Dec. 23, 1930. A. C. DURDIN, JR 1,786,055

VACUUM CONDENSATION PUMP

Filed Dec. 12, 1928 2 Sheets-Sheet 1

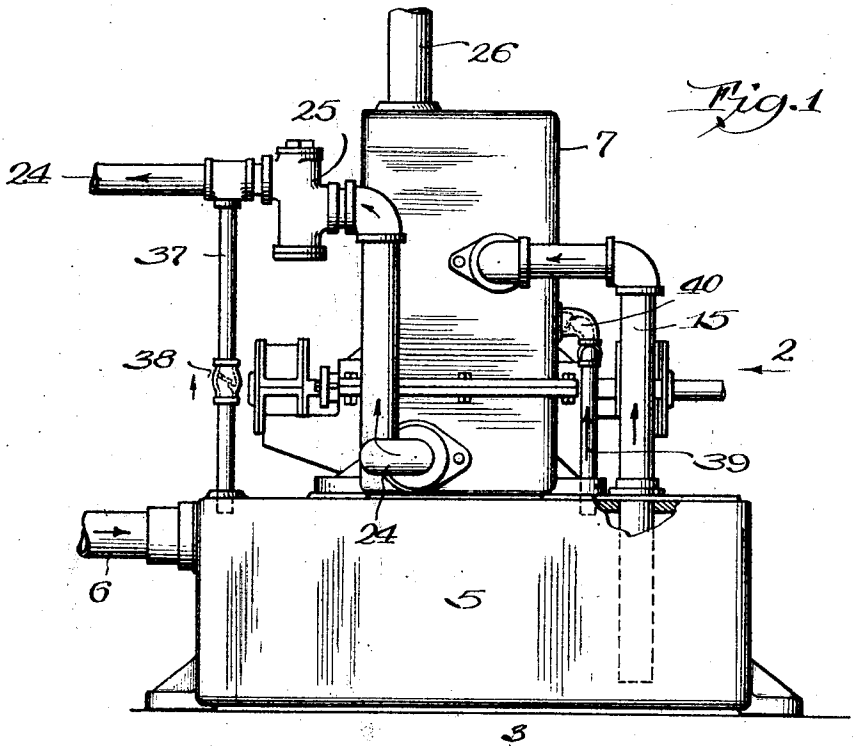


Fig. 1

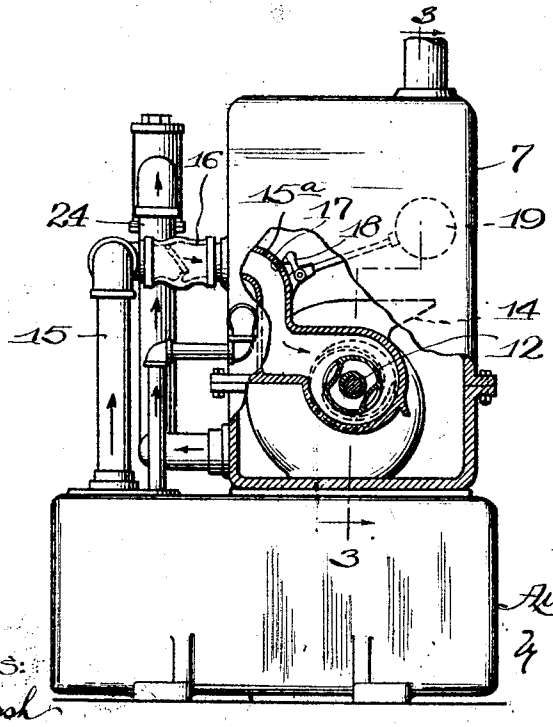


Fig. 2

Witness:
Chas. L. Kirsch

Inventor,
Augustus C. Durdin, Jr.;
by Chas. O. Harvey
his Atty.

Dec. 23, 1930. A. C. DURDIN, JR 1,786,055

VACUUM CONDENSATION PUMP

Filed Dec. 12, 1928 2 Sheets-Sheet 2

Fig. 3

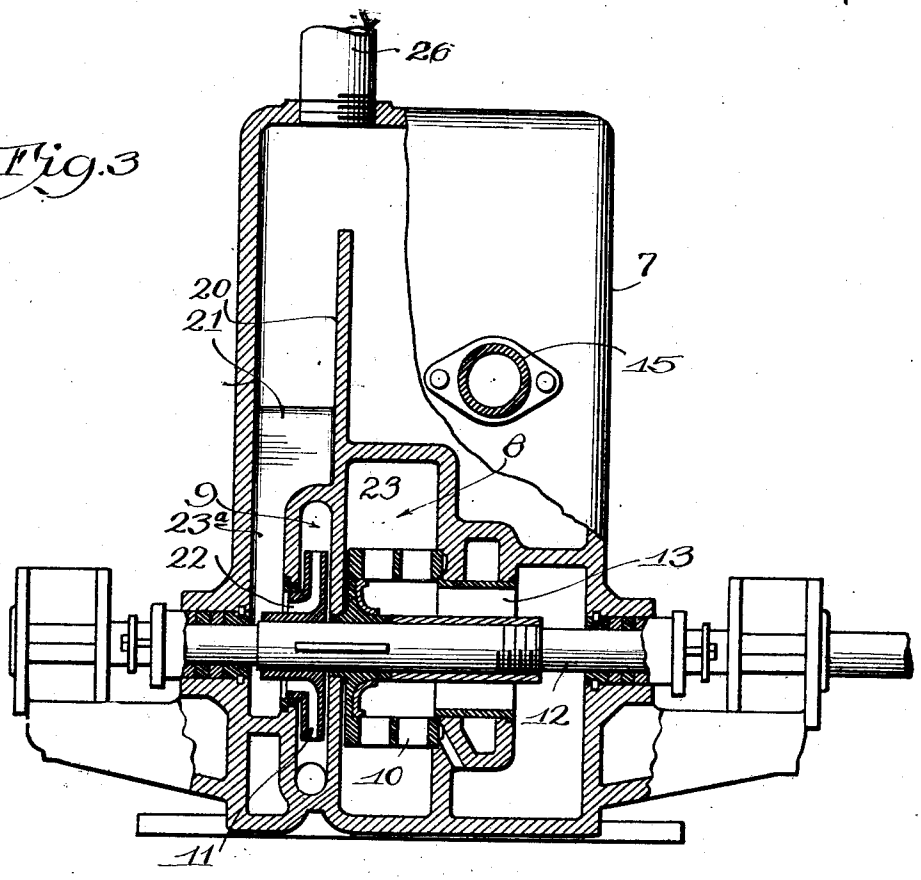
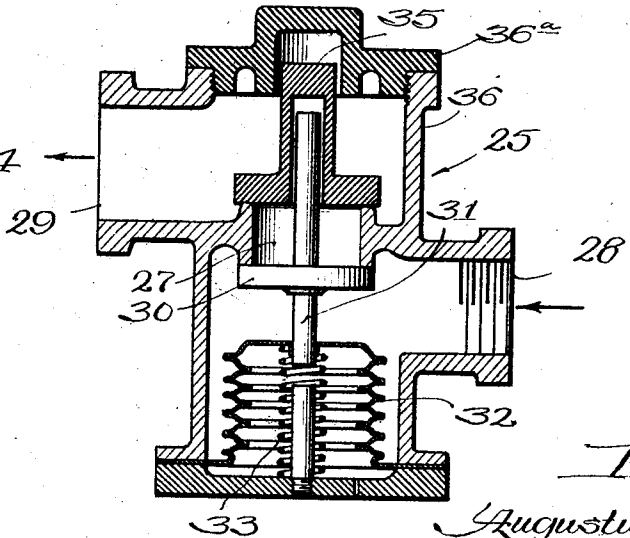


Fig. 4



Witness:
Chas. L. Kourek

Inventor,
Augustus C. Durdin, Jr.,
by Thomas O. Sherry
his Atty

Patented Dec. 23, 1930 1,786,055

UNITED STATES PATENT OFFICE

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

VACUUM CONDENSATION PUMP

Application filed December 12, 1928. Serial No. 325,588.

This invention relates to vacuum condensation pumps adapted particularly for use in creating vacuum in the return pipes of steam heating systems and thereby exhausting the water of condensation, air and non-condensible gases from the system, discharging the air and non-condensible gases to the outer atmosphere and pumping the water back to the boiler or other receptacle.

The vacuum pump of condensation pumps of the type contemplated herein employs throwing water in conjunction with an impeller for creating vacuum, and a reservoir for furnishing throwing water forms part of the unit. A water pump is associated with the vacuum pump and reservoir and acts to discharge water from the reservoir and pump it back to the boiler or other receptacle. The water of condensation exhausted from the system by the vacuum pump is delivered into the reservoir to replenish the water discharged therefrom by the water pump.

Among the objects of this invention is the provision of an improved construction, arrangement and combination of parts for preventing the water in the reservoir from being siphoned out whenever the boiler cools down, which usually occurs during the night when the steam pressure is not kept up. When the boiler is shut down, the steam condenses in the radiators and in the boiler, thereby creating a partial vacuum in the entire system with the result that the throwing water for the vacuum pump was sometimes siphoned out of the reservoir, thereby rendering the vacuum pump inoperative until primed again. Furthermore, when vacuum was created in the return pipe between the vacuum condensation pump and the boiler as a result of the condensation of steam in the system, air and non-condensible gases, which collected in the reservoir instead of being discharged into the atmosphere, were likely to be pumped back into the boiler along with the water.

In accordance with the present invention, these undesirable features have been eliminated, and the invention consists, therefore, in the provision of certain novel features of construction, arrangement and combination of parts in a vacuum condensation pump as hereinafter more fully set forth in detail and particularly pointed out in the appended claims.

The invention is clearly illustrated in the drawings accompanying this specification in which—

Figure 1 is a front elevation of a vacuum condensation pump embodying a simple form of the present invention;

Fig. 2 is an end elevation thereof looking in the direction of the arrow 2 in Fig. 1, the casing of the reservoir being partly broken away to illustrate parts within the same;

Fig. 3 is a view, partly in front elevation and partly in vertical longitudinal section, of the reservoir and vacuum and water pumps, the line of section being indicated at 3—3 in Fig. 2; and

Fig. 4 is a detail longitudinal section through a pressure operated valve device employed in the apparatus.

Referring to said drawings, the reference character 5 designates a receiver or receiving tank adapted for the reception of water of condensation, air and non-condensible gases, and 6 designates the return pipe of a steam heating plant which is connected to the receiver 5. Said return pipe discharges water of condensation, air and other non-condensible gases coming from the radiators of the building into the receiver 5, from which the air and non-condensible gases are discharged to the outer atmosphere and the water returned to the boiler by means of pumping apparatus here shown as mounted directly upon the receiver.

The pumping apparatus here shown comprises a reservoir 7, in which is contained a vacuum pump 8 and a water pump 9, the impellers 10 and 11 of which are mounted on an impeller shaft 12 journaled in suitable bearings carried by the reservoir walls and connected to an electric motor (not shown). The vacuum pump may be of any of the well known types which employ throwing water in connection with an impeller for creating a vacuum. The inlet 13 for admitting the throwing water into the vacuum pump opens to the interior of the reservoir 7 and the dis-

charge end 14 of the vacuum pump discharges directly into the reservoir, whereby the water passing through the reservoir may be used as the throwing water for the vacuum pump.

Leading from the bottom of the receiver 5 is the inlet pipe 15 for the vacuum pump 8. Said inlet pipe has a check valve 16 therein which opens towards the vacuum pump, and from said check valve the inlet conduit is continued into the inlet side of the vacuum pump, as is clearly illustrated at 15ª in Fig. 2. Inasmuch as the check valve 16 is likely to leak, means are provided for preventing the water in the reservoir from being siphoned out as a result of vacuum being created in the reservoir when the vacuum pump is at rest.

In the part 15ª of the inlet conduit to the vacuum pump is an air vent 17 which is provided for the purpose of admitting air from the reservoir to the inlet pipe 15ª when the level of the water in the reservoir is at, or below, the air vent. In case vacuum is created in the receiver when the boiler is shut down and the vacuum pump is not in operation, the inlet pipe 15ª is thereby vented, thus preventing the water from being siphoned out from the reservoir through the vacuum pump. A float valve 18 is provided for controlling the air vent 17, said float valve having a float 19 which is raised by the water in the reservoir when it reaches a predetermined level, thereby completely shutting the air vent 17 and preventing the water above the air vent 17 from draining out through the inlet pipe 15 when the pump is at rest.

The pumps 8 and 9 are separated from each other by partitions 20 and 21 which extend above the pumps and serve to provide chambers 23 and 23ª in the reservoir, one for retaining a body of water to supply the throwing water for the vacuum pump, and one for conducting the surplus water to the water pump. The inlet 22 for the water pump opens into the chamber 23ª and discharges water, entering said chamber, back to the boiler. The discharge pipe for the water pump is seen at 24, and, as a preference, leads up to a place above the water line of the reservoir and thence back to the boiler.

Interposed in the discharge pipe 24 is a pressure operated valve device 25 which is constructed and arranged to remain closed until a pressure somewhat above atmospheric pressure is created therein. The reservoir is open to the outer atmosphere, and, if desired, it may be provided with an air outlet pipe 26 which extends upwardly considerably above the pump. With other condensation pumps it sometimes happens that when a partial vacuum is created in the discharge pipe 24, due to the shutting down of the boiler and consequent condensation of steam therein, the air and non-condensible gases collecting in the reservoir have been pumped back into the boiler along with the water, owing to the difference in pressure at the air outlet opening from the reservoir and the water discharge opening from the water pump. In order to effectively guard against any such occasion, a pressure operated valve device has been interposed in the discharge pipe 24 which remains closed until pressure therein is raised somewhat above atmospheric pressure.

In the form of pressure operated valve device illustrated in the drawing, a port 27 is provided between the inlet side 28 and discharge side 29 of the valve device, which port is closed by a valve disk 30 mounted upon a valve stem 31 connected to and operated by a pressure operated device, such as a diaphragm 32, contained within a chambered part of the casing 36 of the valve device. A coiled compression spring 33 serves to hold the diaphragm 32 in distended position with the valve disk 30 seated upon the seat around the port 27. The area of the upper surface of the diaphragm is made greater than the area of the lower surface of the valve disk 30, and, consequently, when the pressure in the chamber is sufficient to overbalance the tension of the spring 33, the diaphragm is collapsed and the valve disk 30 unseated, thereby establishing open communication between the inlet 28 and the outlet 29 of the valve device and permitting water to pass through the device.

To prevent the return of water through the valve device, a check valve is provided which is here shown as comprising a valve disk 34 adapted to seat upon a seat around the port 27 and having a stem 35 guided in the head 36ª of the casing. The stem 35 of the check valve may be made hollow to receive and guide the upper end of the valve stem 31 for the valve disk 30.

Interposed between the receiver 5 and the discharge pipe 24 is an air pipe 37 in which is a check valve 38 opening towards the discharge pipe. Said air pipe 37 connects with the discharge pipe at some point beyond the pressure operated valve device 25. The purpose of the air pipe 37 is to provide a by-pass around the vacuum condensation pump, whereby when a vacuum is created in the discharge pipe 24, due to the lowering of the pressure in the boiler when it is shut down, the pressure in both pipes 6 and 24 will be equalized, and the water will not be siphoned out of the reservoir 7.

Interposed between the receiver 5 and reservoir is a by-pass which may comprise an air pipe 39 in which is located a check valve 40, opening in the direction of the reservoir. In some situations, when the steam is started in the morning, a rush of water into the receiver occurs with the result that any air above the water level cannot escape freely from the receiver. With the by-pass above mentioned, the air may freely escape from the receiver, pass through the reservoir and escape through the air outlet pipe 26. Moreover, since the air

may thus freely escape, the water will quickly rise in the receiver and actuate the float switch for the motor of the pump.

As is customary, a pressure switch and a float switch (not shown) may be provided for starting the pump motor whenever the pressure in the receiver increases above a predetermined point, or whenever the level of water therein rises above a predetermined level, whereby a low pressure may be maintained in the receiver and on the return pipes of the steam heating plant.

In the operation of the apparatus, the vacuum pump 8, when running, creates vacuum in the receiver and discharges water, air and non-condensible gases from the receiver into the reservoir 7, from which the air and non-condensible gases escape through the pipe 26 to the outer atmosphere. The water pump 9 discharges water which enters the chamber 23^a and pumps the same back into the boiler or other receptacle. When the boiler is shut down, the steam therein and in the remainder of the heating system condenses, and vacuum is created in the system and extends to the receiver, and in case the check valve 16 leaks, it extends through the inlet pipes 15 and 15^a to the vacuum pump.

Any water contained in the reservoir above a predetermined level will flow back by gravity through the pump, the inlet pipe 15^a and 15 and leaky valve 16 and into the receiver until the float 19 falls sufficiently to open the air vent 17 in the inlet pipe 15^a. The remainder of the water in the reservoir is thereby prevented from being siphoned out through the long leg 15 of the inlet pipe, and, consequently, sufficient water is left in the reservoir for priming the vacuum pump 8.

When the water in the receiver rises above a predetermined level, the switch to the motor is closed and the motor started, thereby operating the vacuum and water pumps. In case the pressure in the return pipe 24 beyond the valve disk 25 is below atmospheric pressure, the valve disk 30 of the valve device 25 remains closed until sufficient water pressure is built up in the adjacent section of the return pipe 24 to overcome the spring of the diaphragm device, and, consequently, air and non-condensible gases will escape through the pipe 26 to the outer atmosphere instead of being pumped back into the boiler. When the water pressure in the adjacent section of the discharge pipe 24 overbalances the spring of the diaphragm device, the latter is depressed and the valve disk 30 is unseated, thereby permitting the water freed from air and other gases to be discharged through the pressure operated valve device 25. The pump continues to run until the level of the water in the receiver has lowered to a place where the float valve controlling the motor switch is actuated to break the circuit and stop the motor, or until vacuum is built up in the receiver.

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

1. In a vacuum condensation pump, the combination of a reservoir into which water, air and other condensates are delivered, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, and a normally closed pressure operated valve device in said discharge pipe capable of opening solely in response to pressure by said water pump in excess of a predetermined low pressure.

2. In a vacuum condensation pump, the combination of a reservoir into which water, air and other condensates are delivered, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, a normally closed pressure operated valve device in said discharge pipe capable of opening solely in response to pressure by said water pump in excess of a predetermined low pressure, and a check valve in said discharge pipe opening away from said water pump and pressure operated valve device.

3. In a vacuum condensation pump, the combination of a reservoir into which water, air and other condensates are delivered, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, and a combined pressure operated valve and check valve device in said discharge pipe, the former of which opens solely in response to pressure by said water pump in excess of atmospheric pressure and the latter of which opens away from the first mentioned one and from the water pump.

4. In a vacuum condensation pump, the combination with a receiver having a return pipe for discharging water, air and other condensates thereinto, of a reservoir, a vacuum pump having its intake connected to said receiver and its discharge end discharging water, air and other condensates into said reservoir, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, and a normally closed pressure operated valve device in said discharge pipe capable of opening solely in response to pressure by said water pump in excess of a predetermined low pressure.

5. In a vacuum condensation pump, the combination with a receiver having a return pipe for discharging water, air and other condensates thereinto, of a reservoir, a vacuum pump having its intake connected to said receiver and its discharge end discharg-

ing water, air and other condensates into said reservoir, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, a normally closed pressure operated valve device in said discharge pipe capable of opening solely in response to pressure by said water pump in excess of a predetermined low pressure, and a check valve in said discharge pipe opening away from said water pump and pressure operated valve device.

6. In a vacuum condensation pump, the combination of a reservoir into which water, air and other condensates are delivered, said reservoir being open to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, and a valve device interposed in said discharge pipe and having a pressure operated valve actuating diaphragm therein operating to open the valve solely in response to pressure by the water pump in excess of a predetermined pressure.

7. In a vacuum condensation pump, the combination of a receiver, a return pipe discharging thereinto, a reservoir, a vacuum pump having its intake leading from said receiver and its discharge end discharging into said reservoir, a water pump having its intake leading from said reservoir, a discharge pipe leading from the discharge end of the water pump, and a check valve controlled by-pass between said return pipe and discharge pipe.

8. In a vacuum condensation pump, the combination of a receiver, a reservoir open to the outer atmosphere, a vacuum pump having an inlet pipe leading from the bottom of said receiver and a discharge end discharging into said reservoir, and a check valve controlled by-pass between said receiver and reservoir.

9. In a vacuum condensation pump, the combination of a receiver, a reservoir open to the outer atmosphere, a vacuum pump having an inlet pipe leading from the bottom of said receiver, and a discharge end discharging into said reservoir, an air pipe leading from the receiver to the reservoir, a check valve in said air pipe opening towards the reservoir, and a water pump discharging water from said reservoir.

10. In a vacuum condensation pump, the combination of a receiver, a reservoir thereabove open to the outer atmosphere, a vacuum pump having an inlet pipe leading from the bottom of the receiver and a discharge end discharging into the reservoir, a check valve in said inlet pipe opening towards the vacuum pump, there being an air vent between the reservoir and that part of the inlet pipe for the vacuum pump between the check valve and the vacuum pump, and a float valve for controlling said air vent.

11. In a vacuum condensation pump, the combination of a receiver, a return pipe discharging thereinto, a reservoir, a vacuum pump having its intake leading from said receiver and its discharge end discharging into said reservoir, a water pump having its intake leading from said reservoir, a discharge pipe leading from the discharge end of the water pump, and a check valve controlled by-pass between said receiver and discharge pipe.

12. In a vacuum condensation pump, the combination of a receiver, pumping apparatus above said receiver for discharging liquid from said receiver and having an inlet pipe leading from the bottom of said receiver, and a vent pipe leading from said receiver to said pumping apparatus.

13. In a vacuum condensation pump, the combination of a receiver for liquid and gas, pumping apparatus above said receiver for discharging liquid and gas from said receiver, said pumping apparatus having an inlet pipe leading from the bottom of said receiver and having a liquid discharge opening and a gas discharge opening, and a vent pipe leading from said receiver and discharging through the apparatus above the receiver.

14. In a vacuum condensation pump, the combination of a reservoir in which water, air and other condensates are delivered, said reservoir having an opening for the escape of air and other gases to the outer atmosphere, a water pump for discharging water from said reservoir, a discharge pipe leading from said water pump, and a normally closed pressure operated valve device in said discharge pipe capable of opening solely in response to pressure by the water pump in excess of a predetermined low pressure.

15. In a vacuum condensation pump, the combination of a reservoir into which water, air and other gases are delivered, said reservoir having an opening for the escape of air and other gases to the outer atmosphere, a water pump for discharging water from said reservoir, a normally closed pressure operated valve device on the discharge side of the water pump and capable of opening solely in response to pressure by said water pump in excess of a predetermined low pressure, and a discharge pipe leading from said valve device.

AUGUSTUS C. DURDIN, JR.