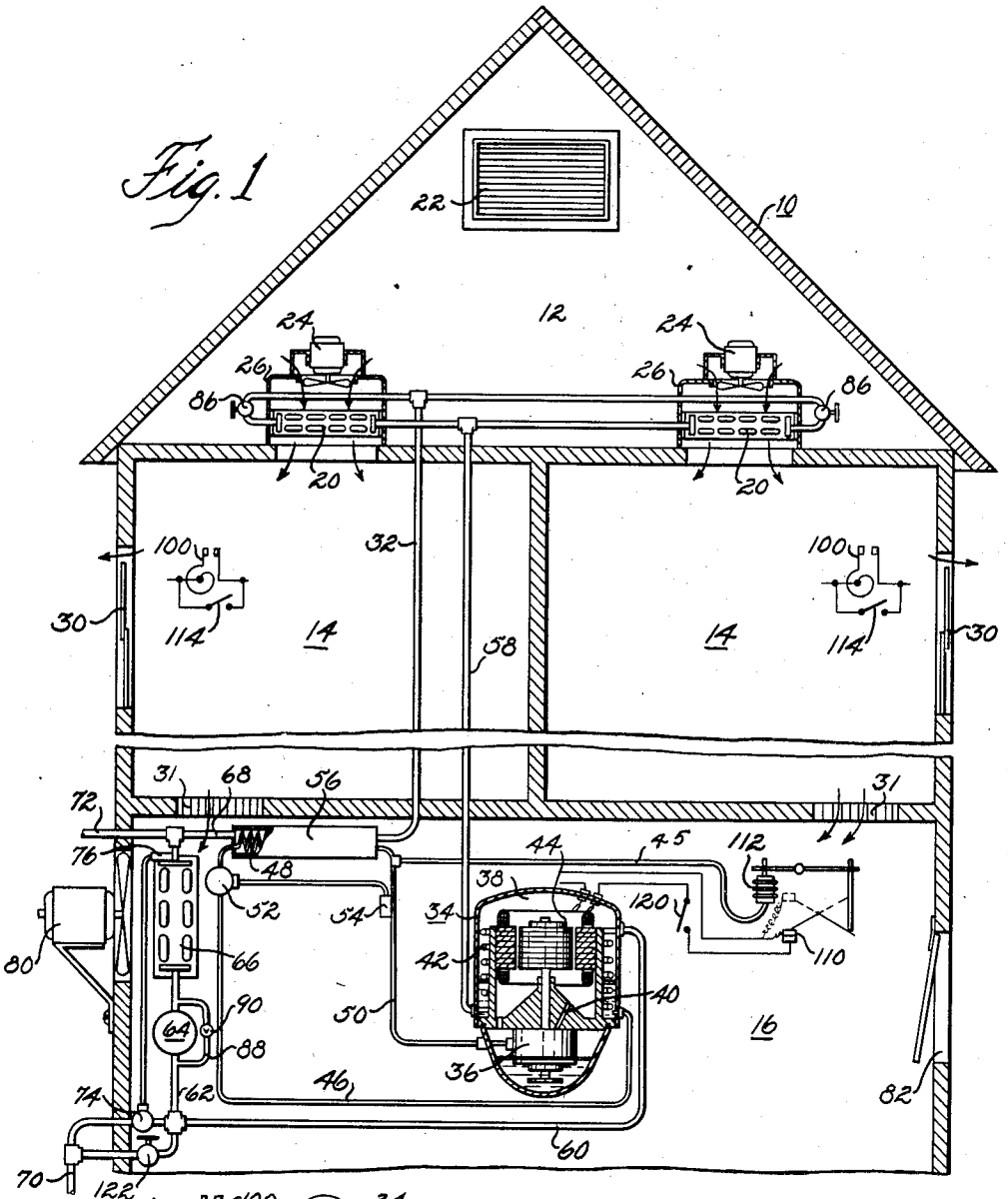
Nov. 2, 1943. R. E. GOULD 2,333,309

REFRIGERATING APPARATUS

Filed April 25, 1941

Fig. 1



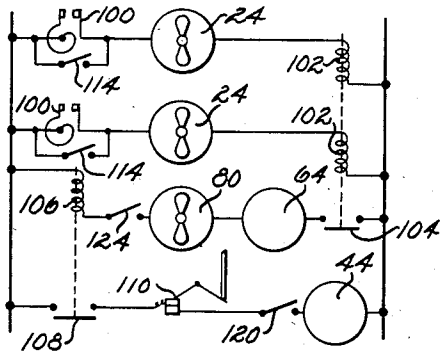


Fig. 2

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REFRIGERATING APPARATUS

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5 Claims. (Cl. 62—6)

This invention relates to refrigerating apparatus and more particularly to an improved apparatus for conditioning the air in a private home or the like.

One of the most practical ways of conditioning the air for a private home or the like is to mount the conditioning apparatus in the attic and to discharge large volumes of conditioned fresh air through one or more ceiling openings. Self-contained air conditioning units have been used for this purpose but their use is limited to those homes in which adequate space is available in the attic for the complete unit.

One object of this invention is to provide a system of the type in which the air cooling coil may be located in the attic space and in which the main refrigeration unit may be located in the basement or at some other remote place.

Another object of this invention is to provide a water cooled refrigerant condensing system which requires a minimum amount of cooling water.

A further object of this invention is to provide a refrigerating system in which the condenser cooling water may be used for directly cooling the air when the cooling load is light.

Another object of this invention is to provide an improved control system for an air conditioning system in which chilled water is used for cooling the air.

Still another object of this invention is to utilize the cooling effect of the basement air and walls for air conditioning purposes.

Another object of this invention is to utilize the air conditioning equipment for ventilating the basement of a home.

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:

Fig. 1 is a diagrammatic view partly in section showing a preferred form of my invention; and

Fig. 2 diagrammatically shows the electrical circuits used for controlling the apparatus shown in Fig. 1.

As shown in Fig. 1, reference numeral 10 generally designates a private home or the like having an attic space 12, a plurality of rooms 14 and a basement 16. Obviously the size and shape of the home is broadly immaterial since the apparatus may be used for conditioning the air for any number of rooms merely by varying the capacity of the apparatus and if necessary the number of cooling coils used. For purposes of illustration, I have shown two separate cooling coils 20 which are adapted to be mounted directly within the attic space 12. The fresh air to be conditioned enters the attic space through the opening 22 and is discharged into the rooms 14 by means of the fan units 24. A casing 26 is provided for supporting each coil 20 together with a fan unit 24.

Inasmuch as the system shown is designed to introduce a large amount of fresh air from the outside and to condition all fresh air only, it is apparent that some arrangement must be made for discharging a corresponding amount of air from the conditioned space. As shown in the drawing each of the rooms 14 is provided with a window 30 which may be left open at the top so as to permit a portion of the surplus air to escape directly to the outside. Some or all of the surplus air may be exhausted from the rooms 14 through floor openings 31 or the like, which convey the air to the basement room 16 in which the main refrigeration system is located. Chilled water is supplied to the coils 20 through the line 32.

The refrigerating system which is used for chilling the water supplied through the pipe 32 whenever the water supplied to the pipe is not cold enough to properly condition the air, comprises a sealed motor-compressor-condenser unit 34, located in the basement 16. This unit comprises a conventional rotary compressor 36 which discharges compressed refrigerant into the motor chamber 38 via the compressor outlet 40. The compressed refrigerant which is discharged into the chamber 38 is condensed by means of the water coils 42 which surrounds the motor 44. The condensed refrigerant leaves the unit 34 through the refrigerant liquid line 46 which supplies liquid refrigerant to the evaporator 48. The refrigerant vaporized in the evaporator 48 returns to the compressor through the vapor line 50. The flow of liquid refrigerant to the evaporator 48 may be controlled by any convenient control such as the thermostatic expansion valve 52. Valve 52 includes the usual thermostatic bulb 54 located adjacent the outlet of the evaporator so as to cause the valve 52 to close when the refrigerating effect at the bulb 54 indicates that too much liquid refrigerant is being supplied to the evaporator.

The evaporator 48 is arranged within the water chamber 56 and is adapted to chill the water flowing therethrough. The water leaving the

coils 20 returns through the line 58 which is connected to the water coil 42 located in the main refrigerant condensing chamber. The heated water leaves the coil 42 through the line 69 which is directly connected to the line 62 leading to the water pump 64. The pump 64 discharges into the heat dissipating coil 66 which serves to dissipate the heat of condensation into the air circulated thereover by the fan unit 80. The water leaves the coil 66 through the line 68 which leads to the water chiller or heat interchanger 56.

Under certain conditions, such as when the basement air is cool and the heat load is not too great, all of the heat may be dissipated by the coil 66 and no cold make-up water needs be supplied. Under heavy heat loads it may be necessary to discharge some of the hot condenser water through the waste line 70 and to introduce a corresponding amount of cold make-up water from the city water main 72. The amount of heated water which is discharged through the line 70 may be manually controlled by the valve 122 or it may be automatically controlled by the valve 74. As shown in Fig. 1, the thermostatic valve 74 has been provided for controlling the amount of water flowing through the waste line 70. This valve is controlled by means of the thermostatic bulb 76 located adjacent the outlet of the coil 66. The calibration of the valve 74 is such that when the temperature of the water leaving the coil 66 indicates that the coil 66 has not dissipated a sufficient amount of heat, the valve 74 will open and when the temperature of the water leaving the coil 66 is sufficiently low for reuse, the valve 74 will be closed.

In order to ventilate the basement and at the same time cool the water flowing through the coil 66, air from the basement 16 is circulated over the coil 66 by the fan unit 80. Make-up air may be supplied to the basement through the basement window 82 and/or through the openings 31 provided in the floor of the rooms 14. For purposes of illustration, the openings 31 have been placed in the floor whereas ducts could be provided from the basement to the upper portion of the rooms 14. By virtue of this arrangement, very little, if any, make-up water needs be supplied to the system since the air which cools the water flowing through the coil 66 is relatively cool.

For purposes of illustration, I have shown a hand valve 86 for individually controlling the supply of cooling medium to the air cooling coils 20. It is within the purview of this invention, however, to provide thermostatically controlled valves in lieu of the hand valves 86. In order to prevent undue loading of the pump 64 in the event that one or more of the valves 86 are closed, I have provided a by-pass 88 around the pump 64. A pressure operated valve 90 is provided in the line 88 and is adapted to allow the water to flow therethrough in the event that the outlet pressure of the water pump becomes excessive due to the closing of one or more of the valves 86.

As shown in the circuit diagram of Fig. 2, the fan units 24 are adapted to be controlled by means of the room thermostats 100. By virtue of this arrangement the temperature within a room is controlled by turning on and off the fan 24. As shown in Fig. 2, a solenoid 102 is provided in series with each of the fans 24 whereby energization of any one of the fan units 24 causes the switch 104 to close. The switch 104 is arranged in series with the pump 64 and the fan 80 as shown. A solenoid 106 which is arranged in series with the pump 64 and the fan unit 80 controls the switch 108 which is arranged in the compressor-motor circuit as shown. The compressor-motor 44 is further controlled by the switch 110 which in turn is controlled by the bellows 112. The bellows 112 is connected to the low side of the refrigerating system by the line 45 and therefore responds to the suction pressure within the refrigerating system. By virtue of this arrangement, the refrigerating system is stopped whenever no refrigeration is required.

Ventilation alone may be provided in any one of the rooms 14 irrespective of the room temperature merely by closing the corresponding hand valve 86 and closing the manual switch 114 arranged in parallel with the thermostatic switch 100 located in that room. When the thermostatic switch 100 is closed it is not necessary to close the switch 114 in order to provide ventilation without cooling.

The system shown makes it possible to cool the air without operating the refrigeration system. Under certain circumstances it may be unnecessary to operate the main refrigerating system. On a spring day, for example, when the main heat load is a sun load and the basement air is relatively cold, operation of the pump 64 and the fan unit 80 may provide sufficient cooling without the operation of the compressor and without the addition of make-up water. A hand switch 120 has been provided in series with the compressor-motor 44 for rendering the refrigerating system inoperative when desired. Under heavier load conditions the cooling coil 66 may not have sufficient capacity for dissipating all of the heat in which case water from the line 72 may be added from time to time as needed. By virtue of my arrangement, city water may be used for cooling air merely by opening the valve 122 and allowing the city water to flow through one or more of the cooling coils 20 and thereafter discharge directly into the drain 70. Operation of the pump 64 and the fan 80 may be stopped by opening the switch 124 when the city water is used for cooling in the manner indicated hereinabove. The water discharged into the drain 70 may be dumped into the sewer or may be used for other purposes such as watering the lawn. Thus on a hot summer evening the refrigerating apparatus may be shut off and the water used in sprinkling the lawn may first be used for cooling the air before being sprinkled on the lawn.

As pointed out hereinabove, the simple system shown in the drawing may be used in a number of different ways so as to condition the air most economically under a number of different conditions.

While the form of embodiment of the 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. Apparatus for conditioning air for a home or the like having a basement room comprising in combination, a condenser casing located in said basement room, a motor within said casing, a compressor within said casing and driven by said motor, baffle means within said casing cooperating with said casing to form a condensing pocket having one wall exposed to the basement room air, an evaporator in refrigerant flow relationship with said compressor and said condensing pocket, means for flowing a heat transferring

liquid in thermal exchange with said evaporator and thereafter with air to be conditioned, means for thereafter flowing said liquid in thermal exchange with said condensing pocket, and means for exhausting air from the conditioned space through said basement room.

2. Air conditioning apparatus for a private home or the like comprising in combination, an air cooling coil, an evaporator, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, a source of water, means for flowing water from said source in thermal exchange with said evaporator and thereafter through said air cooling coil, means for flowing the water leaving the air cooling coil in thermal exchange with said refrigerant liquefying means, means for recooling water circulated in thermal exchange with said refrigerant liquefying means, means for recirculating a portion of the water, and means responsive to the temperature of the water controlling the amount recirculated.

3. Refrigerating apparatus comprising in combination, an evaporator, a refrigerant liquefying unit for supplying liquid refrigerant to said evaporator, an air cooling coil, a water circuit including means for flowing water through said coil and said refrigerant liquefying unit in series, means for recooling a portion of said water, means for draining out a portion of said water, means for adding water to said water circuit, and means responsive to the temperature of the water flowing through said water circuit for varying the amount of water added.

4. In combination with an enclosure having a plurality of rooms, a cooling coil for each of said rooms, means for supplying fresh air to each of said coils, an evaporator, refrigerant liquefying means for supplying liquid refrigerant to said evaporator, means for flowing a heat transfer medium in thermal exchange with said evaporator and thereafter through said cooling coils, means for flowing the heat transfer medium leaving said coils in thermal exchange relationship with said refrigerant liquefying apparatus, means for flowing said fresh air in thermal exchange with said cooling coils, thermostatic means controlling the operation of said air circulating means, and means responsive to the pressure of said refrigerant for controlling the operation of said refrigerant liquefying means.

5. The method of conditioning air for a private dwelling having a plurality of rooms and having an attic space above the rooms to be conditioned which comprises introducing air from outside of said dwelling into said attic space, forcefully discharging a separate stream of air downwardly from the attic into each of said rooms, cooling each of said streams of air, exhausting air from said rooms into the outside atmosphere at a rate substantially equal to the rate at which the outside air is introduced into the attic, and discharging heat removed from the incoming air into the air exhausted into the outside atmosphere.

RICHARD E. GOULD.