

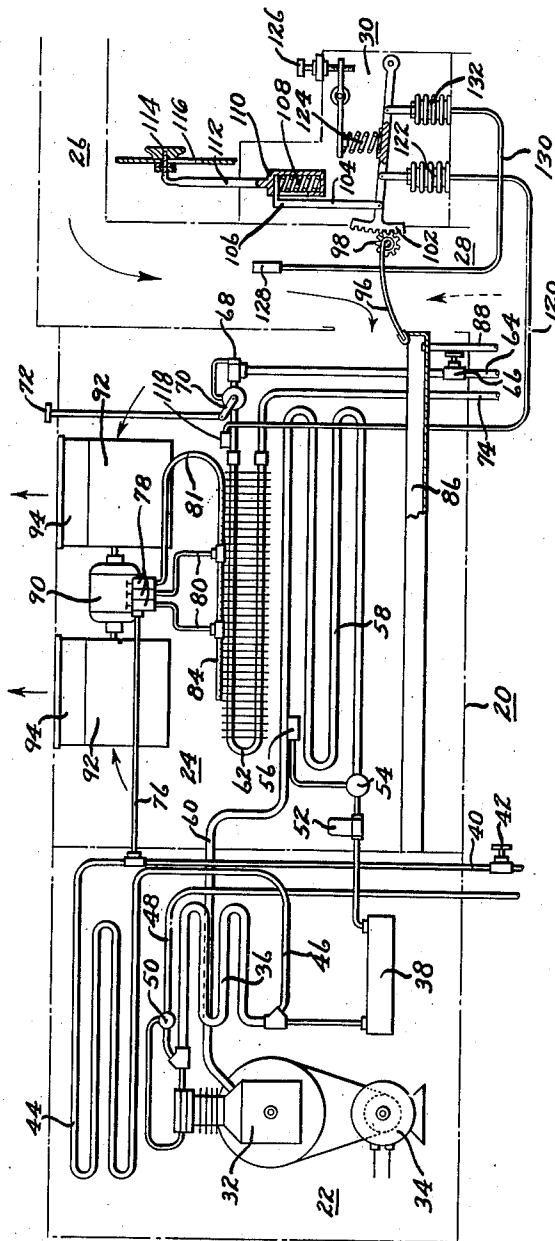
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REFRIGERATING APPARATUS

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REFRIGERATING APPARATUS

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This invention relates to refrigerating apparatus and more particularly to air conditioning apparatus and controls for air conditioning apparatus.

Heretofore, air conditioning apparatus has in some cases been provided with a manual control for controlling the admittance of outside air to the air conditioning apparatus and in other cases has been provided with an automatic control. Neither of these controls are altogether satisfactory under all conditions, since the manual control does not prevent undesirable conditions, especially when neglected, and the automatic control does not permit deviations therefrom as may be desired from time to time.

It is an object of my invention to provide an air conditioning system with a combined automatic and manual control which will control the entrance of external air and yet has automatic controls which will properly take care of operations in case the proper operation of the manual control is neglected.

It is another object of my invention to provide a combined manual and automatic control for an air conditioning system which controls both the supply of external air and the recirculation of room air through the air conditioning unit.

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

In the drawing, the figure is a diagrammatic representation of an air conditioning unit and control system embodying my invention.

In my disclosure, I have disclosed an air conditioning unit containing a refrigerating system for cooling and dehumidifying air, as well as a steam coil with a humidifying device for heating and humidifying the air together with a source of external or outside air and a source of room air which is controlled by a damper capable of being operated manually but also having automatic controls which will shut off the flow of outside air into the unit when the external temperature is rather low and/or which will also shut off the outside air when the steam coil is not in use. This control thus prevents the entrance of too much cold air which would cause the room to become too cold and also prevents the freezing of the steam coil.

Referring now to the drawing, there is shown diagrammatically an air conditioning unit generally designated by the reference character 20 having a compressor compartment 22, a coil compartment 24, an inlet duct 26 for conducting outside air to the unit, a room inlet duct 28 for conducting room air to the coil compartment and a control means 30. Within the compressor compartment 22 there is provided a refrigerant com-

pressor 32 driven by an electric motor 34 for compressing the refrigerant and for forwarding the compressed refrigerant to a water cooled condenser 36 where the condensed refrigerant is liquefied and collected in a receiver 38.

In order to cool the condenser and the compressor compartment 22, there is provided a source of water which is conducted through the pipe 40 under the control of a valve 42. The pipe 40 extends into the compartment 22 and is provided with a serpentine coil 44 for absorbing heat from the compressor compartment. The water, after passing through the coil 44, extends through the pipe 46 to the lower portion of the condenser 36. The condenser 36 is preferably of the double tube type in which the refrigerant passes through the inner tube in one direction, that is downwardly, and the water flows through the space between the inner and outer tubes in the opposite direction, that is upwardly, so as to secure the thermal advantages of the counter-flow method of cooling. The water passes through the condenser 36 in a direction opposite that of the refrigerant and then is discharged through the pipe 48 to a drain. The flow of water is preferably controlled by an automatic valve 50 according to the pressure within the valve chamber of the compressor.

Within the chamber or coil compartment 24 there is provided a solenoid valve 52 which is controlled by an electric circuit (not shown) and a thermostatic valve 54 controlled by the thermostat 56 which controls the flow of liquid refrigerant to the refrigerating coil 58. The refrigerant within the coil 58 evaporates under reduced pressure and absorbs heat from the air flowing through the compartment 24. This evaporated refrigerant is returned to the compressor through the return conduit 60.

The compartment 24 is also provided with a steam coil 62 for heating the coil within the compartment which is supplied with steam through the pipe 64 under the control of a hand valve 66, an automatic valve 68 and a valve 70 provided with a remote manual control 72 which extends to the outside of the compartment 24. The valves 66, 68 and 70 control the flow of steam through the steam coil 62 where the steam condenses and gives off heat to the air within the compartment 24 and the condensed steam is discharged through a discharge pipe 74. The air is humidified by fine sprays or drops of water which drip over the steam coil. This is provided by a pipe 76 which connects with the water pipe 40 and this flow of water is controlled by three manually adjustable sight glass water valves designated by the reference character 78, each of which permits a fine stream of water to flow through the connecting pipes 80 and 81 to a perforated pipe 84 which permits the water to be

sprayed or dripped onto the steam coil 62 to cause its vaporization. Any water or moisture which may drip from the steam coil 62 or which may drip from the evaporator 58 is collected by the large flat pan 86 located in the lower portion of the compartment 24 and provided with a drain 88 for carrying away the drip. Within the compartment 24, there is also provided an electric motor 90 having a centrifugal fan 92 at each end which draw in air either through the external air duct 26 or the room air duct 28 over the surfaces of the coils 58 and 62 and discharges the air through the outlets 94 and into the room.

An opening is provided within the side wall of the compartment 24 and cooperating with this opening is a damper 96 which is provided with a gear 98 which meshes with a segment 102 pivoted at 104 which is employed for moving the damper into its upper position where the external or outside air is cut off and room air flows into the compartment 24 or to the lower position as shown in the drawing where the room air is cut off and external or outside air is permitted to be drawn into the compartment 24. In order to manually operate this damper, I have provided a link 104 having a hook-shaped upper end 106 which is held by a rather weak spring 108 against the wall 110 of the spring cavity which is formed within the lower end of a manually adjustable slidable member 112 which is provided with an adjusting nut and knob 114 which may be used to move the slidable member 112 in either direction but is limited by the slot 116 in its movement. The knob 114 is also used to fasten the slidable member 112 at any point in the slot 116.

With this arrangement, the member 112 may be moved downwardly to forceably move the damper 98 to its upper position in which the external or outside air coming through the outside duct 26 is cut off and prevented from entering the chamber 24. This control member 112 may also be moved upwardly to move the damper 96 to its downward position as shown in the figure whereby the external air is permitted to flow from the duct 26 to the compartment 24 while room air is cut off. This control member 112 may also be moved to intermediate positions and locked by the knob 114 so that some room air may be recirculated while some outside air may also be drawn in. It should be noted that all that holds the damper 96 in its lower position as shown in the figure to cut off the room air and permit the entrance of outside air is the spring 108.

The damper 96 is normally in a position to shut off the room air and to permit the entrance of the outside air during the summer, spring and fall when the air is comparatively mild, such as around 60° F. Under such conditions, a considerable amount of air is drawn into the room when the fan 92 is in operation and so provides a supply of fresh air which is warmed and humidified by the steam coil 62 before it is discharged into the room. It has been found, however, that when the temperature of the outside air is slightly below freezing, and the steam coil is shut off that there is often a small amount of steam which leaks into the coil and condenses there. Under such a condition, there is a possibility that the cold outside air which is drawn over the steam coil by the fans 92 will freeze this condensate and burst the pipes and the coil 62. Thus, under this condition, should the control of a simple manually controlled damper be neglected, there is a possibility that the steam coil will freeze

up and that the room may become excessively cooled. When the weather becomes moderately cool outside, such as 50° F. or below, and the heating has been shut off in the building, there is also the danger that too much cold air will enter the room and the temperature of the room to which the air conditioner supplies its air will become excessively cold should the damper remain open under such conditions.

In order to overcome or prevent these possibilities, I have provided an automatic means which will function to prevent the freezing of the steam coil and to prevent the room from becoming too cold. In order to do this, I provide a thermostat 118 in heat exchange relation with some suitable portion of the steam coil 62 which is connected by a tube 120 to a bellows 122 which is connected to the segment gear 102. By this thermostat 118, when the steam coil is on, the bellows 122 will be expanded to tend to keep the damper 96 in its lowermost position where the air from the room is cut off. This thermostatic bulb 118 is preferably filled with some suitable volatile liquid such as methyl or ethyl alcohol which will only be effective at temperatures above a relatively high temperature such as 150° F. When the steam coil 62 is comparatively cold, the volatile liquid within the thermostat 118 will contract, thus collapsing the bellows 122 and causing the segment gear 102 to be pulled downwardly by a control spring 124 which is provided with a screw threaded adjustment 126 for varying its temperature. The spring 124 is sufficiently stronger than the spring 108 to overcome the force of the spring 108 in order to move the damper 96 from its lower position as shown in the figure to its uppermost position as shown where it will cut off the external or outside air.

Likewise, in order to prevent the entrance of external air when the weather outside is 50° F. or below for preventing the room from becoming too cold, I provide a second thermostat 128 located within the outside air duct 26 which is connected by a tube 130 to a second bellows 132 which in turn is also connected to the segment gear 102. Preferably, the thermostat 128 is provided with a volatile liquid which will be ineffective at temperatures above 50° F. but which will at lower temperatures allow the bellows 132 to collapse under the influence of the spring 124 and move the segment gear 102 downwardly against the tension of the spring 108 in order to move the damper 96 upwardly to close the outside air inlet in the event that no heat is supplied to the heating coil 62 to prevent the room from becoming too cold. When there is steam in the coil 62, the thermostat 118 and the bellows 122 will prevent the collapsing of the bellows 132 by the spring 124.

Thus, in either case I have provided means for overcoming the manual setting when the steam coil has been turned off or when the outside air is too cold in order to prevent the freezing of the coil and to prevent the room from becoming too cold. This, of course, is permitted by providing a resilient connection which includes the spring 108, which can be overcome to permit the movement of the damper 96 despite the position of the manual control 112. Thus, my manual control is effective at all times except when the outside air temperature is too cold or when no steam is passing through the steam coil. The automatic control can always be overcome to close the outside air and the manual control is also capable of shutting off the room

air and permitting the entrance of outside air except under the conditions when it would be undesirable to do so. Thus, I have provided a control for an air conditioning system which permits the normal adjustment of the manual control, but which automatically prevents undesirable situations which might be caused by neglect to attend to the manual control.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. Air conditioning means including a source of external air, a source of internal air, damper means for alternately shutting off the supply of internal and external air, means for changing the temperature of the air, manual control means having a yielding connection with said damper means and provided with a setting for shutting off the source of internal air, and means responsive to the temperature of said temperature changing means for moving said damper means to shut off the supply of external air even when the manual control means is set to shut off the supply of internal air.

2. An air conditioning means including a source of external air, a source of internal air, damper means for alternately shutting off the supply of internal and external air, means for changing the temperature of the air, manual control means for moving and setting said damper means to shut off one of said sources of air, and means responsive to the temperature of said temperature changing means for moving said damper means contrary to the setting of the manual control means to shut off the other source of air and open the source of air for which the manual control means is set to shut off.

3. Air conditioning means including a source of outside air, a source of recirculated air, means for drawing air from said sources, a damper for controlling the drawing of air from said sources including means for shutting off the flow of air from either of said sources, manually manipulatable means incorporating a mechanical yielding connection for operating and setting the damper for controlling the drawing of air from said sources, said manually manipulatable means including mechanical means for positively shutting off the flow of outside air and mechanical yielding means for shutting off the flow of recirculated air, and thermostatic means for operating said damper capable of overcoming said yielding means to move said damper to shut off the flow of outside air when said manually manipulatable means is set to position for opening the damper to outside air.

4. Fluid control means including two different fluid supply means, means for drawing fluid from said supply means, a valve for controlling the drawing of fluid from said two supply means, said valve including means for shutting off the flow of fluid from either of said sources, manually manipulatable means incorporating a mechanical yielding connection for operating and setting said valve for controlling the drawing of fluid from said supply means, said manually manipulatable means including mechanical means for positively moving and setting the valve to shut off the flow of fluid from one of said supply means, said manually manipulatable

means including mechanical yielding means for moving and setting said valve to shut off the flow of fluid from the second supply means, and automatic means for operating said valve capable of overcoming said yielding means to move the valve to shut off the flow of fluid from said one supply means.

5. Air conditioning means including a source of outside air, a source of room air, damper means for alternately shutting off the supply of room air and external air, means for heating the air, manual control means for operating and setting the damper means to shut off the supply of room air, and means effective when the temperature of the outside air falls below 50° F. for moving the damper means to shut off the supply of outside air regardless of the setting of the manual control means.

6. An air conditioning means including a source of outside air, a source of room air, damper means for alternately shutting off the supply of room air and external air, means for heating the air, manual control means for operating and setting the damper means to shut off the supply of room air, means effective when the temperature of the outside air and the temperature of the heating means each fall below certain respective predetermined temperatures for moving the damper means to shut off the supply of outside air regardless of the setting of the manual control means.

7. Air conditioning means including a source of external air, a source of internal air, mechanism for controlling the ratio of internal air to external air, means for changing the thermostatic condition of the air, control means having a yielding connection with said mechanism for controlling the supply of internal and external air, and thermostatic means for moving said mechanism to reduce the supply of external air even when said control means is set to shut off the supply of internal air.

8. An air conditioning means including a source of external air, a source of internal air, mechanism for varying the ratio of internal air to external air, apparatus for changing the thermal condition of the air, control means for moving and setting said mechanism, means to substantially close off one of said sources of air, and means responsive to the operation of said apparatus for moving said mechanism contrary to the setting of the control means to reduce the other source of air and increase the source of air for which the control means is set to reduce.

9. Air conditioning means including a source of outside air, a source of recirculated air, means for drawing air from said sources, mechanism for controlling the drawing of air from said sources including means for reducing the flow of air from either of said sources, control means incorporating a mechanical yielding connection for operating and setting the mechanism for controlling the drawing of air from said sources, said control means including mechanical means for positively reducing the flow of outside air and mechanical yielding means for reducing the flow of recirculated air, and thermostatic means for operating said mechanism capable of overcoming said yielding means to cause said mechanism to reduce the flow of outside air when said control means is set to position for increasing the amount of outside air.

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