VENTILATING AND AIR CONDITIONING APPARATUS

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Fig. 6.
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4 Claims. (Cl. 257—138)

This invention relates to ventilating and air conditioning apparatus, wherein both the temperature and moisture content of the air supplied thereby may be maintained within predetermined limits by suitable cooperative control devices.

An air circulating device is provided which forces air drawn from a heated area through a heating device and which also receives volumes of fresh cold air in accordance with the demands of a control device, whereby the recirculated air is continuously refreshed and simultaneously maintained at a constant temperature. The air, thus heat conditioned, is subsequently forced through a humidifying pan supplying a properly supplementary portion of moisture in response to a humidity control device, whence it is directed to the room to be heated.

The invention will also be found to reside in the structural and cooperative relation between the various elements of the apparatus, as more fully set forth in the specification and pointed out in the appended claims.

In the drawings:

Fig. 1 is a vertical section through the housing with the devices therein shown in elevation.

Fig. 2 is a section on the line 2—2 of Fig. 1 with portions broken away to show the air passage arrangement.

Fig. 3 is a cross section through the window adapter for the cold air passage.

Fig. 4 is a perspective view of the humidifying pan.

Fig. 5 is a cross section through the float basin of the humidifying pan, showing the valve device in section.

Fig. 6 is a diagrammatic view of the circuit layout as associated with the various units.

As shown in the drawings, the air conditioning device consists of a cabinet or outer housing 11 having transversely mounted plates 12 and 13 forming a central air directing chamber 14 and auxiliary chambers 15 and 16 on each side thereof (Fig. 2), the former chamber being devised to contain portions of the air conditioning apparatus as hereinafter described, and the latter chambers being utilized to house the steam lines and other accessories of the apparatus. Access to the chambers for adjustment or repair of the devices contained therein is obtainable through a removable front panel 17 secured to the housing frame 18 by means of screws 19. The top of the cabinet is apertured to provide an output port 20 for the chamber 14.

The lower portion of the chamber 14 is longitudinally divided by a partition 21 to form a cold air passage 22 and a recirculated air passage 23 (Fig. 1), the latter being in communication with the air in the room through louvers 24 provided in the panel 17, and the cold air passage 22 being in communication with the outside atmosphere through a duct 25 secured to the exterior of the rear wall of the cabinet and a registering orifice 30 therein. As shown in Fig. 1, a window adapter 26 is provided for the duct 25, and it comprises a sleeve portion 27, telescopically engaging within the top end of the duct 25, and a bell portion 28 adapted to fit within a lower portion of a window frame 29. The mouth of the bell portion is provided with a peripheral flange 31 to which is secured a cover plate 32, having downwardly opening louvers 33 (Fig. 3). The sides and lower margin of the flange 31 and the attached cover plate are engaged and secured in the usual pane slots of the window frame, while the top margin, in cooperation with a spaced angle member 34, is adapted to provide a mounting means for the lower edge of the window pane 35. This construction permits the window to be opened in the usual manner without interfering with the air input duct or the ventilating qualities of the window, since during this movement the sleeve 27 slides within the duct 25 and the air entering the room through the window is deflected about the ends of the bell portion 28 which thereby acts as a deflector.

The effective cross-sectional area of the air passage 22 is controlled by a damper 37 which is operated by a motor 38 under control of a thermostat operated switch 39. This switch is operated in response to abnormal temperature conditions in the recirculated air stream, and it is conveniently located in a casing 41 mounted on the partition 21 by a bracket 42. As diagrammatically shown in Fig. 6, the switch is interposed in the motor circuit 43 and is movable to complete the connection between the circuit and the power lines 44, 45, whereupon the motor is energized to rotate the damper from its closed position to a vertical open position abutting the stop members 47. This operation is resisted by a return spring 48 which is properly proportioned to return the damper to its closed position when the torque load of the motor is removed by the opening of the switch 39.

Air is drawn from both passages 22 and 23 and directed through a heating element 51 by means of a pair of blowers 52 operated by an electric motor 53, all of which are suspended in the chamber 14 from a horizontal frame member 54.
The motor 53 is controlled by a second switch element 55 operated by a separate thermostat and also mounted in the casing 41. This switch is adapted to close the motor circuit 56, and therefore operates in a similar manner to the described switch 39, with the exception that its control thermostat is set to open the circuit at a higher degree of temperature than required to operate the switch 39.

A second valve, designated by the numeral 57, is mounted within the cabinet 11 and is interposed between the blowers 52 and the passages 22 and 23 to provide a mounting means for an air filter 58. This member is slidable for replacement or cleaning through the open front of the cabinet when the panel 17 is removed.

The previously mentioned heating element 51 preferably comprises an elongated tube core 61 extending across the chamber 14 and provided with heads 62 and 63 supported on the frame member 54. A steam input line 64, located in the chamber 16, extends through the plate 13 for connection with the head 62. The steam, thus introduced into the heating element, is exhausted through an exhaust pipe 65, whence it enters a resistance device or steam trap 66, which, although resisting the passage of steam, permits the passage of condensate therethrough to a drain pipe 67.

A humidifying pan 68 is mounted within the chamber 14 immediately above the heating element 51 and is subjected to the blast of heated air therefrom to provide by evaporation the proper moisture content for the heated air. As shown in Fig. 4, the pan 68 comprises a shallow rectangular container having marginal flanges 69 secured by suitable bolts to a top frame 71 of the cabinet. One end of the pan is formed to provide a float basin 72 for a float device 73, while the remaining area is formed with a plurality of longitudinally extending prismatic air funnels 74 which form upwardly opening troughs therebetween. The pan is supplied with fluid through a supply pipe 75 (Figs. 2 and 5) in communication with the exhaust pipe 65 of the heating element, wherein due to the resistance caused by the steam trap 66 a portion of the condensate is able to enter the same will be forced upwardly in the pipe 75.

The pipe 75 communicates with the pan through a float controlled valve 76, as shown in Fig. 5, wherein a valve body 77 secured to the bottom of the float basin 72 of the pan is provided with an internal chamber 78 for receiving fluid from the pipe 75. A laterally extending valve hole 79 enters the chamber 78 and is provided with a seat portion 81, devised to slidably receive a valve 82. Radial holes 84 are drilled into the seat portion so that, when the valve is unseated, fluid communication is established between the chamber 78 and the pan 68. The body is also provided with guide lugs 86 for pivotally receiving a float mounting 87 in which a rod 88 of the float device 73 is mounted for lateral displacement. The float mounting is formed with a cam portion 89 adapted to engage and move the valve 82 to its seat when the float device rises to a predetermined high level. In the event of failure of the float valve the excess liquid drains through an overflow pipe 91 located in a rear end wall of the pan 68 above the predetermined high level of the pan.

Means are provided for varying the level of the liquid in the pan 68, which comprises a valve 93 interposed in the supply pipe 75 and operable by a solenoid 94 to establish fluid communication between the pipe 75 and the pan 68 when the moistened air in the room to be supplied falls below a predetermined constant. A suitable humidity responsive device 95 of any known form is located in the passage 23 on the bracket 42 and controls a switch 96, which is in turn adapted to open the circuit 97 thereof in accordance with the demands of the device 95.

A return spring 98 is operable to close the valve 93 upon the de-energization of the solenoid 94.

Under conditions wherein the room temperature is below normal, the cold air damper 37 is closed in response to the demands of the thermostat operated switch 39 in the recirculated air passage 23, whereinupon the blowers 52 are supplied only with air from the room. This air is drawn by the blowers through the louvers 24, the passage 23, and the air filter 58. After being forced out of the blowers, the filtered air passes through the heating element 51 for heating, whereupon it is forced through the air funnels 74 in the humidifying pan 68 to receive its supply of moisture before exhausting through the output port 20 to the room to be heated. When the recirculated air is raised to a slightly abnormal temperature, the switch 39 is immediately operated by its thermostat to close the motor circuit of the damper 37, which is opened to permit cold air to be drawn through the duct 25 and air passage 22 to supplement the recirculated air stream from the passage 23.

During the latter of the above described operating conditions, it is anticipated that, due to a sudden rise in outside temperature, the room temperature would rise above the predetermined normal, even if receiving a full allotment of cold air. Upon this occurrence, the thermostat of the switch element 55 of the blower motor circuit would open the same and thereby stop the operation of the blowers and the attendant circulation of the heated air until such time as a temperature drop would cause the closing of the same circuit.

During all operating conditions, the moisture content of the air stream is varied in accordance with the demands of the humidity responsive device 95, which, through its control of the valve 93 in the supply pipe 75, controls the liquid level in the pan 68. Due to the prismatic construction of the air funnels 74, the surface or evaporation area of the pan 68 decreases as the liquid level is lowered by evaporation, and it will be apparent that the device 95 in controlling the liquid level also controls the evaporation area of the pan. Thus, when the moisture content of the room is above a predetermined normal, the liquid in the pan 68 is not replenished and its level recedes by evaporation, until such time as the demands of the device 95 permits the entry of liquid to the pan to replenish the same, at least in part. It is not intended that the float controlled valve 76 in the described apparatus act in any other capacity than as a safety device to prevent excess amounts of fluid from being supplied to the pan, in the event the liquid level of the valve device 93. It is contemplated, however, that in certain systems the valve 93 and control device 95 may be eliminated and the lateral adjustment of the float device on its mounting be accomplished in manual adjustment for setting the predetermined fixed liquid level in the pan 68.

I claim:

1. In an air conditioning apparatus, a heating...
device, supply means for supplying air to the heating device, a humidifying pan placed in the path of the heated air, said pan being formed with an upwardly opening liquid containing trough, fluid supply means for the pan, and means responsive to humidity conditions in the air supply for controlling the fluid supply to the pan, whereby the liquid level in said pan may be varied.

2. In an air conditioning apparatus, a heating device, supply means for supplying air to the heating device, a humidifying pan formed with a plurality of air passages, said pan being mounted in the path of the heated air for passage thereof through said air passages, and a plurality of troughs in said pan between said air passages adapted to contain liquid for evaporation.

3. In an air conditioning apparatus, a heating device, an air passage, blower means for withdrawing air from said passage and directing the air through said heating device, said air passage having a vertical extension, an adapter having a portion adapted to be mounted in a window for communicating with the outside atmosphere, and a depending portion telescopically engaging in said extension, whereby said adaptor, when moved with the window, slides in said extension to maintain communication between the outside atmosphere and said passage.

4. In an air conditioning apparatus, a heating device, means for supplying steam to the device, supply means for directing air to the heating device, a humidifying pan placed in the path of the heated air, conduit means communicating with the heating device for directing liquid therefrom to the pan, control means responsive to humidity conditions in the air supply, and valve means in said conduit means operative by said control means.

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