

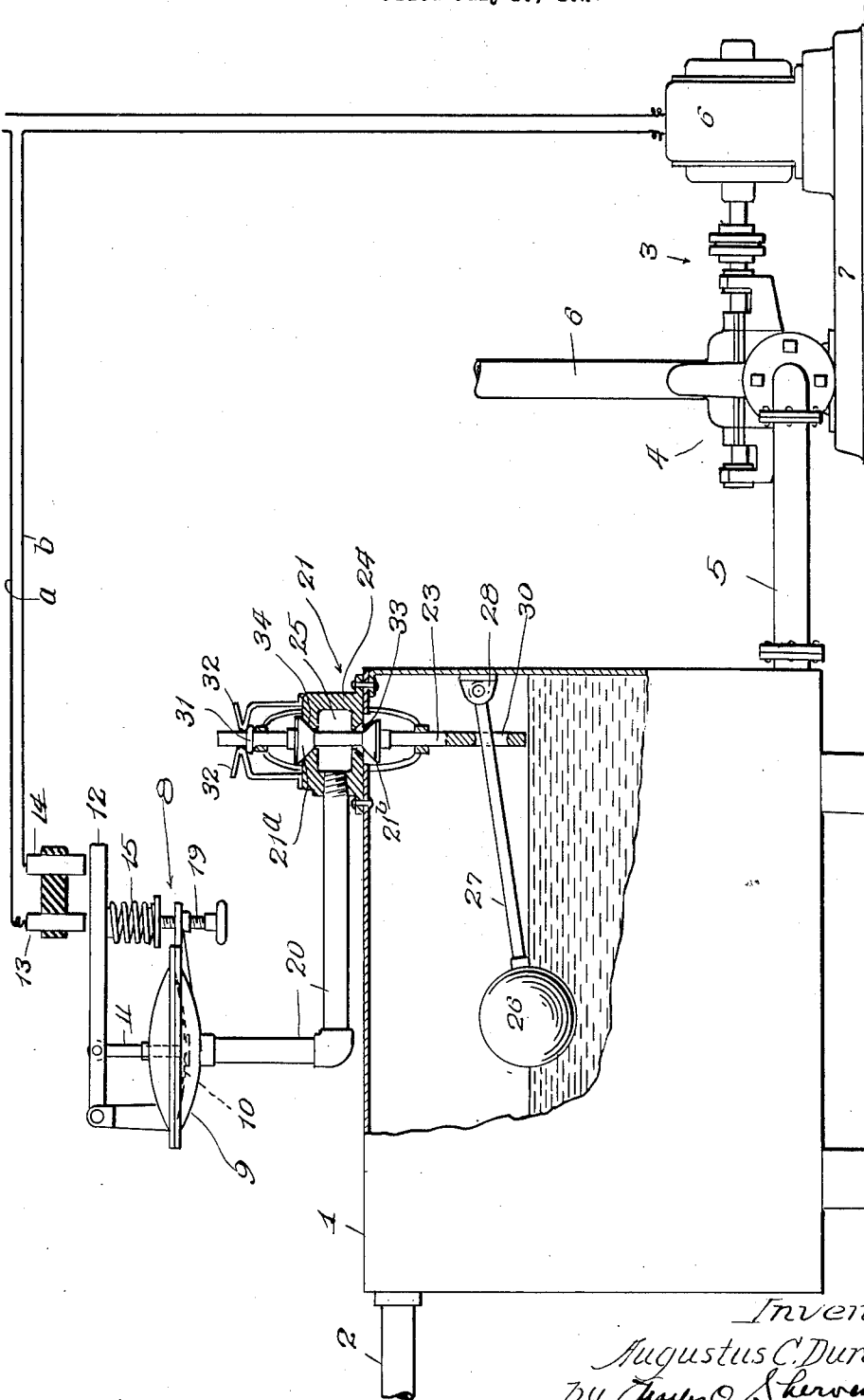
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A. C. DURDIN, JR

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PUMPING APPARATUS

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Inventor:
Augustus C. Durdin, Jr.
by Charles O. Sherry,
His Att'y.

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AUGUSTUS C. DURDIN, JR., OF CHICAGO, ILLINOIS.

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. The invention is in the nature of an improvement upon the pumping apparatus shown and described in my co-pending application filed on even date herewith and designated by the Serial No. 206185. In the apparatus disclosed in that application a receiver is employed for receiving liquid and gas and a vacuum switch is employed in connection with the receiver for starting and stopping the motor of the pump mechanism. Outside air is admitted to the receiver of that apparatus for the purpose of increasing the pressure therein so as to operate the vacuum switch and start the pump motor.

In accordance with the present invention, a receiver, vacuum switch and float valve are employed but instead of admitting outside air to the receiver for the purpose of increasing the pressure in the vacuum switch, little or no outside air is admitted to the receiver, but the float valve operates to admit outside air directly to the vacuum switch without admitting the air to the receiver, whereby the pump may exhaust the water from the receiver and lower the vacuum therein without the necessity of exhausting any air admitted to the receiver from the outside.

Among the objects of the present invention are to provide improved automatically operating control means for pumping apparatus, which shall be reliable, positive and highly efficient in operation. Another object is to provide automatic control means for pumping apparatus, which is made operative for the purpose of closing the switch to the pump motor when the water in the receiver reaches a predetermined high level and without admitting any appreciable amount of outside air to the receiver. Another object is to provide automatic control means for pumping apparatus employing a vacuum switch for starting and stopping the motor, in which the fluctuations of pressure in the vacuum switch are governed by low pressure or vacuum in the receiver and atmospheric pressure supplied to the vacuum switch independently or the receiver.

With these and other objects and advantages in view, this invention consists in liquid and gas pumping apparatus, embodying a receiver for the liquid and gas, motor operated pumping apparatus connected with the

receiver, a vacuum switch for starting and stopping the motor of the pumping apparatus, said vacuum switch being connected to the receiver and a float operated valve for alternately establishing communication between the receiver and vacuum switch and between the vacuum switch and outside air. The invention further consists in an apparatus as above described, in which the float operated valve is interposed between the vacuum switch and receiver. The invention further consists in an apparatus as above described in which the float of the float valve has a limited amount of lost motion with respect to the valve member of the float valve. The invention further consists in the several novel features hereinafter fully set forth and claimed.

The invention is illustrated in the drawing accompanying this specification, in which the figure is a diagrammatic view, partly in elevation and partly in section, illustrating a simple embodiment of the present invention.

Referring to said drawing which illustrates diagrammatically the application of one embodiment of the present invention, to the return pipe 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-condensable 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-condensable 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, comprises 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-condensable 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 vacuum 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 predetermined 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 created in the receiver 1, reaches a predetermined low 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.

Instead of admitting outside air to the receiver (when the liquid reaches a high level therein) for the purpose of breaking the vacuum in the vacuum switch, outside air is admitted directly to said vacuum switch and practically no outside air is admitted to the receiver. The mechanism for controlling communication between the receiver and vacuum switch and between the vacuum switch and the outside air comprises a float valve, designated generally by the reference character 21, which is interposed between the vacuum switch 8 and the receiver. In the embodiment of the invention, as illustrated, the float valve 21, comprises a valve casing 24 containing a chamber 25 which communicates through a port 33 with the receiver and through a port 34, with the outside air. The pipe 20 enters the casing 24 and opens into the air chamber 25. The ports 33, 34 are arranged to be controlled by a valve member, here shown as comprising two valves 21^b, 21^a, mounted upon a valve stem 23, said valves 21^b, 21^a being so arranged that one or the other thereof will seat upon the valve seat around its associated port. The float valve has a float 26 located within the receiver and mounted upon a float arm 27, which arm is fulcrumed on a bracket 28, and said float arm 27 engages the valve stem 23 and operates to move the same when the float approaches its upper and lower limits of movement to thereby simultaneously unseat one valve 21^b and seat the other 21^a. Mechanism is provided for positively holding either valve on its seat and the mechanism shown comprises spring catches 32 that engage with a rib 31 on the valve stem. In order that the float valve may have a limited amount of lost motion without affecting the valves 21^b, 21^a, a slot 30 is provided in the valve stem through which the float arm 27 may move before it engages the ends of the slot and actuates the valves. The float valve is somewhat in the nature of a two way valve, that is to say it controls the passage of air from the outside to the vacuum switch and between the vacuum switch and receiver. The exact form of float valve illustrated is, of course, not material to this invention, but is chosen merely for the purpose of illustrating the invention.

In the operation of the apparatus and assuming the parts to be in the position illustrated in the drawing with the pump idle, and liquid, gases and other condensates flowing into the receiver, and the valve 21^a being closed and the valve 21^b open, as the liquid rises in the receiver the float is moved upward until the valve 21^b is closed and the valve 21^a opened, air under atmospheric pressure is therefore admitted to the vacuum switch, but not to the receiver and the vacuum in the vacuum switch being broken, the spring 15 of the switch moves the switch lever upward and closes the circuit through the terminals 13, 14 of the electric circuit which runs to the pump motor and the pump is thereupon started. The pump exhausts the liquid from the receiver and continues to lower the pressure therein until the float 26 reaches a low position in which it closes the air valve 21^a to the outer atmosphere and opens the valve 21^b between the vacuum switch and receiver and when the vacuum in the receiver reaches the low point where the vacuum switch is operated thereby, the vacuum switch is actuated, the circuit through the terminals 13, 14 is broken and the motor of the pumping apparatus stopped.

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 because outside air for reducing the pressure in the

vacuum switch is not admitted to the receiver, the pressure in the receiver is not increased from external sources and consequently the vacuum in the receiver may be maintained with less work on the part of the pumping apparatus. It will also be observed that the vacuum switch and float valve co-operate in the control of the motor of the pumping mechanism and that the float valve operates to admit external air directly to the vacuum switch and simultaneously closes communication between the receiver and vacuum switch when the water in the receiver reaches a high level, and vice versa closes the valve to the outside air and simultaneously establishes communication between the vacuum switch and receiver when the liquid reaches a low level in the receiver, whereby the pressure in the receiver is not materially affected from outside sources.

In the present application I have shown the embodiment of my invention in connection with the return pipe of a vacuum steam heating system. In such a system, air and other non-condensable gases must be removed from the pipe in order to maintain a vacuum and the water condensation must be disposed of. Although an apparatus of this type has been described in detail, it will be apparent that the apparatus is adapted for any service where it is required that both air and water, either hot or cold, must be handled under a vacuum. While the drawing is merely schematic, it is intended to illustrate the invention only, and shows the various instrumentalities diagrammatically.

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 vacuum operated control means for the motor of said pumping apparatus, said control means being connected with the receiver, and operating to start the motor of the pumping apparatus when the pressure in the control means exceeds a predetermined amount, a float operated two way air valve openable to the outer atmosphere and interposed between said control means and the receiver and operated by a float in the receiver, said float operated air valve controlling the passage of atmospheric air directly to the control means and controlling the passage of air from the control means to the

receiver, whereby no substantial amount of outside air is admitted through the valve to the receiver.

2. 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 air from said receiver, a vacuum operated control means for the motor of said pumping apparatus, said control means being connected with the receiver, and operating to start the motor of the pumping apparatus when the pressure in the control means exceeds a predetermined amount, a float operated air valve interposed between said control means and the receiver and operated by a float in the receiver, said float operated air valve having a valve which opens an air vent for admission of atmospheric air to the control means and a valve which simultaneously closes communication between the control means and receiver when the liquid in the receiver rises above a predetermined level, whereby said control means is actuated to start the motor of the pumping mechanism, without admitting any substantial amount of outside air to the receiver.

3. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and gas, an electric motor operated pump connected to and operating to exhaust liquid and gas from said receiver, a vacuum switch interposed in the circuit to the electric motor of the pump, said vacuum switch being connected to the receiver, and a float valve interposed in the connection between the vacuum switch and receiver, said float valve having a float in said receiver, and having an atmospheric air vent to the vacuum switch, closable by a member of the valve when the liquid in the receiver reaches a predetermined low level, said vacuum switch operating to close the circuit to the motor when the liquid in the receiver reaches a predetermined high level and the atmospheric air vent is thereby opened, and said vacuum switch operating to break the circuit when the liquid in the receiver reaches a predetermined low level and vacuum is created in the vacuum switch.

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

- switch and receiver and operated by a float in the receiver, said float valve having an atmospheric air vent and a valve member which closes said atmospheric air vent to the vacuum switch when the liquid in the receiver reaches a predetermined low level, simultaneously opens communication between the vacuum switch and receiver, said valve member operating to open said atmospheric air vent to the vacuum switch and simultaneously close communication between the vacuum switch and receiver 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 liquid and air, an electric motor operated pump connected to and operating to exhaust liquid and air from said receiver, a vacuum switch connected to said receiver and interposed in the circuit to the motor of the pump, and a float valve having an atmospheric air vent and interposed in the connection between the vacuum switch and receiver, and having a float in said receiver.
6. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and air, an electric motor operated pump connected to and operating to exhaust liquid and air from said receiver, a vacuum switch connected to said receiver and interposed in the circuit to the motor of the pump, and a float valve having an atmospheric air vent and interposed in the connection between the vacuum switch and receiver, said float valve having a valve operated atmospheric air vent between the atmospheric air and vacuum switch, and having a float in said receiver.
7. Automatically controlled liquid and gas pumping apparatus, comprising in combination, a receiver for liquid and air, an electric motor operated pump connected to and operating to exhaust liquid and air from said receiver, a vacuum switch connected to said receiver and interposed in the circuit to the motor of the pump, and a float valve having an atmospheric air vent and interposed in the connection between the vacuum switch and receiver, and having a float in said receiver, said valve having means for positively holding the same in its operative positions.

AUGUSTUS C. DURDIN, JR.