

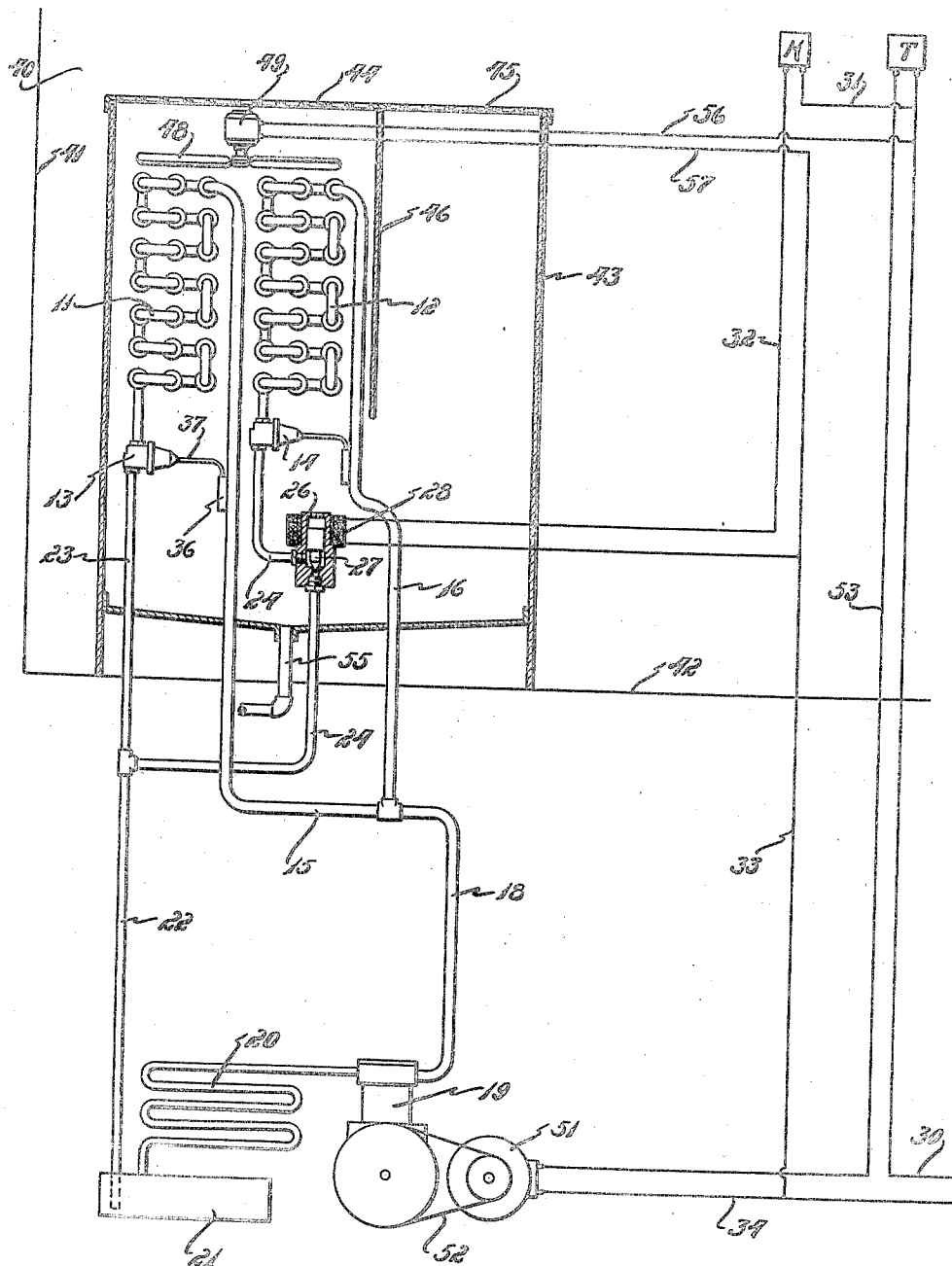
Nov. 19, 1940.

L. A. PHILIPP

2,222,241

AIR CONDITIONING SYSTEM

Filed Dec. 23, 1933



INVENTOR.
LAWRENCE A. PHILIPP

BY
Warren H. Schenck
ATTORNEY.

UNITED STATES PATENT OFFICE

2,222,241

AIR CONDITIONING SYSTEM

Lawrence A. Philipp, Detroit, Mich., assignor, by mesne assignments, to Nash-Kelvinator Corporation, Detroit, Mich., a corporation of Maryland

Application December 23, 1933, Serial No. 703,810

4 Claims. (Cl. 62—6)

The present invention relates to refrigeration and particularly to refrigerating apparatus for cooling and dehumidifying air.

One of the objects of the present invention is to provide refrigerating apparatus employing a plurality of evaporators each of which is controlled by an expansion valve and to provide for controlling the flow of refrigerant to one of the expansion valves in accordance with the relative humidity.

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

In the drawing the single figure shows diagrammatically my improved refrigerating apparatus employed in a system for cooling and dehumidifying air.

My invention contemplates the use of a plurality of evaporators about which the air to be conditioned is circulated for the purpose of at times removing principally sensible heat and at times principally latent heat from the air. When the relative humidity of the air is above a predetermined minimum, one of the evaporators is cooled to a relatively cold temperature for cooling the air considerably below the dew point thereof in order to cause precipitation and thereby removal of a large part of the moisture from the air.

Referring to the drawing, I have shown two evaporators 11 and 12. The flow of refrigerant to the evaporators is controlled by expansion valves 13 and 14. Gaseous refrigerant is withdrawn from evaporators 11 and 12 through pipes 15 and 16 respectively, which pipes are connected by a pipe 18 with the low pressure side of a compressor 19. The gaseous refrigerant is compressed by the compressor 19 and is forced into a condenser 20 where it is cooled and liquefied and conducted to a receiver 21 to a pipe 22 and by branch pipes 23 and 24 to the expansion valves 13 and 14.

A magnetic valve 26 is disposed in the branch pipe 24 for controlling the flow of liquid refrigerant to expansion valve 14 and evaporator 12. The magnetic valve 26 includes a solenoid core 27 which functions as the valve and is arranged to be lifted from its seat when a magnetic coil 28 is energized. The coil 28 is connected in series with the humidostat H and the circuit thereto includes wires 30 and 31, humidostat H, wire 32, coil 28, and wires 33 and 34. When the relative humidity is too high the humidostat H operates to open the circuit to the coil 28 so that the coil is de-ener-

gized and the solenoid valve 27 rests upon its seat.

Any suitable type of expansion valve may be employed for controlling the flow of liquid refrigerant from the high pressure side of the refrigerating apparatus to the evaporator and for illustrative purposes I have herein shown what is known in the art as "thermostatically controlled expansion valve." A form of this type of expansion valve is shown in the patent to Marshall No. 1,425,265, August 8, 1922, in which the valve is opened in response to decreasing pressure in the evaporator but is closed when refrigerant vaporizes at the outlet of the evaporator and for this purpose I provide bulbs 36, containing a volatile fluid, which are connected by pipes 37 to the back side of the diaphragm of the valve and which are arranged to close or partly close the valve when refrigerant vaporizes at the point where the bulbs 36 are connected to the outlet pipes 15 and 16 of the evaporators. The air conditioner herein illustrated is the type for cooling a room 40, such as an office or living room in a home, the side wall of which is shown at 41 and the floor at 42. The evaporators 11 and 12 are disposed in a cabinet 43 having a top air inlet opening 44 and a top air outlet opening 45. A partition 46 depends from the top wall of the cabinet and from the front to the rear thereof, for directing air within the cabinet. The evaporators 11 and 12 are arranged side by side and air is directed downwardly over the same by a fan 48 which is driven by a motor 49, the air entering the inlet 44, passing downwardly over the evaporators 11 and 12 and then passing upwardly on the right side of partition 46 and out through the opening 45. The air passing over the evaporators will be cooled and in order to control the heat exchange between the air and the evaporator, I control the operation of the refrigerating apparatus in accordance with the temperature of the air in the room. This control is accomplished in the present illustration by starting and stopping the compressor. The compressor is herein shown as being driven by a motor 51 through a belt 52 and the circuit to the motor is controlled by a thermostat T and this circuit includes wire 30, thermostat T, wire 53, motor 51 and wire 34. The thermostat is adjusted so as to maintain the temperature of the air in the room between predetermined limits. When the temperature of the air rises above a predetermined degree the thermostat T will close the circuit to the compressor motor 51 whereby to cause a lowering of the temperatures of the evaporators 11 and 12 and when the temperature of the air in the room is lowered to a predeter-

mined desired low minimum, the thermostat T interrupts the circuit to the motor 51.

In addition to maintaining the air at the desired comfortable temperature, it is also desirable to control the relative humidity of the air. When the magnetic valve 26 is open, the evaporators 11 and 12 are maintained at a temperature at which, at times only a small precipitation of moisture is effected and under relatively high humidity conditions, insufficient moisture would be removed. When the relative humidity of the air is high, it is desirable to increase the precipitation of moisture from the air. In order to accomplish this I provide for lowering the temperature of evaporator 11 to considerably below the dew point of the air passing thereover and for this purpose I employ the humidostat H and the magnetic valve 26. When the relative humidity is too high, the humidostat H functions to cause the valve 26 to impede the flow of refrigerant to the evaporator 12 and in the preferred embodiment the valve 26 is arranged to positively stop the flow of liquid refrigerant to the expansion valve 14 when the relative humidity of the air is above that desired. When the valve 26 impedes the flow of refrigerant to the evaporator 12, the suction action of the compressor is concentrated or substantially concentrated, as the case may be, on reducing the pressure in section 11. This in effect will cause a material lowering of the temperature of section 11 and the size of section 11 is computed relative to the size of the compressor so that the temperature of section 11 will be reduced to materially below the dew point of the air flowing thereover. This will cause a greater precipitation of moisture from the air and a consequent lowering of the relative humidity thereof. A drain pipe 55 carries the water from the bottom of the cabinet.

If desirable the fan motor 49 may be connected in parallel with the compressor motor 51 and controlled by the thermostat T so that it will operate only when the compressor is in operation but in the preferred embodiment the motor 49 is connected by wire 56 to wire 30 and by wires 57 and 33 to wire 34 so that it operates continuously.

From the foregoing, it will be apparent that I have provided a refrigerating apparatus suitable for air conditioning system in which the air will be maintained between predetermined high and low temperature limits and in which the air will also be maintained between predetermined high and low relative humidity conditions. Thermostat T controls the heat exchange between the circulating air and the refrigerating apparatus and the humidostat H controls the amount of moisture removed from the air.

Under certain conditions, it will be desirable to cause some precipitation of moisture at the evaporators 11 and 12 when the valve 26 does not impede the flow of refrigerant to evaporator 12, and it is to be understood that when the evaporator 12 is referred to as functioning to remove principally sensible heat, such term is used merely to define the main functional purpose of evaporator 12 as distinguished from the main functional purpose of evaporator 11 at the time valve 26 impedes the flow of refrigerant to section 12.

While the form of embodiment of the present invention as herein described 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:

I claim:

1. An air conditioning system comprising in combination, a plurality of evaporators about which air, to be conditioned, is circulated; means for withdrawing gaseous refrigerant from the evaporators and for condensing the refrigerant and for returning the condensed refrigerant to the evaporators; means for causing one of said evaporators to increase in temperature and another of said evaporators to decrease in temperature, said means including means at the inlet of one of said evaporators for controlling the flow of refrigerant to said evaporator; and means responsive to the relative humidity of the air to be conditioned for actuating said flow control means.

2. An air conditioning system comprising in combination, a plurality of evaporators about which air, to be conditioned, is circulated; means for withdrawing gaseous refrigerant from the evaporators and for condensing the refrigerant, and for returning the condensed refrigerant to the evaporators, said means including a conduit for conducting refrigerant to one of the evaporators; means for causing one of said evaporators to increase in temperature and another of said evaporators to decrease in temperature, said means including means in said conduit for controlling the flow of refrigerant to said one evaporator; and means responsive to the relative humidity of the air to be conditioned for actuating said flow control means.

3. An air conditioning system comprising in combination, a plurality of evaporators about which air, to be conditioned, is circulated; means for withdrawing gaseous refrigerant from the evaporators and for condensing the refrigerant, and for returning the condensed refrigerant to the evaporators, said means including a conduit for conducting refrigerant to one of the evaporators; means responsive to the temperature of the air to be conditioned for controlling the heat exchange between the air and the evaporators; means for causing one of said evaporators to increase in temperature and another of said evaporators to decrease in temperature, said means including means in said conduit for controlling the flow of refrigerant to said one evaporator; and means responsive to the relative humidity of the air to be conditioned for actuating said flow control means.

4. An air conditioning system comprising in combination, a plurality of evaporators about which air, to be conditioned, is circulated; means for withdrawing gaseous refrigerant from the evaporators and for condensing the refrigerant, and for returning the condensed refrigerant to the evaporators, said means including a conduit for conducting refrigerant to one of the evaporators; means responsive to the temperature of the air to be conditioned for controlling the first means; means for causing one of said evaporators to increase in temperature and another of said evaporators to decrease in temperature, said means including means in said conduit for controlling the flow of refrigerant to said evaporator; and means responsive to the relative humidity of the air to be conditioned for actuating said flow control means.

LAWRENCE A. PHILIPP.