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AIR CONDITIONING SYSTEM
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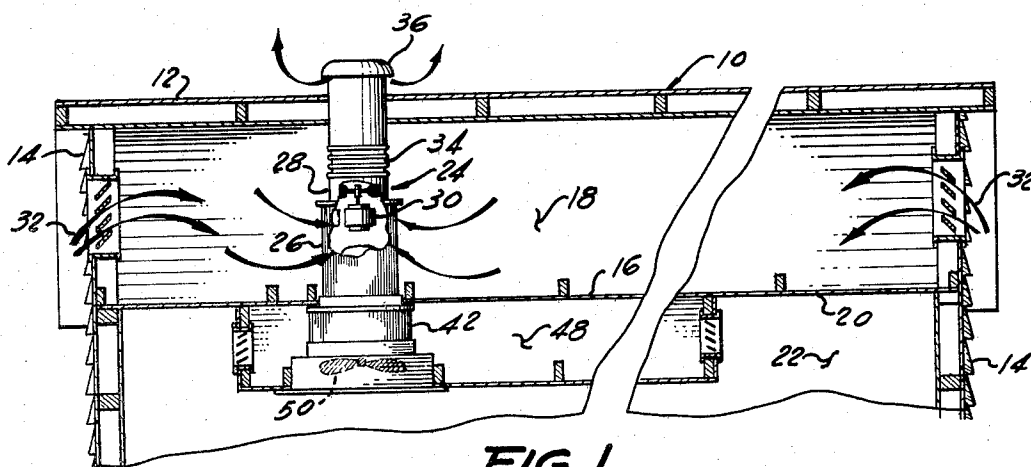


FIG. 1.

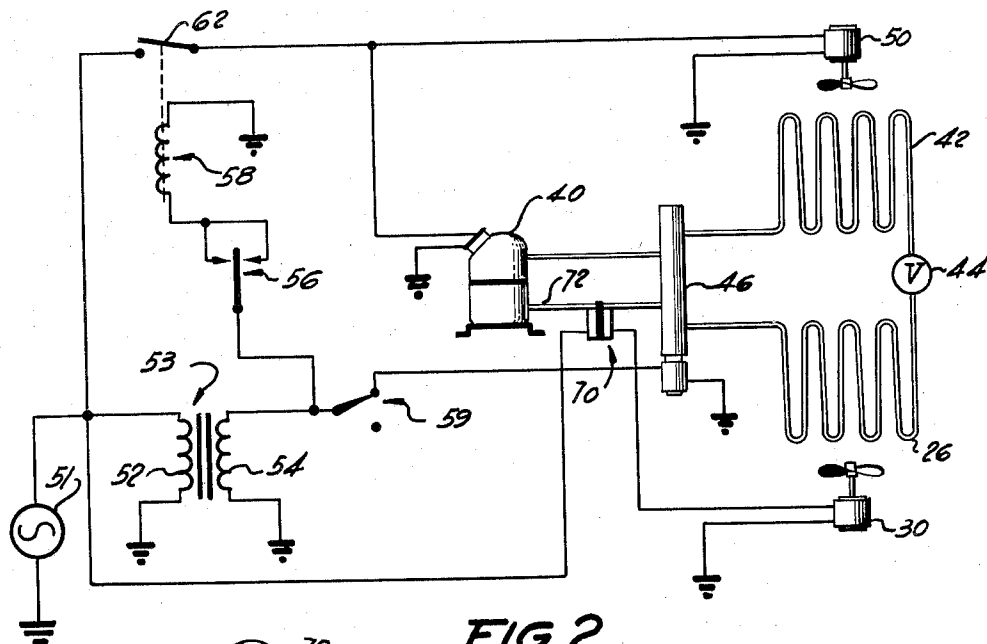


FIG. 2.

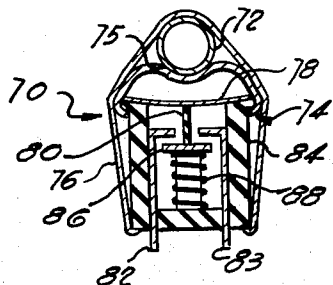


FIG. 3.

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1

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AIR CONDITIONING SYSTEM

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3 Claims. (Cl. 62—183)

This is a continuation-in-part of my copending application Serial No. 294,949, filed July 15, 1963, and entitled Centralized Heating and Air Conditioning System.

This invention relates to a heat pump type air conditioning system in which one of the coils is located in the attic space of the enclosure, and more particularly, to the combination with such a system of means including a blower for providing a heat sink for the attic coil by the circulation in the attic space and over the coil of ambient atmosphere air, and of a control for operating the blower both dependently and independently of the heat pump.

Commonly, a heat pump is a refrigerant charged system including a compressor and a pair of coils connected in circuit with a pressure throttling means. Recent developments in temperature conditioning of dwelling houses have located the compressor and one coil in the attic space and have located the other coil in an appropriate air conduit for heat transfer with the conditioning air for the enclosure. A blower is provided in the attic for circulating air over the attic coil and compressor, and commonly this air is drawn from the outdoors through special conduits and subsequently discharged back to the outdoors. However, such systems do not vent the attic space which, because of the high heat gains from the direct sunlight and the low heat losses to the separated cooler atmosphere, is oftentimes at a temperature far in excess of the outdoor temperature. Consequently, there is generally a greater temperature differential across the enclosure ceiling between the enclosure and the attic space than between the enclosure and the outdoor air, and thus a greater heat load for the conditioning system to overcome.

Accordingly, an object of this invention is to provide a heat pump air conditioning system that automatically vents the attic when the air conditioning system is operating.

Another object of this invention is to provide a control for such an air conditioning system for automatically operating the venting means when the attic temperature exceeds a predetermined minimum.

In order that these and other objects can be more fully appreciated, reference is herein made to the accompanying drawings, wherein:

FIG. 1 is an elevational view, partly in longitudinal center section, of an attic mounted air conditioning system for a dwelling house having therein a preferred embodiment of the subject invention.

FIG. 2 is an electrical and heat pump flow circuit diagram for use in the subject invention; and

FIG. 3 is an enlarged cross-sectional view of a thermostatic control switch having particular adaptability for use in the subject invention.

My above mentioned copending application Serial No. 294,949, filed July 15, 1963, and entitled "Centralized Heating and Air Conditioning System," discloses an air conditioning system in which the heat pump compressor and one coil are located in the attic space. Blower means in the attic draws outside air through louvered openings in the attic wall, passes it over the attic coil and compressor, and discharges it back to the atmosphere. To this extent the disclosures are the same. This application also discloses a control for such a system in which the attic blower means can be controlled both dependently and independently of the heat pump system.

2

FIG. 1 shows a typical attic space of a dwelling house 10 and a preferred embodiment therein of a heat pump conditioning system as was disclosed in my above mentioned copending application. The house 10 includes typically a roof 12, spaced vertical side walls 14, and a floor 16 which define therein an attic space 18. The opposite side of the floor 16 typically defines the ceiling 20 of the enclosure space 22 located below the attic. In the embodiment shown herein a heat pump system 24 includes an attic coil 26 of generally cylindrical contour having a terminal 28 disposed on its upper end. A blower or fan unit 30 is disposed within the terminal 28 operable to draw outside air through louvers 32 in the walls 14 and over the coil 26. A bellows type connector 34 connects the terminal 28 to a vent 36 disposed in the roof 12. It will be appreciated that when the roof 12 is subjected to direct sunlight and the attic is closed, the air temperature within the attic space 18 becomes 20° to 50° F. hotter than the ambient outdoor temperature. However, the disclosed system includes drawing the cooler ambient air into and circulating it throughout the attic space 18 before ultimately passing it over the attic coil 26 and discharging it back to atmosphere. This circulation causes the attic temperature to approach that of the cooler outdoor ambient air.

FIG. 2 shows heat pump flow circuit and the electric control for such a circuit. The heat pump includes typically a compressor 40, the attic coil 26, an enclosure coil 42, a pressure throttling or expansion means 44 connected between opposite ends of the coils 26 and 42, and typically a 4-way valve 46 connected between the otherwise opposite ends of the coils and the compressor 40. This system represents a typical reversible heat pump circuit wherein the direction of refrigerant flow in the circuit determines which of the coils acts as a condenser or heating coil and which of the coils acts as the evaporator or cooling coil. It will be appreciated that for a cooling cycle the attic coil is the condenser and the enclosure coil is the evaporator. The distribution system for the conditioning air is described fully in my above mentioned copending application, but as shown herein in FIG. 1, includes a plenum 48 in which the enclosure coil 42 and blower means 50 are located. The enclosure air is drawn into the plenum 48, circulated over the enclosure coil 42, and discharged back to the enclosure.

The electric control for the system includes a high voltage power source 51 connected to a coil 52 of a transformer 53 having also low voltage coil 54. The low voltage coil 54 is connected to the various controls including the thermostat 56, starter relay 58, and the heat pump selection control 59. Typically the switch 59 is mounted within the enclosure and is connected to the solenoid operated 4-way valve 46 operable to reverse the spring bias of the valve and switch the heat pump between the cooling and heating cycles. The thermostat 56 is disposed in the temperature controlled enclosure 22 and operates the starting relay 58 having a switch 62 connected by appropriate means through the compressor 40 and enclosure blower 50 to the power source 51.

The subject control includes means by which the attic blower 30 is operated both dependently and independently of the operation of the compressor 40. The control includes a thermostatic switch 70 connected in series with the attic blower 30 to the power source 51. The switch 70 is in the attic strapped to the hot outlet line 72 from the compressor 40 to the 4-way valve 46. Thus, the switch senses the temperatures of both the attic air and the outlet line 72 and either, if sufficient, can actuate the switch to complete the control circuit to the blower 30.

A preferred embodiment of a thermostatic switch is shown in FIG. 3. The switch includes a casing 74 having a groove 75 formed therein adapted to receive in flush

engagement the line 72 and be strapped thereto by spring means 76. The switch further includes a bimetal element 78, which in this case is shown as an overcenter disc, mounted within the casing 74 and adapted to bias a follower element 80. The switch includes a pair of control terminals 82 and 83 mounted in insulating block 84 in the casing 74 and presenting adjacent contacts proximate but spaced from one another. A movable contact element 86 is adapted to engage the terminal contacts to complete a circuit through the switch. The contact element 86 is biased on its one side by follower member 80 to open the switch and on its opposite side by coil spring 88 to close the switch.

It will be appreciated that the bimetal element 78 of the thermostatic switch 70 senses the temperatures of both the attic air and the heat pump at conduit 72. The actuating temperature of the element 78 preferably is chosen to be approximately 80° to 100°, or the lowest temperature at which the operation of the attic blower is desired independently of the operation of the compressor 40. Since the operating temperature of line 72 is well in excess of 80° to 100° F., the thermostatic switch 70 controls the blower responsive to the operation of the compressor. Any lag in the control of the attic blower is beneficial, since a lag in starting reduces line surges of current upon the initial starting of the heat pump and a lag in stopping conveys away the excess residual heat in the heat pump components. However, since the attic temperature also controls the attic blower, even when the enclosure thermostat 56 is satisfied and opened, the attic blower will operate independently of the heat pump at all attic temperatures above the set maximum temperature.

While this disclosure has so far been directed more to the cooling cycle for the enclosure, it also improves the overall operation of the heating cycle. During the heating cycle the attic coil acts as the evaporator coil having refrigerant temperatures therein approximately 15° F. less than that of the air ambient the coil. Since the outdoor air is heated in passing through the attic to the attic coil, the higher evaporator coil temperatures reduce the temperature difference between the coils against which the heat pump must work. Also, since heat pump efficiency and output drop off sharply at low evaporator coil temperatures, the improved heat pump operation at the higher coil temperatures is generally sufficient to more than overcome the increased heat loss across the enclosure ceiling because of the reduced attic temperatures.

While only a single embodiment of the subject invention has been disclosed, it will be appreciated that variations can be made therein without departing from the inventive concept. Accordingly, it is desired that the subject invention be limited only by the scope of the claims hereinafter following.

What is claimed is:

1. An air conditioning system for an enclosure having an attic space thereabove, the improvement comprising a compressor, a refrigerant charged circuit having a hot side extending from said compressor and optionally connected to either a first coil in said circuit disposed in the attic space or a second coil in said circuit disposed in the enclosure for either cooling or heating said enclosure, air inlet means open generally to the attic from the outside ambient air from at least one location in the attic spaced from the attic coil, exhaust vent means adjacent the coil between the attic and the outside ambient atmosphere,

blower means operable proximate the attic coil and the exhaust vent means operable to draw air through the inlet means and across the attic generally to the coil and to discharge said air from the vent means back to the ambient atmosphere, and a temperature sensitive switch disposed in temperature sensing relation both with the hot side of the refrigerant charged circuit and with the attic air operable at a predetermined minimum temperature of either said hot side or a minimum temperature of the air in said attic for automatically operating said blower means adjacent said attic coil to vent the air in said attic and draw air through said inlet means.

2. For use in an air conditioning system including a refrigerant charged circuit having a compressor and a first coil disposed in the attic space of a dwelling and a second coil disposed in an enclosure to be conditioned by said system below said attic space, the improvement comprising air inlet means open generally to the attic from the outside ambient atmosphere from at least one location in the attic spaced from the attic coil, exhaust vent means adjacent the attic coil between the attic and the ambient atmosphere, blower means operable proximate the attic coil and the exhaust vent means operable to draw outside air through the inlet means and across the attic generally to the attic coil and to discharge said air from the vent means back to the atmosphere, and a temperature sensitive switch disposed in external engagement with said hot side in temperature sensing relation both with the hot side of the heat pump circuit and with the attic air operable at a predetermined minimum temperature of the order of 80° to 100° F. at which the venting of the attic is desired to control the operation of the blower means, so that the control thereby is actuated either by the refrigerant charged circuit upon its operation or independently thereof by the attic air directly when the latter exceeds the predetermined minimum temperature.

3. For use with an air conditioning system of the type having a compressor in a refrigerant charged circuit including a coil located in an attic space and a coil located in a space to be conditioned by said system with a hot conduit from said compressor connected alternatively to either coil and each coil having a respective fan associated therewith and the fan associated with the attic coil arranged to circulate air external to said attic through said attic past said attic coil, the improvement comprising a thermally responsive switch, means for securing said switch in external engagement with said hot conduit for enabling said switch to sense both the temperature of said hot conduit and the air temperature adjacent said conduit for operating said switch in the event the temperature in either said conduit or the air temperature exceed desired values, and means operated by said operated switch for operating said fan associated with said attic coil to circulate air through said attic.

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