Dec. 2, 1930. I. C. JENNINGS 1,783,428

PRESSURE CONTROL MECHANISM FOR VACUUM HEATING SYSTEMS

Filed April 30, 1929 2 Sheets-Sheet 1

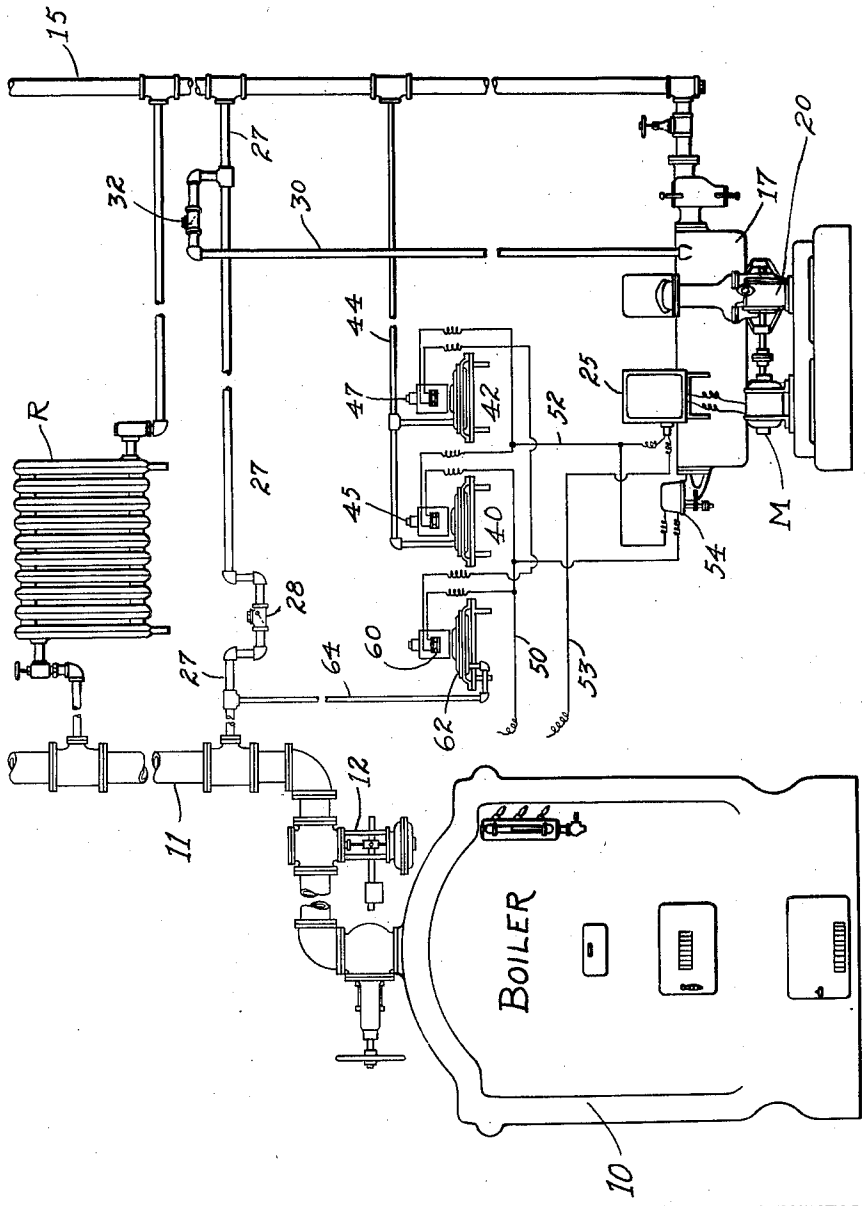


Fig 1

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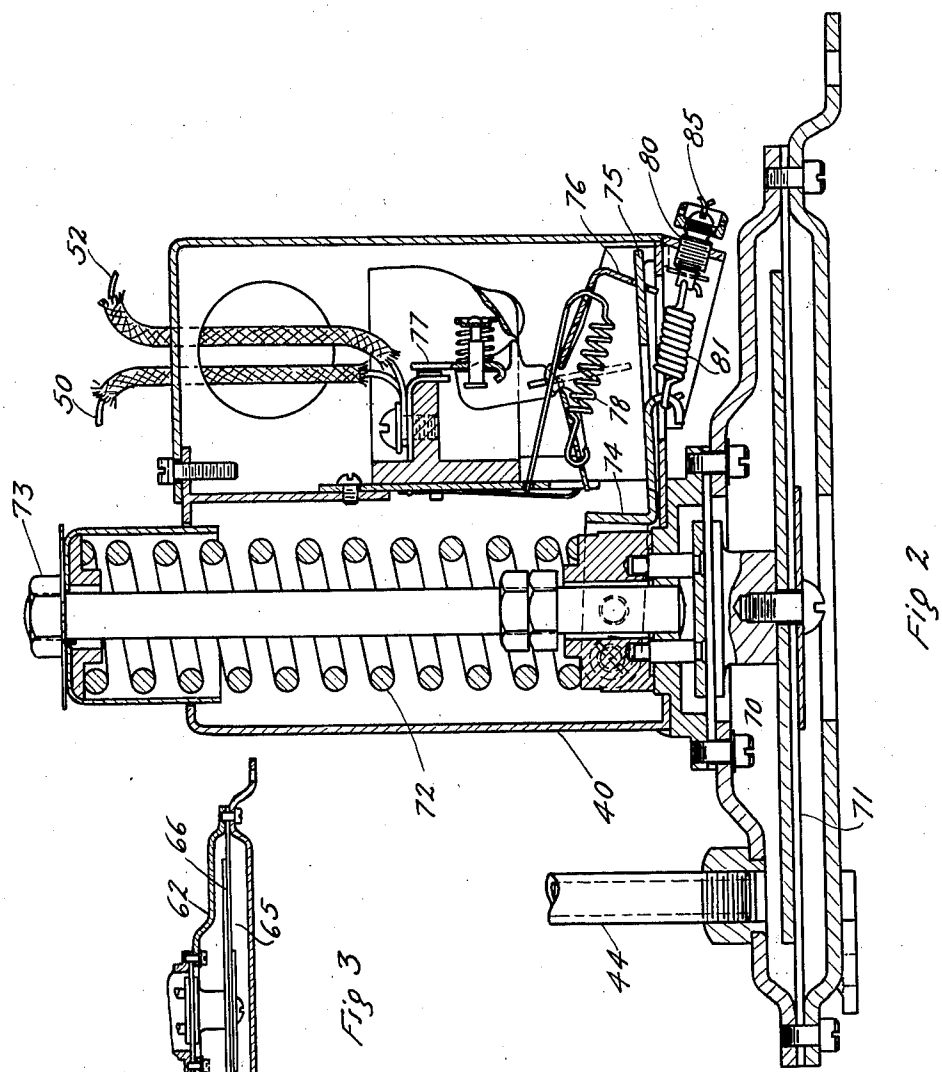


Fig 2

Fig 3

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Patented Dec. 2, 1930

1,783,428

UNITED STATES PATENT OFFICE

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PRESSURE-CONTROL MECHANISM FOR VACUUM HEATING SYSTEMS

Application filed April 30, 1929. Serial No. 359,315.

This invention relates to heating systems of the low pressure or vacuum type, in which a circulation of steam is maintained at less than atmospheric pressure.

It has been found economical and desirable to provide a lower absolute pressure on the supply side of such a heating system during mild weather and to increase this pressure in colder weather.

In this specification, a vacuum measured by a column of less inches of mercury is designated a "lower" vacuum and a vacuum of more inches is termed a "higher" vacuum.

The vacuum on the return side of the system is commonly controlled by an automatic vacuum regulator, set to maintain the vacuum on the return side within a predetermined limited range, say between five and ten inches of mercury. If the system is to be operated with a higher vacuum, measured by more inches of mercury, on the supply side of the system in mild weather, the vacuum on the return side must also be increased, say to between fifteen and twenty inches of mercury, but this higher vacuum is unnecessary and uneconomical for cold weather operation.

It is the object of my invention to provide a control mechanism for the vacuum on the return side of a vacuum heating system by which the operative vacuum range will be automatically shifted in accordance with pressure changes in the supply side of the system, so that the vacuum on the return side may not be higher at any time than the requirements of the system demand, as determined by the absolute pressure on the supply side. In other words, with my invention in use, the pressure on the supply side may be raised or lowered as desired and the vacuum on the return side will be automatically adjusted to an economical operative point relative thereto.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings in which

Fig. 1 is a front elevation of portions of a vacuum heating system embodying my improvements;

Fig. 2 is a sectional elevation of one of the vacuum regulators; and

Fig. 3 is a partial sectional view of a control device connected to the supply side of the system.

Referring to Fig. 1, I have shown a boiler 10 connected to a supply pipe 11, the pressure in which is controlled by a pressure regulator 12 which may be manually adjusted to provide any desired pressure in the supply pipe 11. Radiation R is connected between the supply pipe 11 and a return pipe 15, through which the condensation is conducted to a separating tank 17. A combination air and water pump 20 is commonly provided for exhausting the air or vapor from the system and for returning the condensate to the boiler 10 or to a suitable hot well. The combination pump 20 is driven by a motor M controlled by a suitable starting device 25.

A shunt connection 27 is provided between the supply pipe 11 and the return pipe 15, with a check valve 28 opening toward the supply pipe 11. The shunt connection is included for equalizing the pressure in the system, if for any reason the pressure in the supply pipe 11 is reduced below the pressure in the return pipe 15. A vent pipe 30 connects the tank 17 through a portion of the pipe 27 to an elevated point on the return pipe 15 and is provided with a check valve 32 opening toward the return pipe. This branch pipe 30 vents the tanks 17 into the return pipe 15 when the air pump is not in operation and renders it unnecessary for air or vapor displaced by the accumulation of condensate in the tank to pass upward along the return pipe 15, opposing the downward flow of the condensate.

The parts thus far described in themselves form no part of my present invention, which relates more particularly to the control of the motor M through its starting device 25. For this purpose I provide two vacuum-regulated switch-closing control devices 40 and 42, said devices being connected by a pipe 44 to the return pipe 15.

The control device 40 includes a circuit-closing switch 45, inserted between a feed or line wire 50 and a wire 52 connected to the starting device 25. A return or second line wire 53 is connected direct to the starting device 25.

The control device 42 is similarly provided with a circuit-closing switch 47, also connected between the line wire 50 and the connection 52. If the circuit is closed by either of the switches 45 or 47, which switches are connected in parallel, the starting device 25 will be rendered operative and the motor M will be started to drive the combination pump 20.

A float-controlled switch 54 is also provided for starting the motor when the condensate in the tank 17 reaches a predetermined height, but this device 54 is a usual commercial attachment and forms no part of the present invention.

The switch 47 is not directly connected to the line wire 50 but is connected through an intermediate switch 60 forming a part of a pressure-regulated control device 62, which device is connected by a pipe 64 to a portion of the pipe 27 on the supply side of the check valve 28.

The control devices 40, 42 and 62 are of commercial design and need not be described in specific detail. The devices 40 and 42 are preferably constructed substantially as shown in Fig. 2, with the pipe 44 connected into a vacuum chamber 70 above a diaphragm 71. A heavy coil spring 72 forces the diaphragm outward or downward against atmospheric pressure, and the pressure of the spring 72 may be regulated by turning an adjusting nut 73. A lever 74 is pivoted for movement by the diaphragm as the latter is forced upward, and a tongue 75 projecting from the lever 74 extends through a slot in an arm 76, connected to open or close switches 77 with a snap action.

When the pressure inside the chamber 70 is reduced to a predetermined point, say eight inches of mercury, the diaphragm 71 will be pushed upward against the spring 72 by atmospheric pressure and will act through the lever 74, tongue 75 and arm 76 to open the switches 77 and stop the further operation of the combination air and water pump 20.

The arm 76 is positioned by a spring 78 having a toggle action by which the return or closing movement of the arm 76 is delayed until the pressure in the vacuum chamber 70 has increased by a substantial amount, say to five inches of mercury.

The extent of this range of pressures may be regulated by an adjusting screw 80 which tensions a spring 81 connected to the lever 74, and the actual operating pressures may be controlled by adjusting the nut 73 previously described.

The regulating device 42 is identical with the device 40, except that the range would be set for a higher vacuum, say between fifteen and twenty inches of mercury.

The control device 62, connected to the supply pipe 11, is substantially similar in construction to the devices 40 and 42, with the exception that the vacuum chamber 65 (Fig. 3) is formed below the diaphragm 66, rather than above the diaphragm as in the regulators 40 and 42. With this construction, the switch 60 will be closed as the pressure goes down in the vacuum chamber 65, whereas in the regulators 40 and 42 the switches 77 will be opened under similar conditions.

Having described the details of construction of my improved control mechanism, the method of operation of the system is as follows:—

The usual regulator 12 is set to maintain any desired pressure in the supply pipe 11, which pressure is commonly below atmospheric. The regulator 40 is set for a certain range of low pressure or vacuum, say from five to eight inches of mercury, and acts to start the motor M at a five inch vacuum and to stop the motor at an eight inch vacuum. Similarly, the regulator 42 is set to start the motor at a predetermined vacuum, say fifteen inches, and to stop the motor at twenty inches. The control device 62 is set to close the switch 60 whenever there is a predetermined high vacuum in the supply pipe 11, say six inches.

The vacuum in the return line and separating tank will be controlled by the regulator 40 so long as the vacuum in the supply pipe is not higher than six inches. If this vacuum is increased above six inches, a higher vacuum in the return line becomes necessary and the switch 60 is closed, throwing the regulator 42 into operation and establishing the return line vacuum between fifteen and twenty inches of mercury until such time as the vacuum in the supply pipe becomes less than six inches, in which event the regulator 42 will be cut out and the regulator 40 will again function.

With this arrangement, the vacuum on the return side of the system is automatically adjusted to relatively correspond with the vacuum on the supply side and the expense of maintaining an excessive vacuum is avoided.

The regulator 40 is continuously in circuit, but cuts out at a vacuum below that at which the regulator 42 begins to operate, so that no interference arises.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. In a vacuum heating system having a supply side, a return side, and a vacuum

pump connected to the return side, in combination, a starting mechanism for said pump, a vacuum-controlled circuit-closing device for said starting mechanism, a second vacuum-controlled circuit-closing device for said starting mechanism, said devices being adapted to operate between different vacuum ranges in the return side of the system, and a control switch effective to render one of said devices operative or inoperative, in response to the degree of vacuum maintained in the supply side of the system.

2. The combination in a vacuum heating system as set forth in claim 1, in which the circuit-closing device controlled by said control switch operates at a higher vacuum range than the other circuit-closing device.

3. The combination in a vacuum heating system as set forth in claim 1, in which one circuit-closing device is constantly in circuit with its operating current, and in which the current for said second circuit-closing device is broken by said control switch when the vacuum on the supply side of the system is lower than a predetermined limit.

4. In a vacuum heating system having a supply side, a return side, and a vacuum pump connected to the return side, in combination, a device effective to render said pump operative within a predetermined vacuum range, a second device effective to render said pump operative within a second predetermined vacuum range, and means controlled by the degree of vacuum in the supply side of the system effective to render said second device operative or inoperative to control said vacuum pump.

In testimony whereof I have hereunto affixed my signature.

IRVING C. JENNINGS.