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STEAM HEATING APPARATUS.

APPLICATION FILED AUG. 27, 1901.

NO MODEL.

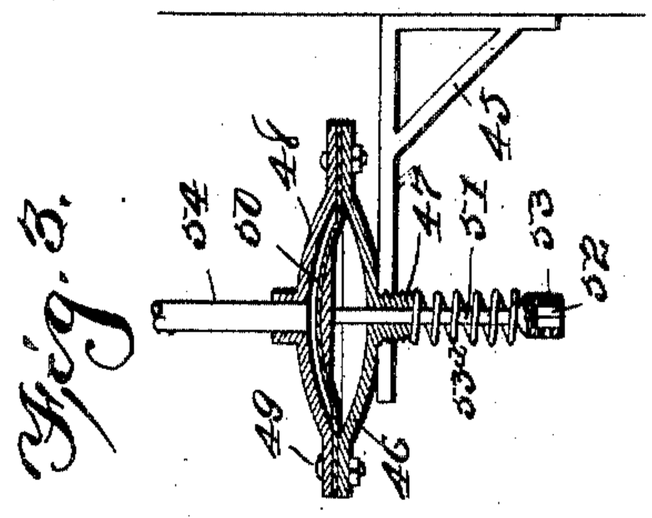

Fig. 3.

Fig. 1.

Fig. 2.

Fig. 4.

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UNITED STATES PATENT OFFICE.

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STEAM-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 777,184, dated December 13, 1904.

Application filed August 27, 1901. Serial No. 73,437. (No model.)

To all whom it may concern:

Be it known that I, JOHN COLLIS, a citizen of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Steam-Heating Apparatus, of which the following is a specification.

This invention relates to that class of steam-heating apparatus in which the air is first removed from the apparatus and then steam admitted into it at or below atmospheric pressure.

My object is to provide a steam-heating system having both a high and a low vacuum-compartment, the low vacuum-compartment being sufficient for the ordinary requirements of the apparatus and the high vacuum-compartment arranged to be automatically placed in communication with the low vacuum-compartment to thereby increase the amount of vacuum in the low vacuum-compartment in the event that through leakage or otherwise the normal amount of vacuum in the lower vacuum-compartment has been decreased.

A further object of my invention is to provide an apparatus of this class of simple, durable, and inexpensive construction and having few parts.

A further object is to provide an apparatus of this class in which the vacuum is automatically maintained at a certain predetermined amount from the vent-valves of the radiator to the vacuum-tank and also at a certain predetermined amount of considerable less degree throughout the radiators and supply-pipes of the entire system, to the end that the difference in the amount of vacuum in the radiator and the pipes leading to the vent-valves will be sufficient to maintain the vent-valves in their closed position and for the further reason that in the event of a leakage in any point throughout the entire apparatus the vacuum will not be destroyed and will be automatically maintained at the desired amount no matter whether the leakage occurs beyond the vent-valves or throughout the radiator and supply-pipes.

My invention consists in the construction, arrangement, and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 illustrates diagrammatically the complete heating apparatus, a part of the vacuum-tank being broken away to show its interior construction. Fig. 2 shows an enlarged detail view, partly in section, of the thermostatic regulator and valve. Fig. 3 shows an enlarged detail sectional view illustrating the fluid-pressure motor for controlling the admission of steam to the radiator, and Fig. 4 shows a sectional view of the valve controlling the fluid-pressure motor of the radiator.

Referring to the accompanying drawings, I have used the reference-numeral 10 to indicate a vacuum-tank. Near the top of the tank is a horizontal partition 11, dividing the tank into two compartments. A vacuum-indicator 12 is connected with the upper compartment, and a similar indicator 13 is connected with the lower compartment. The upper and lower compartments are connected with each other as follows: The numeral 14 indicates a pipe communicating with both compartments and arranged on the exterior thereof. In said pipe 14 is a throttle-valve 15, controlled by the valve-stem 16. A pipe 17 communicates with the pipe 14 at one end and an automatic diaphragm-motor 18 at its other end, which motor is connected with the valve-stem 16. The said automatic diaphragm-motor is of common construction and is so arranged that when the vacuum in the pipe 17 reaches a certain predetermined amount the valve 15 will be automatically closed.

The reference-numeral 19 indicates a pipe communicating with a vacuum-pump 20 and the upper compartment of the tank 10. The said vacuum-pump 20 is operated by an engine 21, said engine being provided with a steam-supply pipe 22. A cut-off valve 22ª is placed in this pipe, and in the supply-pipe 22 is a throttle-valve 23, and this throttle-valve 23 is connected with an automatic diaphragm-motor 24, said motor communicating, by means

of a pipe 25, with a pipe 19. The motor is so arranged that when the amount of vacuum in the upper compartment of the tank 10 and in the pipe 19 reaches a certain amount the throttle-valve 23 will be automatically closed and when the amount of vacuum falls below a certain point the throttle-valve 23 will be automatically opened, so that the steam-engine 21 will be started and the air will be pumped from the upper compartment of the tank 10.

As will hereinafter appear, the water of condensation is discharged or drawn into the lower compartment of the tank 10, and I have provided means whereby this water of condensation is automatically pumped to a point of discharge—for instance, into a steam-boiler—this mechanism comprising an automatic diaphragm-motor 26, communicating with the lower compartment of the tank 10. The lever of the automatic diaphragm-motor connects with the valve-stem 27 of the throttle-valve 28 on the steam-supply pipe 29, leading to the steam-engine 30. The steam-engine 30 operates a pump 31, and said pump is provided with a pipe 32, communicating with the bottom of the lower compartment of the tank 10. Hence when the steam-engine 30 is operated the pump 31 will withdraw the water of condensation from the lower compartment of the tank 10 and discharge it through the pipe 33 to a boiler or other point of discharge. This mechanism obviously provides means whereby when the water of condensation has accumulated to a certain amount the pressure in the lower compartment of the tank 10 will be increased by the weight of said water to such an extent as to discharge a portion of this water of condensation.

The reference-numeral 34 indicates a pipe leading from the upper compartment of the tank 10 to the vent-valve 35 of the radiator 26. This vent-valve is of the class that closes by the passage of air through it at a certain predetermined speed and is held closed by the difference in the amount of vacuum in the pipe 34 and in the interior of the radiator. In the pipe 34 is a cut-off valve 37, for purposes hereinafter made clear.

The reference-numeral 38 indicates the steam-supply main, one end of which communicates with the lower portion of the lower compartment of the tank 10. A cut-off valve 39 is provided in said pipe adjacent to the tank. In the supply-main is a main fitting 40, with which a riser 41 and a return-pipe 42 communicate. These pipes 41 and 42 communicate with a circulating-valve 43 of ordinary construction. The riser 41 and the return-pipe 42 both communicate with the valve 43 on one side of its valve-seat. They also communicate with each other, and the radiator 36 communicates with the valve 43 on the other side of the valve-seat. When the valve-stem is elevated and the valve is closed, the riser and return-pipes communicate with each other, and when the valve is open steam enters the radiator through the riser, and the water of condensation returns through the return-pipe in the manner common to this class of valves. I have provided an automatic diaphragm-motor, clearly illustrated in Fig. 3, for operating this valve 43, said motor comprising a bracket 45, designed to be attached to a vertical support and having a vertical screw-threaded opening in its outer end. Seated in the screw-threaded opening is a concavo-convex plate 46, having a cylindrical screw-threaded projection 47 passed through the screw-threaded opening in the bracket.

The numeral 48 indicates a concavo-convex plate similar to the plate 46, but curved in an opposite direction and connected with the plate 46 by means of the bolts 49. Between the plates 46 and 48 is a flexible diaphragm 50, the edges of which are secured between the plates 46 and 48. Connected with the under surface of the diaphragm 50 is a stem 51, having a socket 52 at its lower end provided with a transverse opening 53 to receive a pin. This socket is designed to receive the upper end of the valve-stem 44, and obviously a pin may be passed through the opening 53 and through the valve-stem 44 to detachably connect said parts. A spring 53^a on the stem 51 normally holds the stem downwardly. A pipe 54 passes through the top portion of the plate 48, and obviously the diaphragm is moved upwardly by suction within the pipe 54. As will be seen by referring to Fig. 1, this pipe 54 communicates with the upper compartment of the tank 10. I have also provided an automatic thermostatic regulator in the pipe 54, whereby the amount of steam admitted to the radiator may be controlled and governed by the heat of the room in which the thermostatic regulator is placed.

Referring to Fig. 2 of the accompanying drawings, the reference-numeral 55 is used to indicate a bracket attached to a support presented vertically and having an opening in its upper end. The numeral 56 indicates a concavo-convex plate having a cylindrical extension 57 passed through the opening in the bracket and supported thereby. A second concavo-convex plate 58 is mounted on top of the first, and between the two plates is a thermostatic motor 58^a of the class comprising two metal pieces, the edges of which are hermetically sealed, and between the plates is a substance capable of a considerable degree of expansion and contraction under variations of temperature. These thermostatic motors are now in common use. Connected with the under surface thereof is a stem 59, passed through the extension 57 and connected with a three-way valve 60, said valve being mounted on the pipe 54 and having one outlet 61 communicating with the outside atmosphere. When the stem 59 is pushed down-

wardly by the expansion of the thermostatic motor, the valve 60 is so arranged that air is admitted through the part 61 of the valve 60, and thence to the motor for the valve 43, and when the stem 59 is elevated the passageway through the pipe 54 is not interrupted. Any valve accomplishing a similar purpose may be used in this connection. An extensile coil-spring 62 is interposed between the thermostatic motor 58[a] and the plate 56 to normally hold the stem 59 elevated. A thermometer 63 is connected with the plate 56 by means of the bracket 64, but does not affect the operation of the thermostatic motor. I have also provided means whereby the system may be adapted for using the exhaust-steam from an engine either by itself or in conjunction with live steam under pressure.

The numeral 70 indicates a T connection on the main 38, having a plug 71 therein. This plug may be removed and an exhaust-pipe attached thereto.

In practical use and assuming that the pipes 22, 29, and 38 are all connected with a boiler or other source of steam-supply, and assuming, further, that the entire apparatus is filled with air, the valve 22[a] is first opened by hand and the steam-engine 21 started to operate. This will operate the pump 20 and withdraw the air from the upper compartment of the tank 10. The upper and lower compartments of this tank communicate through the pipe 14, and hence air will be drawn from the entire tank. The cut-off valve 37 and the cut-off valve 39 are both opened by hand, and obviously the air from the entire apparatus will be drawn through the pipes 34 and 38. Then when the amount of vacuum reaches a certain predetermined amount—say, for instance, ten inches—the automatic diaphragm-motor 18 will operate to close the valve 15. Hence the amount of vacuum in the lower compartment of the tank and throughout the entire apparatus will remain stationary at ten inches. Then the valve 37 is closed by hand, the pump 20 continues to operate until the amount of vacuum in the upper portion of the tank 10 reaches a certain predetermined amount—say, for instance, twenty inches—whereupon the automatic diaphragm-motor 24 is operated to close the valve 23 and stop the steam-engine 21 and the pump 20. Then the valve 37 is manually opened, thus providing a considerable vacuum above the vent-valve 35 sufficient to instantly close it if not already closed.

Assuming that on account of a leakage of air into the apparatus the amount of vacuum in the lower compartment of the tank 10 and throughout the entire apparatus as far as the vent-valve of the radiators is reduced, it is obvious that the diaphragm-motor 18 will be automatically operated to open the valve 15, thus permitting the amount of vacuum in the upper compartment of the tank 10 to rapidly increase the vacuum in the lower compartment of the tank and in the radiator and supply-pipes to the proper amount. If the amount of vacuum in the upper compartment is reduced below a predetermined amount, the automatic diaphragm-motor 24 is operated to set in motion the steam-engine 21 and pump 20 until the proper amount of vacuum is reached. When the water of condensation reaches a certain height in the lower compartment of the tank 10, the steam-engine 30 and pump 31 are automatically set in motion by means of the diaphragm-motor 26. The upper compartment constitutes what is sometimes called a "high" vacuum-compartment and the lower one a "low" vacuum-compartment. The lower chamber is connected with the return-pipe of the radiator, and a vacuum is maintained therein sufficient for the ordinary requirements of the system, and in the upper compartment a vacuum is maintained in excess of the requirements of the system.

I shall next describe the means by which the amount of steam admitted to the radiator is controlled by the temperature of the room in which the radiator is placed. The vacuum-pipe 54 connects the upper compartment of the tank 10 and the diaphragm-motor on the valve 43, and the thermostatic motor is attached to this pipe. In one position the thermostatic motor holds the valve 60 so that the ends of the pipe 54 communicate, and in another position that part of the pipe 54 leading to the radiator communicates with the opening 61. At no time is air admitted from opening 61 to the pipe 54, that leads to the vacuum-tank 11. On starting the heating apparatus the air may be drawn from the radiators and then steam admitted thereto freely through the valve 43 no matter what amount of vacuum there is in the pipe 54 up to the thermostatic motor. In the event that the heat of the room becomes so great that the thermostatic motor expands sufficiently to move the valve 60 to position to communicate between the ends of the pipe 54 then the vacuum immediately draws the diaphragm 50 upwardly by suction and closes the valve 43 and holds it closed until a fall of temperature causes the thermostatic motor to move the valve 60 to position to admit outside air through the opening 61, thus destroying the vacuum and aiding the spring 53[a] to open the valve 43.

Obviously my apparatus would operate without vent-valves on the radiators or pipes leading to the vent-valves, and when these are omitted the air is all pumped from the supply-main, and the operation of the other parts of the device would be the same as before described.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States therefor, is—

1. In a heating apparatus, the combination of a radiator, a vent-pipe communicating with

the radiator, a supply-main also communicating with the radiator, a compartment communicating with the vent-pipe, a second compartment communicating with the supply-main, means for pumping air from the compartment that communicates with the vent-pipe, a pipe providing communication between said compartments and means for automatically closing the passage-way through said pipe when the amount of vacuum in the compartment communicating with the supply-main reaches a certain predetermined degree.

2. In a heating apparatus, the combination of a radiator, a vent-valve on the radiator capable of being closed by the passage of air through it, a pipe communicating with the vent-valve, a compartment communicating with said pipe, a supply-main communicating with the radiator, a second compartment communicating with the supply-main, means for pumping the air from the compartment communicating with the vent-pipe, a pipe providing communication between the said compartments, a throttle-valve in said pipe, a pipe communicating with the said second compartment, a diaphragm-motor operated by the pressure in the latter of said pipes and controlling said throttle-valve.

3. In a heating apparatus, the combination of a radiator, a vent-valve on the radiator capable of being closed by the passage of air outwardly through it, a pipe leading from the vent-valve, a cut-off valve in said pipe, a tank divided into two compartments and having said pipe communicating with one of the said compartments, means for pumping air from this compartment, a supply-main communicating with the radiator and also with the other compartment of the tank, a cut-off valve in the supply-main, a vacuum-indicator for each compartment, a pipe providing communication between the compartments, a throttle-valve therein, a pipe communicating with the compartment that communicates with the supply-main, and a diaphragm-motor operated by pressure in the latter of said pipes and controlling said throttle-valve.

4. In a heating apparatus, the combination of a radiator, a vent-pipe communicating with the radiator, a supply-main also communicating with the radiator, a compartment communicating with the vent-pipe, a second compartment communicating with the supply-main, means for pumping air from the first compartment, a pipe providing communication between said compartments, means for automatically closing the passage-way through said pipe when the amount of vacuum in the second compartment reaches a certain predetermined degree, a discharge-pipe for the second compartment, a pump communicating with this pipe and means controlled by the amount of pressure in said compartment for automatically operating said pump.

5. In a heating apparatus, the combination of a radiator, a vent-pipe communicating with the radiator, a supply-main also communicating with the radiator, a compartment communicating with the vent-pipe, a second compartment communicating with the supply-main, means for pumping air from the first compartment, a pipe providing communication between said compartments and means for automatically closing the passage-way through said pipe when the amount of vacuum in the second compartment reaches a certain predetermined degree, a discharge-pipe for the second compartment, a pump communicating with said pipe, a steam-engine coupled to the pump, a steam-supply pipe for the engine, a throttle-valve in the steam-supply pipe, and an automatic diaphragm-motor connected with the said throttle-valve and communicating with the said second compartment whereby the pressure in the second compartment controls the operation of the pump.

6. In a heating apparatus, the combination of a radiator, and a supply-pipe therefor, of a compartment communicating with the radiator, means for pumping air from said compartment, a pipe communicating with the compartment, an automatic motor operated by the pressure in the said pipe, a valve in the radiator supply-pipe controlled by said motor, a three-way valve in the pipe between the motor and compartment to provide communication in one position between the compartment and motor and in a second position between the outer air and motor and a thermostatic motor controlling said valve.

7. In a heating apparatus, the combination of a radiator, a pipe for supplying a heating medium to the radiator, a valve for regulating the supply of heating medium, a fluid-pressure motor for actuating said valve, a pipe communicating with the motor, an exhauster therefor, said pipe having an opening therein between the motor and exhauster, and a thermostatic valve controlling said opening, and also controlling the passage-way through said pipe.

8. The combination of a radiator, a vent-pipe communicating with the radiator, a supply-main also communicating with the radiator, a compartment connected with the vent-pipe, a second compartment connected with the supply-main, an exhauster for the first of said compartments, a pipe providing communication between the said compartments, a valve in said pipe, and a fluid-pressure motor actuated by the pressure in the latter compartment for controlling said valve.

9. The combination of a radiator, a supply-pipe therefor, a compartment communicating with the supply-pipe, a second compartment communicating with the first, a valve for controlling said communication between the first and second compartments, a diaphragm-motor operated by the pressure in the first compartment for controlling said valve, a

pipe communicating with the second compartment, an exhauster for said pipe, a valve for controlling the operation of the exhauster, and a diaphragm-motor operated by the pressure in said pipe for controlling said valve.

10. In a heating apparatus in which the heating fluid is used at or below atmospheric pressure, the combination of a radiator, a supply-pipe, an exhauster for the supply-pipe, a valve in said supply-pipe for controlling the admission of the heating fluid to the radiator, a fluid-pressure motor for controlling said valve, a pipe communicating between the motor and the exhauster, a three-way valve in said latter pipe adapted in one position to provide communication through the pipe to the motor and in a second position to provide communication between the outside air and motor, and a thermostatic motor controlling said valve.

11. In a heating apparatus, the combination of one or more radiators, pipes for conveying a heating medium to and from the radiators, two vacuum-compartments, one of said compartments communicating with the said pipes, an air-pump exhausting from the other compartment, means for automatically controlling said air-pump by the amount of vacuum in the latter compartment, a pipe communicating between the two compartments, and means for automatically controlling the passage-way through the pipe by the amount of vacuum in the compartment that communicates with the radiator-pipes.

13. In a heating apparatus, the combination of one or more radiators, pipes for conveying a heating medium to and from the radiators, two vacuum-compartments, one of said compartments communicating with the said pipes, an air-pump exhausting from the other compartment, means for automatically controlling said air-pump by the amount of vacuum in the latter compartment, a pipe communicating between the two compartments, and means for automatically controlling the passage-way through the pipe by the amount of vacuum in the compartment that communicates with the radiator-pipes, a pump communicating with the said compartment and means governed by the water-pressure in said compartment for operating said pump to discharge the water of condensation from said compartment.

13. In a steam-heating system, the combination of the radiators or coils and a vacuum creating and maintaining means connected to the return side thereof, said means comprising in combination a high vacuum-compartment and a low vacuum-compartment in communication with each other, said low vacuum-compartment being in communication with the radiators or coils, means for creating and maintaining a vacuum in the high vacuum-compartment equal to or in excess of the requirements of the system, and means for governing the communication between said compartments according to the requirement of the radiators or coils.

14. In a steam-heating system, the combination of the radiators or coils, and a vacuum creating and maintaining means connected to the return side thereof, said means comprising in combination a high vacuum-compartment and a low compartment in communication with each other, said low compartment being in communication with the radiators or coils, means for creating and maintaining a vacuum in the high vacuum-compartment equal to or in excess of the requirements of the system, and a valve for governing the communication between said compartments according to the requirements of the radiators or coils.

15. In a steam-heating system, a vacuum-pipe communicating with the return side thereof, means for producing an initial vacuum in said return side equal to the requirements of the system, a valve in said pipe between the vacuum source and the radiators or coils, an adjustable weight tending to open said valve, and a diaphragm exposed on one side to atmospheric pressure and on its other side to the pressure in the vacuum-pipe and operating to close said valve when the initial vacuum has been produced.

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