April 20, 1954 B. SHARE 2,675,762

PUMP DRIVE CONTROL

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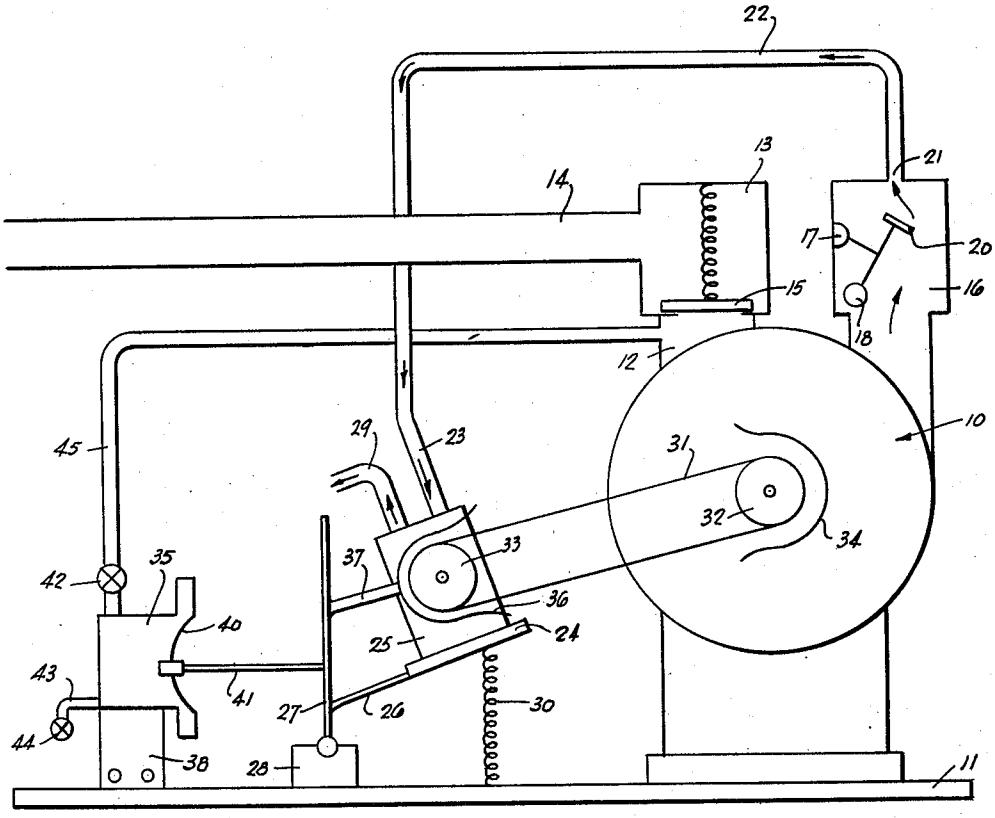


Fig. 1.

INVENTOR.
Barnett Share
BY
Dayton Sturgis & Hall
ATTORNEY

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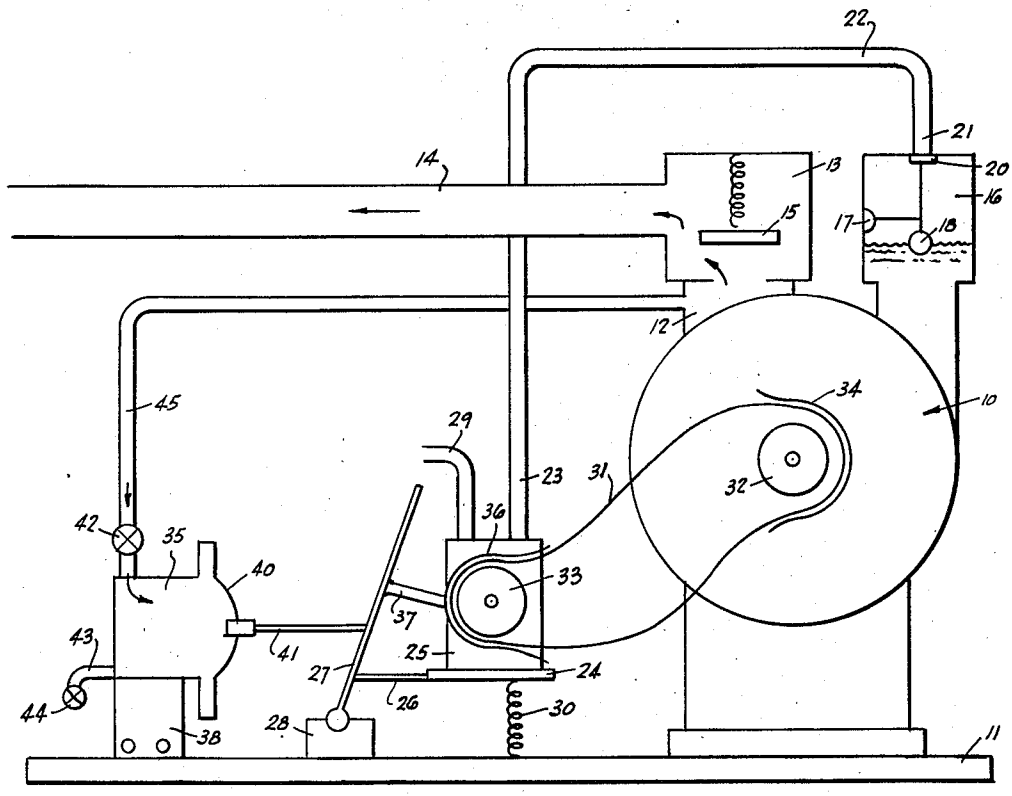


Fig. 2.

INVENTOR.
Barnett Share
BY
Dan J. Moseng
his ATTORNEY

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PUMP DRIVE CONTROL

Barnett Share, Jamaica Estates, N. Y.

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14 Claims. (Cl. 103—113)

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This invention relates to controls for pump drives wherein a priming pump is driven from a main pump and, more particularly, to an automatic control, responsive to liquid pressure at the main pump outlet, to control the driving connection of the priming pump from the main pump.

Centrifugal pumps are frequently used for water extraction purposes, for example, with a series of driven well-points designed to maintain the water level of an area, such as an excavation, below a predetermined level. In initiating the pumping action, it is necessary to prime the centrifugal pump until a predetermined liquid pressure is developed at its outlet.

For this purpose, an auxiliary or priming pump is connected to the centrifugal pump to evacuate air therefrom and thus provide for flow of water through the centrifugal pump. Most conveniently, these priming pumps are driven from the centrifugal pump so that the priming pump is started whenever the centrifugal pump is started.

While the priming pump can be continually operated all during the time the centrifugal pump is operated, this is wasteful of power. Hence, many arrangements have been devised for disconnecting the drive of the priming pump after the centrifugal pump has begun to deliver water from its outlet.

These prior disconnecting arrangements have included both manually operable devices and automatically operable devices. Manually operable devices are dependent upon the human element and thus reliability of disconnection of the priming pump at the proper time can be assured. The automatic devices hitherto proposed have been unduly complicated or expensive, or have not been reliable.

In accordance with the present invention, a simple, inexpensive, and fully automatic priming pump drive control is provided which is effective not only to disconnect the priming pump drive when priming of the centrifugal pump is no longer needed, but also to reconnect the priming pump drive automatically whenever further priming is needed. To assure reliability of operation, the actuation of the drive control is made directly dependent upon the liquid pressure at the centrifugal pump outlet, this pressure being a direct indication of whether or not priming is needed.

More specifically, the priming pump is mounted for movement toward and away from the main pump and driven from the latter by driving means which must be maintained under

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tension to be effective. Means are provided to normally bias the priming pump away from the main pump to maintain the drive means effective. Other means are provided, operating directly in response to liquid pressure at the main pump outlet, to move the priming pump toward the main pump to render the driving means ineffective. Thus, whenever the liquid pressure at the main pump outlet is at or above a pre-set value, the priming pump drive is rendered ineffective, but the drive is immediately and automatically made effective whenever such outlet pressure drops below such pre-set value. Other means, responsive to liquid output from the main pump, interrupt the priming connection to the priming pump when the main pump is delivering liquid.

For an understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing. In the drawing:

Fig. 1 is a somewhat schematic elevation view, partly in section, illustrating the invention drive control in the priming position; and

Fig. 2 is a similar view showing the control with the priming pump drive ineffective.

Referring to Fig. 1, a main centrifugal pump 10 is shown as supported on a suitable base 11. Pump 10, in the usual manner, has an axial inlet (not shown) and an outlet 12 connected to a chamber 13. A spring biased valve 15 closes the connection between outlet 12 and chamber 13 except at such times as the liquid pressure at the outlet equals or exceeds a pre-set value. When the pressure attains this value, valve 15 is lifted so that liquid flows from outlet 12 into chamber 13 and out through discharge pipe 14.

In communication with outlet 12, and thus with the interior of pump 10, is a float chamber 16. A float valve 20 is pivoted at 17 on the side wall of the chamber 20, and carries a float 18. When the liquid in chamber 16 reaches a pre-set level, valve 20 is swung to close an opening 21 to a priming line 22 leading to the inlet 23 of a relatively small priming or auxiliary pump 25 having a discharge pipe 29.

Priming pump 25 is supported on a platform 24 carried by arms 26 projecting laterally from an upright 27. The latter is pivotally mounted in a bearing 28 on platform 11. For a purpose to be described, pump 25 and platform 24 are biased upwardly and counterclockwise by a spring 30 between platforms 11 and 24. To permit movement of pump 25 relative to pump 10, prim-

ing line 22 is made partially or completely flexible.

Pump 25 is driven from pump 10 by a belt 31 trained over a pulley 32, on the drive shaft of pump 10, and a pulley 33 on the drive shaft of pump 25. A guard 34 partially surrounds pulley 32, and a guard 36, carried by an arm 37 on support 27, surrounds pulley 33.

The drive control further includes a pressure chamber 35 mounted on a support 38 on platform 11 and having its wall toward pump 25 constituted by a flexible diaphragm 40. This latter carries a projection 41 continually engaging support 27 on the side of the latter opposite platform 24. A liquid line 45 connects chamber 35 to outlet 12, and is provided with a normally open valve 42. Chamber 35 has an outlet 43 controlled by a normally at least partially closed valve 44.

In the off or starting conditions of pump 10, the components occupy the positions shown in Fig. 1. No pressure is applied to chamber 35 so that diaphragm 40 is collapsed, allowing spring 30 to bias pump 25 counterclockwise to maintain driving tension on belt 31. Valve 15 is closed and valve 20 is open as there is no outlet pressure from pump 10.

When pump 10 is started, pump 25 is driven to draw the air from pump 10 and its connections through priming line 22, discharging this air through pipe 29. As pump 10 commences to deliver liquid, the liquid level in chamber 16 rises so that float valve 20 eventually closes priming line 22.

Meanwhile, fluid pressure builds up in outlet 12, and is communicated to chamber 35 through line 45 and open valve 42. The pressure in chamber 35 builds up as valve 44 is at least partially closed to restrict flow of liquid from chamber 35. Thus, diaphragm 40 is moved to the right to swing pump 25 clockwise to remove the tension from belt 31, thus rendering the priming pump drive ineffective. Guards 34, 36 prevent displacement of belt 31. As the outlet pressure reaches a pre-set value at least equal to that at which the foregoing takes place, valve 15 is lifted and pump 10 discharges through pipe 14. Should the outlet pressure fail at any time, the pressure is reduced in chamber 35 so that diaphragm 40 collapses, allowing spring 30 to swing pump 25 to restore the belt tension whereby pump 25 is again operative to prime pump 10. These actions are controlled by proper relative settings of valves 42 and 44 aforementioned.

In the event that it is desired to control the operative association of the pump 25 in relation to pump 10 to effectuate actions other than those hereinbefore described, valves 42 and 44 may be manually set as follows: by closing inlet valve 42 with diaphragm 40 undistended as in Fig. 1, pump 25 can be maintained continually driven with pump 10; by closing both inlet valve 42 and outlet valve 44 with diaphragm 40 distended as in Fig. 2, pump 25 can be maintained inoperative.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a tension driving means interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said priming pump away from said main pump to maintain driving tension on said driving means; and mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to be displaced by said pre-set pressure to move said priming pump toward said main pump to remove the driving tension from said driving means.

2. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a tension driving means interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said priming pump away from said main pump to maintain driving tension on said driving means; and mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to be displaced by said pre-set pressure to move said priming pump toward said main pump to remove the driving tension from said driving means; and valve means in said priming connection operable responsive to delivery of liquid from said main pump to interrupt said priming connection.

3. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a belt interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said belt; and mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to be displaced by said pre-set pressure to move said support toward said main pump to remove the driving tension from said belt.

4. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a belt interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said support

away from said main pump to maintain driving tension on said belt; mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to be displaced by said pre-set pressure to move said support toward said main pump to remove the driving tension from said belt; and valve means in said priming connection operable responsive to delivery of liquid from said main pump to interrupt said priming connection.

5. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a tension driving means interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said priming pump away from said main pump to maintain driving tension on said driving means; mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to be displaced by said pre-set pressure to move said priming pump toward said main pump to remove the driving tension from said driving means; and a float controlled valve in said priming connection operable responsive to delivery of liquid from said main pump to interrupt said priming connection.

6. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet, a mounting base for said pump, a priming pump having a priming connection to said main pump, a belt interconnecting said pumps for driving said priming pump from said main pump, a support mounting said priming pump on said base for movement relative to said main pump, biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said belt; mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to move said support toward said main pump to be displaced by said pre-set pressure to remove the driving tension from said belt and a float controlled valve in said priming connection operable responsive to delivery of liquid from said main pump to interrupt said priming connection.

7. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump, a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; and mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to move said support toward said main pump to be displaced by said pre-set pressure to remove the driving tension from said driving means.

8. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump, a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; mechanism, including liquid pressure responsive operating means connected to said priming pump and in pressure communication with said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to move said support toward said main pump to be displaced by said pre-set pressure to remove the driving tension from said driving means; and a float controlled valve in said priming connection operable responsive to delivery of liquid from said main pump to interrupt said priming connection.

9. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump, a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; a pressure chamber having one wall constituted by a flexible diaphragm expansible toward said support; a pressure transmitting connection between said liquid outlet and said pressure chamber; a projection carried by said diaphragm and engaging said support whereby, as said diaphragm expands, said support is swung toward said main pump to remove the tension from said driving means; and a restrictable discharge connection for said pressure chamber.

10. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump, a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump, biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; a pressure chamber having one wall constituted by a flexible diaphragm expansible toward said support; a valve pressure transmitting connection between said liquid out-

let and said pressure chamber; a projection carried by said diaphragm and engaging said support whereby, as said diaphragm expands, said support is swung toward said main pump to remove the tension from said driving means; and a valved discharge connection for said pressure chamber.

11. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump; a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps from driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; a pressure chamber having one wall constituted by a flexible diaphragm expansible toward said support; a pressure transmitting connection between said liquid outlet and said pressure chamber; a projection carried by said diaphragm and engaging said support whereby, as said diaphragm expands, said support is swung toward said main pump to remove the tension from said driving means, a pressure transmitting connection between said liquid outlet and said pressure chamber; a normally open valve in said pressure transmitting connection; and a restrictable discharge connection for said pressure chamber.

12. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump, a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; a pressure chamber having one wall constituted by a flexible diaphragm expansible toward said support; a pressure transmitting connection between said liquid outlet and said pressure chamber; a projection carried by said diaphragm and engaging said support whereby, as said diaphragm expands, said support is swung toward said main pump to remove the tension from said driving means; a normally open valve in said pressure transmitting connection; a discharge connection for said pressure chamber; and a normally at least partially closed valve in said discharge connection.

13. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump; a priming pump having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; a support mounting said priming pump on said base for movement relative to said main pump; biasing means engaged with said support and said base and biasing said priming pump away from said main pump to maintain driving tension on said driving means; mechanism, including liquid pressure responsive means connected to said liquid outlet, operable, upon attainment of a pre-set outlet pressure of said main pump, to move said priming pump toward said main pump, to move said priming pump toward said main pump to remove the driving tension from said driving means; a discharge pipe for said main pump; and a normally closed, fluid pressure opened valve between said liquid outlet and said discharge pipe.

14. A pump drive control comprising, in combination, a main pump for displacing liquid, and having an outlet for liquid under pressure and a liquid inlet; a mounting base for said pump; a support pivotally secured on said base for swinging movement toward and away from said main pump; a priming pump carried by said support and having a priming connection to said main pump; a tension driving means interconnecting said pumps for driving said priming pump from said main pump; biasing means engaged with said support and said base and biasing said support away from said main pump to maintain driving tension on said driving means; a pressure chamber having one wall constituted by a flexible diaphragm expansible toward said support; a pressure transmitting connection between said liquid outlet and said pressure chamber; a projection carried by said diaphragm and engaging said support whereby, as said diaphragm expands, said support is swung toward main pump to remove the tension from said driving means; a normally open valve in said pressure transmitting connection; a discharge connection for said pressure chamber; a normally at least partially closed valve in said discharge connection; a discharge pipe for said main pump; and a normally closed, fluid pressure opened valve between said liquid outlet and said discharge pipe; said pressure transmitting connection connecting to said outlet upstream of said fluid pressure opened valve.

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