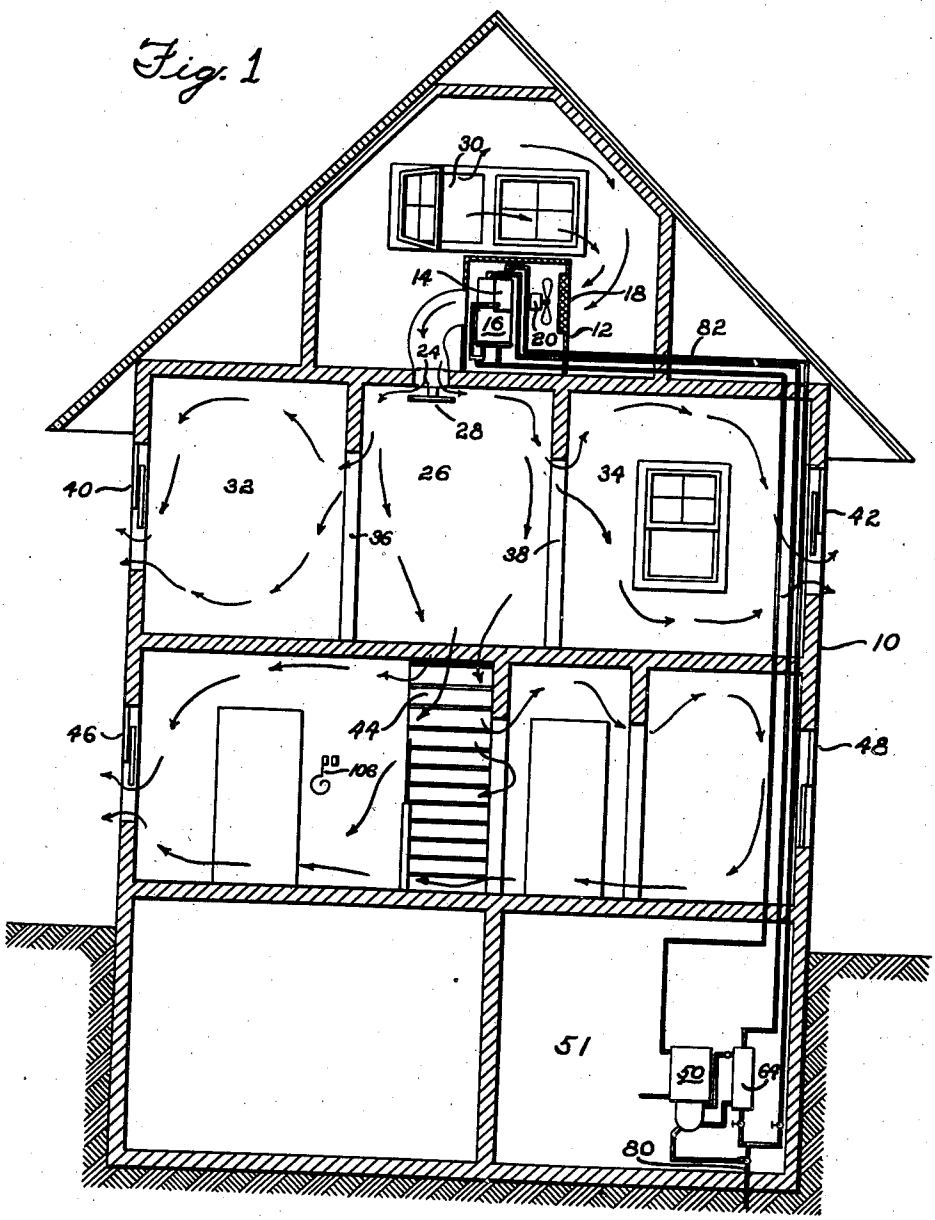
May 25, 1943. R. E. GOULD 2,320,035

REFRIGERATION APPARATUS

Filed Oct. 29, 1940 2 Sheets-Sheet 1

Fig. 1



INVENTOR.

BY Richard E. Gould

Spencer, Hardman & Fehr

ATTORNEYS

May 25, 1943. R. E. GOULD 2,320,035

REFRIGERATION APPARATUS

Filed Oct. 29, 1940 2 Sheets-Sheet 2

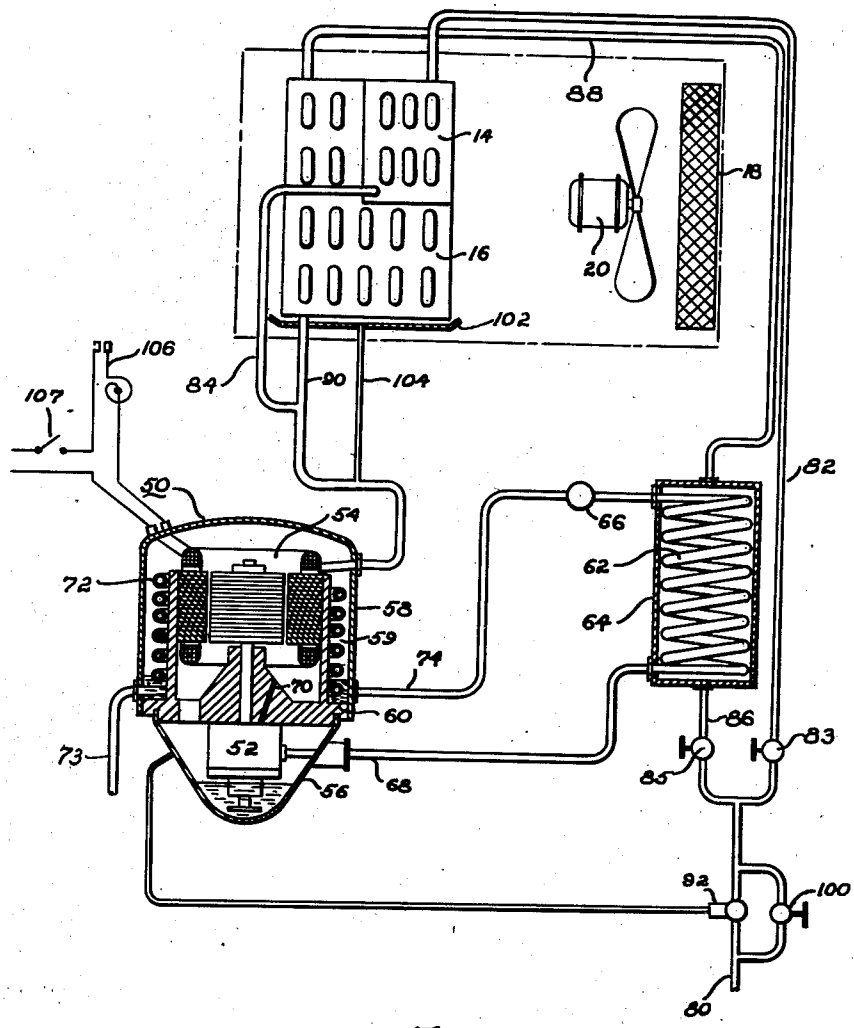


Fig. 2

INVENTOR.
BY Richard E. Gould
Spencer, Hardman & Fehr
ATTORNEYS.

Patented May 25, 1943 2,320,035

UNITED STATES PATENT OFFICE

2,320,035

REFRIGERATING APPARATUS

Richard E. Gould, Oakwood, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application October 29, 1940, Serial No. 363,318

7 Claims. (Cl. 62—129)

This invention relates to refrigeration and more particularly to an improved refrigerating system for conditioning air for private homes and the like.

One object of this invention is to provide an improved conditioning system adapted to condition primarily fresh air only.

Another object of this invention is to provide an improved air conditioning system which incorporates the advantages of a refrigerating system mounted within the basement of a home with the advantages of a refrigerating system mounted within the attic of a home.

Still another object of this invention is to provide an improved coil arrangement for an air conditioning unit.

A further object of this invention is to provide a simplified arrangement for modulating the refrigeration.

Another object of this invention is to utilize, to the fullest advantage, city water in an air conditioning system.

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

In the drawings:

Fig. 1 is a sectional view of a private home or the like equipped with an air conditioning system constructed in accordance with my invention; and

Fig. 2 is a diagrammatic view partly in section, showing the refrigerant circuit.

It has been found that a very practical way of distributing air in a private home or the like is to place the conditioning apparatus in an upper room such as the attic of the home and to discharge all of the conditioned air directly into a hallway or the like, which is in turn provided with openings leading to the rooms to be conditioned. In the average home the second floor hallway, for example, may be used for distributing the conditioned air to all of the upstairs rooms as well as the downstairs hallway, which in turn may be used for distributing the conditioned air to the downstairs rooms.

Inasmuch as the space available in the attics of many homes is rather limited and inasmuch as it is not always practical to mount heavy weight refrigerating apparatus in the attics of many homes, I have designed a system which makes it possible to mount a light weight cooling coil in the attic space and to utilize the hallways or the like for distributing the conditioned air to all of the rooms in the house.

The term "attic" as used herein is intended to designate any room located above a space which is to be conditioned.

Referring now to the drawings wherein I have shown my invention applied to a conventional private home, the reference character 10 is used to designate the entire home. The reference numeral 12 designates a cabinet within which is mounted a first cooling coil 14 and a second cooling coil 16. The cabinet 12 is adapted to be mounted directly within the attic space or any room corresponding to the attic and is provided with an inlet 18 through which air to be conditioned enters the cabinet. The air to be conditioned is circulated through the cabinet by means of a fan 20, mounted within the cabinet. The conditioned air is discharged through the opening 24 provided in the ceiling of the hallway 26. A plaque 28 is located directly beneath the opening 24 so as to distribute the conditioned air outwardly along the ceiling of the hallway whereby the air is caused to flow downwardly along the walls as shown in Fig. 1 of the drawings. The air to be conditioned enters the attic through any conventional opening such as the window opening 30. Preferably fresh air only is conditioned, although it is within the purview of this invention to provide means for recirculating a portion of the air, if desired.

Reference numerals 32 and 34 designate second floor rooms provided with doorways 36 and 38 respectively, communicating with the second floor hallway 26. The conditioned air discharged into the hallway enters the rooms 32 and 34 through the doorways 36 and 38 respectively. Inasmuch as a continuous supply of fresh air is being introduced into the hallway 26, some of the windows may be left open so that a corresponding amount of room air can flow out through the windows, to make room for the fresh conditioned air introduced by the conditioning apparatus.

A portion or all of the conditioned air discharged into the second floor hallway 26 may be caused to flow downstairs through the stairway 44 from whence the conditioned air will be distributed to the adjoining downstairs rooms through the usual door openings and the like. While the amount of fresh conditioned air which is distributed into each room depends in part upon the amount that the windows in each room are opened, it has been found that the turbulence of the air within the hallway very effectively causes circulation of the conditioned air into

adjoining rooms even though some of the rooms have all of their windows closed.

Reference numeral 46 designates a living room window which for purposes of illustration has been shown open. Reference numeral 48 designates a closed window in one of the first floor rooms.

While I have referred to the use of the conventional doorways and windows for controlling the distribution of the conditioned air, it is obvious that special openings may, if desired, be provided for distributing the air within the house. In actual practice it has been found unnecessary in the majority of cases to provide special openings since the existing doorways and windows may be used very effectively in distributing the conditioned air to the desired rooms. The refrigerating apparatus used in conditioning the air comprises a hermetically sealed motor-compressor-condenser unit 50 located within a basement room 51. As shown in Fig. 2, the motor-compressor-condenser unit comprises a conventional rotary compressor 52 driven by means of a conventional electric motor 54. A first casing section 56 serves as a lubricant reservoir and a second casing section 58 cooperates with the main motor compressor frame 60 to form a condensing chamber 59. The motor-compressor-condenser unit 50 is connected in refrigerant flow relationship with an evaporator 62 mounted within the water cooling chamber 64. The flow of refrigerant to the evaporator 62 is controlled by means of any conventional control such as the expansion valve 66. The refrigerant vaporized in the evaporator 62 enters the compressor through the suction line 68 and is discharged by the compressor through the outlet 70 which leads to the motor compartment. The compressed refrigerant discharged into the motor compartment condenses on the cold surfaces of the water coil 72 mounted within the space 59 formed between the main motor compressor frame 60 and the outer dome 58. The condensed refrigerant collects in the lowermost portion of the space 59 and is supplied to the evaporator through the line 74.

Reference numeral 80 designates any conventional water supply line such as a city water main. Inasmuch as there may be times when the water supplied from the city main is sufficiently cold to provide the necessary cooling capacity without further refrigeration, I have provided a first water coil 14 which may be supplied with water directly from the water main through the pipe line 82. The water flowing to the coil 14 through the line 82 leaves the coil 14 through the line 84 which connects with the condensing coil 72 mounted within the main motor-compressor-condenser casing. The water leaves the coil 72 through the outlet 73 which may be connected to any suitable drain. A portion of the water may flow through the branch line 86 which discharges into the main water cooling chamber 64 in which the evaporator 62 is mounted. The relative amounts of water flowing in the lines 82 and 86 may be varied by manipulating the hand valves 83 and 85. The water flowing through the cooling chamber 64 is conveyed to the main cooling coil 16 through the pipe line 88. After leaving the main coil 16, the water flows through the drain line 90 which is joined to the drain line 84 whereby all of the water discharges into the condensing coil 72. The flow of water through the line 80 may be controlled by the valve 92 which in turn is controlled in accordance with the head pressure within the refrigerating system. The valve 92 is so calibrated that as the head pressure increases the valve will allow more water to flow and as the head pressure decreases the valve will reduce the flow of water until finally the supply of water is completely cut off. Thus, when the head pressure indicates that the compressor is not operating the valve 92 will automatically close.

In order to fully utilize the cooling effect produced by the cooling water alone even when valve 92 is closed, I have provided a by-pass valve 100 which may be opened when it is desired to cool the air without using mechanical refrigeration. It will be noted that opening of the valve 100 allows water from the supply line 80 to flow through both sections 14 and 16 of the cooling coil located in the attic.

Inasmuch as moisture will be condensed from the air flowing over the coils 14 and 16, a condensate drain pan 102 has been provided for collecting the drip water. The condensate collected in the pan 102 drains through the pipe 104 whereby the condensate also flows through the condensing coil 72.

In order to control the starting and stopping of the compressor motor 54, I have provided a conventional thermostat 106 which may be located in the living room or any other desired location. A manual switch 107 is also provided in the compressor circuit. In order to simplify this disclosure the usual safety devices such as the current overload protective relay, the high and low refrigerant pressure safety device and the like, have not been shown. Obviously, these conventional safety devices would be used in actual installations in accordance with standard practice.

While I have shown an ordinary thermostatic control for the compressor motor and manual controls for the valves 83, 86 and 100, it is within the purview of this invention to use wet bulb, wet and/or dry bulb or humidity responsive controls for these elements. The controls used may respond to either the outside temperature, the inside temperature or a combination of both.

By virtue of the arrangement of the cooling coils 14 and 16, the cooling water supplied through the pipe 80 may be used with maximum efficiency. The relatively hot outside air first strikes the coil section 14 through which water at normal temperature flows and thereafter strikes the coil section 16 through which the refrigerated water flows. The system may be operated with the valve 85 closed and the switch 107 open, in which case only the coil 14 would be useful for cooling the air. When coil 14 alone is used for cooling the air, it will be noted that only a portion of the air being circulated is cooled. With this arrangement it is possible to remove more moisture from the air than would otherwise be possible.

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. Air conditioning apparatus comprising in combination, an evaporator, refrigerant liquefying means including a condenser for supplying liquid refrigerant to said evaporator, an air cooling coil, means for flowing a stream of liquid in thermal exchange with said evaporator and thereafter through said air cooling coil, means for

flowing liquid leaving said air cooling coil in thermal exchange with said condenser, a second air cooling coil, and means for flowing a second stream of liquid directly into said second air cooling coil and thereafter in thermal exchange with said condenser.

2. Air conditioning apparatus comprising in combination, an evaporator, refrigerant liquefying means including a condenser for supplying liquid refrigerant to said evaporator, an air cooling coil, means for flowing a stream of liquid in thermal exchange with said evaporator and thereafter through said air cooling coil, means for flowing liquid leaving said air cooling coil in thermal exchange with said condenser, means responsive to condenser pressure for controlling the flow of said liquid, a second air cooling coil, and means for flowing a second stream of liquid directly into said second air cooling coil and thereafter in thermal exchange with said condenser.

3. Air conditioning apparatus comprising in combination, an air passage, means for flowing a stream of air through said passage, a first cooling coil arranged in the path of a portion of said air stream, a second cooling coil arranged in the path of said air stream, means for circulating a cooling fluid through said first coil, means for circulating a cooling fluid through said second coil, means for refrigerating the cooling fluid flowing through one of said coils, said last named means comprising a volatile refrigerant system having an evaporator in thermal exchange with the liquid flowing through said one coil and having a condenser arranged in thermal exchange with liquid leaving both of said coils, and means responsive to condenser pressure controlling the flow of liquid through said condenser.

4. Air conditioning apparatus comprising in combination, a first heat exchange unit, a second heat exchange unit, means for circulating air to be conditioned in thermal exchange with said units, a source of water, means for supplying water from said source to said units, a refrigerant evaporator in thermal exchange relationship with the water flowing to one of said heat exchange units, refrigerant liquefying means for supplying refrigerant to said evaporator, and means for flowing water returning from both of said heat exchange units in thermal exchange relationship with a portion of said refrigerant liquefying apparatus.

5. Air conditioning apparatus comprising in combination, an air passage, means for flowing a stream of warm air through said passage, a first cooling coil arranged in the path of said air stream, a second cooling coil arranged in the path of said air stream, means for circulating a cooling fluid from a common supply through said first and second coils in parallel flow relationship, and a volatile refrigerant system having an evaporator arranged in thermal exchange with the cooling fluid flowing to said second cooling coil.

6. Air conditioning apparatus comprising in combination, an air passage, means for flowing a stream of warm air through said passage, a first cooling coil arranged in the path of said air stream, a second cooling coil arranged in the path of said air stream, means for circulating a cooling fluid from a common supply through said first and second coils in parallel flow relationship, a volatile refrigerant system having an evaporator arranged in thermal exchange with the cooling fluid flowing to said second cooling coil, and means for varying the amount of fluid flowing through one of said coils.

7. Air conditioning apparatus comprising in combination, a first heat exchange unit, a second heat exchange unit, means for circulating air to be conditioned in thermal exchange with said units, a source of water, means for supplying water from said source to said units in parallel flow relationship, a refrigerant evaporator in thermal exchange relationship with the water flowing to one of said heat exchange units, refrigerant liquefying means for supplying refrigerant to said evaporator, and means for flowing water returning from one of said heat exchange units in thermal exchange relationship with a portion of said refrigerant liquefying apparatus.

RICHARD E. GOULD.