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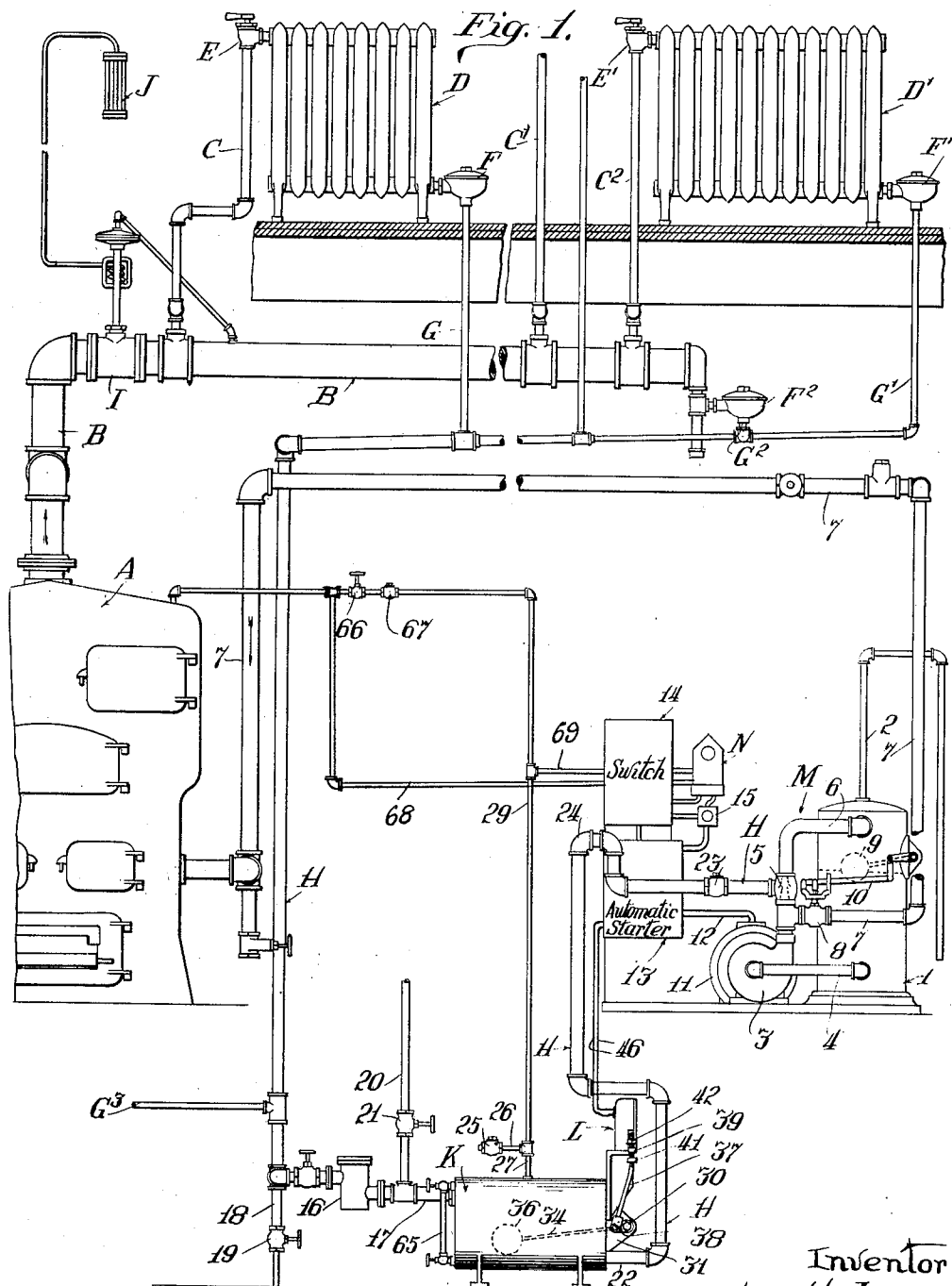
B. H. JARVIS

1,802,383

STEAM HEATING SYSTEM

Filed June 14, 1926

2 Sheets-Sheet 1



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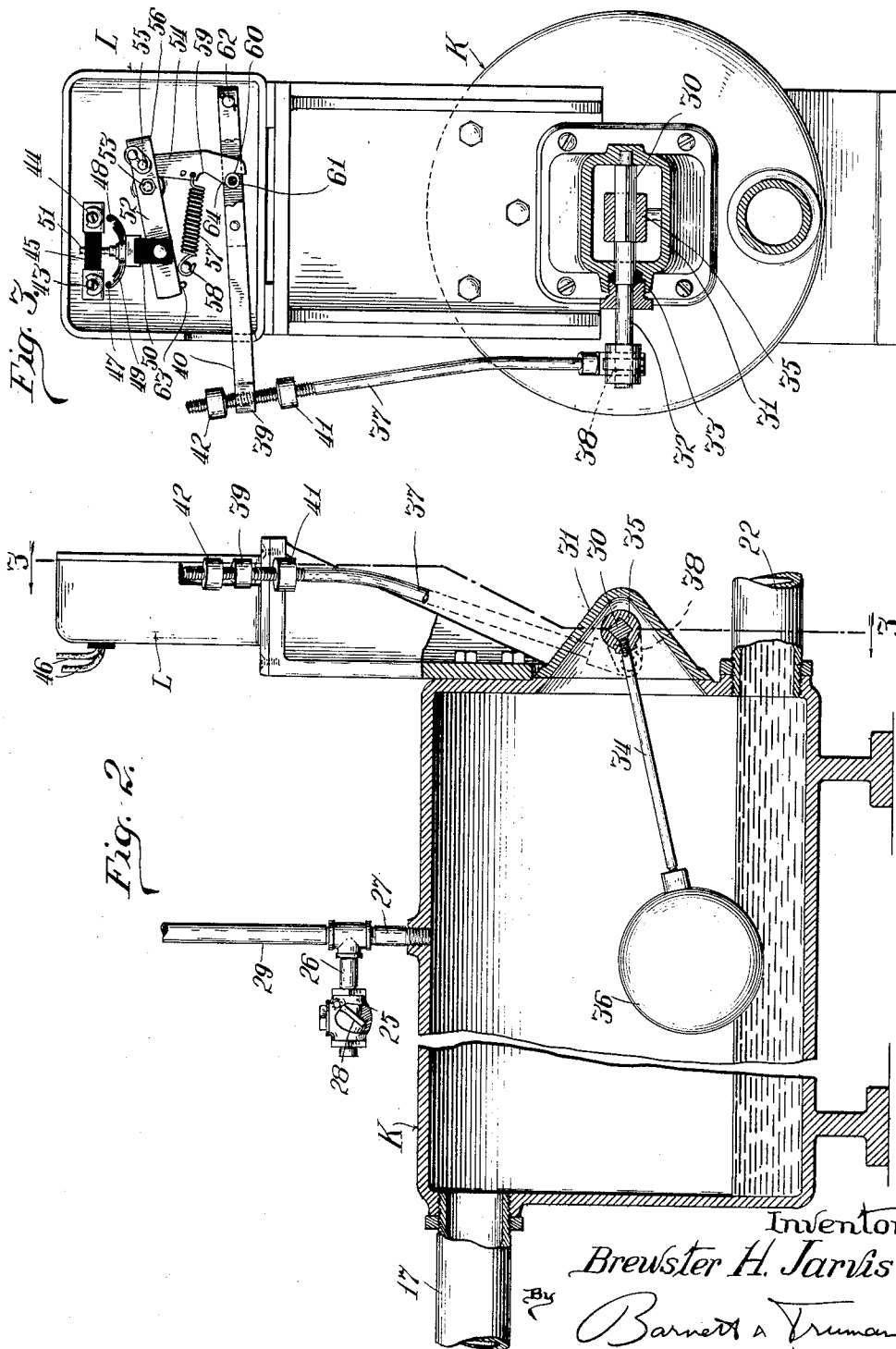
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STEAM-HEATING SYSTEM

Application filed June 14, 1926. Serial No. 115,866.

This invention relates to improvements in steam heating systems, and more particularly to the combination with a heating system normally operated to maintain a pressure in the radiators below atmospheric and including a boiler and a pumping means for returning condensate to the boiler and also for maintaining a predetermined pressure differential between the supply and the return sides of the system, of an accumulator tank located in the return main beneath the level of the boiler and pumping system for collecting by gravity all of the condensate. Means are provided, controlled by the level of the accumulated liquid in the tank for starting and stopping the pumping means so that the liquid will be withdrawn from the tank at intervals.

In some heating systems, the positioning of the different parts of the installation requires that the return main, through which the condensate flows down by gravity, shall return to the vicinity of the boiler and pumping system at a lower level than it is feasible to position these parts of the system. It is therefore impossible to have the condensate gravitate directly into the boiler, or directly into the pumping system. According to this invention, a tank is located in the return main, at its lowest level, in which the condensate can accumulate. A float is positioned in this tank, which will rise as the condensate accumulates, and actuate a switch which controls the motor which actuates the pump. The pump will create a suction which will draw up the accumulated liquid, and force same from the pumping system into the boiler. Other features and improvements of this system will be apparent from the detailed description which follows hereinafter.

The principal object of this invention is to provide in a heating system an accumulator tank of the type briefly referred to hereinabove, and described in more detail in the specification which follows:

Another object is to provide the combination of an accumulator tank with a float-controlled switch for governing the operation of the pumping system.

Another object is to provide an accumulator tank having an air-vent which will pre-

mit the escape of the accumulated air in the return main when the system is operating at or above atmospheric pressure, but will prevent the entrance of air when a pressure less than atmospheric or a partial vacuum exists in the return side of the system.

Other objects and advantages of this invention will be more apparent from the following detailed description of one approved form of installation involving the principles of this invention.

In the accompanying drawings:

Fig. 1 is a diagrammatic view of a heating system, illustrating the use of the new accumulator tank.

Fig. 2 is a longitudinal section through the accumulator tank, on a larger scale.

Fig. 3 is a vertical section through the float controlled switch, and associated parts, the view being taken substantially on the line 3—3 of Fig. 2.

Referring first to Fig. 1, A designates a steam generator or boiler, and B is the steam supply pipe leading from the boiler for supplying steam through the branch supply pipes C, C' and C², to a plurality of radiators, two of which are shown and designated D and D', respectively. Steam is admitted to the radiators D, D', etc., through control valves E, E', etc., and F, F', and F² are steam traps associated with the radiators and with the end of the supply line B, from which the condensate passes through pipes G, G', G², G³, etc., to the common return main H. At I is indicated a pressure reducer in the supply pipe B, which is controlled by pressure of the steam on the low pressure side of the reducer, and by a thermostat J which may be located at any desired point either within or outside of the building heated by the apparatus.

At K is shown the accumulator tank, and L indicates the float controlled switch associated with this tank, these features constituting the particular improvements of this invention, and being referred to in more detail hereinafter.

At M is indicated the pumping system which functions to maintain the desired pressure differential between the supply and return sides of the system, and also functions

to force the liquid condensate back into the boiler A. This pumping system comprises a receiving tank 1, always containing a variable supply of water, and a pipe 2 for venting
 5 air or other gases from this tank. The centrifugal pump 3 operates to force water through a hurling circuit, the water being withdrawn through pipe 4 from the lower portion of tank 1, and forced through the jet
 10 exhaustor 5 and return pipe 6 back into the upper portion of tank 1. The jet exhaustor 5 communicates with the end of return pipe H, and functions to create a suction in this return main, and to withdraw condensate
 15 from this return main into the hurling circuit and deliver the condensate into the tank 1. The gases are permitted to escape through vent pipe 2. At 7 is shown a pipe leading from the hurling circuit, beneath the jet
 20 exhaustor 5, to the boiler A, and the centrifugal pump 3 is adapted to force water from the tank 1 through the pipe 7 into the boiler. A control valve 8 in pipe 7 is normally closed so that all of the liquid withdrawn by the
 25 pump 3 from tank 1 will be forced through the hurling circuit and back into the tank. However, when the water level within tank 1 reaches a predetermined height, (the accumulation of water in this tank being constantly
 30 increased by the addition of condensate from return main H), the float 9 in tank 1 will, through the lever and link connections 10, open the valve 8 and permit the pump 3 to force part of the water in the hurling circuit
 35 through pipe 7 to the boiler. When the water level in tank 1 has been lowered sufficiently, valve 8 will close. The centrifugal pump 3 is driven by electric motor 11, controlled through leads 12 from the automatic starter
 40 indicated diagrammatically at 13. For reasons of economy, the pump 3 need not be operated continuously, but its action is controlled by the automatic starter 13 and certain switch mechanism hereinafter described, so that the
 45 pump will only be driven when it is necessary to increase the pressure differential between the two sides of the system, or to force condensate back to the boiler.

At N is shown diagrammatically the vacuum regulator which acts, through switch 14 and automatic starter 13, to start and stop the motor 11 when necessary, in accordance with the variations in pressure between the supply and return sides of the heating system. Such
 50 a device has been disclosed in detail and claimed in previous applications, for example, the co-pending application of Dunham, Serial No. 669,363, filed October 18, 1923, and need not be here described in detail. It is sufficient
 55 to state that when the difference in pressure between the supply and return sides of the system falls below a certain predetermined minimum, the vacuum regulator N will function to start the pump 3, and thus increase
 60 the vacuum in the return main. When a

desired maximum pressure differential is reached, the regulator N will function to shut off power to the motor 11 and thus stop the pump 3.

In any heating system, especially at night, there are times when it is desired to reduce the cost of operating the vacuum pump. In such instances, especially when the fires are banked, it is desired to preclude the possibility of damaging the boiler by providing automatic return of condensate, and at the same time to avoid the expense of constant operation of the pump. In such cases, the snap switch, shown at 15, would be set to disconnect the vacuum regulator, and the condition
 70 then prevailing in the return line would be substantially atmospheric pressure, and the condensate could gravitate directly into the tank 1, provided all of the returns from the radiators came in at a higher level than the
 75 pump 3 or tank 1. In such cases, a switch could be provided, controlled by the float 9, for only actuating pump 3 at such intervals as became necessary to force the excess accumulation of water in tank 1 back to the
 80 boiler.

However, in some heating installations, the arrangement is necessarily such that some of the return pipes come in at a lower level than the boiler or pumping system, and obviously the return main cannot drain directly into the boiler or into the receiving tank 1. For example, in Fig. 1 a return pipe G³ is shown delivering into the return main H at a lower level than the pumping system. It is to adapt a system of the type hereinabove briefly described to such conditions that the improvements of the present invention have been created. According to this invention, the accumulator tank K is provided, which
 95 may if necessary, be located in a pit beneath the floor which supports the boiler and pumping system. The lowest portion of the return main H drains through the suction strainer 16 and the pipe connection 17 into the upper portion of the tank K. At 18 is indicated a by-pass from the lower end of return main H to the sewer, this by-pass being controlled by the valve 19, and at 20 is indicated a pipe connection with the outside
 100 water supply, this connection being controlled by the valve 21, in order to admit additional water to the system when necessary. The accumulator tank K is merely a substantially closed metal receptacle of suitable size, into the upper portion of which one section of the return main H drains at 17, and from the lower portion of which the further extension of the return main H leads, as shown at 22. This portion of the return main leads up to the jet exhaustor 5, as already described. A check valve or one-way valve 23 of any approved type is located in the return main H near the jet exhaustor 5, this valve 23 permitting fluids to be drawn up through this
 105 110 115 120 125 130

portion of the return main H, by the action of the jet exhauster and hurling circuit, but preventing the back flow of any fluids toward the accumulator tank K. The siphon loop 24, positioned between the vertical and horizontal portions of this section of return main H, is for the purpose of providing space for the water to accumulate after reaching the top, and to prevent the water slug, which is the form in which the liquid is lifted from the accumulator tank K, from breaking up and running back down the vertical section of return main H. At 25 is shown an air release check valve, connected by pipes 26 and 27 with the accumulator tank K. This release valve may be of any approved form which will permit the flow of air or gases from the tank K, but prevent any inflow. The valve is here shown as comprising an outwardly swinging flap or check 28. The low pressure air pipe 29 extends from the connection to the air release check valve 25 to make connection direct with the top inlet to boiler A or to the boiler steam header, with a gate valve 66 and a check valve 67, (which may be similar in construction to valve 25) installed in this extension of air line 29. The check valve is so installed as to close against the steam pressure. The vacuum or pressure differential regulator N is connected with the supply and return sides of the system in any suitable manner, for example by the pipes 68 and 69 connected respectively with the high and low pressure sides of the equalizing pipe 29.

A short shaft 30 is pivoted horizontally in an outwardly projecting portion 31 of one end of tank K, and one end portion 32 of this shaft projects outside of the tank through a stuffing box 33. A lever 34 within the tank has one end 35 keyed on shaft 30, and carries at its other end the float 36 adapted to be sustained by the accumulated liquid within tank K. A link 37 is connected at its lower end to the crank arm 38 secured to the projecting end portion 32 of shaft 30, and its upper end projects slidably through a loop or eye 39 on the end of the operating lever 40 of float-operated switch L. A pair of adjustable stops 41 and 42, here shown as nuts screwed on the threaded end portion of link 37, are adapted to engage and operate the lever 40 when the link 37 has been raised or lowered to predetermined positions by the movement of float 36.

The snap switch L may be of any approved type, the one here shown by way of example having been found especially suitable for this purpose. The stationary contacts 43 and 44 are mounted on the insulating block 45, these contacts 43 and 44 being connected by the leads 46 with the automatic starter 13. A pair of movable contacts 47 and 48 are adapted to contact with the fixed contacts 43 and 44 respectively, these movable con-

tacts being carried by and electrically connected by the springs 49 supported on insulating block 50. The guide rod 51 extends from block 50 and is slidable through the insulating block 45. The block 50 and movable contact members are carried by one end of the lever 52, intermediately pivoted at 53 in the casing of switch L. A lever or link 54 has its upper end pivoted at 55 to the short arm 56 of lever 52, and the intermediate portion of lever 54 is connected to one end of spring 57, the other end of the spring being anchored at 58 within the casing. One side of the lower end portion of lever or link 54 is formed with a cam contour comprising a pair of notches 59 and 60, adapted to engage the roller 61 mounted on the operating lever 40. The inner end of operating lever 40 is pivoted at 62 within the casing.

With the several parts in the relative positions shown in Figs. 2 and 3, as the water level rises within tank K, the float 36 will be raised, and through the lever connections will elevate the rod or link 37 until the stop member 41 contacts with and raises the outer end of operating lever 40. The roller 61 will push up against the cam surface 60, but lever 54 cannot be raised vertically since the opposite end of lever 52 is held down against the fixed stop 63. As a result, the lever 54 will be swung toward the right, Fig. 3, against the resistance of spring 57, until the roller 61 has just passed over the high portion 64 of the cam surface, at which time the spring 57 will contract and snap the lever 54 downwardly until the roller 61 rests within the notch 59. This will draw down the end 56 of lever 52, and elevate the other end of the lever thus moving contacts 47 and 48 into engagement with the fixed contacts 43 and 44. This will close a circuit to the automatic starter 13, which in turn will act to start the motor 11 and consequently the pump 3. The water of the hurling circuit, passing through jet exhauster 5, will create a suction in the return main H, which will draw the water from accumulator tank K through outlet 22 and the return main H, into the hurling circuit, and hence into the receiving tank 1. When the water level within tank K has been lowered to the desired extent, the downward movement of float 36 will cause stop 42 to move operating lever 40 of switch L downwardly, and an action of the parts, substantially the reverse of that previously described, will cause the movable contacts 47 and 48 to snap away from the fixed contacts 43 and 44 and break the circuit to automatic starter 13. As a result the motor 11 and pump 3 will be stopped.

A water level gauge 65 may be positioned at one end of accumulator tank K. As shown in Fig. 1, this may be of the usual type involving a vertically positioned glass tube, both

ends of which are in communication with the interior of the tank.

In normal operation of this heating system, when a desired predetermined pressure differential is to be maintained between the supply and return sides of the system, steam passes from the boiler or generator A through supply pipe B and pressure reducer I to the several branch pipes C, and thence through control valves E to the radiators D. In the normal operation of the apparatus the pressure in the radiators and at times also in the boiler will be below atmosphere. That is, the quantity of steam admitted to the radiators, which are kept free of air and water by action of the vacuum pump, is so limited by the pressure reducing valve I that the pressure in the radiators is below atmospheric pressure and the temperature of the steam correspondingly low. For all except excessively cold weather this system will operate in this manner, the steam supply being regulated for different outside temperatures so that the radiators will receive steam in proportion to heat losses from the building. The thermostatic traps F permit condensate to pass from the several radiators, and from the end of supply pipe B, through the return pipes G to the return main H. The condensate gravitates down through return main H, and strainer 16 into the accumulator tank K. If the difference in pressure between the supply and return sides of the system falls below a certain minimum, the vacuum regulator N functions to start the operation of motor 11 and pump 3, and the water in the hurling circuit passing through jet exhauster 5 creates a suction in that portion of return main H connecting the jet exhauster with the tank K, this suction extending back through the entire return side of the system as far as the thermostatic traps F. The air and water, or both, which have drained into tank K, will be drawn up into the hurling circuit and delivered into the receiving tank 1. The air and other gases will escape through vent pipe 2, and when the accumulated liquid in tank 1 reaches a certain level, the float 9 will function to open the valve 8 and permit the pump 3 to force a portion of the water in the hurling circuit through pipe 7 to the boiler. During this operation, since the pressure in tank K is sub-atmospheric, the air release check valve 25 will remain closed and all gases in the condensate will be drawn up, along with the liquid, into tank 1, the gases then escaping through the vent pipe 2. When the desired maximum pressure differential has been established in the system, the vacuum regulator N will operate to shut off power to the motor 11, and the pump 3 and the hurling circuit will cease to operate until it is again necessary to build up the pressure differential. In case there is sufficient accumulation of water in tank K during the period when the vacuum

established is higher than that requiring the vacuum regulator to operate the pump, the float 36 will function, through switch L, and automatic starter 13, to start the operation of pump 3 and draw the excess fluids up into the receiving tank 1. It will be seen that the pump-driving motor 11 is normally under the control of either or both of the switches N and L, that is, the pump will be started or stopped by the vacuum regulator N, in accordance with the requirements of maintaining the desired pressure differential in the system, and the pump will simultaneously be controlled by the float-operated switch L in accordance with the water level within the tank K.

Now at times, especially at night when the fires are banked, it is desirable to reduce the cost of operating the vacuum pump, and it is unnecessary at such times to maintain the pressure differential between the two sides of the system. In such cases, the snap switch 15 will be turned to disconnect the vacuum regulator N, and the pump 3 will then be left entirely under the control of the float operated switch L. The condensate materials will now simply gravitate into the accumulator tank K, and since the pressure in the return line is now substantially atmospheric, the air release check valve 25 will open to permit the escape of air and gases which accumulate in tank K. When the liquid accumulated in tank K reaches a certain maximum level, the float 36 will operate the switch L so that pump 3 will be started and the accumulated liquid will be drawn up into the receiving tank 1, in the manner hereinabove described. When this accumulated liquid in tank 1 reaches a certain level, the float controlled valve 8 will be opened so that the excess liquid will be forced through pipe 7 into the boiler. This operation of pump 3 will only be required at long intervals, and the pump will be operated for only a very short period of time, and a very appreciable reduction in the cost of electric current results.

When heat is on, and the system being supplied by boiler A and pump M is operating on vacuum control there will necessarily be a greater pressure on the steam side of the system e. g. boiler A, steam header B, and steam risers C, C' and C², etc., than on the return side of system, e. g. return lines G, G', G³, H and accumulator tank K, and this will cause check valve 67 in the equalizing air line 29 to be closed. Should however the source of heat being supplied to the boiler be shut off by thermostatic, manual, or other control the steam side of the system, including the radiators, by natural condensation of steam therein may have a high vacuum created in it, and this may be even a higher vacuum than exists on the return side of the system due to the exhausting action of the pump. Under this condition check valve 67 will open thus permitting the vacuum on the return

side of the system to equalize with that of the steam side of the system so that natural gravitation of water from the radiators through the returns and into accumulator tank K will be accomplished. This equalizing connection is again disclosed and is claimed in a division of this present application, Serial No. 469,510, filed July 21, 1930.

I claim:

1. In a heating system, in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, a return main from the radiator, and a pumping system for lowering the pressure in the return main and forcing condensate back to the boiler, an accumulator tank located in the return main, at a lower level than the pumping system, a float within the tank, and means actuated by the float for controlling the pumping system.

2. In a heating system, in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, a return main from the radiator, a pump for lowering the pressure in the return main and forcing condensate back to the boiler, and a motor for actuating the pump, an accumulator tank located in the return main at a level beneath the pump, a controlling switch for the motor, a float within the tank, and operating connections between the float and switch.

3. In a heating system, in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, a return main from the radiator, a pump for lowering the pressure in the return main and forcing condensate back to the boiler, and a motor for actuating the pump, an accumulator tank located in the return main at a level beneath the pump, a snap-switch for starting or stopping the motor, a float within the tank, and lost-motion connections between the float and switch, whereby the pump will be actuated when the accumulated liquid in the tank reaches a predetermined level, and the pump will be stopped when the liquid has been withdrawn from the tank to a predetermined lower level.

4. In a heating system, in combination with a radiator, a source of steam, connections for supplying steam from the source to the radiator, a return main from the radiator, and a pumping system for lowering the pressure in the return main, an accumulator tank positioned in the return main below the level of the pumping system, one portion of the return main leading from the radiator into the upper portion of this tank, and the other portion extending from the lower portion of the tank up to the pumping system, and an air-relief valve in the upper portion of the tank.

5. In a heating system, in combination with a radiator, a source of steam, connections

for supplying steam from the source to the radiator, a return main from the radiator, a pump for lowering the pressure in the return main, and a motor for operating the pump, an accumulator tank positioned in the return main below the level of the pump, one portion of the return main leading down from the radiator into the upper portion of this tank, and the other portion of the return main extending from the lower portion of the tank, beneath the normal liquid level therein, up to the pump, a float within the tank, a control switch for the motor, and operating connections between the float and switch.

6. In a heating system, in combination with a radiator, a source of steam, connections for supplying steam from the source to the radiator, a return main from the radiator, a pump for lowering the pressure in the return main, and a motor for operating the pump, an accumulator tank positioned in the return main below the level of the pump, one portion of the return main leading down from the radiator into the upper portion of this tank, and the other portion of the return main extending from the lower portion of the tank, beneath the normal liquid level therein, up to the pump, an air-relief valve in the upper portion of the tank, a float within the tank, a control switch for the motor, and operating connections between the float and switch.

7. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a pumping system having connections with the return main and boiler and adapted to create a partial vacuum in the return main, and also to force liquid condensate back into the boiler, a motor for operating the pumping system, a vacuum regulator for controlling the operation of the motor in accordance with the pressure differential between the supply and return sides of the system, an accumulator tank located in the return main at a lower level than the pumping system, the pumping system also functioning to withdraw accumulated condensate from the accumulator tank, and means in the tank for controlling the pumping system in accordance with the level of the accumulated condensate therein.

8. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a pumping system having connections with the return main and boiler and adapted to create a partial vacuum in the return main, and also to force liquid condensate back into the boiler, a motor for operating the pumping system, a vacuum regulator for controlling the operation of the motor in accordance with the pressure differential between the supply and return sides of the system, an accumulator tank located in

the return main at a lower level than the pumping system, a float in this tank, and a switch actuated by the float for controlling the motor.

5 9. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a pumping system having connections with the return main and boiler and adapted to create a partial vacuum in the return main, and also to force liquid condensate back into the boiler, a motor for operating the pumping system, a vacuum regulator for controlling the operation of the motor in accordance with the pressure differential between the supply and return sides of the system, an accumulator tank located in the return main at a lower level than the pumping system, a float in this tank, a switch actuated by this float for controlling the motor, means for temporarily disconnecting the vacuum regulator so that it is not in control of the system, and an air relief valve for venting accumulated gases from the accumulator tank when the vacuum regulator is disconnected.

10 10. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a closed hurling circuit comprising a receiving tank, a pump and a jet exhauster, the jet exhauster being in communication with the end of the return main and adapted to create a partial vacuum therein, a pipe connection from the hurling circuit to the boiler, a valve in this pipe, a float in the receiving tank to open said valve when the water in the receiving tank reaches a predetermined level so that the pump will force a part of the water back to the boiler, a motor for operating the pump, an accumulator tank located in the return main at a level below the pump, a float in this tank, and a switch operated by said last named float for controlling the motor.

11. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a closed hurling circuit comprising a receiving tank, a pump and a jet exhauster, the jet exhauster being in communication with the end of the return main and adapted to create a partial vacuum therein, a pipe connection from the hurling circuit to the boiler, a valve in this pipe, a float in the receiving tank to open said valve when the water in the receiving tank reaches a predetermined level so that the pump will force a part of the water back to the boiler, a motor for operating the pump, an accumulator tank located at a level below the pump, one portion of the return main draining into the upper portion of this tank, and a continuation of the return main which extends to the jet exhauster leading from this tank at a point

below the normal water level therein, an air-vent in the upper portion of the accumulator tank, a float in this tank, and a switch operated by said last named float for controlling the motor.

12. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a closed hurling circuit comprising a receiving tank, a pump and a jet exhauster, the jet exhauster being in communication with the end of the return main and adapted to create a partial vacuum therein, a pipe connection from the hurling circuit to the boiler, a valve in this pipe, a float in the receiving tank to open said valve when the water in the receiving tank reaches a predetermined level so that the pump will force a part of the water back to the boiler, a motor for operating the pump, an accumulator tank located at a level below the pump, one portion of the return main draining into the upper portion of this tank, and a continuation of the return main which extends to the jet exhauster leading from this tank at a point below the normal water level therein, a vacuum regulator controlling the operation of the motor so as to maintain a predetermined pressure differential in the supply and return sides of the heating system, means for throwing the vacuum regulator into or out of operation, an air-relief valve in the upper portion of the accumulator tank, a float in the tank, and a switch operated by the last named float for controlling the motor.

13. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a closed hurling circuit comprising a receiving tank, a pump and a jet exhauster, the jet exhauster being in communication with the end of the return main and adapted to create a partial vacuum therein, a pipe connection from the hurling circuit to the boiler, a valve in this pipe, a float in the receiving tank to open said valve when the water in the receiving tank reaches a predetermined level so that the pump will force a part of the water back to the boiler, a motor for operating the pump, an accumulator tank located at a level below the pump, one portion of the return main draining into the upper portion of this tank, and a continuation of the return main which extends to the jet exhauster leading from this tank at a point below the normal water level therein, a vacuum regulator controlling the operation of the motor so as to maintain a predetermined pressure differential in the supply and return sides of the heating system, means for throwing the vacuum regulator into or out of operation, an air-relief valve in the upper portion of the accumulator tank, a float in the tank, a switch operated by the last named float for controlling the motor, a pipe con-

nection between the accumulator tank and the supply side of the system, and a check valve in this pipe positioned to be held closed by pressure in the supply side of the system.

14. In a heating system, a boiler, a radiator, connections for supplying steam from the boiler to the radiator, a return main leading from the radiator, a pumping system adapted to create a partial vacuum in the return main, and also to force liquid condensate back into the boiler, a motor for operating the pumping system, a vacuum regulator for controlling the operation of the motor in accordance with the pressure differential between the supply and return sides of the system, an accumulator tank located in the return main at a lower level than the pumping system, a float in this tank, a switch actuated by this float for controlling the motor, means for disconnecting the vacuum regulator so that it is no longer in control of the system, an air relief valve in the tank, a pipe connection between the accumulator tank and the supply side of the system, and a check valve in this pipe positioned to be held closed by pressure in the supply side of the system.

15. In a heating system in combination with a radiator, a source of steam, connections for supplying steam from the source to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle positioned at substantially the lowest point in the return main for accumulating condensate, and a pumping mechanism positioned at a higher level and connected with the return main for withdrawing gases from the return main and also lifting condensate from the receptacle.

16. In a heating system in combination with a radiator, a source of steam, connections for supplying steam from the source to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle positioned at substantially the lowest point in the return main for accumulating condensate, and a pumping mechanism positioned at a higher level and connected with the return main for withdrawing gases from the return main and also lifting condensate from the receptacle, a float in the receptacle, and means controlled by the float for starting and stopping the operation of the pumping mechanism.

17. In a heating system in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle connected in the return main at substantially its lowest point for accumulating condensate, and a pumping mechanism positioned at a higher level and connected with the return main and with the boiler for withdrawing gases from the return main and also lifting

condensate from the receptacle and returning same to the boiler.

18. In a heating system in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle connected in the return main at substantially its lowest point for accumulating condensate, and a pumping mechanism positioned at a higher level and connected with the return main and with the boiler for withdrawing gases from the return main and also lifting condensate from the receptacle and returning same to the boiler, a float in the receptacle, and means controlled by the float for stopping and starting the operation of the pumping mechanism.

19. In a heating system in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle connected in the return main at substantially its lowest point for accumulating condensate, and an exhausting mechanism located at a higher level and connected with the return main, said exhausting mechanism comprising suction means for lowering the pressure in the return main and for lifting condensate from the receptacle, means for venting the gases withdrawn from the return main, and means for returning the condensate to the boiler.

20. In a heating system in combination with a radiator, a boiler, connections for supplying steam from the boiler to the radiator, and a return main for delivering condensate from the radiator, a closed receptacle connected in the return main at substantially its lowest point for accumulating condensate, and an exhausting mechanism located at a higher level and connected with the return main, said exhausting mechanism comprising suction means for lowering the pressure in the return main and for lifting condensate from the receptacle, means for venting the gases withdrawn from the return main, means for returning the condensate to the boiler, a float in the receptacle, and means controlled by the float for stopping and starting the operation of the exhausting mechanism.

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