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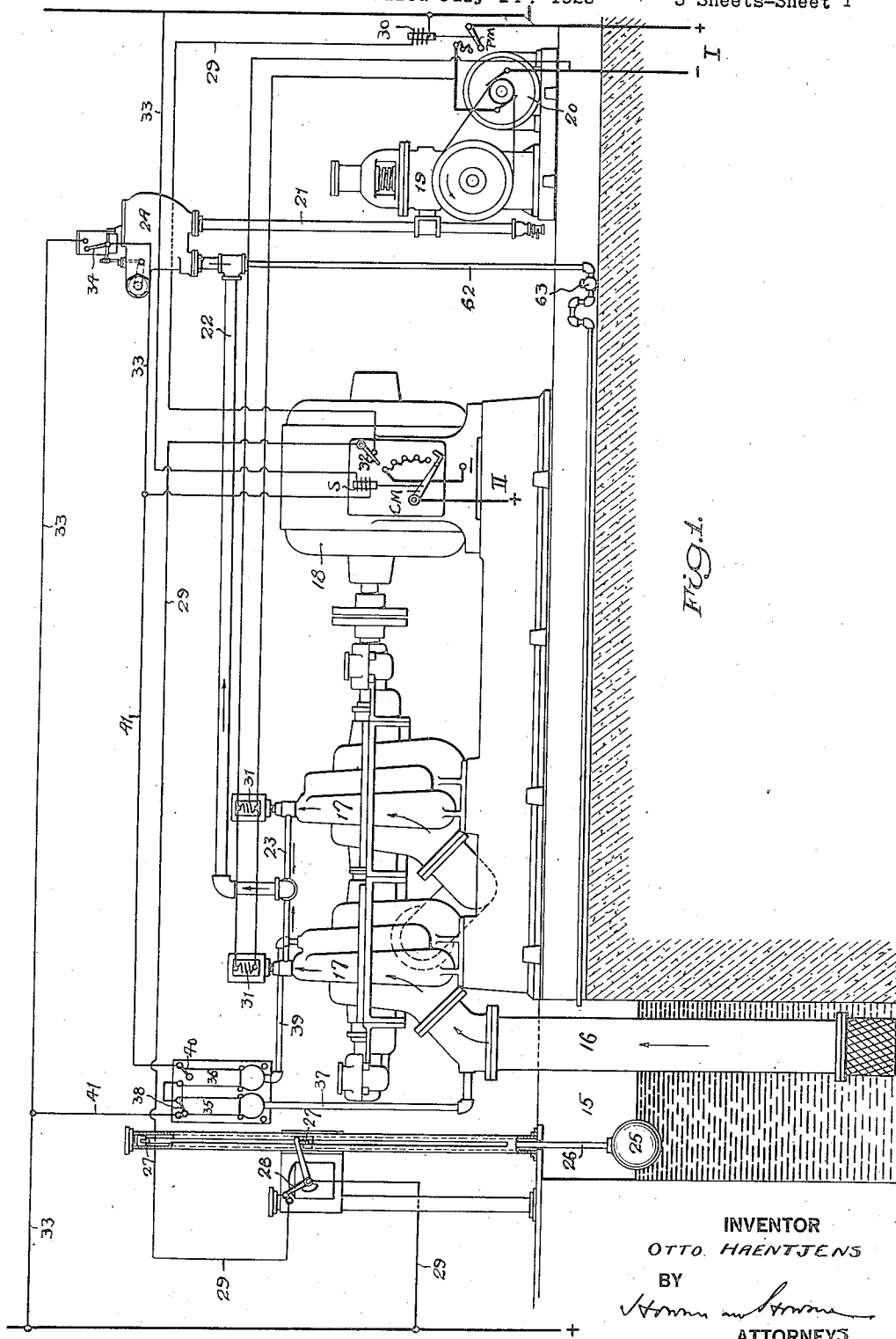
O. HAENTJENS

1,513,705

PUMP SYSTEM

Filed July 14, 1923

3 Sheets-Sheet 1



INVENTOR

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BY

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Oct. 28, 1924.

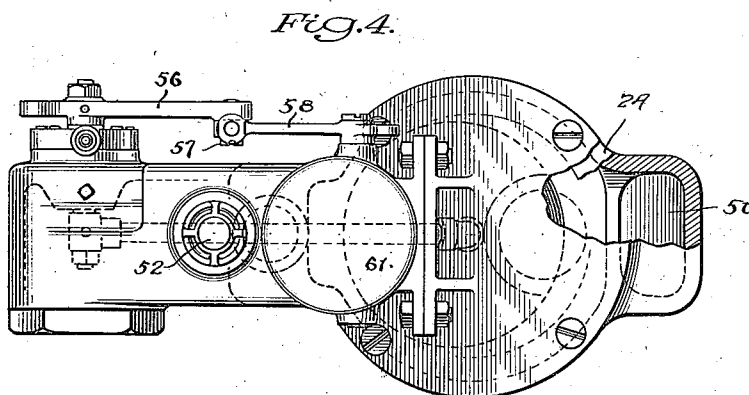
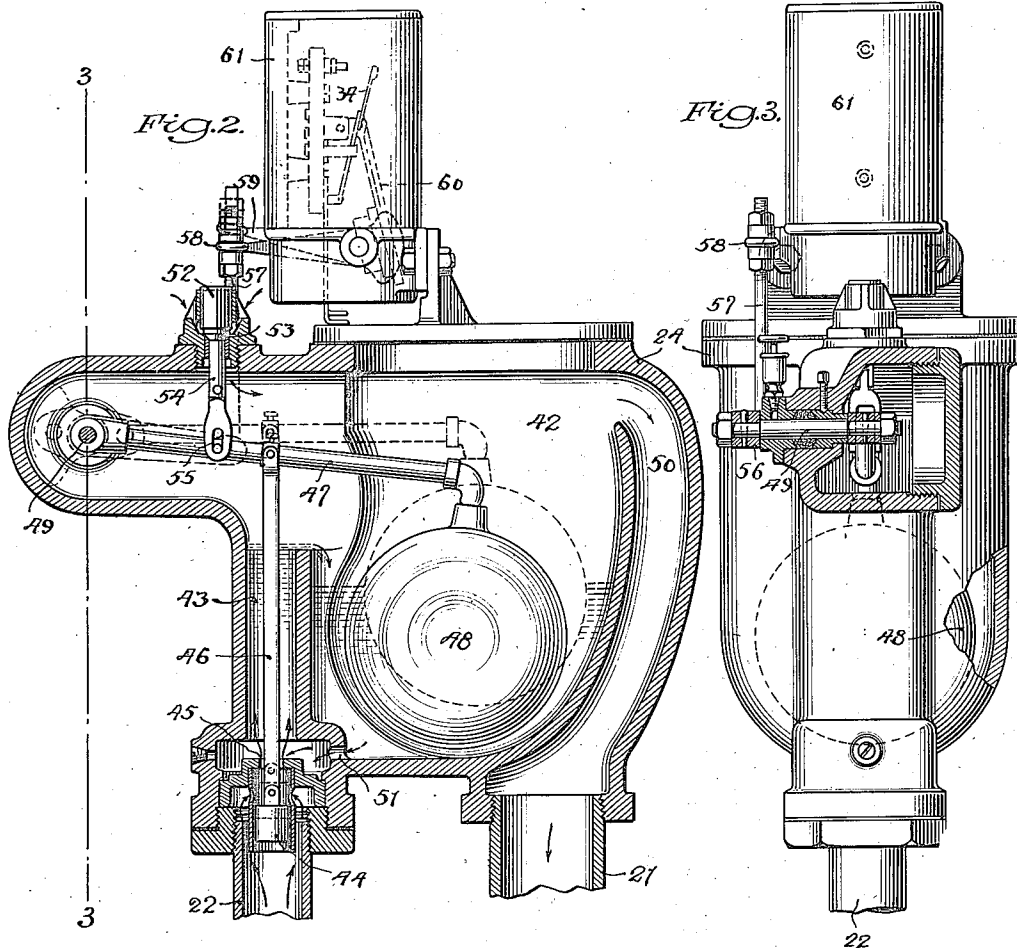
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3 Sheets-Sheet 2



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PUMP SYSTEM

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Fig. 5.

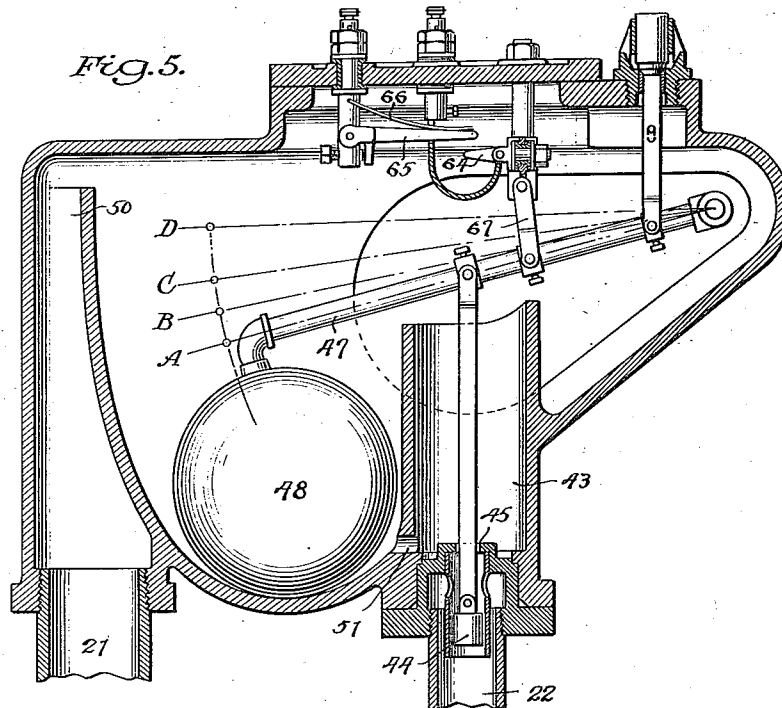
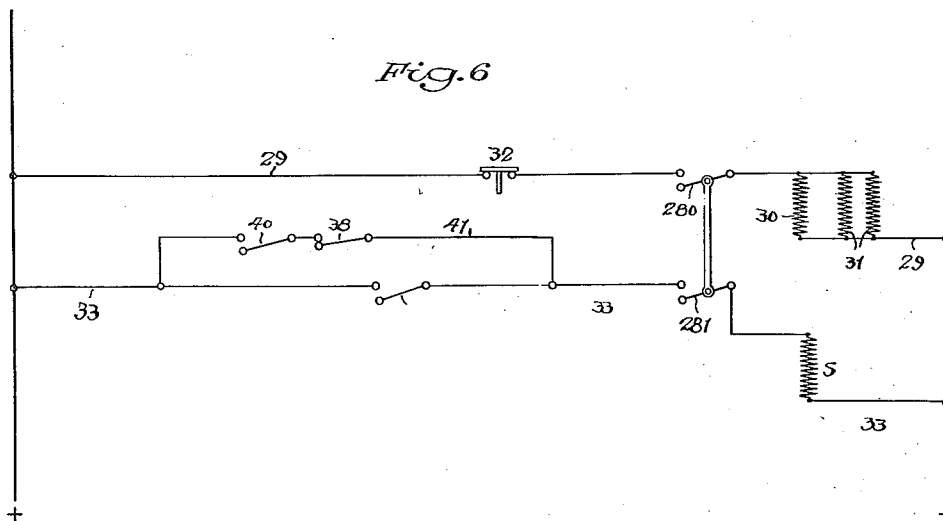


Fig. 6



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UNITED STATES PATENT OFFICE.

OTTO HAENTJENS, OF HAZLETON, PENNSYLVANIA.

PUMP SYSTEM.

Application filed July 14, 1923. Serial No. 651,583.

To all whom it may concern:

Be it known that I, OTTO HAENTJENS, a citizen of the German Republic, residing at Hazleton, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Pump Systems, of which the following is a specification.

My invention relates to pump systems, and particularly to systems employing a main pump, e. g., one of the centrifugal type, and an associated priming pump.

Among the objects of my invention may be mentioned—

(1) The provision of a float device in the connection between the pumps, which device, when the main pump has been primed, operates a switch in a control circuit governing a switch in the power line of the main pump motor, and thus starts the latter in operation.

(2) The control of the float device in such manner that the float switch is maintained closed until the main pump is sufficiently underway to establish automatically an auxiliary control circuit shunting the float switch.

(3) The automatic opening of the float switch after the shunt circuit has been established.

(4) The automatic opening of the circuit of the priming pump motor when the main pump is sufficiently underway.

(5) The association with the float device of a vacuum breaker valve and a check valve of the type indicated in my Patent No. 1,445,507, and particularly their operation in properly timed relation to the operation of the switch.

(6) Certain features of structural novelty and advantage hereinafter described or shown in the accompanying drawings, in which—

Fig. 1 is a more or less diagrammatic illustration of a pumping system in which my invention is embodied in one form;

Fig. 2 is a vertical section through the float device drawn to a larger scale;

Fig. 3 is a section on the line 3—3, Fig. 2;

Fig. 4 is a broken view of the float device;

Fig. 5 is a vertical section through a modified construction; and

Fig. 6 is a diagram of the control circuits.

In order that the invention may be properly understood, explanation must be made of the general pump system with which it is related. The layout illustrated in Fig. 1 is of a type advantageously employed for draining mines and the like, in which the water to be pumped is collected in a sump 15. Into the latter dips an intake pipe 16 leading to the main pump 17, here indicated as a battery of centrifugals, driven by an electric motor 18. In order to prime the centrifugals the water is sucked from the sump into their runner chambers by an independent priming pump 19, driven by an electric motor 20 and connected by a suction line 21, 22 and 23 to ports at the top of the runner chambers. Arranged in the priming suction line between the sections 21 and 22 thereof is the float device 24 to which more particular reference will be hereinafter made.

The system indicated is of the automatic type in which the circuits are automatically controlled. Thus, in the sump 15 is a float 25 which, through the rod 26 and spaced lugs 27 thereon, or other suitable connection, operates a switch 28 to close or open a circuit 29 when the water in the sump reaches a predetermined high or low level. In the circuit 29 is a solenoid 30, which operates a switch PM in the power circuit I of the priming pump motor 20 and thus starts the priming pump in operation. A normally closed contactor 32 is also arranged in this control circuit 29. The solenoids 31 arranged in a shunt in the priming pump power circuit (or if preferred in motor control circuit 29) open valves controlling ports in the runner casings which lead to the suction line 23, 22, 21 of the priming pump.

A second control circuit 33, which includes the solenoid S for operating the switch CM in the power circuit II of the centrifugal pump motor 18, is closed by the switch 34 of the float device 24 when the centrifugal has been primed by the pump 19. The centrifugal is thus set in motion.

Associated with the centrifugal are automatic suction and pressure regulators 35 and 36. The suction or vacuum regulator 35 is connected by pipe 37 to the sump pipe 16 and registers the suction effort exerted therein by the centrifugal. It has an associated switch 38 which is normally closed, but opens when the suction effort becomes

too great, incident, for example, to a blocked strainer at the foot of the suction line 16. The pressure regulator 36 is connected by the pipe 39 with the runner chamber of one of the centrifugals, and registers the pressure exerted thereby. Its associated switch 40 tends automatically to open, and it closes only when the discharge pressure of the centrifugal approximates normal. These switches are arranged in a circuit 41 shunting the float switch 34 in the second control circuit 33. The shunt circuit 41 around the float switch 34 is thus closed only when the pressure regulator switch 40 is closed. Inasmuch as there is some lapse of time—from 10 to 15 seconds—before the centrifugal develops sufficient pressure to close switch 40, it is necessary to maintain switch 34 closed during this interval. Turning to Figs. 2, 3 and 4, the float device 24 comprises a float chamber 42 to which the suction pipe 22, incoming from the centrifugal pump 17, opens through a riser 43. The check valve 44 governing the port 45 at the foot of the riser, is actuated through the rod 46 connected to the arm 47 of the float 48 pivoted at 49. The pipe 21 leading to the priming pump 19 opens to the top of the float chamber through a passage 50, the opening from which to the float chamber 42 is well above the water level therein, and thus serves to prevent flow of water to the priming pump 19. One or more restricted openings 51 pierce the foot of the riser 43 and permit slow drainage of the pocket of the float chamber below the top level of the riser 43.

A vacuum breaker valve 52 controlling a port 53 in the top of the float chamber is operated by a rod 54 connected with lost motion to the float lever 47 by pin and slot engagement 55.

Keyed to the pivot pin 49 of the float lever is a switch-operating lever 56, which, through a link and lever system 57, 58, 59 and 60, operates the switch 34 housed within a casing 61 supported upon the cover of the float device casting 24.

The vacuum breaker per se will be understood by reference to my Patent No. 1,445,509. Its modification for utility in the present system will be understood from the following description.

When the water in the sump 15 rises to predetermined level, the float 25 rising therewith closes the switch 28, thus completing the control circuit 29 through the solenoid 30 which closes the switch PM in the circuit of the priming pump motor 20. The valve solenoids 31 are now energized and open the ports in the runner chambers of the centrifugals. When the priming pump, now set in motion, has performed its function, that is to say, when the centrifugals 17 are primed and the water has risen

through the line 23, 22 to the float chamber 24, the float 48 and its lever 47 rise. As the float rises it successively operates, first, the switch 34, second, the vacuum breaker valve 52, and third, the check valve 44. Upon the closing of the switch 34 the second control circuit 33 is completed and the solenoid S therein closes the motor starting switch CM in the circuit of the centrifugal pump motor 18.

Inasmuch as the priming pump is no longer needed, its circuit is automatically interrupted in any suitable way, for example, by the lever of the switch CM, the toe of which, as it reaches full current "on" position, kicks open the contactor 32, thus opening the control circuit 29, and deenergizing the solenoid 30 which permits the switch PM of the priming motor to automatically open under the pull of its spring. The priming pump thus halts while the centrifugal picks up speed.

As the centrifugal 17 comes to speed, the pressure of the delivery therefrom rises to approximately normal and the switch 40 in shunt 41 of the second control circuit 33, is closed. Consequently, until the vacuum breaker switch 34 opens, incidental to the draining of the float chamber 24, and the fall of the float 48, the current flows in parallel through the float switch 34 and the shunt 41. Upon the automatic opening of the switch 34 by the fall of the float 48, the current flows wholly through the shunt 41 in which the vacuum regulator and pressure regulator switches 38 and 40 are arranged.

It will be obvious from the foregoing that it is necessary, in order to maintain the second control circuit 33 during the period of acceleration of the centrifugal 17, that the vacuum breaker switch 34 be maintained closed during this period, since it is not until the delivery pressure of the centrifugal reaches substantially normal that the shunt 41 is closed at the pressure regulator switch 40. Hence the necessity that the drainage of the float chamber be slow in order to delay the fall of the float 48 and thus to retard the opening of the switch 34. It is for this reason that the admission to the float chamber 24 is through the riser 43, and that the discharge from the pocket in the lower portion of the float chamber is effected through the small drainage holes 51. In other words, the drainage of the float chamber pocket is so slow through the port 51 that the fall of the float lever 47 is sufficiently retarded to maintain the switch 34 closed until the centrifugal 17 comes to speed and fully establishes the shunt circuit 41 at switch 40.

It will be further obvious that if, after float switch 34 opens, there should be some obstruction in the pump line—such as a clogged screen at the foot of the intake pipe

16—the second control circuit, now passing through shunt circuit 41, will open at the switch 38, or at the switch 40, whereupon, the solenoid S becoming deenergized, the centrifugal motor switch CM automatically opens and halts the drive of the centrifugal. As the switch lever CM moves to “off” position, the contactor 32 in the first control circuit 29 automatically returns to closed circuit position. If the sump switch 28 is still closed, by reason of the fact that the level of the water 15 in the sump is still sufficiently high, the priming pump will again be set in motion and the cycle of operations repeated until the centrifugal is again in operation. If the pump line of the centrifugal is not cleared, the centrifugal motor will be again automatically halted and the cycle repeated until the attendant becomes aware of the clogging of the line and takes steps to remedy the difficulty.

In the system shown in Fig. 1 the circuit of the centrifugal motor is opened through the automatic regulator switch 38, which opens control circuit 33 and deenergizes solenoid S when the water level in the sump 15 falls to a predetermined level for which the switch 38 is adjusted. If the switch 38 should fail to operate, and the water level should fall below the mouth of the suction pipe 16, then the pressure regulator switch 40 would function to open the control circuit and deenergize the solenoid S, with the same result.

Another way of securing the same result is accomplished if the sump switch 28 be of the duplex type, as indicated in Fig. 6—one switch bar 280 being arranged in the priming pump control circuit 29 and the other blade 281 in the centrifugal pump control circuit 33. In this case both control circuits 29 and 33 are opened by the sump switch when the water in the sump falls below a predetermined level. This is of course the most desirable type of construction, but certain mine workings are shallow and extend over a large area, so that when the sump is pumped down the water recedes from the pump house and long suction lines 16 are required. Where such conditions exist, the sump switch can be used for starting only, as in Fig. 1, and the vacuum switch 38 must be depended upon for stopping.

It will be noted that in Fig. 6 I have indicated the valve solenoids arranged in the control circuit 29—the possibility above referred to.

The drainage of the float chamber 24 following the opening of the vacuum breaker valve 52, may be accomplished in any desired fashion. I have indicated by way of example a drainage line 62 leading to the sump 15. Arranged in the line is a check valve 63 which automatically closes under the vacuum pull of the priming pump 19,

but automatically opens when the priming pump is halted.

It will be understood that the switches are but diagrammatically shown and that any appropriate types may be used. For example, the float switch 34 may be of the type shown in Fig. 5, comprising but a single pair of cooperating contact arms 64 and 65, the latter yielding against the action of the spring 66 when lifted by the contact arm 64 which is connected by link 67 to the float lever.

Various modifications in detail of construction and arrangement of parts will readily occur to those dealing with the problem which do not depart from what I claim as my invention.

I claim—

1. A pump system comprising a centrifugal pump, an electric motor for driving the same, a priming pump connected to the centrifugal pump, a float chamber arranged in said connection, and a float-operated switch controlling the energization of the centrifugal pump motor, a normally open shunt around the float switch, and means for closing said shunt circuit when the centrifugal pump is in operation.

2. A pump system comprising a centrifugal pump, an electric motor for driving the same, a priming pump connected to the centrifugal pump, a float chamber arranged in said connection, and a float-operated switch controlling the energization of the centrifugal pump motor, a normally open shunt around the float switch, and means for closing said shunt circuit when the centrifugal pump is in operation, together with means delaying the opening of the float switch by the fall of the float until the centrifugal pump is in operation.

3. A pump system comprising a centrifugal pump, an electric motor for driving the same, a priming pump connected to the centrifugal pump, a priming pump electric motor, a float chamber arranged in the connection between the priming and centrifugal pumps, and a normally open float switch controlling the circuit through the centrifugal pump motor, together with means for cutting out the priming pump motor on the closing of the circuit through the centrifugal pump motor by the float switch, and means for delaying the fall of the float and the consequent opening of the float switch during the acceleration of the centrifugal pump.

4. A pump system comprising a main pump and a priming pump, an electric motor for the main pump, a float chamber in the connection between the priming pump and the main pump, a float-operated switch controlling the circuit of the main pump motor, and means for delaying the drainage of the float chamber to maintain the

float switch closed while the main pump is coming to action.

5 5. A pump system comprising a centrifugal pump, an electric motor for driving the same, a priming pump connected to the centrifugal pump, a priming pump electric motor, a float chamber arranged in the connection between the priming and centrifugal pumps, and a normally open float switch
10 controlling the circuit through the centrifugal pump motor, together with means for cutting out the priming pump motor on the closing of the circuit through the centrifugal pump motor by the float switch, and
15 means for delaying the fall of the float and the consequent opening of the float switch during the acceleration of the centrifugal pump, together with a normally open shunt around the float switch in the motor-control
20 circuit for the main pump, and means governed by the pressure exerted by the main pump for closing said shunt.

6. In a pump system, a main pump and a priming pump therefor, a float device in the
25 connection between said priming and main pumps, and means associated with the float device for operating in sequence, first a switch controlling the main pump motor, second an air relief valve for the priming
30 pump, and third a check valve in the suction connection.

7. In a pump system, a main pump and a priming pump therefor, a float chamber
35 in the connection therebetween, an inlet riser opening to the float chamber above its bottom for the admission of water from the main pump thereto, a drainage outlet and a

restricted port opening to said outlet to insure the slow fall of the water below the level of said inlet riser.

8. In a pump system, a main pump and a priming pump therefor, a float chamber in the connection therebetween, an inlet riser opening to the float chamber above its bottom for the admission of water from the
40 main pump thereto, a drainage outlet and a restricted port opening to said outlet to insure the slow fall of the water below the level of said inlet riser, together with a
45 switch operated by the float.

9. In a pump system, a main pump and a priming pump therefor, a float chamber in the connection therebetween, an inlet riser opening to the float chamber above its bottom for the admission of water from the
50 main pump thereto, a drainage outlet and a restricted port opening to said outlet to insure the slow fall of the water below the level of said inlet riser, together with a suction passage opening to the float chamber
55 above the level of said riser.

10. In a pump system, a main pump and a priming pump therefor, a float chamber in the connection therebetween, inlet and outlet ports opening to the chamber; a check
60 valve associated with the inlet port, an air relief valve and port opening to the chamber between said inlet and outlet ports, a switch, and a float operatively associated with said check and relief valves and switch.
65

In testimony whereof I have signed my name to this specification.
70

OTTO HAENTJENS.