

March 31, 1942.

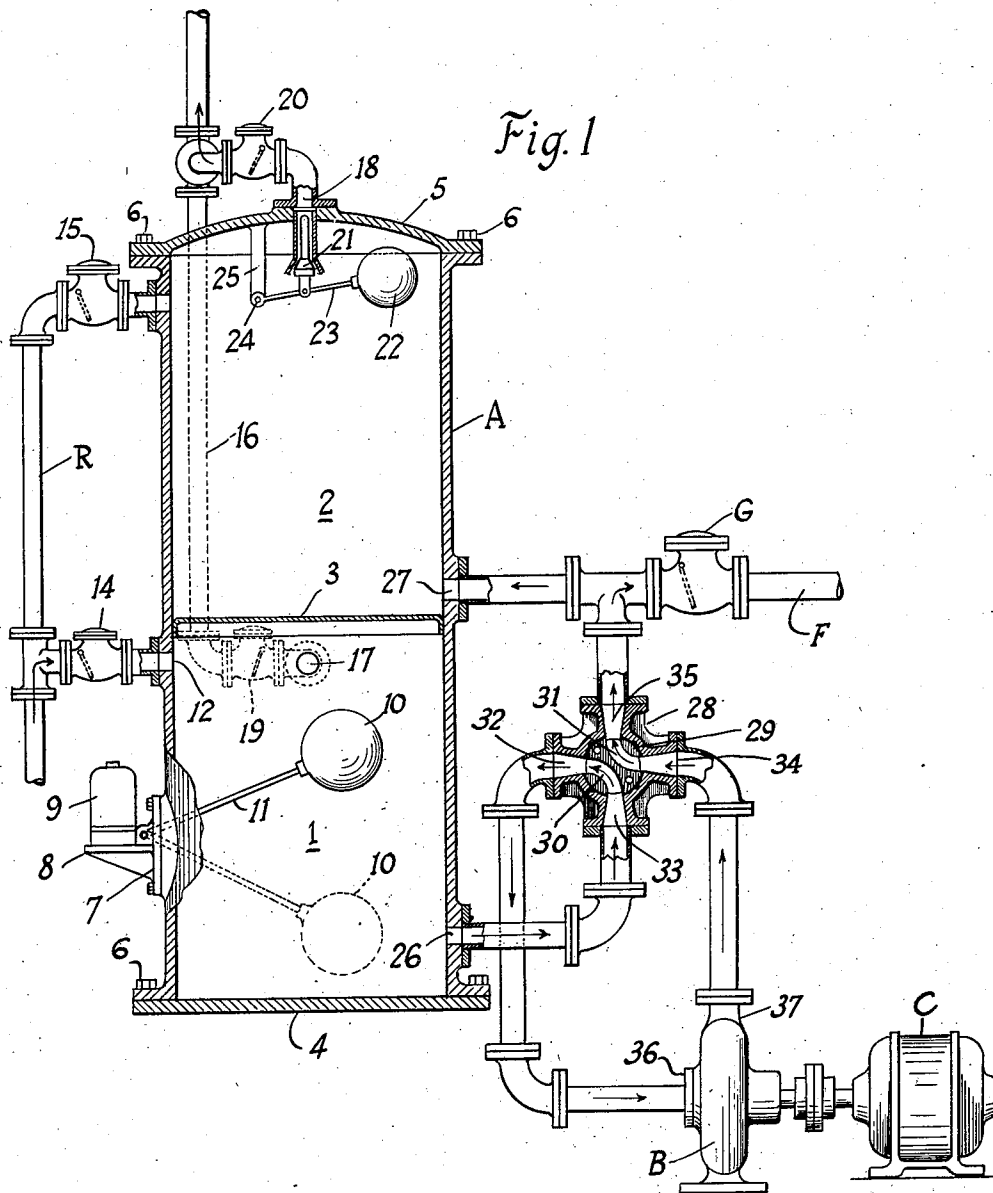
L. H. HESSE

2,277,977

HEAT TRANSFER SYSTEM

Filed Jan. 27, 1940

3 Sheets-Sheet 1



Louis H. Hesse INVENTOR.

BY

Bay R. Newcomb

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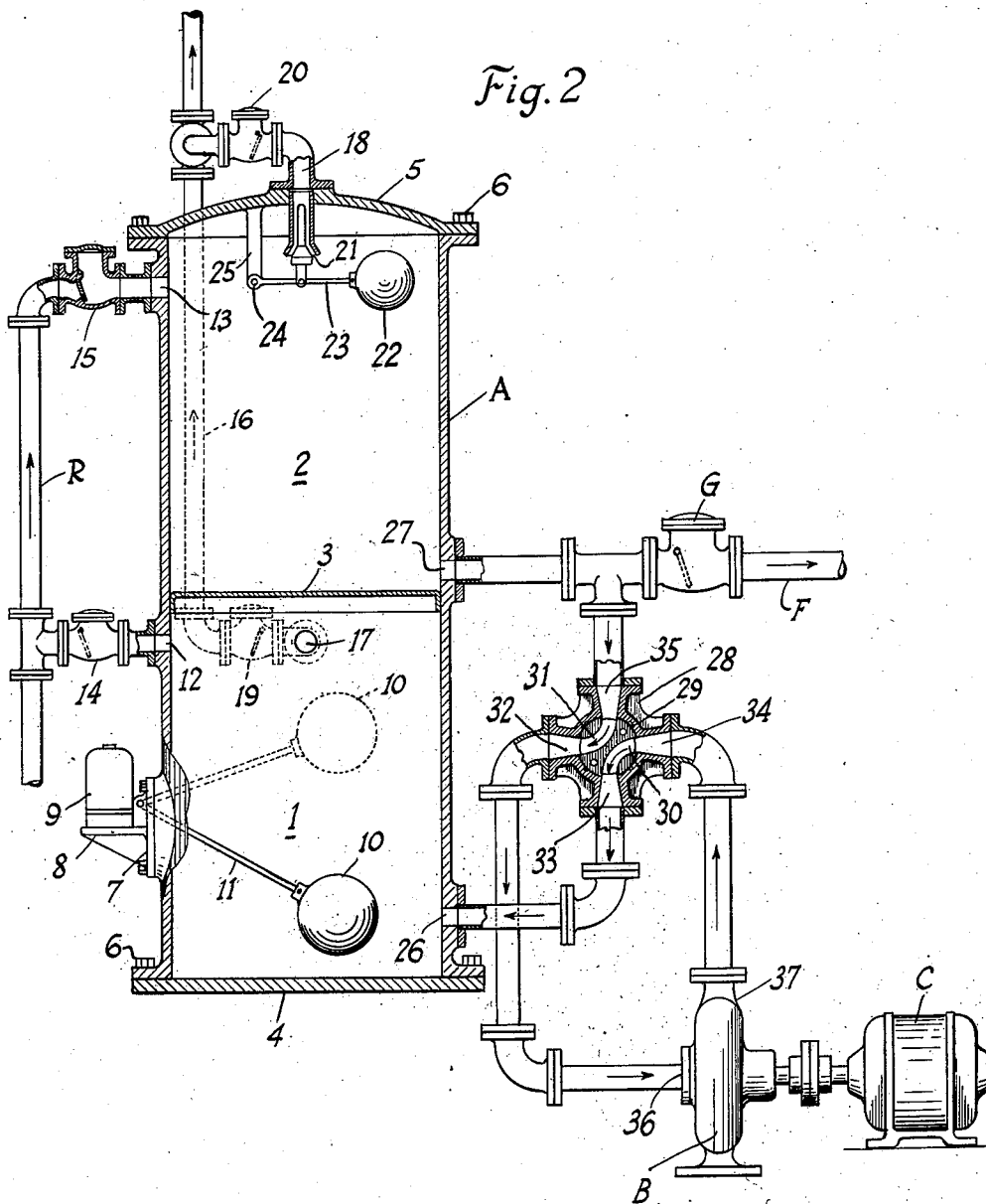
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HEAT TRANSFER SYSTEM

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3 Sheets-Sheet 2



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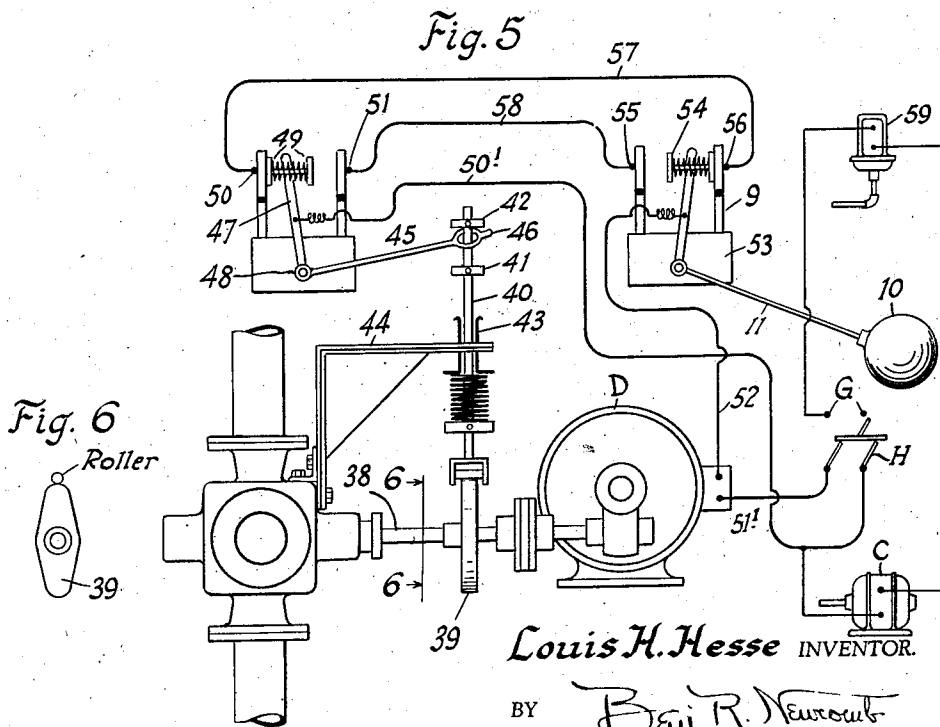
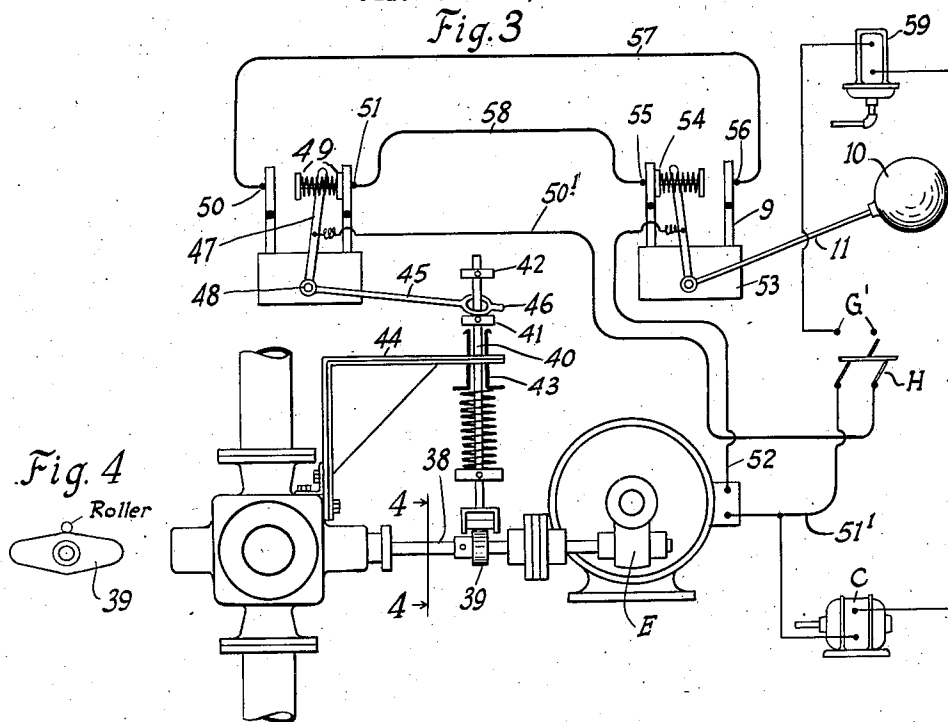
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HEAT TRANSFER SYSTEM

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,277,977

HEAT TRANSFER SYSTEM

Louis H. Hesse, Roselle Park, N. J.

Application January 27, 1940, Serial No. 315,943

4 Claims. (Cl. 103-6)

This invention is a vacuum return apparatus for heat transfer systems.

Vacuum boiler feed return apparatus for vapor heating systems has been known and widely used, and the prior art is full of disclosures along this line with which I am familiar but, in the main, such systems are costly, use two pumps, or are complicated by appurtenances which render it inadvisable, from the standpoint of cost and operating attention, to include the same in smaller systems where infrequent attention is the rule.

The present invention has, as an object, a simplified vacuum return and boiler feed apparatus which is low in initial cost and is free of the intricate and expensive appurtenances of the present widely used apparatus of this character.

A further feature of the invention resides in the use of a single centrifugal or other pump to maintain the necessary vacuum on the system, and return the condensate to the boiler at proper boiler feed pressure.

Additionally the invention is directed to a combination of a multi-chambered condensate tank and pump with reverse flow mechanism cooperative with level and valve position control to automatically operate the apparatus with a minimum power consumption.

With the above and other features in view I shall now describe a particular embodiment of the invention which, for the purpose of satisfying the patent statutes, I have illustrated in the accompanying drawings.

In the drawings—

Fig. 1 is a sectional view through apparatus of the present invention with the parts thereof in one position of operation;

Fig. 2 is a view similar to Fig. 1 with the parts in another position of operation;

Fig. 3 is a diagrammatic view showing the valve mechanism in the position of Fig. 1;

Fig. 4 is an end view of the cam and roller in the position shown in Fig. 3;

Fig. 5 is a view similar to Fig. 3 with the valve mechanism in the position of Fig. 2; and

Fig. 6 is an end view of the cam and roller in the position shown in Fig. 5.

In the form of the invention illustrated, a closed receiver A is divided into compartments 1 and 2 by the diaphragm 3, the bottom 4 closing the lower chamber 1 while the flanged head 5 closes the upper chamber 2, both the bottom 4 and head 5 being suitably secured by bolts or cap screws 6.

In the lower chamber 1 is an opening to which

is secured a flange 7 having a bracket 8 which supports a float operated switch 9 actuated through the medium of float 10 within the lower chamber 1 and on the end of the operating lever 11 for the switch 9.

The switch 9 is shown diagrammatically in Figs. 3 and 5 wherein it is included with a motor operating circuit as therein indicated.

Adjacent the top of each of the chambers 1 and 2 are condensate return entrances 12 and 13 connected with check valves 14 and 15, respectively, which prevent back flow from the chambers into the common condensate return line R when there is positive pressure in either the chamber 1 and 2. Also an atmospheric vent line 16 has outlets 17 and 18 controlled by check valves 19 and 20 to prevent reverse flow into the chambers 1 and 2. The upper chamber 2 has its outlet 18 controlled by a valve 21 opened and closed, dependent on water level in the upper chamber 2, by a float 22 on the end of an arm 23 pivoted at 24 to the dependent member 25.

At the lower portion of each of the chambers 1 and 2 is an outlet 26 and 27, respectively, and both of which lead through suitable pipe connections, as shown, to the body 28 of a reversing valve, the valving element 29 of which is double ported as indicated at 30 and 31, and which serves, through the proper combinations of body ports 32, 33, 34 and 35, to selectively connect the suction intake 36 or the outlet 37 of a centrifugal pump B, driven by a motor C, with the chambers 1 and 2. The motor C driving pump B is controlled as shown by vacuum switch 59 connected to return line R and is operated only by loss of vacuum.

The valving element 29 of the reversing valve is rotated by a motor D (see Figs. 3 and 5) through a reduction gearing E coupled, as shown, to the stem 38 of the said valving element 29.

The stem 38 has keyed thereto a cam 39 shown in end elevation in Figs. 4 and 6 in the place of the lines 4-4 and 6-6 of Figs. 3 and 5, respectively.

The cam 39 raises and lowers a spring-pressed plunger 40 having lugs 41 and 42 spaced at the upper end thereof. The plunger stem is suitably guided as at 43 in a bracket 44 and operates a lever arm 45, the eye 46 of which is between the lugs 41 and 42 and is engaged by them to move the arm 47 pivoted at 48 to swing the double ended contact 49 back and forth for selective engagement with the fixed contacts 50 and 51.

The circuit for control of position of the valving element 29 includes the electric line G and switch

H through which energy is fed by the wire 50' to the lever 47 and its contacts 49, while the other side of the line G, as indicated by the wire 51', is connected direct to the motor D. The other terminal of the motor D is connected by wire 52 to the arm 53 actuated by the float 10 of the switch 9 and which carries the double contacts 54 for engagement with either of the contacts 55 or 56 dependent upon the position of the float 10. The contacts 50 and 56 are connected by wire 57 while contacts 51 and 55 are connected by wire 58, as shown.

The operation of the float 10 thus serves to energize the motor E for 80 degrees intermittent movement of the valving element 29.

In operation the following takes place:

Condensate from a heating system, steam jacketed kettle or other vapor heated heat transfer system returns through the pipe R and inlets 12 and 13 served by check valves 14 and 15, respectively.

Consider firstly Fig. 1 and the position of the apparatus as therein disclosed, condensate is entering the chambers through the check valve 14 with the reversing valve in the position shown, that is to say with the outlet 26 discharging to the suction intake 36 of the centrifugal pump B, through the pump discharge outlet 37 and through the opening 27 into the chamber 2. As the condensate in chamber 1 is removed check valves 15 and 19 are, of course, closed and a vacuum is created in the chamber 1 with the result that condensate is drawn in through return line R and check valve 14.

However, as this takes place the chamber 2 is filling with liquid and air is escaping from the vent valve 21 through the vent pipe 16 controlled by check valve 20 in the vent outlet 18. When the chamber 2 is filled with liquid the float 22 operates to close the vent valve 21 and a cushion of air accumulates in the upper portion of the chamber 2, the pump B then begins to build up pressure greater than the prevailing boiler pressure on the feed line F controlled by the check valve G which prevents pressure from the boiler feed line from returning water to chambers 1 and 2. In this condition of the apparatus the pump B then begins to discharge excess condensate through non-return valve G to the boiler feed line F.

When the chamber 1 is empty a single pole double throw switch 9 operated by the float 10 in the chamber 1 is actuated to energize reversing valve motor D to move the valve element ahead one quarter turn to the position shown in Fig. 2.

In the position shown in Fig. 2 the liquid in chamber 2 returns through the reversing valve and centrifugal pump B to chamber 1 creating a vacuum which closes check 20 and opens check 15 to draw condensate through return line R into chamber 2. At the time this cycle starts chamber 1 is empty, and as liquid enters the air is expelled through check valve 19 to atmosphere. The liquid continues to fill chamber 1 until the level therein is sufficient to raise the float 10 to a location high enough to actuate the switch 9, which, in conjunction with a single pole double throw limit switch, as shown in Figs. 3 and 5, actuated by the cam 39, again closes the circuit of the reversing valve motor D and advances the reversing valve element a quarter turn to deliver water from the chamber 1 to the chamber 2 with excess condensate pumped to the boiler feed line F.

It is to be noted that each quarter turn ahead

of the stem of the reversing valve advances the valve one cycle; cycles 1 and 3 place the valve in corresponding positions, while cycles 2 and 4 place the valve in corresponding positions opposite to 1 and 3, the positions being shown respectively in Figs. 3 and 5.

Also it is to be understood that the relative positions of chambers 1 and 2 with respect to each other and the centrifugal pump is such that transference of liquid from chamber 2 to chamber 1 in the position of the valve mechanism indicated in cooperating Figs. 2 and 5 may take place by gravity regardless of whether the pump is or is not actuated.

While, in the foregoing, I have described a particular form of the apparatus it is nevertheless to be understood that in practicing the invention I may resort to any and all modifications falling within the scope of the appended claims defining the invention.

I claim—

1. In apparatus of the character described, a receiver having superimposed separate chambers, a condensate entrance to each chamber with a non-return valve in each entrance, an atmospheric non-return vent valve for each chamber, one of which is provided with a fluid level actuated seal for the upper chamber, a motor driven condensate pump, a connection to each chamber, a four way valve, connections between the pump suction and discharge and said valve, and between said valve and each of the connections to said chambers, whereby condensate may be selectively pumped from one to the other of said chambers, and a non-return discharge outlet receiving the direct discharge of the pump when the pressure in the chamber with the level actuated seal is above the pressure in the direct discharge, and means for selectively positioning the four way valve.

2. In apparatus of the character described, a double chambered receiver, a condensate entrance to each chamber with a non-return valve in each entrance, an atmospheric vent valve of the non-return type for each chamber, one of which is provided with a fluid level actuated seal, a motor driven condensate pump, a connection to each chamber, a four way valve, connections between the pump suction and discharge and said valve and between said valve and each of the connections to said chambers whereby condensate may be selectively pumped from one to the other of said chambers, a discharge outlet of the non-return type receiving the direct discharge from the pump when the pressure in the chamber with the level actuated seal is above the pressure in the direct discharge, and means conditioned by liquid level in the non level sealed chamber for instantaneously positioning the four way valve with a power impulse.

3. In apparatus of the character described, a receiver having superimposed separate chambers, a condensate entrance to each chamber with a non return valve in each entrance, an atmospheric non return vent valve for each chamber, one of which is provided with a fluid level actuated seal for the upper chamber, a motor driven condensate pump, a connection to each chamber, a four way valve, connections between the pump suction and discharge and said valve and between said valve and each of the connections to said chambers, whereby condensate may be selectively pumped from one to the other of said chambers, and a non-return discharge outlet receiving the direct discharge of the pump when the pressure

in the chamber with the level actuated seal is above the pressure in the direct discharge, and a motor power impulse system positioning the four way valve successively and conditioned from liquid level in the non level sealed chamber.

4. In apparatus of the character described, a receiver having superimposed separate chambers, a condensate entrance to each chamber with a non-return valve in each entrance, an atmospheric non-return vent valve for each chamber, one of which is provided with a fluid level actuated seal for the upper chamber, a motor driven condensate pump, a connection to each chamber, a four-way valve, connections between the pump

5 suction and discharge and said valve and between said valve and each of the connections to said chambers whereby condensate may be selectively pumped from one to the other of said chambers, and a non return discharge outlet receiving the direct discharge of the pump when the pressure in the chamber with the level actuated seal is above the pressure in the direct discharge, a motor power impulse system positioning the four way valve successively and conditioned from liquid level in the non level sealed chamber, and a vacuum operated switch energizing the pump motor only in a selected low vacuum range.

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