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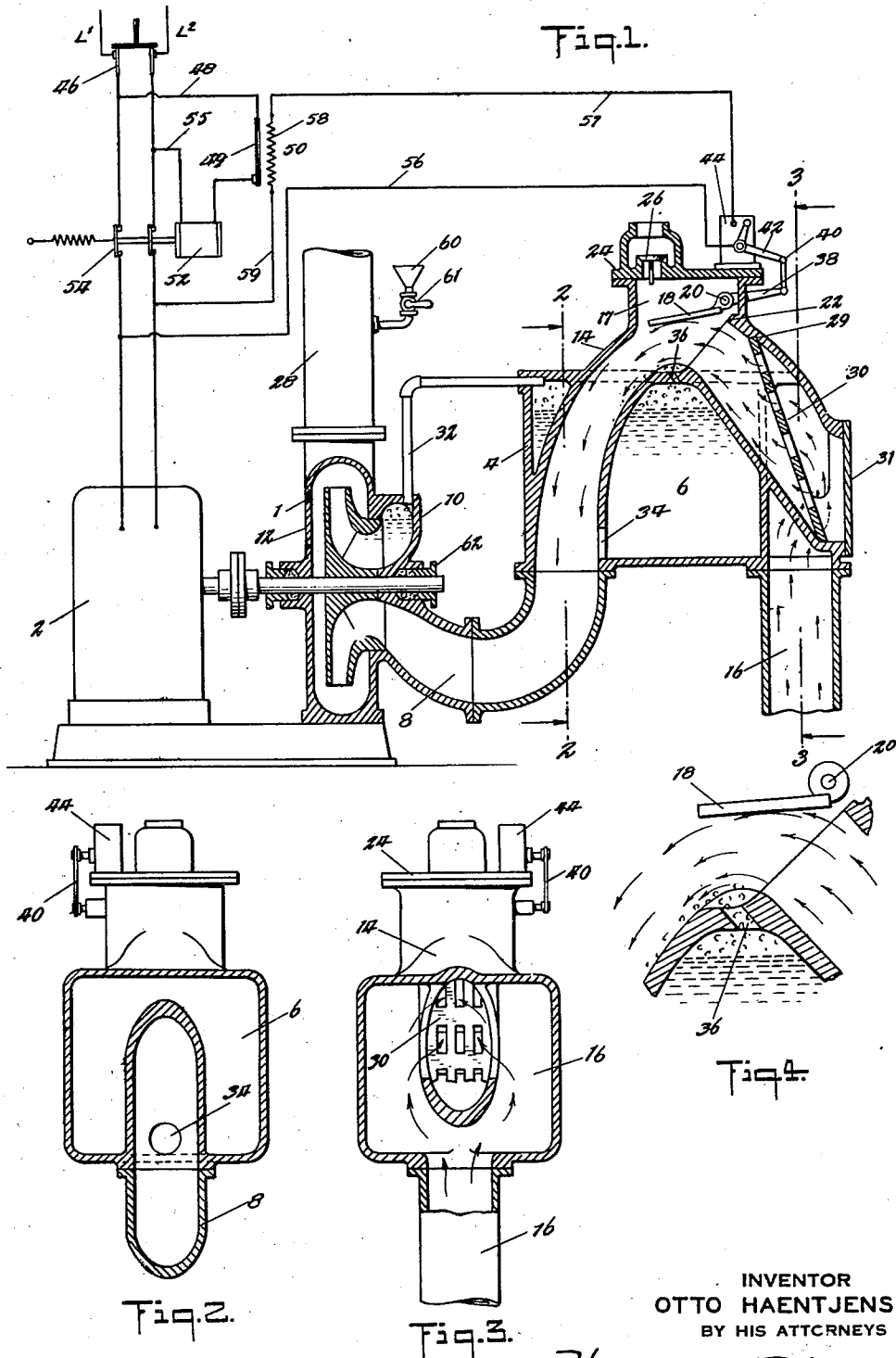
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2,057,570

SELF PRIMING CENTRIFUGAL PUMP

Filed March 18, 1933

2 Sheets-Sheet 1



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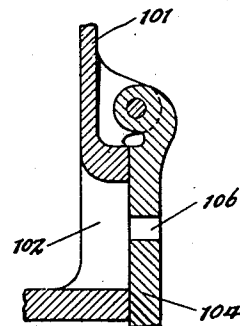
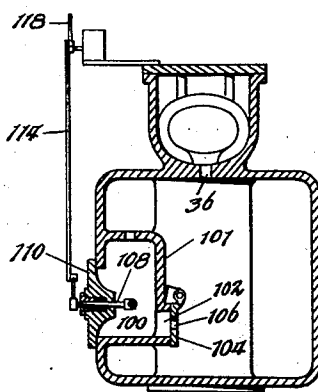
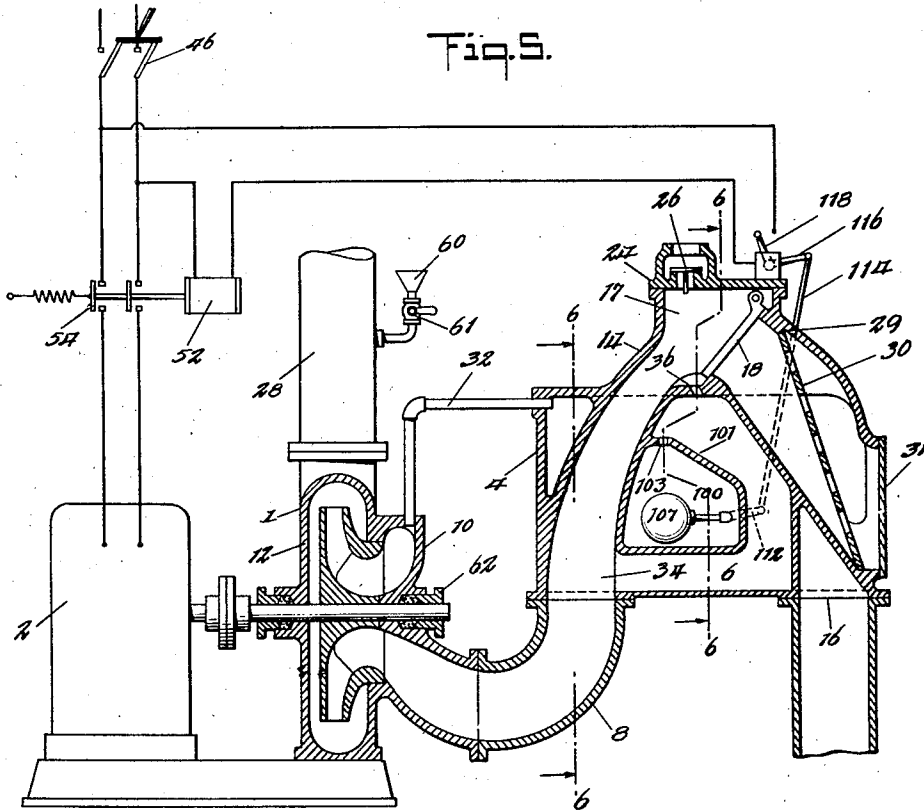
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UNITED STATES PATENT OFFICE

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SELF-PRIMING CENTRIFUGAL PUMP

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11 Claims. (Cl. 103—113)

This invention relates to centrifugal pumps and more particularly to priming means therefor and it is an object of this invention to provide an improved priming means for centrifugal pumps having a priming chamber of small capacity and a pump controlling means so controlled that successive fillings and emptying of the priming chamber follow in such quick succession that the liquid flowing to and from the priming chamber acts as the piston of an air pump and draws the air from the suction line supplying the pump thus making it possible to use a priming chamber of small capacity to prime a centrifugal pump connected to a suction line of large capacity.

It is also an object of this invention to provide the priming chamber in the form of a single compact unit adapted to be fitted into the suction line and having walls therein which form a curved passage constituting part of the suction line. The walls forming the curved passage are arranged for conveniently and accessibly mounting a check valve and a screen in the passage.

It is also an object of this invention to so arrange the curved passage through the priming chamber that the liquid is delivered to the pump from the suction line with little or no loss due to friction and passes through the curved passage at substantially constant velocity and without the separation of air therefrom.

It is also an object of this invention to provide means for drawing air which gathers in the pump casing to the priming chamber and discharging it into the liquid stream passing to the pump from the suction line and it is also an object of this invention to provide a priming means of such construction that priming of the pump will be automatically accomplished upon the starting of the pump motor.

In the drawings—

Fig. 1 is a partial vertical section of centrifugal pump and priming chamber constructed in accordance with this invention, the control circuits being shown diagrammatically;

Fig. 2 is a transverse vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a transverse vertical section taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary sectional view drawn to a larger scale and showing the arrangement for drawing air or gas from the priming chamber.

Fig. 5 is a view similar to Fig. 1 of a modified construction;

Fig. 6 is a transverse vertical section taken on the line 6—6 of Fig. 5; and

Fig. 7 is a fragmentary sectional view drawn to a larger scale and showing the valve controlling a discharge port for the float chamber.

In the drawings a priming means in connection with a centrifugal pump 1 driven by a motor 2 and com-

prises a casing 4 shown as formed by casting in the preferred manner. The casing 4 comprises a chamber 6 which serves as a priming chamber for the pump 1 and is connected through pipe 8 to the suction head 10 of the pump casing 12. Formed integrally with the casing 4 is a substantially inverted U-shaped pipe section 14 which forms a connection through the casing from the suction inlet 16 to the pipe 8. At its upper portion the U-shaped pipe 14 is enlarged to form a chamber 17 in which a check valve 18 is pivotally mounted on a shaft 20 extending through a wall of the pipe section 14. The chamber 17 is closed by a cover plate 24 in which there is an opening closed by valve 26, the opening leading either to atmosphere or to the usual discharge pipe 28 of the pump 1. The U-shaped pipe 14 is also provided with a valve seat 22 engaged by the valve 18 in closed position and with a seat 29 which is engaged by a screen 30, access to the screen being had through a hand-hole closed by a cover plate 31, while access to the valve 18 is had through cover plate 24. A pipe 32 establishes a connection between the suction head 10 of the pump 1 and the upper portion of the chamber 6 while openings 34 and 36 establish connection between the priming chamber 6 and the lower and upper portions of the pipe 14. To the shaft 20 of the check valve 18 is attached an arm 38 which is connected through link 40 to an arm 42 of the switch 44.

To operate the motor 2 current is supplied from a suitable source of power through the power lines L¹, L² and a switch 46 which may be either a hand-operated switch as shown or an automatically operated float controlled switch, if desired. Upon closing the switch 46 a circuit is established from the line L¹ through lead 48 and the closed contacts 49 of a thermal relay 50 to the solenoid 52 of the automatically operating switch or motor controller 54 and through lead 55 to the line L². Upon the closure of the controller 54 a circuit is established from lead L¹ through lead 56 and switch 44, lead 57, resistance 58 of the thermal relay 50 and lead 59 to the line L². The relay 50 is shown as of a type in which passage of current for a predetermined time through the resistance 58 will cause the contacts 49 to be opened, interrupting the circuit to the solenoid 52 of the motor controller 54 while the motor controller 54 is of a type in which the circuit through the controller is completed so long as the solenoid 52 is energized and is interrupted when the current through solenoid 52 is interrupted. As both the thermal relay 50 and the motor controller 54 are of well known types they are not illustrated and described in detail and the particular construction thereof forms no part of this invention.

Upon an initial priming of the device water or other liquid is supplied through the funnel 60

and valve 61 until the discharge pipe 28, pump casing 12, pipes 8 and 14 and chamber 6 are filled to the check valve 18, the check valve being closed at this time and preventing flow of the water or other liquid to the suction inlet 16. The air in the pipes 8 and 14 and priming chamber 6 is driven out through the valve 26 as the water fills the same. When the pipes and priming chamber are filled the valve 61 is closed. Thereafter upon the closing of the switch 46 the solenoid 52 is energized, closing the switch 54 to start the motor 2 and operate the pump 1 to draw the water from the priming chamber 6 and pipe 8 and discharge the same to the discharge pipe 28. During the discharge of the water from the pump 6 and pipe 8 air is drawn from the suction inlet 16, which air passes the valve 18 but does not move the valve sufficiently to open switch 44 and interrupt the circuit through the thermal relay 50. Operation of the pump will be continued long enough to complete the discharge of the liquid from the chamber 6 and the pipe 8 while the current in the thermal relay 50 is heating the resistance 58 to the temperature at which the contacts 49 open, de-energizing the solenoid 52 and operating the motor controller 54 to open the circuit of the motor 2. Upon the opening of the motor circuit and the stopping of the pump the liquid discharged to discharge pipe 28 flows back through the pump 1 and pipe 8 to the priming chamber 6, forcing the air in pump 1, pipes 8 and 14 and chamber 6 out through the valve 26. While the water is flowing back through the pump to the priming chamber the thermal relay 50 is cooling and upon the return of the liquid to the priming chamber 6 the relay 50 is cooled sufficiently to cause the contacts 49 to close, whereupon the solenoid 52 is again energized and the motor controller 54 operated to close the circuit of motor 2 to start the pump. The operation of the pump again draws liquid from the chamber 6 and pipe 8 and discharges it to the discharge outlet 28 until the thermal relay 50 is again operated to cause the motor controller 54 to stop the pump.

The stopping and the starting of the pump is thus repeated at short intervals causing the liquid in the priming chamber 6 and pipe 14 to be drawn therefrom and be fed back thereto so that the liquid serves as a piston, drawing the air from the suction inlet 16 past the valve 18 and forcing it out through the valve 26. This operation continues until liquid is drawn from the suction inlet 16 and supplied to the pump 1. Passage of the liquid from the suction inlet 16 past the valve 18 operates the valve 18 to a position such as shown in Fig. 1, in which the switch 44 in the circuit of the thermal relay 50 is open and the operation of the motor controller 54 to stop the pump is prevented until the valve 18 again closes upon the stopping of the flow of liquid from the suction inlet 16, whereupon the pump will be stopped by the operation of the motor controller 54 and liquid will be again supplied from the discharge outlet 28 to the priming chamber 6. Where the switch 46 is a float operated switch operating in accordance with the level of the liquid in a sump, operation of the switch 46 to stop the motor upon the emptying of the sump will cause the priming chamber 6 to be filled in the same manner as when the motor is stopped by operation of the motor controller 54.

During the operation of the pump more or less air gathers in the upper portion of the suction head 10, either by passing through the stuffing

box 62 or by separation from the liquid in the pump. Inasmuch as the top of the priming chamber 6 is positioned above the top of the pump casing 12, the suction at the top of the priming chamber 6 is greater than in the pump casing 12 so that the air which gathers in the pump casing 12, as at the top of the suction head 10, is drawn through pipe 32 to the upper portion of the priming chamber 6. It will be noted that the port 36 is arranged at the top of the pipe 14 and that the shape of the plate 14 at this point is such that the liquid flowing through the pipe 14 acts to draw the air from the upper portion of the priming chamber 6 into the pipe 14 so that the air which gathers in the upper portion of the pump casing 12 is drawn off to priming chamber 6 and through the port 36 into the pipe 14 to be carried by the liquid flowing in the pipe 14 to the discharge outlet 28.

In the modification shown in Figs. 5, 6 and 7 there is provided in priming chamber 6 a float chamber 100, the walls 101 of which are formed integral with the casing 4 and pipe 14. The float chamber 100 is connected to the priming chamber 6 through a large portion 102 in the lower portion of the float chamber and through a restricted port 103 in the upper portion of the float chamber. Port 102 is controlled by a valve 104 arranged to open to permit a free flow of liquid from the float chamber 100 to the priming chamber 6 and to close and restrict the flow from the priming chamber 6 to the float chamber 100, the flow to the float chamber being through a restricted port 106 in the valve 104. The float 107 in the float chamber 100 is pivotally mounted on a shaft 108 which projects through a removable wall 110 of the float chamber and is provided at its outer end with an arm 112 to which is connected one end of a link 114, the other end of which is connected to an arm 116 of a switch 118. As in the previous modification, current to drive the motor 2 to operate the pump 12 is supplied through a switch 46 and a motor controller 54. In this arrangement, however, the circuit of the solenoid 52 of the motor controller 54 is controlled by the switch 118 operated by the float 107. The operation of this modification is the same as that of the previous modification, the capacity of the priming chamber 6 and the float chamber 100 being such that they are emptied and filled quite rapidly so that the pump is stopped and started at short intervals to fill and empty the priming chamber and float chamber, causing the liquid drawn from the float chamber and priming chamber to serve as a piston, drawing the air from the suction inlet 16 and forcing it out through the valve 26. The valve 104 opens freely to permit the discharge of the fluid from the float chamber 100 so that the float chamber 100 is emptied and the float 107 permitted to fall and operate the switch 118 as the priming chamber is emptied through the port 34 and pipe 8 but the closing of the valve 104 causes the float chamber 100 to be filled through the restricted port 106 in the valve, thus delaying the operation of the float 107 and permitting time for the air to be forced out of the priming chamber 6 and pipe 14 through the valve 26 before the float 107 operates to close the switch 118 and again start the pump. It is thus seen that the operation of the two modifications is the same in that both provide for the starting and stopping of the pump at short intervals in order to empty and fill the priming chamber and thus draw air from the suction inlet 16 and force it out through the valve

26 until the liquid is drawn from the suction inlet 16. It will also be noted that the pipe 14 furnishes a curved passage through which the flow from the suction inlet 16 to the pump 1 is uniform when the pump is drawing liquid from the suction inlet 16, thus reducing the tendency for air to separate from the liquid in those cases in which there is considerable air in the liquid drawn from the suction inlet 16. It will also be noted that provision is made for the drawing off of such air as accumulates in the pump casing and priming chamber so there is no danger of the device becoming air bound and causing the priming of the pump to be lost.

15 I claim—

1. The combination with a centrifugal pump of a priming chamber, a suction line, a discharge line, means controlling said pump to discharge fluid from said priming chamber to said discharge line and supply fluid to said priming chamber from said discharge line in timed cycles to draw fluid from said suction line and means interrupting the cyclic changes upon the flow of liquid from the suction line.

2. The combination with a centrifugal pump of a motor to operate said pump, a priming chamber, a suction line, a discharge line, automatically operating means comprising a circuit controlling switch controlling the action of said motor to intermittently operate said pump to discharge fluid from said priming chamber to the discharge line and to supply fluid to said priming chamber from said discharge line, and means preventing back flow to said suction line, said means controlling said switch to end the intermittent action of said pump upon the flow of liquid from said suction line.

3. The combination with a centrifugal pump of a motor to operate said pump, a priming chamber, a suction line, a discharge line, electrically operating means comprising a circuit controlling switch controlling the action of said motor to intermittently operate said pump to discharge fluid from said priming chamber to said discharge line and supply fluid to said priming chamber from said discharge line, a valve preventing back flow to said suction line and means connecting said switch and valve, said valve being operated to open said circuit and end the intermittent operation of said pump upon the flow of liquid from said suction line.

4. The combination with a centrifugal pump of a motor to operate said pump, a priming chamber, a suction line, a discharge line, a float chamber in said priming chamber, a float in said float chamber, a switch operated by said float and controlling said motor to operate said pump to discharge liquid from said priming chamber to the discharge line and to supply liquid to said priming chamber from said discharge line to draw liquid from said suction line and means restricting the flow to said float chamber from said priming chamber to time the operation of said pump in emptying and filling said priming chamber.

5. The combination with a centrifugal pump of a motor to operate said pump, a priming chamber, a suction line, a discharge line, a float chamber in said priming chamber, a float in said float chamber, a switch operated by said float and controlling said motor to operate said pump to discharge liquid from said priming chamber to said discharge line and to supply liquid to said priming chamber from said discharge line to draw liquid

from said suction line, and a valve opening to permit flow from said float chamber to said priming chamber and closing to restrict flow to said float chamber from said priming chamber to time the operation of said pump in emptying and filling said priming chamber.

6. The combination with a centrifugal pump having a suction head of a suction line, a connection between said suction line and pump comprising a section of inverted U-shape providing a continuous passage, a priming chamber for said pump connected at its lower portion to said passage and a connection for venting air directly from said pump suction head to the upper portion of said chamber, said priming chamber having a port for venting air from the upper portion of said chamber to said passage.

7. The combination with a centrifugal pump, of a suction line leading thereto, a priming chamber therefor, said priming chamber comprising a substantially rectangular casing having partition walls therein forming an inverted U-shaped portion of the suction line and partition walls forming a float chamber within said priming chamber.

8. The combination with a centrifugal pump, of a suction line leading thereto, a priming chamber therefor, said priming chamber comprising a substantially rectangular casing having partition walls therein forming an inverted U-shaped portion of the suction line and partition walls forming a float chamber within said priming chamber, said partition walls having openings therein establishing connection between said passage and said priming chamber and between said priming and float chambers.

9. The combination with a centrifugal pump, of a suction line leading thereto, a priming chamber therefor, said priming chamber comprising a substantially rectangular casing having partition walls therein forming an inverted U-shaped portion of the suction line and partition walls forming a float chamber within said priming chamber, said partition walls having openings therein establishing connection between said passage and said priming chamber and between said priming and float chambers and a valve restricting flow from said priming chamber to said float chamber and operating to permit liquid to flow freely from said float chamber to said priming chamber.

10. The combination with a centrifugal pump having a suction head of a priming chamber, a suction line, a connection providing a continuous passage between said suction line and pump comprising a section of inverted U-shape, said passage having a connection to the lower portion of said priming chamber, means for venting air from said passage and means connecting said priming chamber and pump suction head, said curved portion having a port opening into the priming chamber for withdrawing air from said priming chamber and pump suction head when the pump is drawing liquid from the suction line.

11. The combination with a centrifugal pump, a suction line leading thereto, a priming chamber therefor, partition walls forming a float chamber within said priming chamber, said walls having openings connecting said float and priming chambers and means connecting said pump and priming chamber for equalizing pressures therebetween and allowing said float chamber to drain to said pump upon leakage of air to said pump.

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