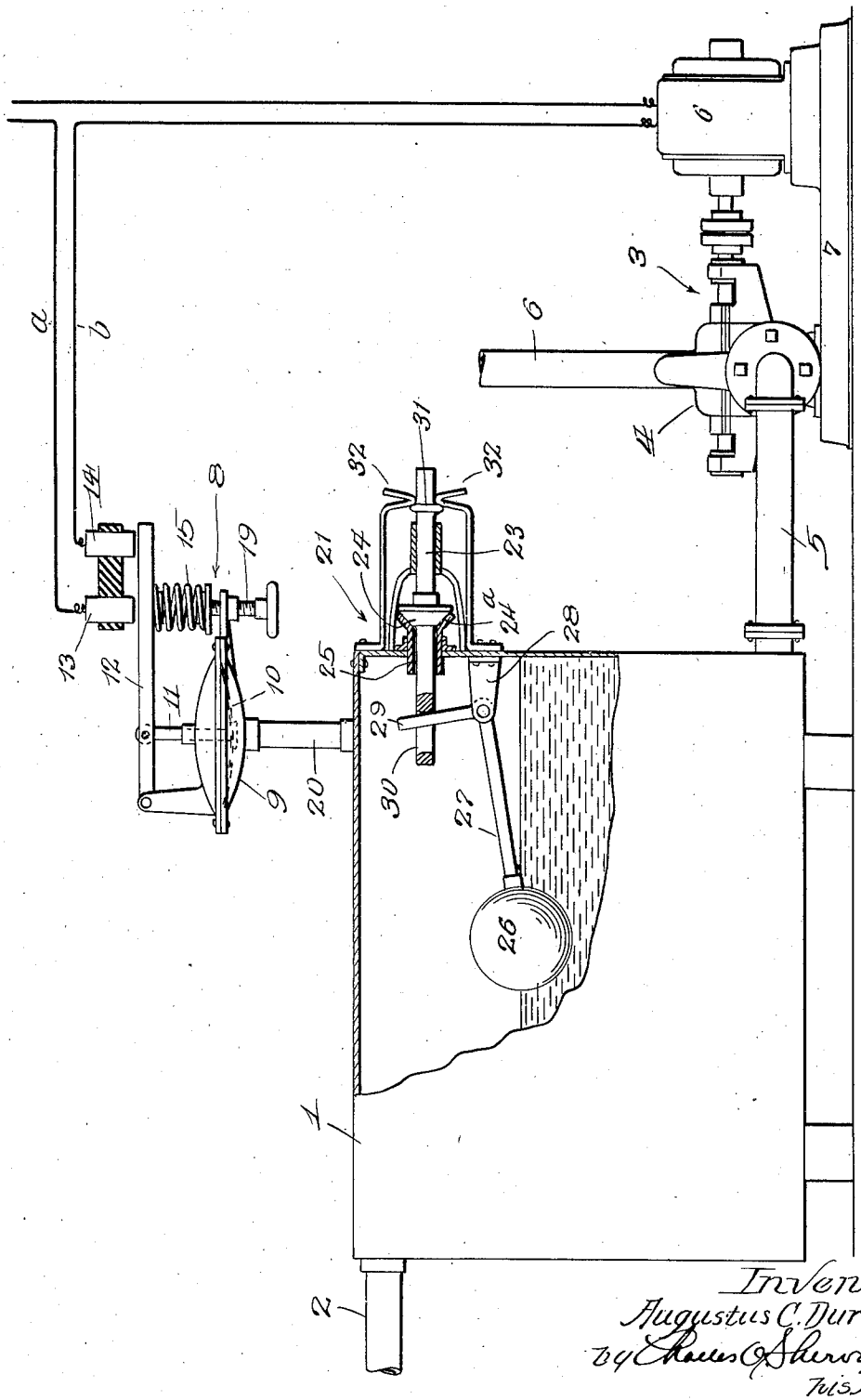
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PUMPING APPARATUS

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PUMPING APPARATUS.

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This invention relates to pumping apparatus and more particularly to automatic control means for starting and stopping the motor of the pumping apparatus. Among the objects of the invention are to provide automatic control means for pumping apparatus which shall be entirely reliable, positive in action, simple in construction and highly efficient in operation. Another object of the invention is to provide automatically operating pumping apparatus for exhausting the water and non-condensible gases from heating systems and returning the water of condensation back to the boiler or other receptacle. Another object is to provide automatically controlled means, in pumping apparatus of this type, embodying a pressure switch or vacuum switch controlled by fluctuations of pressure and the volume of liquid in the receiver, for starting the pump when the pressure in the switch reaches a predetermined high point, and stopping the pump when the pressure in the receiver and switch reaches a certain predetermined low point. Other objects and advantages will appear in the course of this specification and with all of said objects and advantages in view, this invention consists in an automatically controlled pumping apparatus embodying a receiver and a pressure switch connected therewith, for starting and stopping the motor, in combination with a float valve for admitting air directly or indirectly to the pressure switch when the water in the receiver reaches a predetermined level. The invention further consists in automatically controlled pumping apparatus as above described in which the float valve is capable of remaining open and closed during a considerable portion of the movement of the float. The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawing accompanying this specification, in which the figure is a diagrammatic view, partly in elevation and partly in section, of automatically controlled pumping apparatus embodying a simple form of the present invention.

Referring to said drawing which illustrates diagrammatically the application of one embodiment of the present invention to the return of a steam heating plant, the reference character 1 designates a receiver, such as a tank or other receptacle for receiving water or other liquids and non-condensible gases. When used in connection with a steam heating plant the return pipe 2 of the system is connected to the receiver 1 and discharges the water of condensation and other condensates into the receiver. Pumping apparatus, designated as a whole, by the reference character 3 is provided for exhausting the water, non-condensible gases and other condensates from the receiver and pumping the water back to the boiler or other receptacle. In the embodiment of the invention as shown, the pumping apparatus 3 embodies a pump 4 connected to the receiver 1 by a pipe 5 and having a discharge pipe 6 through which the contents of the receiver are discharged. The pump 4 is connected with and driven by a motor 6, here shown in the form of an electric motor. The pump and motor may be mounted upon a single base 7 and in the form shown, comprise a pumping unit in the form of an electric motor operated pump. It will be understood that the pumping apparatus is of that character which is capable of exhausting not only the water contained in the receiver but also the non-condensible gases and other condensates that enter the receiver.

Connected to the receiver as by a pipe 20, is a pressure switch, designated generally by the reference character 8, which switch controls the starting and stopping of the motor 6. The pressure switch is preferably of the vacuum type of switch and embodies means for making and breaking the electric circuit to the motor. In the form of vacuum switch shown it embodies a diaphragm casing 9 in which is contained a diaphragm 10, from which extends a stem 11, which moves a switch lever 12 in a direction to break the circuit between the two terminals 13, 14 of the switch, when the pressure in the diaphragm chamber reaches a predetermined low point. Adjustable means are provided in the vacuum switch for opposing the action of the vacuum on the diaphragm, said means operating to move the switch lever and close the circuit through the terminals 13, 14, when the pressure in the diaphragm chamber reaches a predeter-

mined high point, and as shown said means comprise a coiled compression spring 15, one end of which bears against the switch lever 12 and the other end of which bears against an adjustment screw 19 threadedly mounted in a lug formed on the diaphragm casing. The terminals 13, 14 of the vacuum switch are interposed in the wiring *a*, *b*, for the electric motor 6. It will be obvious that when the vacuum in the receiver 1, is built up to a predetermined point, the diaphragm of the pressure switch will be moved down and the switch lever 12 thereby drawn down against the pressure of the spring 15, thereby breaking the electric circuit to the motor of the pumping mechanism and stopping the pump, and that when the pressure in the vacuum switch reaches a predetermined high point, the spring 15 will move the switch lever in a direction to close the circuit to the electric motor 6 of the pumping mechanism thereby starting the pump.

A float valve, designated generally by the reference character 21, is provided for admitting air at atmospheric pressure directly or indirectly to the vacuum switch when the water in the receiver accumulates above a predetermined quantity, whereby the pressure in the vacuum switch may be raised, causing it to actuate and close the circuit and start the pump. Obviously any suitable type of float valve may be employed, the one shown in the drawing being merely for the purposes of illustrating the invention. As illustrated, the float valve embodies a poppet valve 22 mounted upon a valve stem 23 and arranged to seat upon a valve seat 24ª, the valve 24 being arranged to control the passage through an air vent 25 to the receiver. The float 26 is secured upon a float lever 27 mounted on a bracket 28 and having an arm 29 which engages with the valve stem 23. In order that the float may have a limited amount of lost motion without effecting the valve 24, the valve stem is provided with a slot 30 through which the lever arm 29 extends. It is evident that the float may rise and fall and the lever arm 29 may move idly through the length of the slot and unseat the valve 24 only when it reaches one end of the slot, and seat the valve only when it reaches the other end of the slot.

It is preferable that the valve 21 remain positively closed or open during the idle movements of the float and therefore the float valve is preferably of that type in which the valve remains open or closed during the idle movements of the float. In the simple form of mechanism illustrated the valve stem 23 is provided with an annular rib 31, and one or more spring catches 32 are provided, which are adapted to engage with either side of the rib 31, and thereby positively hold the valve closed or open, the drawing showing the spring catch in engagement with the outer side of the rib 31 and operating to hold the valve 24 on its seat. When the valve is unseated the rib moves past the spring catches 32, and the opposite side of the rib is therefore engaged by the spring catches and the valve held open.

In the operation of the apparatus and assuming parts to be in the position illustrated in the drawing, with the pump idle, and liquid, gases and other condensates flowing into the receiver, as the liquid rises in the receiver, the float 26 is moved upward until the valve 24 is unseated, thereby admitting air, under the atmospheric pressure, through the receiver to the vacuum switch. The pressure in the vacuum switch being raised, the vacuum switch operates to close the electric circuit to the motor 6 of the pumping apparatus 3, thereby starting the pump 4 and withdrawing the water, and afterwards the gases and the condensates, from the receiver 1. As the level of the water in the receiver lowers, the float 26 moves downward, and when the water reaches a predetermined low level, the float lever seats the valve 24, but the pump continues to operate until sufficient vacuum is built up in the receiver to overcome the pressure of the spring 15 of the vacuum switch, whereby the diaphragm of the switch is moved down, and therewith the switch lever 12, thus breaking the circuit to the motor and thereby stopping the pump.

From the above it will be understood that the operation of the pumping mechanism is directly controlled by the vacuum switch and that the fluctuations or variations of the pressure in the vacuum switch are controlled by the quantity or level of the liquid in the receiver. It will also be observed that the vacuum switch and float valve cooperate in the control of the motor of the pumping mechanism and that the float valve operates to admit air to the vacuum switch when the water in the receiver reaches a high level, to thereby make the vacuum switch effective for the purpose of closing the circuit to the motor, and that said float valve operates when the water in the receiver reaches a low level to close the air vent, whereby the pumping mechanism may continue to operate and exhaust the remainder of the water and build up the necessary vacuum in the receiver to actuate the vacuum switch and break the circuit to the motor.

While the pumping apparatus has been shown diagrammatically, merely for the purposes of illustration, it is to be understood that any suitable pumping mechanism, capable of handling both water and non-condensible gases may be employed in the system, and while I have shown the embodiment of my pumping apparatus as applied to vacuum steam heating service, it is to be understood that the invention is adapted for any service where it is required that both

water and non-condensible gases must be handled under a vacuum.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention; I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims, to point out all of the invention disclosed herein.

I claim as new, and desire to secure by Letters Patent:

1. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, a motor operated pumping apparatus connected to and operating to exhaust liquid and gas from said receiver, a pressure responsive control means for starting and stopping the motor of said pumping mechanism, said control means being connected to said receiver, and operating to start said pumping mechanism when the pressure in said control means exceeds a predetermined amount, and a float operated air valve between the receiver and outer atmosphere, having a float in said receiver operating to open the valve and admit atmospheric air to said control means when the liquid in the receiver reaches a predetermined high level.

2. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, a motor operated pumping apparatus connected to said receiver, a pressure responsive control means for starting and stopping the motor of said pumping apparatus and connected to said receiver, said control means operating to start said pumping apparatus when the pressure in said control means exceeds a predetermined amount and operating to stop the pumping apparatus when the pressure reaches a predetermined low point, and a float operated air valve between the receiver and outer atmosphere and having a float in said receiver, said float operated air valve operating to open and admit atmospheric air to said control means when the liquid in the receiver reaches a predetermined high level therein and to close when the liquid reaches a predetermined low level.

3. An automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, an electric motor operated pumping mechanism connected to said receiver, a vacuum operated electric switch for controlling the circuit to the motor, said vacuum operated electric switch being connected to the receiver and operating to close the circuit to the motor when the pressure in the vacuum operated electric switch exceeds a predetermined amount, and a float operated air valve between the receiver and outer atmosphere and having a float in said receiver, and operating to open and admit atmospheric air to said vacuum operated electric switch when the liquid in the receiver reaches a predetermined high level.

4. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, an electric motor operated pumping mechanism connected to said receiver, a vacuum switch interposed in the circuit to the motor, said vacuum switch being connected to said receiver and operating to start the motor of the pumping mechanism when the pressure in said vacuum switch exceeds a predetermined amount and operating to stop the motor when the pressure reaches a predetermined low point, and a float valve between said receiver and the outer atmosphere and having a float in said receiver and operating to open and admit atmospheric air to said vacuum switch when the liquid in the receiver reaches a predetermined high level.

5. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for the liquid and gas, an electric motor operated pump connected to said receiver, a vacuum switch interposed in the circuit to the pump motor, said vacuum switch being connected to said receiver and operating to start the motor when the pressure in the receiver exceeds a predetermined amount, and a float valve between the receiver and outer atmosphere having a float in the receiver, said float valve operating to open and admit atmospheric air to said receiver when the liquid in the receiver reaches a predetermined high level.

6. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for the liquid and gas, an electric motor operated pump connected to said receiver, a vacuum switch interposed in the circuit to the pump motor, said vacuum switch being connected to said receiver and operating to start the motor when the pressure in the receiver exceeds a predetermined amount, and said vacuum switch operating to stop the motor when the pressure in the receiver reaches a predetermined low point, and a float valve between the receiver and outer atmosphere having a float in said receiver and operating to open and admit atmospheric air to said receiver when the liquid in the receiver reaches a predetermined high level.

7. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, an electric motor operated pump connected to said receiver, a vacuum switch interposed in the circuit to the motor, said vacuum switch being connected to the receiver and operating to start the motor when the pressure in the receiver exceeds a predetermined amount, and a float valve between the receiver and outer

atmosphere having a float in the receiver, there being a lost motion connection between the float and valve of the float valve, whereby the valve may remain open or closed during the idle movements of the float, said float valve operating to open and admit atmospheric air to the vacuum switch when the liquid in the receiver reaches a predetermined high level.

8. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, an electric motor operated pump connected to said receiver, a vacuum switch interposed in the circuit to the pump motor, said vacuum switch being connected to the receiver and operating to close the circuit and start the motor when the pressure in the receiver exceeds a predetermined amount and operating to break the circuit and stop the motor when the pressure reaches a predetermined low point, and a float valve between the receiver and outer atmosphere connected with said receiver and having a float in the receiver capable of a limited amount of lost motion with respect to the valve of the float valve, said float valve operating to open and admit atmospheric air to the receiver when the liquid in the receiver reaches a predetermined high level, and to close when the liquid reaches a predetermined low level.

9. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, a motor operated pumping apparatus connected to said receiver, a pressure responsive control means for the motor of said pumping mechanism, said control means being connected to said receiver, and operating to start said pumping mechanism when the pressure in said control means exceeds a predetermined amount, and a float operated air valve between the receiver and outer atmosphere having a float in said receiver operating to open the valve and admit atmospheric air to said control means when the liquid in the receiver reaches a predetermined high level, said float valve having means for positively holding the same in open position and in closed position.

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