

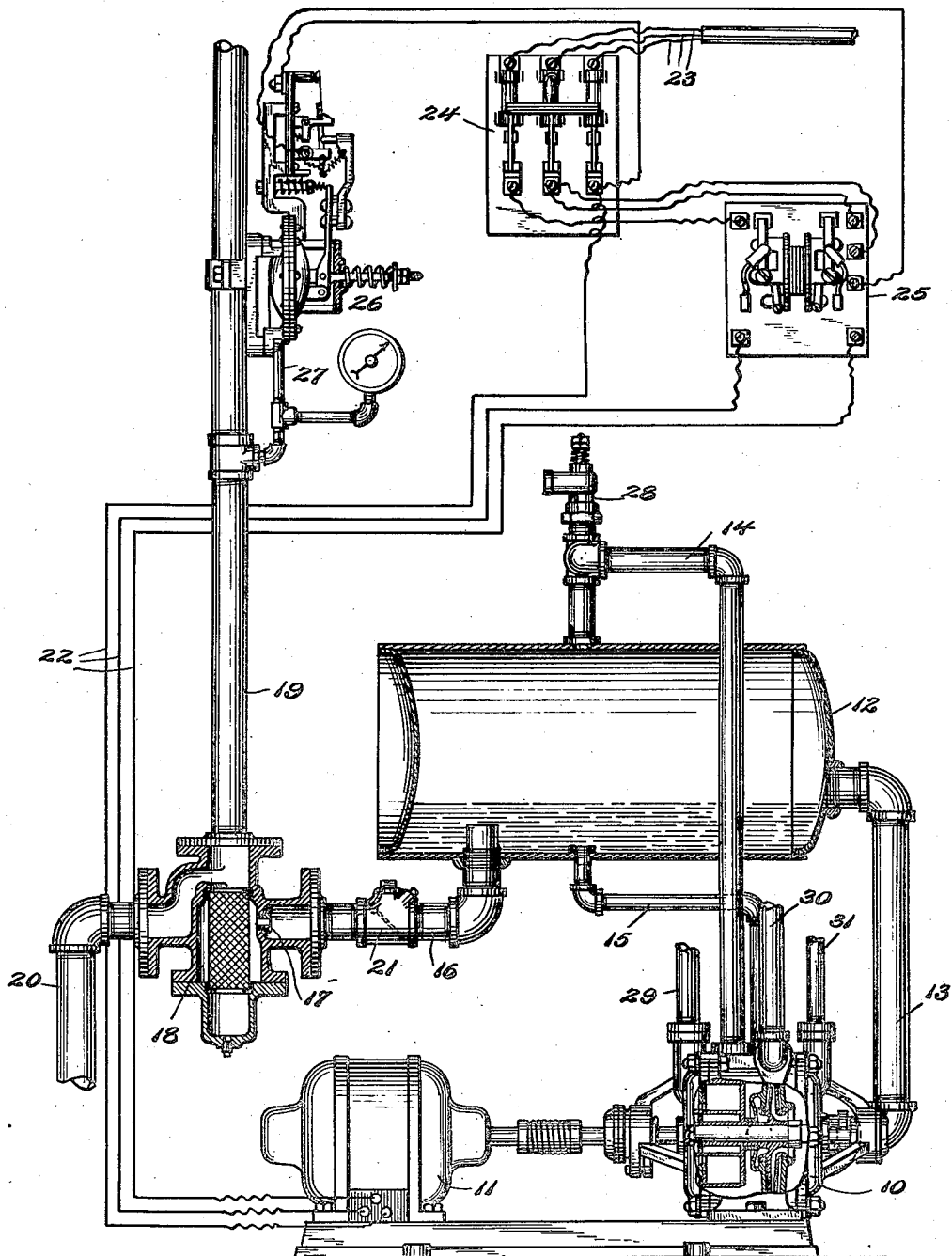
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GAS AND LIQUID PUMPING APPARATUS

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UNITED STATES PATENT OFFICE.

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GAS AND LIQUID PUMPING APPARATUS.

Application filed June 19, 1920. Serial No. 390,174.

To all whom it may concern:

Be it known that I, IRVING C. JENNINGS, a citizen of the United States, and residing at South Norwalk, county of Fairfield, State of Connecticut, have invented certain new and useful Improvements in Gas and Liquid Pumping Apparatus, of which the following is a specification.

This invention relates to gas and liquid pumping apparatus adapted for use whenever it is desired to simultaneously pump air or vapor and water and particularly adapted to be used in connection with vacuum steam heating systems having direct returns for the water of condensation, to remove the air and non-condensable gases from the piping to maintain a partial vacuum therein, and at the same time to remove the condensed steam. In my copending application, Serial No. 174,953, filed June 15, 1917, I describe and illustrate an apparatus of this character in which the return pipe of the heating system is connected to a receiver into which the returns of air and water are discharged, the water collecting in the bottom of the receiver and the air in the upper portion thereof. A pumping unit comprising a centrifugal water pump and a hydro-turbine air pump is provided, the water pump being arranged to withdraw the water from the bottom of the receiving tank and to discharge it into a boiler or hot well, and the air pump being arranged to withdraw air from the top of the tank and discharge it into the atmosphere. The pumping unit is driven by an electric motor which is automatically started when either the pressure of the air, or the volume of water in the receiver is greater than a predetermined amount, and automatically stopped when the desired conditions in the tank have been obtained.

A common defect of apparatus of this character heretofore utilized is that air often leaks through the pump and into the piping of the heating system, when the pump is not operating, due to the fact that it is extremely difficult to keep the packing of the pump air tight. This causes the pump to operate too frequently and thereby shortens its life as well as increasing the cost of operation. Another defect of such prior pumping devices, especially of the type in which a reciprocating pump adapted to

handle both gas and air is employed, consists in the liability of the pump to become so flooded with liquid that it cannot readily free itself when first started, which sometimes results in the pump being severely strained.

The objects of the present invention are; to provide means whereby leakage of air from the pumping apparatus into the piping system is prevented, thereby reducing the work required of the pump; to provide an automatic governor for the pumping unit which is controlled in accordance with the pressure actually existing in the piping system instead of in accordance with the pressure existing in the receiver which, in my improved apparatus, may have a vacuum or partial vacuum therein or no vacuum whatever, as desired; and to provide means for preventing flooding of the receiving tank with water which would result in water passing to the air pump side of the pumping unit and destroying its effectiveness.

To these ends I provide the conduit leading from the heating system to the receiving tank with a liquid sealed non-return valve; attach the pressure governed motor controlling switch directly to the piping of the heating system whereby it is governed directly by the pressure existing therein; and provide the intake conduit leading to the receiver with a restricted neck of such cross sectional area that liquid cannot pass through the same to the receiver faster than the centrifugal pump can exhaust it.

Other advantages of the invention will be apparent as it is disclosed in the following description and in the accompanying drawing, in which the apparatus is illustrated partly in side elevation and partly in section.

In this drawing a pumping unit is indicated at 10, this pumping unit comprising a centrifugal water pump and a rotary air pump both mounted on a single shaft which is rotated by an electric motor 11. The specific form of pump is not germane to this application but I prefer to use one of the type herein shown which is fully described and claimed in my copending application, Serial Number 174,953. Disposed above the pump is a gas and liquid receiver or separating tank 12 and the intake of each of the pumps of the pumping unit is con-

nected to this tank, the pipe 13 serving to convey water from the tank 12 to the water pump, and the pipe 14, connected to the top of the separating tank, serving to convey air or vapor from the tank to the air pump. A conduit 15 opening into the bottom of the tank communicates with the casing which encloses the water pump and serves to convey priming liquid to this pump.

Below the tank is disposed a pipe or conduit 16 which communicates through a restricted neck 17 at one end having a strainer 18 into which the condensed liquid from the return pipes 19 and 20 flows, and the inner end of which communicates with the interior of the tank 12, the outlet orifice of the conduit being disposed at a substantial distance above the bottom of the tank. Intermediate the tank and the restricted neck 17 is a gravity operated non-return valve 21 which prevents the flow of liquid and gas from the tank back into the heating system. It will be noted that the inlet end of the priming conduit 15 is below the inlet end of the pipe 13 and it will also be seen that the outlet orifice of conduit 16 is a substantial distance above the inlet opening of the conduit 15 so that priming fluid cannot be entirely withdrawn from the tank, even in case the non-return valve 21 should develop a leak.

The lead wires 22 of the electric motor are connected to means 23 through a manually operable knife switch 24 and through a pressure controlled automatic switch which comprises a main magnetically operated switch 25 and a diaphragm pressure relay switch 26. The switches 25 and 26 are of well known type and need not be specifically described, but it will be observed that the diaphragm relay switch 26 is actuated in accordance with the pressure existing within the heating system, the diaphragm chamber of the switch being connected by means of a conduit 27 with the return pipe 19. The diaphragm relay switch 26 is adjusted to close the circuit through the magnets of switch 25 when the pressure in the pipe 19 has increased to a predetermined amount thereby causing the switch 25 to close the main motor circuit, and to open the same when the pressure has decreased to a predetermined amount to thereby open the main motor circuit at switch 25 and cause the motor to stop. In order to prevent an excessively high vacuum being created in the tank 12 due to any failure of the automatic switches to stop the motor at the proper time a pressure release valve 28 is provided, of well known type.

The air withdrawn from the tank 12 is discharged through the pipe 29, preferably into the atmosphere, and the water withdrawn by the water pump is preferably forced through a pipe 30 into the steam boiler of the heating plant, although it may

be discharged into a hot well, if desired. An air vent pipe for the centrifugal pump is indicated at 31.

From the above description it is thought that the operation of the device will be apparent. To start the apparatus the switch 24 is closed and the motor immediately operates, inasmuch as the pressure in the system will be high and the relay circuit closed. The air pump immediately withdraws air from the tank 12 creating a vacuum or partial vacuum therein which causes the valve 21 to open to admit water of condensation followed by air or vapor, into the tank through the conduit 16. The restricted neck 17 prevents any inrush of fluid which might flood the tank 12 before the water pump could dispose of it, to thereby cause water to be drawn by the air pump through the pipe 14 to flood the air pump and destroy its effectiveness. As soon as the pressure in the system has been reduced to the proper predetermined amount the automatic switch will operate to stop the motor, all of the water of condensation having by this time been removed. The pump will remain inactive until the pressure in the system has again risen above the desired amount when it will operate as before. The water sealed non-return valve 21 prevents leakage of water or air from the tank 12 back into the heating system and it is therefore immaterial whether a vacuum or partial vacuum is maintained in the separating tank or not. In fact, in some instances a small opening may be made in the tank through which air may enter to destroy the vacuum therein when the pump is inactive.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a pumping apparatus, in combination, a fluid pump, an outlet for said pump, and an inlet having a restricted portion of such size that the quantity of fluid passing therethrough in a given time cannot exceed the capacity of the pump for the same time interval.

2. In a gas and liquid pumping apparatus, in combination, a pumping unit for pumping gas and liquid, and an inlet for said unit having a restricted portion of such size that the quantity of liquid passing therethrough in a given time cannot exceed the capacity of the pump to exhaust the same during the same time interval.

3. In a gas and liquid pumping apparatus, in combination, a pumping unit comprising a gas and a liquid exhausting pump, and an inlet for said unit having a restricted portion of such size that the quantity of liquid passing therethrough in a given time cannot exceed the capacity of the liquid exhausting pump to impel the same, during the same time interval.

4. In a gas and liquid pumping apparatus, in combination, a receiver for gas and liquid, a pumping unit comprising a gas and a liquid exhausting pump each having its inlet connected to said receiver, an inlet for said receiver having a restricted portion of such size that the quantity of liquid passing therethrough in a given time cannot exceed the capacity of the liquid exhausting pump to exhaust the same, during the same time interval.

5. In a gas and liquid pumping apparatus, in combination, a receiver for gas and liquid which also constitutes a separating tank, a pumping unit comprising a gas and a liquid exhausting pump, an inlet for the gas exhausting pump having communication with said separating tank at the top thereof, an inlet for the liquid exhausting pump communicating with the separating tank near the bottom thereof, and an inlet for the separating tank having a restricted portion of such size that the quantity of liquid passing therethrough in a given time cannot exceed the capacity of the liquid exhausting pump to exhaust the same, during the same time interval.

6. In a gas and liquid pumping apparatus, in combination, a receiver for gas and liquid, means for creating a partial vacuum in the receiver, an inlet conduit for the receiver disposed below the receiver and entering the same through its bottom, and a non-return valve in said inlet conduit normally sealed by water in the conduit on the tank side of the valve.

7. In a gas and liquid pumping apparatus, in combination, a receiver for gas and liquid, means for creating a partial vacuum in the receiver, an inlet conduit through which gas and liquid pass to the receiver, said conduit being disposed with its outlet orifice below the normal level of the liquid in the tank, and a non-return valve in said conduit normally sealed by water in the conduit on the tank side of the valve.

8. The combination with a conduit in which it is desired to maintain a partial vacuum, of a receptacle communicating with the conduit through a passage, having a rela-

tively restricted portion and containing a non-return valve, an automatic means for exhausting the fluid contents of said receptacle, said means comprising a pump connected to said receptacle, an electric motor for operating the pump, and an automatic pressure controlled switch for controlling the motor circuit, said switch being automatically closed by an increase in pressure in the conduit beyond a predetermined amount and automatically opened when the pressure has been reduced to a predetermined amount.

9. In a gas and liquid pumping apparatus, in combination, an air exhaust unit, a conduit or receptacle, a pipe leading from the receptacle to the air exhaust unit, the mouth of said pipe being above the bottom of the receptacle so that water continually covers the bottom of the receptacle, and the intake conduit for said receptacle opening through the bottom wall thereof and provided with a non-return valve which is sealed by the water in the bottom of the receptacle.

10. In a gas and liquid pumping apparatus, in combination, a receiver for gas and liquid, a pump arranged below said receiver for exhausting fluid therefrom, a conduit for priming fluid connecting said pump and said receiver, and an inlet conduit for said receiver having its outlet orifice disposed above the inlet to said priming fluid conduit, for the purpose set forth.

11. In a gas and liquid pumping apparatus, in combination, a receiving tank for gas and liquid, a pump arranged below said tank for exhausting fluid therefrom, a conduit for priming fluid connecting said pump and said tank, an inlet conduit for said tank having its outlet orifice disposed above the inlet to the priming fluid conduit, and a conduit for conducting water to be pumped from the tank to the pump, said last mentioned conduit having its inlet orifice above the inlet to the priming fluid conduit, for the purpose set forth.

In testimony whereof I affix my signature.

IRVING C. JENNINGS.