump.

The adjustment of the amount of pressure required to pull the arm 31 downward is taken care of by nut 39, on bolt 36. The nut 39 may be screwed up or unscrewed to increase or decrease the tension on spring 38, which spring is in contact with the lower end of the arm. When the tension on the spring 38 is increased the tendency of the arm to move upward is increased, thus the amount of pressure required to move it down is increased. Conversely, with less tension on spring 38, less pressure will be required to move arm 31 downward to close valve 28. Thus by the adjustment of the nut 39, a maximum speed of the pump may be maintained regardless of the pressure output side of the pump, and by the adjustment of the nuts 37 and 39 the pump may be set to generate a maximum discharge and a maximum operating speed, independently of each other. Therefore, if the pump should run out of fluid to pump, it will operate at the set speed without tearing itself to pieces, as would have been the case heretofore because the speed of the pump would have increased. Furthermore, if the pump is set at a given operating pressure, it will operate at any speed up to the maximum speed while still maintaining the given pressure.

It is to be pointed out that the device is auxiliary to the pump and is arranged to create its own air supply, and therefore may be attached to any pump that has a motivating fluid line.

Having thus described the invention, I claim:

1. In a fluid pressure regulator, the combination with a fluid supply apparatus having a fluid actuated fluid supply valve for controlling the supply of motivating fluid in a fluid inlet line, of a fluid pressure generating apparatus having a conduit interconnecting said fluid pressure generating apparatus and said motivating fluid supply valve for actuating said fluid supply valve, means for maintaining a maximum gauged opening of a valve for regulating the pressure on said fluid pressure generating apparatus so as to govern the maximum operating speed of said fluid supply apparatus, pressure means operated by the discharge pressure of said fluid supply apparatus for regulating the minimum speed thereof.

2. In a fluid pressure regulator, the combination with a fluid supply apparatus having a fluid actuated supply valve for controlling the supply

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of motivating fluid into said fluid supply apparatus, of a fluid pressure generating apparatus having a conduit interconnecting said fluid pressure generating apparatus and said motivating fluid supply valve for actuating said fluid supply valve, means comprising a threaded member for regulating the maximum opening of a valve for regulating the outlet of fluid from the fluid pressure generating system, a further control apparatus for said valve comprising a pressure responsive element actuated by the pressure of the discharge of said fluid supply apparatus so as to further control the speed of the fluid supply apparatus so as to maintain a substantially uniform pressure on the discharge side of said fluid supply apparatus.

3. In a controller for a fluid pressure operated pump, an air pump adapted to be operated in timed relation to the movement of a member of said fluid pressure operated pump, an air chamber connected with said air pump in which a pressure is adapted to be maintained, a passage interconnecting said air chamber with atmospheric pressure, an orifice within said passage, means for limiting the maximum opening of said orifice, a valve to close said orifice by a pressure exerted upon a pressure responsive element interconnected with the discharge side of the fluid pressure operated pump, a resilient member adapted to hold valve closing means in an open position, means for adjusting tension on said resilient member so as to vary the effective maximum discharge of said pressure operated pump.

4. In a controller for a fluid pressure operated pump, an air pump adapted to be operated in timed relation to the movement of a member of said fluid pressure operated pump, an air chamber connected with said air pump in which a pressure is adapted to be maintained, a passage interconnecting said air chamber with atmospheric pressure, an orifice within said passage, means for limiting the maximum opening of said orifice, a valve to close said orifice by a pressure exerted upon a pressure responsive element interconnected with the discharge side of the fluid pressure operated pump, a resilient member adapted to hold valve closing means in an open position, means for adjusting tension on said resilient member so as to vary the effective maximum discharge of said pressure operated pump, means for adjusting the pressure responsive valve actuating element so as to cause said element to engage valve closing means at different relative positions.

5. In a pressure regulating system for stroke pumps and the like, an air pump actuated in timed relation by the reciprocation of the stroke pump, said air pump being adapted to maintain a pressure in a reservoir in accordance with the volumetric output of said air pump operating at a timed speed and with a gauged outlet therefor, means for controlling the air outlet to atmosphere from the reservoir including an orifice in communication with said reservoir, a valve positioned within said orifice which orifice is adapted to be closed thereby when the valve is in one position and to permit the escape of air from said reservoir when said valve is in another position, adjustable means for regulating the maximum opening of said valve, resilient means adapted to normally hold a valve operating means in one position, means for adjusting said resilient means, valve closing means adapted to move said valve from open position to closed position in proportion to the pressure generated by said discharge

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side of said stroke pump and transmitted to a pressure responsive element connected to the discharge side of said stroke pump.

6. In an apparatus for regulating the stroke speed and the pressure output of a stroke pump, an air pump operated by the stroke of said stroke pump and in timed relation thereto, said air pump being adapted to pump air into a reservoir upon operation of said stroke pump, said air pump being of such capacity as to pump a constant supply of air into said reservoir, valve means having a maximum set opening for bleeding a maximum predetermined amount of air from said reservoir to atmosphere, a fluid line connecting said reservoir and the diaphragm chamber of a valve, which valve is positioned within a motivating fluid supply line leading to said pump, said diaphragm valve to be operated in accordance with the back pressure on the diaphragm thereof to control the supply of motivating fluid to said stroke pump, an arm adapted to close said bleeder valve in response to a pressure responsive element connected to the discharge side of said pump, a spring adapted to hold said arm in position to permit said valve to open under the air pressure escaping from said reservoir, means for adjusting said spring, a linkage arrangement adapted to move the arm in one direction but being free to move in the opposite direction without engagement with said arm.

7. A pump control comprising a motor for driving the pump, a pressure generating system operated by said pump, means for controlling the speed of said motor by pressure from said pressure generating system, and means responsive to pressure developed by said pump for controlling said speed controlling means to maintain the pressure developed by said pump below a predetermined maximum.

8. A pump control comprising a motor for driving said pump, a pressure generating system operated by said pump, means for controlling the speed of said motor by pressure from said pressure generating system, and means respon-

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sive to the speed of said pump for controlling means to maintain the speed of the pump below a predetermined maximum.

9. A pump control comprising a pump, a fluid motor for driving said pump, a valve for controlling motive fluid to said motor, a pressure generating system driven by said pump, means for operating said valve by pressure from said pressure generating system, and means responsive to pressure developed by said pump for controlling said last named means to maintain the pressure developed by said pump below a predetermined maximum.

10. A pump control comprising a pump, a fluid motor for driving said pump, a valve for controlling motive fluid to said motor, a pressure generating system driven by said pump, means for operating said valve by pressure from said pressure generating system and means responsive to the speed of said pump for controlling said last named means to maintain the speed of said pump below a predetermined maximum when the pump is operating without load.

11. A pump control comprising a pump, a fluid motor for driving said pump, a valve for controlling motive fluid to said motor, a pressure generating system driven by said pump, means for operating said valve by pressure from said pressure generating system, and means responsive to pressure developed by said pump for controlling said last named means to maintain the pressure and speed of said pump below a predetermined maximum.

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