HEATING AND HUMIDIFYING APPARATUS

Fig. 2.

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Aug. 2, 1949. Filed Feb. 27, 1947

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Filed Feb. 27, 1947

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UNITED STATES PATENT OFFICE

HEATING AND HUMIDIFYING APPARATUS

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Application February 27, 1947, Serial No. 731,345

7 Claims. (Cl. 219—39)

1. My invention relates to heating and humidifying apparatus and in particular to a compact unit which may be installed within a room or space to heat the air therein to the desired temperature and to maintain proper humidity conditions within the room or space.

It is the principal object of my invention to provide an improved unit space heater and humidifier which will maintain the air temperature and the humidity within the space at predetermined or desired levels.

Another object of the present invention is to provide an improved unitary space heater and humidifier which is compact, pleasing in appearance and extremely efficient in operation.

Another object of the present invention is to provide an improved room heater and humidifier which gives a more uniform operation than those heretofore developed.

Still another object of the present invention is to provide a room heater and humidifier of the hot water type which is safe in its operation and has a minimum of operating parts.

Other objects of the invention will become apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a medial, longitudinal cross-sectional view of my novel heater and humidifier with a portion of the apparatus shown in elevation;

Fig. 2 is a cross-sectional view taken substantially along the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is an elevational view of the heater and humidifier on a greatly reduced scale, looking at the apparatus from the righthand side of Fig. 1; and

Fig. 4 is a diagram of a preferred electrical circuit forming a part of this apparatus.

Referring primarily to Figs. 1 and 2, my improved heater and humidifier includes a tank 10 forming a boiler which contains a quantity of liquid, generally water, to be heated. The tank 10 comprises a cylindrical wall 12 and a pair of end walls 14 and 16 which are welded around their peripheral edges to the cylindrical wall 12 to form a fluid-tight tank. A plurality of heat-radiating fins 18 are mounted on the exterior surface of the cylindrical wall 12 and may have a generally rectangular form as shown in Fig. 2. The heat-radiating fins may be mounted on the cylindrical wall 12 by having the cylindrical wall pressed outwardly or expanded against the plurality of fins 18 while the latter are held in a jig. I prefer to fill the spaces between adjacent fins with metal foil or shavings 20 to increase the heat radiating surface.

A second pan-like tank 22 is mounted on the upper edges of the fins 18. The tank 22 is secured in place and prevented from accidental dislodgment by a pair of mounting plates 24 which are welded at 25 to the end walls 28 of the tank 22 and are secured to the end pair of the radiating fins 18 by suitable sheet metal screws 30. The tank 22 forms the humidifier portion of my apparatus as will hereinafter appear.

The tanks 10 and 22 are interconnected by means of a short conduit or pipe 32 which extends from the bottom of the tank 22 to the top of the boiler tank 10. The conduit 32 may be brazed or welded to the cylindrical wall 12 of the boiler tank 10 and to bottom wall 34 of the tank 22. The boiler tank 10 is filled by first introducing liquid into the humidifier tank 22 and allowing it to run through the interconnecting conduit 32 into the boiler tank 10. When the boiler tank 10 has been completely filled with water, the tank 22 is then filled with water to the desired level.

During the operation of my heater the interconnecting conduit 32 also serves as an equalizer to relieve any pressure which may tend to form within the boiler tank 10. Thus, it is not necessary to construct the boiler tank 10 so that it will be required to withstand any substantial pressures.

At times it may be desirable to drain my apparatus completely of water or the operating liquid, and for that purpose I provide a drain valve 35 of well known type which is mounted in the wall 36 at the bottom of the boiler tank 10.

The tanks 10 and 22 are mounted within a housing 38 which comprises a front wall 40, a rear wall 42 and end walls 44 and 46. A removable top cover 48 closes the top of the housing. The walls and cover are preferably made of sheet metal and the walls may be secured together at the corners of the housing by welding or by sheet metal screws. The air to be heated is admitted into the housing through openings 50 at the bottom of the front and rear walls 40 and 42 and circulates into the space or room being heated through an outlet 52 in the upper portion of the front wall 40. The effective size
of the outlet opening 52 may be controlled by suitable adjustable louvres 55 which are pivotally mounted in angle brackets 56 at either side of the opening 52.

The boiler tank 10 is supported on a pair of mounting blocks 58 which rest on a pair of angle members 80 which are secured as by spot welding to the front and rear walls 40 and 42. Each mounting block 58 has a generally rectangular shape and is provided in its upper edge with a semicircular cutout portion 62 which embraces the outer surface of the wall 42, thereby holding and supporting the boiler tank 10 in the housing 38. The mounting blocks 58 may be additionally supported within the housing by means of screws which extend through the walls of the housing into the blocks. In order to give added rigidity to the assembly, screws 54 may be used to secure the blocks 58 to the end fins of the heat radiating fins 18.

The water is heated by an electric heating element 66 which may be of any suitable type. The one which I have shown in the drawings is a dual immersion unit electric heater of the type manufactured by General Electric Company which can be connected to give varying heat outputs. The heating element 66 preferably extends the length of the boiler tank 10 so as to obtain a more rapid heating of the liquid contained within the tank. The element 66 is provided at one end with a pipe thread 80 which is threaded tightly into a union 79 which is in turn welded at 72 to the end wall 14 of the tank thus insuring that all connections are water-tight.

In order effectively to control the operation of the heater and of the heating element 66, I provide a dual aquastat 74 which may be of the type manufactured by the White-Rodgers Electric Company of St. Louis, Missouri. The aquastat 74 includes a pair of heat responsive elements 76 and 78 contained within a tube 80 which extends into the interior of the boiler tank 10. The tube 80 is provided with a pipe thread 82 which is screwed into a union 84 which is in turn welded to the end wall 14 at 86 just above the union 76. The heat responsive elements 76 and 78, responsive to the temperature of the liquid in the boiler tank 10, operate a pair of switches 88 and 90 (Fig. 3) respectively, the operation of which will be explained hereinafter.

In order to promote the circulation of air through the housing 38 and over the fins 18 and metal foil or shavings 28, I provide a blower or fan 92 including a small electric motor 94. The motor 94 is secured to the under side of the cover 46 by a suitable bracket 96 which is bolted to the motor 94 by bolts 88 and to the cover by a bolt 100. The operation of the blower or fan 92 will be explained hereinafter in connection with the explanation of the electric circuit.

Water may be supplied to the humidifier tank 22 through a pipe 102 which is connected to a low pressure source. If no low pressure source is available it may be connected to a pressure reducing valve of any well known type which will reduce the pressure from the regular city water main to a pressure which is suitable for supplying water to my improved heater and humidifier. The pipe 102 extends through the end wall 46 of the housing and the end wall 28 of the tank 22 and terminates in an upwardly extending portion 104 having a valve seat 106. A valve member 108 and a springs 109 fit and terminate in an upwardly extending portion 104 having a valve seat 105. A valve member 108 and a springs 109 fit and terminate in an upwardly extending portion 104 having a valve seat 106. A valve member 108 and a springs 109 fit and terminate in an upwardly extending portion 104 having a valve seat 105.
the heating element 66 is broken and is, therefore, deenergized. The limit aquastat switch 88 thus prevents overheating of the heater.

The second switch 90 in the dual aquastat 74 completes the operation of the fan or blower motor 94. It is not desirable that the fan or blower motor 94 and the heating element 66 run simultaneously. Consequently, it is desirable to set the operation of the control switch 70 by means of the dial 156 so that the switch 90 closes when the water in the tank 10 reaches a temperature somewhat higher than 175° F., for example, 180° F. or 185° F. When the water has reached this temperature, the heat responsive element 76 closes the switch 90. The switch 90 is connected by means of conductor 160 to one side of the fan motor 94 and by a conductor 162 to the line 118; the fan motor 94 is connected to the line 118 by a conductor 164. When the switch 90 closes, it closes the circuit including line 118, switch 120, conductor 154, motor 94, conductor 160, switch 76, conductor 162, and line 118. If the temperature of the water in the boiler tank 10 falls below a predetermined value and is undesirable to circulate air across the tank 10 and radiating fins 18, the heat responsive element 76 will open the switch 90 to break the circuit to the fan motor 94. The operation of the blower is independent of the room thermostat 152, but operation of the room thermostat switch is dependent upon room temperature which is in turn a function of the amount of heated air circulated by the blower. Thus the operation of the heater is actually dependent upon the load imposed by the space being heated.

It will be seen from the foregoing description of the system that it is possible to maintain the temperature within a predetermined range because overheating is prevented by connecting the room thermostat 152 in series with the limit aquastat switch 88 and by connecting the fan aquastat 98 so that its operation is independent of the room thermostat 152 but is dependent upon the temperature of the water in the boiler tank 10. I have not been able to find experience that the limit switch 88 closes before the room thermostat 152 so that the circuit controlling the operation of the heating element 66 is conditioned for operation when the room temperature requires raising.

The humidity of the air is maintained substantially constant because the circulating heated air passes over the humidifier tank 22 which contains a quantity of water at all times. This water is heated somewhat by the means of the connecting导管 32 which provides communication between the water in the boiler tank 10 and that in the humidifier tank 22, positioned the tank 22 immediately above the boiler tank 10 and in contact with the heat radiating fins 18 also aids in heating this water.

I do not advise heating the temperature of the water in the boiler tank 10 above the boiling point of water, i.e., above 212° F., because I have found that more uniform heat conditions can be obtained if this water temperature is maintained within the range of 175° F. to 195° F. Furthermore, by keeping the temperature of the water below the boiling point, I do not generate any steam which would bubble through the tubing connecting conduit 32 to cause splashing of the water in the tank 22 or the introduction of steam into the circulating air. It will be observed that the heater is extremely efficient in its operation because all of what might at first appear to be heat losses, that is, the heating of the housing, etc., actually results in the heating of the air which is circulated in the room in which the heater is installed; consequently, the efficiency of this heater is extremely high.

While I have illustrated but a single embodiment of the present invention, it will be obvious to those skilled in the art that various modifications may be made therein without departing from the spirit and scope of my invention, and I, therefore, desire to be limited only by the scope of the appended claims.

What I desire to claim as new and secure by United States Letters Patent is:

1. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain a liquid to be heated, a plurality of heat radiating fins mounted on said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat liquid contained within said boiler tank, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of liquid to humidify the air circulating over said fins, a conduit interconnecting said second tank and said boiler tank so that liquid will flow from said second tank into said boiler tank until said latter tank is filled, and an aquastat including an element responsive to the temperature of the liquid in said boiler tank and a switch operated thereby, said switch being connected in series with the source of electric power and arranged to control the operation of said heating element, whereby the temperature of the liquid in said boiler tank may be maintained within a predetermined range.

2. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain a liquid to be heated, a plurality of heat radiating fins mounted on said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat liquid contained within said boiler tank, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of liquid, a conduit interconnecting said second tank and said boiler tank so that liquid will flow from said second tank into said boiler tank until said latter tank is filled, a room thermostat responsive to the temperature of the space being heated, an aquastat including an element responsive to the temperature of the liquid in said boiler tank and a switch operated thereby, and a circuit connecting said room thermostat and said switch in series and in series with the source of electric power and arranged to control the operation of said heating element, whereby the temperature of the air in the space being heated may be maintained within a predetermined temperature range.

3. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain a liquid to be heated, a plurality of heat radiating fins mounted on said boiler tank, a heating element mounted in said boiler tank and adapted to heat liquid contained therein, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of liquid, said second tank being positioned in the flow path of the air circulating over...
said boiler and said fins, a conduit interconnecting said second tank and said boiler tank so that liquid will flow from said second tank into said boiler tank until said latter tank is filled, a blower for circulating air over said fins and past said second tank, a conduit interconnecting said second tank and said boiler tank, and means contained within said housing for controlling the operation of said heating element so that the liquid temperature may be maintained within a predetermined temperature range.

4. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain a liquid to be heated, a plurality of heat radiating fins mounted on said boiler tank, a heating element mounted in said boiler tank and adapted to heat liquid contained therein, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of liquid, said second tank being positioned in the flow path of the air circulating over said boiler and said fins, a blower for circulating air over said boiler and said fins and past said second tank, an inlet pipe for said second tank, a valve for regulating the flow of liquid from said inlet pipe, float means responsive to the liquid level in said second tank controlling the operation of said valve thereby to maintain the liquid in said second tank at a predetermined level, a conduit interconnecting said second tank and said boiler tank so that liquid will flow from said second tank into said boiler tank until said latter tank is filled, and means responsive to the temperature of the liquid in said boiler tank for controlling the operation of said heating element so that the liquid temperature may be maintained within a predetermined temperature range.

5. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain a liquid to be heated, a plurality of heat radiating fins mounted on said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat the water contained within said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat the water contained within said boiler tank, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of liquid, a conduit interconnecting said second tank and said boiler tank so that liquid will flow from said second tank into said boiler tank until said latter tank is filled, an electric motor driven blower adapted to circulate air over said heat radiating fins and past said second tank, a housing enclosing said tanks and said blower, and an aquastat including a pair of elements responsive to the temperature of the liquid in said boiler tank and a pair of switches, each operated by one of said elements, one of said switches being connected so as to control the operation of said heating element so that the temperature of the liquid may be maintained within a predetermined temperature range and the other of said switches being connected in series with said boiler tank and adapted to control the operation thereof according to the temperature of the liquid contained within said boiler tank.

6. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain water to be heated, a plurality of heat radiating fins mounted on said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat the water contained within said boiler tank, a second and open top tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of water for humidifying said tanks and said blower, a conduit interconnecting said humidifier tank and said boiler tank so that water will flow from said humidifier tank into said boiler tank until said latter tank is filled, an electrically operated blower adapted to promote circulation of air over said humidifier tank and said boiler tank and a switch operated thereby, a circuit connecting said switch in series with the source of electric power and arranged to control the operation of said heating element whereby the temperature of the water in said boiler tank may be maintained within a predetermined range, and said aquastat including a second element responsive to the temperature of the water in said boiler tank and a switch operated thereby, said last mentioned switch being connected in series with said blower and the source of electric power to control the operation of said blower.

7. A space heater and humidifier comprising in combination, a tank forming a boiler and adapted to contain water to be heated, a plurality of heat radiating fins mounted on said boiler tank, an electric heating element mounted in said boiler tank and adapted to be connected to a source of electric power so as to heat the water contained within said boiler tank, a second tank mounted on the upper edges of and in heat exchange relation with said heat radiating fins and adapted to contain a quantity of water for humidifying the circulating air, a conduit interconnecting said humidifier tank and said boiler tank so that water will flow from said humidifier tank into said boiler tank until said latter tank is filled, an electrically operated blower adapted to promote circulation of air over said heat radiating fins and past said humidifier tank, a housing enclosing said tanks and said blower and having inlet and outlet openings, an aquastat including a pair of elements responsive to the temperature of the water in said boiler tank and a pair of switches, each operated by one of said elements, a room thermostat responsive to the temperature of the air in the space being heated, a circuit connecting said room thermostat and one of said switches in series and in series with the source of electric power and arranged to control the operation of said heating element whereby the temperature of the air in the space being heated may be maintained within a predetermined range, and a second circuit connecting the other of said switches in series with said blower and the source of electric power.

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