

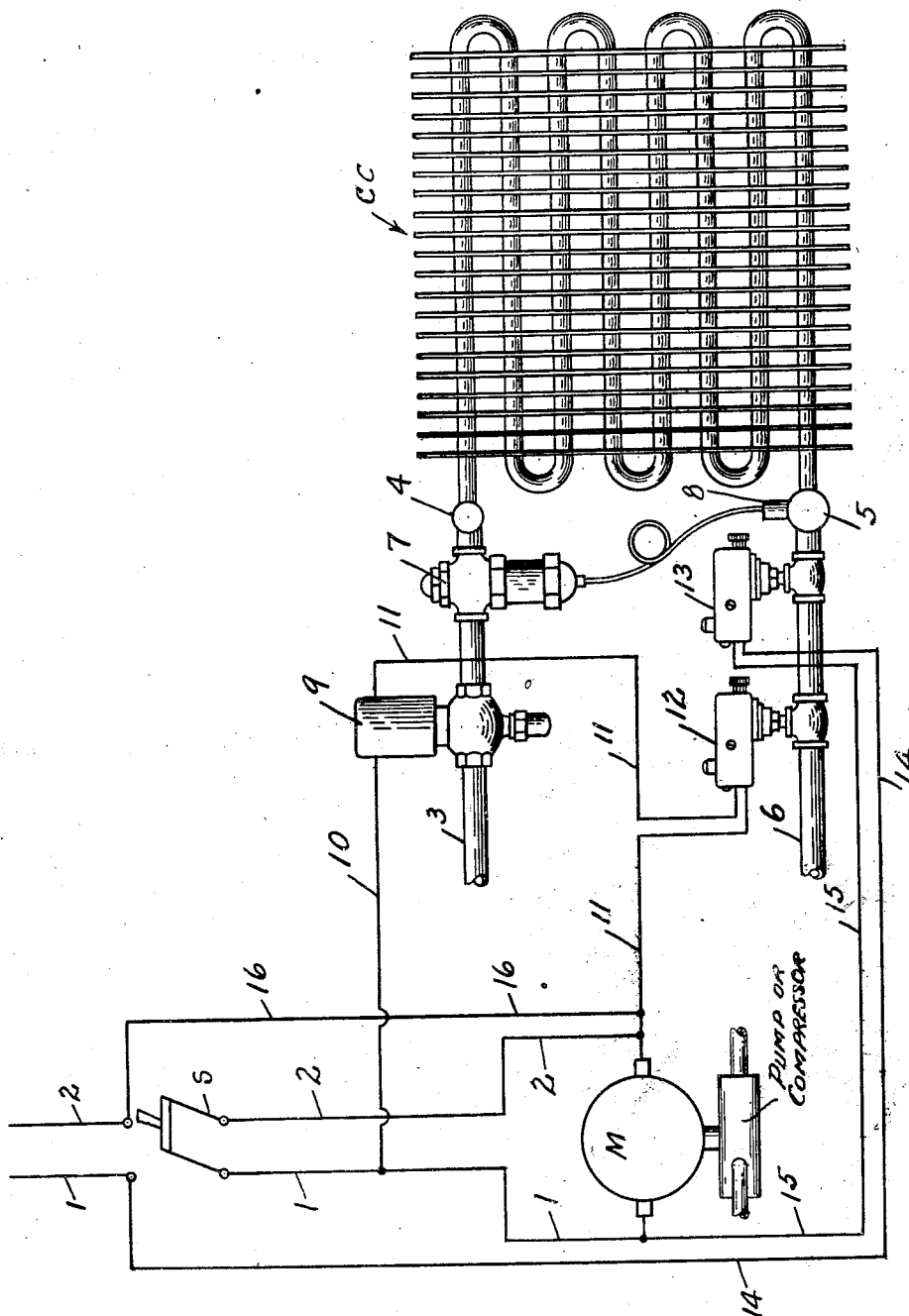
March 30, 1937.

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2,075,349

REFRIGERATION

Filed Aug. 26, 1935,



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UNITED STATES PATENT OFFICE

2,075,349

REFRIGERATION

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Application August 26, 1935, Serial No. 37,911

5 Claims. (Cl. 62—4)

This invention relates to improvements in refrigeration and more particularly to electrically controlled and operated refrigeration apparatus.

In both the compression and absorption type of electrically controlled and operated refrigeration apparatus, the refrigerant is allowed to change from the liquid to the gaseous state in a cooling coil or evaporator, and in so doing, absorbs heat from the surrounding atmosphere. The gaseous refrigerant is returned from the cooling coil or evaporator to either the compressor or absorber, as the case may be, by the suction due to the reduced pressure in the respective elements. The operation of the apparatus causes the circulation of the refrigerant through the cooling coil or evaporator and the admission of the liquid refrigerant to the cooling coil or evaporator is automatically controlled by an expansion valve or by a float-operated valve in accordance with the system employed.

It is an object of this invention to automatically control the operation of the apparatus so that when the circulation of the refrigerant ceases as the apparatus becomes idle, it will create and maintain a pressure below atmospheric pressures or vacuum within the return pipe of the gaseous refrigerant from the cooling coil or evaporator, and, therefore, make it impossible for any of the gaseous refrigerant to leak into the atmosphere to cause a fire or health hazard.

With the above and other objects in view, reference is made to the figure upon the accompanying drawing, which illustrates, partly in elevation and partly in diagram, a preferred embodiment of this invention with the understanding that minor detail changes may be made without departing from the scope thereof.

In the embodiment illustrated, a motor M is shown diagrammatically in connection with a wiring diagram in which wires 1 and 2 lead from the motor M through a hand switch S to a commercial source of electricity. If the apparatus is automatically controlled, a relay would be substituted for hand switch S. If the invention is applied to a compression type refrigerating apparatus, the motor M will operate the compressor, and if an absorption type of apparatus, the motor M will operate a circulating pump for the solution, so, in either case, the energizing of the motor will initiate operation. The refrigerant in both cases is lead by a pipe 3 to a commercial cooling coil CC entering the upper coils from a manifold 4 and is discharged from the lower coils into a manifold 5 and from thence

into a pipe 6, which will return the refrigerant to the apparatus.

The cooling coil CC is shown as preferably controlled by a commercial thermostatically operated expansion valve 7 in the pipe 3 having a thermal actuator 8 mounted in the lower manifold 5 whereby the expansion valve automatically admits sufficient refrigerant to maintain a predetermined temperature within the cooling coil. A commercial solenoid valve 9 is interposed in pipe 3 between the expansion valve 7 and source of liquid refrigerant and is connected by wire 10 to commercial wire 1 and by wire 11 through a commercial pressure switch 12 to commercial line 2. The pressure switch 12 is arranged and so connected to pipe 6 to be actuated by the pressure therein. Another commercial pressure switch 13 is connected by wires 14 and 15 to the commercial line 1 beyond the hand switch S and to the line lead of the motor M, also connected to line 1, respectively, and is so arranged and connected to pipe 6 to be actuated by the pressure therein. A wire 16 connects the other line of the motor M and wire 11 to the commercial line 2 beyond the hand switch S.

The solenoid valve 9 is of commercial construction which is normally closed and opens when the circuit is established through it. The pressure switches 12 and 13 are likewise of commercial construction and are adjustable, such as disclosed in Patent 1,791,839, of February 10, 1931. In this use, the switch 13 is adjusted to close at one inch vacuum and to open at approximately five and a half inches of vacuum, while switch 12 is adjusted to open at two inches of vacuum and to close at approximately ten inches of vacuum.

In describing the operation of this invention, it is necessary to refer to a concrete example of refrigerating apparatus, and as this invention has been operated in connection with a commercial absorption type of refrigerating apparatus such as described in Serial No. 736,232, filed July 20, 1934, which is particularly adapted to employ dichloromonofluoromethane as the refrigerant and ethyl ether of diethylene glycol acetate as the solvent, the conditions existing in such an apparatus will be used.

Assuming the apparatus has been idle with the switch S open, such as during a period between normal operations, and assuming approximately four inches of vacuum in the return pipe 6, switch 12 will be open breaking the circuit through the solenoid valve 9 so the valve will be closed in pipe 3, and switch 13 will be open.

Upon closing switch S to produce refrigeration, the motor M will start to operate, causing the vacuum in pipe 6 to increase until it reaches approximately ten inches, and switch 12 will close to energize the solenoid 9, and the valve in pipe 3 will open and admit the refrigerant to enter the cooling coil CC to produce refrigeration, and under normal running conditions the vacuum will become about four inches in pipe 6.

When sufficient refrigeration has been produced, switch S is opened, the motor M ceases operation, and the vacuum in pipe 6 decreases until it reaches two inches and then switch 12 opens. The solenoid valve 9 in pipe 3 closes the admission of refrigerant into the cooling coil CC when the motor ceases to operate. The vacuum in pipe 6 will continue to decrease and when it reaches one inch, switch 13 closes the circuit from commercial line 1 through wires 14, 15, motor M, and wire 16, so that the motor M will begin to operate. The circuit through switch 12 being open, the solenoid valve 9 in pipe 3 is closed, and as no refrigerant can enter the cooling coil, the operation of the motor increases the vacuum in pipe 3 until it reaches about five and a half inches and then switch 13 opens the motor circuit and the apparatus becomes idle. Under abnormal high outside atmospheric temperatures, whenever the vacuum in pipe 3 decreases to one inch the above operation is repeated.

It is seen that by the above described arrangement at no time after the refrigeration apparatus has been installed, whether idle or in operation, can any of the refrigeration leak into the atmosphere to become a hazard. Various changes in temperature of the atmosphere surrounding the apparatus may create conditions other than those given in the above description, but the general operation will not be affected thereby. This system may be applied to air conditioning units, industrial refrigeration, or domestic refrigerators. Of course, it is to be understood that the operation of this system depends upon the apparatus to which it is applied operating at a pressure below atmospheric pressure during its running periods.

What is claim is:

1. An electrically operated and controlled refrigerating apparatus having a motor for circulating a refrigerant through a cooling coil and reducing the pressure in the return from said coil, in combination with means actuated by variations in pressure within said return to maintain a reduced pressure therein sufficient to prevent the refrigerant leaking therefrom, said means including a solenoid operated valve in the refrigerant supply adjacent the cooling coil connected in the motor circuit and controlled by said pressure actuated means.

2. An electrically operated and controlled refrigerating apparatus having a motor for circulating a refrigerant by conduits through a cooling coil and reducing the pressure in the return conduit from said coil, a circuit for connecting the motor to a source of electricity, and a switch therein for controlling the operation of the motor, in combination with a normally closed solenoid valve in the refrigerant supply conduit adjacent the cooling coil connected in the motor circuit and operating to open when the motor circuit is closed, a pressure actuated switch in the solenoid circuit connected to the return conduit from the coil adjusted to open at a pressure slightly less than atmospheric pressure and to close at a pressure considerably less, whereby upon closing the motor circuit the solenoid valve is not opened until the operation of the motor has created a pressure in the return conduit considerably less than atmospheric pressure.

3. The structure of claim 2, wherein an additional circuit is provided from the source to include the motor adapted to operate the motor when the motor switch is open, including an additional pressure actuated switch connected to the return conduit adjusted to close said circuit to operate the motor independently of the solenoid valve to maintain a predetermined less than atmospheric pressure in the return conduit during the periods between the normal operation of the apparatus to produce refrigeration.

4. An electrically operated and controlled refrigerating apparatus having a motor for circulating a refrigerant by conduits through a cooling coil and reducing the pressure in the return conduit from said coil, a circuit for connecting the motor to a source of electricity, and a switch therein for controlling the operation of the motor, in combination with a normally closed solenoid valve in the refrigerant supply conduit adjacent the cooling coil connected in the motor circuit and operating to open when the motor circuit is closed, a pressure actuated switch in the solenoid circuit connected to the return conduit from the coil adjusted to open at a pressure slightly less than atmospheric pressure and to close at a pressure considerably less, and a second pressure actuated switch in an additional circuit from the source through the motor independent of the motor switch and solenoid circuit connected to the return conduit from the coil adjusted to close after the opening of the pressure switch in the solenoid circuit to operate the motor and to open when a predetermined pressure less than atmospheric pressure has been created in the return conduit, whereby during periods between normal operation of the apparatus to produce refrigeration the motor is caused to operate to maintain a sub-atmospheric pressure in the return conduit to prevent the escape of refrigerant therefrom.

5. An electrically operated and controlled refrigerating apparatus having a motor for circulating a refrigerant through a cooling coil and reducing the pressure in the return from said coil, in combination with means actuated by variations in pressure within said return to maintain a reduced pressure therein sufficient to prevent the refrigerant leaking therefrom, wherein, when the apparatus is idle, a controlled circuit is provided to independently operate the motor to maintain the said reduced pressure, and wherein said circuit is controlled by said pressure actuated means.

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