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2,409,561

AUTOMATIC CONTROL VALVE FOR JET PUMPS

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5 Claims. (Cl. 103—5)

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My invention relates to an automatic valve unit for providing more reliable and more efficient operation of the present type of jet operated deep well pumps. More exactly it relates to means for overcoming the effects of varying water level, in the well, on the pump operation, it being well known that when the water level becomes very low, the boosting effect of the jet may not be sufficient to keep water coming to the pump, so that the pump loses operating pressure, and ceases to operate.

Also, when a manually adjustable pressure valve is used, the pump may fail to build up the required operating pressure when starting after an idle period. My invention relates to providing an automatic repriming valve to provide sure build up and maintenance of the proper operating pressure, under the conditions just mentioned. More exactly this invention provides for combining, in one unit, a repriming valve, such as is described in my previous Patent No. 2,183,351, issued December 12, 1939, with an automatic jet passage control valve of special design, operating both of these automatic valves from the same diaphragm element. The jet passage control valve has the double purpose of entirely closing the jet passage while the pump is idle, so that water may not escape back from the tank to the well, and it also operates to automatically vary the volume of the jet flow while the pump is operating, to reduce this flow at high water levels, so that a greater proportion of the water passes to the tank. Other minor advantages also result from the use of this unit as mentioned herein.

Referring to the accompanying drawing,

Figure 1 shows a median longitudinal section of the automatic valves and the operating diaphragm.

Figure 2 shows a sectional view of the jet passage control valve in the open position.

Referring to Figure 1, a diaphragm chamber 1 has the diaphragm 2, which carries the control rod 3. One side of the diaphragm chamber has the air port 4, which puts this side of the diaphragm into communication with atmospheric pressure. To this side of the diaphragm chamber is fixed a valve chamber 5, with the control rod 3 extending through the wall of the diaphragm chamber, into this valve chamber, rod 3 passing through the packing gland 6.

Valve chamber 5 has the inlet port 7, which is connected by pipe 8 to the discharge chamber 9 of pump 10, the pump being operated by motor 11. Valve chamber 5 also has the discharge port

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12, which communicates with passage 13 and pipe 14, which connects to the jet of jet unit 15.

The discharge port 12 is controlled by the valve 16, which is fixed to control rod 3. Valve 16, preferably has fixed to it the tubular sleeve 17, which fits loosely into the tubular extension 18 of the casing of valve chamber 5. This sleeve 17 is cut away at portions just beneath valve 16 to provide ports 19, 20.

The tubular extension 18 is also cut away at the portion near the end of sleeve 17 to form ports 21, 22, so that when valve 16 is lifted water may flow under it, through ports 19, 20, into the sleeve 17, and from there, by ports 21, 22, to passage 13.

These valve parts are so proportioned that ports 19, 20, at all positions of the partly closed valve offer a more free passage than do the ports 21, 22, as shown in Figure 2. Therefore any drop in pressure at this valve occurs chiefly at the ports 21, 22, so that the pressures above and below valve 16 remain very constant, not affecting the movement of this control valve, the control being from the diaphragm. But when valve 16 is entirely closed it provides a positive check to any flow past this valve, from the tank to the well piping, while the pump is idle.

The side of the diaphragm chamber which is opposite to the air port 4 has the push spring 23, which tends to hold the diaphragm at the position as shown in Figure 1. This side of the diaphragm casing also has the intake port 24, which connects with passage 25, and then, by pipe 26, with storage tank 27.

A valve member 28 is disposed to control port 24, being normally held closed by push spring 29. Valve 28 is so placed that control rod 3 engages it, to lift it from its seat, at a predetermined point in the movement of rod 3, as it opens valve 16.

A discharge port 30 opens from that portion of the diaphragm chamber into which port 24 opens. Port 30 is connected by pipe 31 to the intake chamber 32 of pump 10. A pipe 33 extends from chamber 32 to the jet unit 15 in the well 36 and preferably has check valve 33'. A pipe 35 extends from the jet unit to connect with the water of the well and preferably has foot valve 35'. A pipe 34 connects the discharge chamber 9 to the tank 27, through the pressure valve 27'.

Since diaphragm 2 is subject to atmospheric pressure on one side, while the opposite side is connected to the pump intake passage, the position of the diaphragm is determined by the degree of vacuum, or pressure that exists in the

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pump intake. Therefore, when the pump is in operation, if the water level of the well falls to a lower level the degree of vacuum in the intake becomes greater, so that the diaphragm moves to give a more free flow to the jet, through valve 16. If the water level continues to fall, after valve 16 is well open, then at a predetermined point in the movement of the control rod, it engages the priming valve 28 to admit water to flow from the tank to the pump to keep up its operating pressure. The pump then continues to receive its normal supply of water, although as the water level continues to fall, the pump will take increasingly from the tank and less from the well. Eventually the water level will fall to where the well inflow just balances the take by the pump, at which point the water level continues stationary, and in no case will the pump cease to operate because of lack of sufficient pressure on the jet, neither will the water level fall to where air might enter the piping.

Again if the water level is high there is little or no vacuum in the pump intake chamber, in which case the valve 16 remains closed, or partly closed with an increased flow to the tank.

As soon as the pump stops, the vacuum in chamber 32 disappears, or becomes a positive pressure, causing valve 16 to close tightly, preventing any flow from the storage tank should foot valve 35' leak. Then if the check valve 33' is used to prevent back flow through pipe 33, all dependence on the foot valve to hold the tank pressure is made unnecessary. For should water escape from the piping past the foot valve, it is quickly replaced from the tank when the pump starts, throwing a vacuum into chamber 32 to open valve 28, allowing water to flow from the tank to the pump intake.

I claim as new:

1. In a jet type deep well pumping plant, the combination of a suction type force pump, means for operating said pump, a storage tank, a discharge passage from said pump to said tank, a pressure control valve in said discharge passage, an intake pipe extended downwardly from said pump, a jet booster unit connected to said pipe, an automatic control unit, said unit comprising a diaphragm chamber, a diaphragm across said chamber, one side of said diaphragm being open to atmospheric pressure, a push spring disposed against said diaphragm in the closed side of said diaphragm chamber, two ports from this side of said diaphragm chamber, one of said ports being connected by a pipe to said intake pipe at a point near the pump, the remaining port being connected by a pipe to said storage tank, a valve disposed to control this port, said valve being operably connected with said diaphragm; a valve chamber fixed to that side of diaphragm chamber that is open to atmospheric pressure, an intake port into said valve chamber, said port being connected by a pipe to said discharge passage near the pump, a discharge port from said valve chamber, said port being connected by a pipe to the jet of said jet unit, a valve controlling said discharge port, said valve being operably connected to said diaphragm.

2. In a jet type deep well pumping plant, a control unit comprising a diaphragm chamber, a diaphragm across said chamber, one side of said chamber being open to atmospheric pressure, a push spring disposed in the closed side of said di-

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aphragm chamber against said diaphragm, an intake port and a discharge port in the wall of the closed side of said diaphragm chamber, a valve disposed to control the intake port, said valve being operably connected with said diaphragm, a valve chamber fixed to the open side of said diaphragm chamber, an intake port and a discharge port in the wall of said valve chamber, said discharge port being formed to take a poppet type valve, said port being also formed to take a tubular sleeve type sliding valve, a control valve assembly for said port, said control valve assembly comprising a poppet type valve to which is fixed a suitably formed sleeve valve, said control valve assembly being operably connected to said diaphragm.

3. In a jet type deep well pumping plant, an automatic control unit, comprising a diaphragm chamber and diaphragm, one side of said chamber being open to atmospheric pressure, a push spring disposed to move said diaphragm toward the open side of said diaphragm chamber, an intake port and a discharge port in the wall of the closed side of said diaphragm chamber, a valve disposed to control said intake port, said valve being operably connected with said diaphragm, a valve chamber fixed to the open side of said diaphragm chamber, an intake port and a discharge port in the wall of said valve chamber, a valve disposed to control said discharge port, said valve being operably connected to said diaphragm.

4. The combination of a suction type pump, a booster jet unit, an intake pipe extended from the intake of said pump to the discharge port of said jet unit, a main discharge port from said pump, also a second discharge port with a discharge pipe extended from the discharge chamber of said pump to the jet orifice of said jet unit, an encased chamber, a movable partition across said chamber, an opening through the chamber casing on one side of said movable partition, the opposite side of said chamber being connected by a closed passage to the intake pipe of said pump, a push spring disposed against said movable partition on this side of said chamber, a valve in said second discharge pipe, said valve being connected to said movable partition.

5. In a jet pump, the combination of a suction type pump, a storage reservoir, a jet booster unit, a discharge passage from said pump to said reservoir, an intake passage extended downwardly from said pump to said jet unit; an automatic control unit comprising a closed control chamber, a movable partition across said chamber, a passage from one side of said chamber to the intake passage to said pump, a spring disposed against said movable partition in this intake side of said control chamber, also a passage from this portion of said chamber to said storage reservoir, a valve disposed to control said passage, said valve being operably connected with said movable partition, a jet passage control chamber fixed to the opposite or discharge end of said main control chamber, a passage from said jet control chamber to said pump discharge passage, a second passage from said jet control chamber, said second passage extending to said jet booster unit, a valve disposed to control said passage, said valve being operably connected with said movable partition.

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