Oct. 29, 1935. L. A. PHILIPP 2,019,091

AIR CONDITIONING SYSTEM

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Fig. 1.

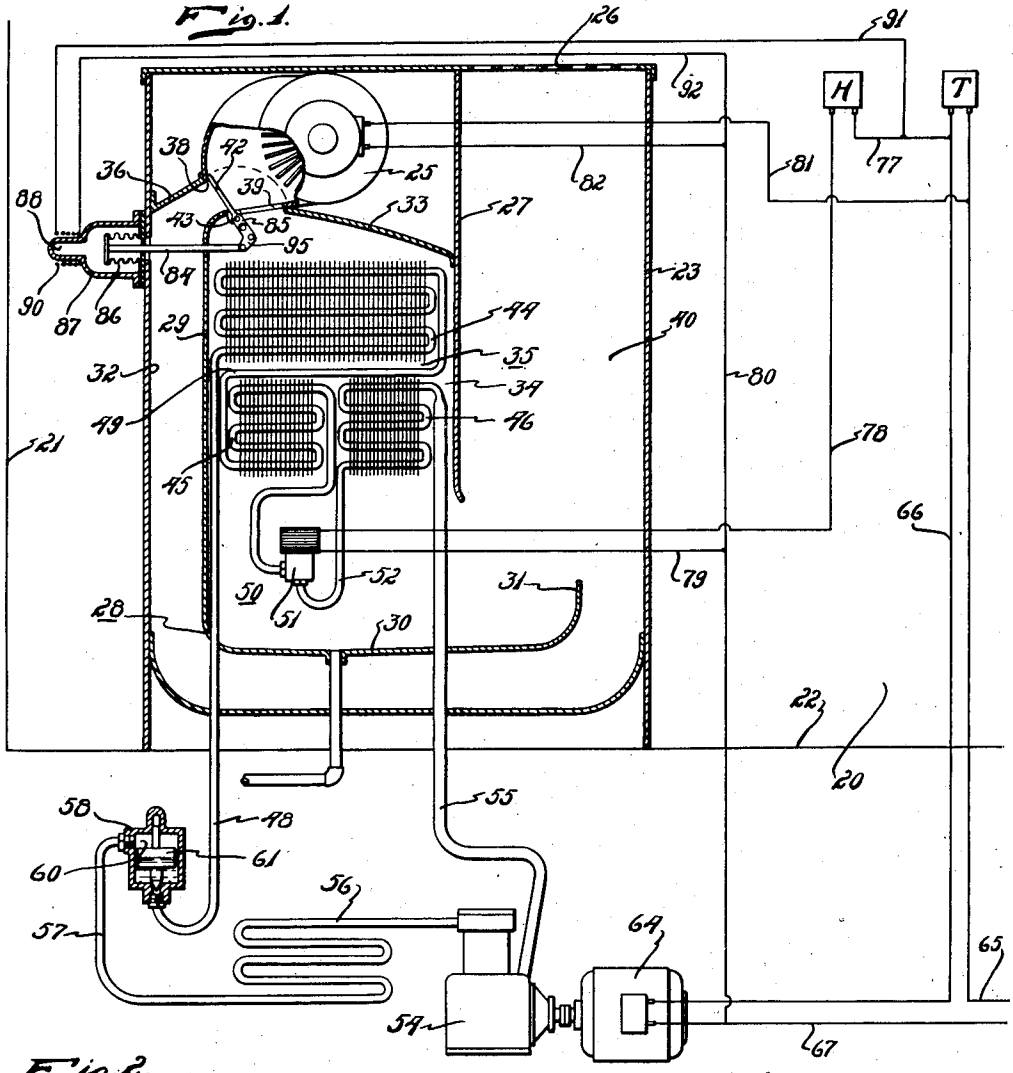


Fig. 2.

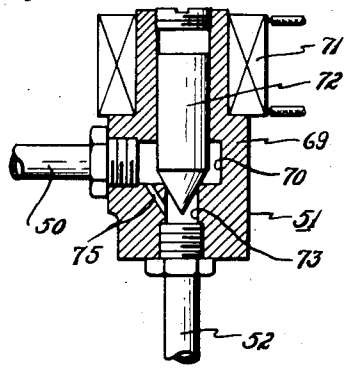
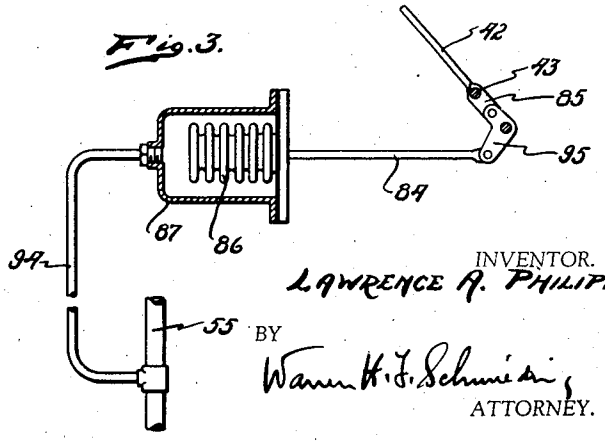


Fig. 3.



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AIR CONDITIONING SYSTEM

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9 Claims. (Cl. 62—6)

The present invention relates to air conditioning systems and particularly to systems for cooling and dehumidifying air.

In certain types of air conditioning systems, air to be conditioned is circulated in heat exchange relation with a heat absorber for the purpose of cooling the air. One of the objects of the present invention is to provide an improved air conditioning system in which the air in the room is continually in circulation, whether or not it is being cooled, and to prevent the circulation of the air in heat exchange relation with the heat absorber when the heat absorber is not being cooled.

In one embodiment of the invention, an artificial refrigerating apparatus is employed and it is another object of the present invention to prevent the flow of circulating air about the heat absorber of refrigerating apparatus when the apparatus is inactive.

Further objects and advantages will be apparent from the following description, reference being had to the accompanying drawing wherein preferred forms of embodiment of the present invention are clearly shown.

In the drawing:

Fig. 1 is a diagrammatic view of one form of my improved air conditioning system;

Fig. 2 is a longitudinal sectional view of one of the valves used in the system and

Fig. 3 is a view partly in section showing a control mechanism for use in another form of the invention.

Referring to the drawing, a room 20 is shown diagrammatically by a side wall 21 and a floor 22. A cabinet 23 is disposed in the room and air is circulated therethrough for the purpose of cooling the air to remove either the sensible or the latent heat or both, from the air to be conditioned. A blower fan 25 is used for circulating the air in the room. This fan is disposed within the cabinet 23 and draws air into the cabinet through the side wall thereof and forces the air out of the top of the cabinet between the interstices 26. A partitioned wall 27 depends from the top wall of the cabinet and extends from the front to the rear thereof for directing air flow within the cabinet.

A partitioned wall 28 including a side 29, a bottom 30 and an opposed side 31 is disposed within the cabinet 23 and is spaced from the side wall and the bottom of the cabinet so as to provide a duct for the circulation of air within the cabinet. One wall 33 of the blower 25 is joined with partition 27 and cooperates with partition 27 and wall 29 of partition 28 to form a compartment 34 for an evaporator 35. Another wall 36 of the blower 25 is joined with the right side wall of the cabinet 23 and forms the upper end of the duct 32. The blower 25 is provided with two outlets 38 and 39 which are connected respectively with the duct 32 and the compartment 34. The partition 27, the right side wall of cabinet 23, and the front and back of the cabinet form a compartment 40.

Air drawn into the cabinet 23 by the blower 25 will be conducted either through the duct 32 to the side compartment 40 or through the compartment 34 to the side compartment 40. The air from the compartment 40 passes outwardly through the interstices of the top 26 of the cabinet. A movable baffle 42 is arranged to open and close the outlets 38 and 39 of the blower 25. This baffle 42 is pivoted at 43 and is shown as closing the outlet 38 so that the air is directed through the outlet 39 and through compartment 34. This baffle can be swung clockwise from the position shown so as to open the outlet 38 and close the outlet 39 and when in the latter position, the air from the blower 25 will pass through the outlet 38 and duct 32 and thus bypass compartment 34.

The evaporator 35 is shown as comprising three sections 44, 45 and 46 all connected in series circuit relation. Refrigerant is delivered to the section 44 by a pipe 48. Refrigerant is delivered from section 44 to section 45 by a pipe 49 and refrigerant is delivered from section 45 through a pipe 50, a throttle valve 51 and a pipe 52 to section 46. From section 46 the gaseous refrigerant is delivered to a compressor 54 by a pipe 55. When the compressor 54 is operating it will withdraw gaseous refrigerant from the evaporator 35 to lower the temperature thereof and it will compress this gaseous refrigerant and force the same into a heat dissipator or condenser 56 wherein it will be cooled and liquefied and then delivered by a pipe 57 to suitable expansion valve herein shown as a high-side-type-float valve 58. The valve 58 forms a chamber 60 in which is disposed a float 61 which actuates a needle valve 62. As the liquid refrigerant accumulates within chamber 60, it will lift the valve 62 from its seat and permit the refrigerant to flow into the pipe 48 whence it is delivered to the evaporator 35.

The compressor 54 is driven by a motor 64 and the motor 64 is controlled by a thermostat T. This thermostat T is disposed within the room 20 and is responsive to the temperature of the air in the room. When the temperature of the room attains a predetermined high value, the

thermostat T will complete the circuit to the compressor motor 64 as follows; wire 65, thermostat T, wire 66, motor 64 and wire 67. When the temperature of the air in the room attains a predetermined lower value, the thermostat T will interrupt the motor circuit and thereby stop the compressor 54.

In addition to controlling the temperature of the air, it is also desirable to control the humidity of the air and for this purpose the valve 51 and a humidistat H are provided. The valve 51 (see Fig. 2) comprises a casing 69 forming a chamber 70. A magnet coil 71 is carried by the valve 51 and is arranged when energized to lift a magnet core or solenoid 72. Refrigerant from pipe 50 flows into chamber 70 and through the port 73 to pipe 52 when the coil 71 is energized and core 72 is raised, the core 72 functioning as a valve for closing the port 73. A small bypass 75 permits the flow of refrigerant from the chamber 70 to the pipe 52 when the magnet coil 71 is deenergized and the core or solenoid 72 rests upon its seat.

The humidistat H is adjusted so that the magnet coil 71 is energized when the percentage of relative humidity of the air in the room is below a predetermined maximum, therefore, when the air is in this condition, there is an unobstructed flow of refrigerant from section 45 of the evaporator to section 46. In that event the sections 44, 45 and 46 operate at substantially the same temperature, and, the evaporator and compressor are computed in size so as to remove, at this time, principally sensible heat from the air flowing over the evaporator sections. When the relative humidity is too high, which of course will be above the maximum adjusted setting of the humidistat H, the humidistat H will interrupt the circuit to the magnetic coil 71 whereby the solenoid valve 72 will close on its seat and refrigerant can pass only through the bypass 75. Under this condition the flow of refrigerant from sections 44 and 45 to the compressor 54 will be impeded causing a higher pressure and likewise a higher temperature to be maintained in sections 44 and 45. However, under this condition the suction effect of the compressor 44 on section 46 will be increased which will cause a material lowering of the pressure and a consequent material lowering of the temperature of section 46. The arrangement is such that the temperature of section 46 will be decreased to considerably below the dew point of the air flowing thereover and thereby cause condensation or increased condensation of moisture from the air. The refrigerating apparatus will continue to operate in this manner until the relative humidity of the air in the room 20 is decreased to a predetermined desirable minimum at which time the humidistat H will again complete the circuit to the coil 71 and thus again permit all of the sections of the evaporator to operate at substantially the same temperature. The circuit for the magnet coil 71 includes wire 65, thermostat T, wire 77, humidistat H, wire 78, coil 71, and wires 79, 80 and 67.

It is desirable to cause continuous circulation of the air within the room 20 and therefore the blower 25 is maintained operative continuously, the circuit therefore including wires 65, 81, motor 25 and wires 82, 80 and 67. It is not desirable to permit the circulating air to pass over the evaporator 35 when the refrigerating apparatus is not in operation. If air is permitted to pass over the evaporator 35 when the compressor is not operating, this air will not be cooled by the evaporator but will tend to assimilate the water which is clinging to the evaporator and increase the humidity of the air. In accordance with the present invention, when the refrigerating apparatus is rendered ineffective by the thermostat T, the baffle 42 is moved from the position shown to a position in which it closes the outlet 39 of the blower and opens the outlet 38 of the blower. In this manner the air will bypass the compartment 34 containing the evaporator 35.

In the illustration of Fig. 1, the baffle 42 is actuated by a rod 84 connected to an arm 85 of the baffle 42. This rod 84 is connected to a metallic bellows 86 which is arranged to collapse or expand in accordance with the pressure within a container 87. Container 87 is attached to the side wall 23 of the cabinet and includes an extension 88. This extension and the container 87 contain a volatile fluid which, when heated, is adapted to collapse the bellows to the position shown in the drawing and when the heat is removed, the bellows 86 will expand drawing the rod 84 to the left to move the baffle from the position of closing outlet 38 to the position of closing outlet 39. In Fig. 1 the fluid in extension 88 and container 87 is heated by an electric heating coil 90. This heating coil 90 is connected in parallel with the compressor motor 64 and is controlled by the thermostat T so that it will be energized when the motor 64 drives the compressor 54. The circuit for the heating coil 90 includes wire 65, thermostat T, wire 77, wire 91, coil 90, wire 92 and wires 80 and 67. Thus it is apparent that when the thermostat T closes the motor circuit to drive the compressor 54, the bellows 86 will move the baffle 42 to the position shown in the drawing and will maintain the same in this position as long as the compressor is operating. When the thermostat interrupts the compressor motor circuit, it will also interrupt the circuit to the heating coil 90. The volatile fluid in the container 87 will cool quickly with the consequent lowering of the pressure within the container and an expansion of the bellows 86 will quickly take place to close the outlet 39 and open the outlet 38.

In the embodiment shown in Fig. 3, the pressure within the chamber 87 is controlled by the pressure in the refrigerating system, it being connected by a pipe 94 to the suction pipe 55 in the present illustration. When the compressor operates, it will reduce the pressure in pipes 55 and 94 and in chamber 87 causing the bellows 86 to expand to move the rod inwardly and when the compressor stops, the pressure within chamber 87 and pipes 94 and 95 increase to cause a collapsing movement to be imparted to the bellows 86 whereby the rod 84 will move to the right. In this embodiment the rod 54 is connected through a bell-crank lever 95 to the arm 85 of baffle 42 for the purpose of imparting the proper movement to the baffle 42.

From the foregoing it will be seen that I have provided an air conditioning system which maintains a constant circulation of air in the room but the circulating air does not pass over the wet surface of the evaporator when the evaporator is inactive.

While the forms of embodiment of the present invention as herein described constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow:

I claim:

1. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; and means operated when the refrigerating apparatus is inoperative for preventing the flow of circulating air about the heat absorber.

2. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the temperature of the air for cyclically controlling the operation of the refrigerating apparatus; and means operated when the refrigerating apparatus is inoperative for preventing the flow of circulating air about the heat absorber.

3. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; and means controlled by the refrigerating apparatus for directing the circulating air about and for preventing the flow of circulating air about the heat absorber.

4. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; a movable baffle, said baffle in one position being adapted to cause the circulating air to flow about the heat absorber and when in another position being adapted to prevent the circulating air from flowing about the heat absorber; and means controlled by the refrigerating apparatus for actuating said baffle.

5. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; a fan for continuously causing air to circulate through the housing; and means controlled by the control means of the refrigerating apparatus for controlling the flow of circulating air about the heat absorber.

6. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the temperature of the air for cyclically controlling the operation of the refrigerating apparatus; a fan for continuously causing air to circulate through the housing; and means controlled by the control means of the refrigerating apparatus for controlling the flow of circulating air about the heat absorber.

7. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; a fan for continuously causing air to circulate through the housing; and means controlled by the refrigerating apparatus for controlling the flow of circulating air about the best absorber.

8. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; a fan for continuously causing air to circulate through the housing; and means responsive to the pressure of the refrigerant in the refrigerating apparatus for controlling the flow of circulating air about the heat absorber.

9. An air conditioning system comprising in combination, a housing through which air to be conditioned is circulated; a refrigerating apparatus including a heat absorber and a heat dissipator, said heat absorber being disposed in the housing for cooling the circulating air, said apparatus including means responsive to the condition of the air for cyclically controlling the operation of the refrigerating apparatus; a fan for continuously causing air to circulate through the housing; and means responsive to an increase in pressure in the refrigerating apparatus for preventing the flow of circulating air about the evaporator.

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