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ELECTRICALLY OPERATED AND CONTROLLED REFRIGERATING APPARATUS

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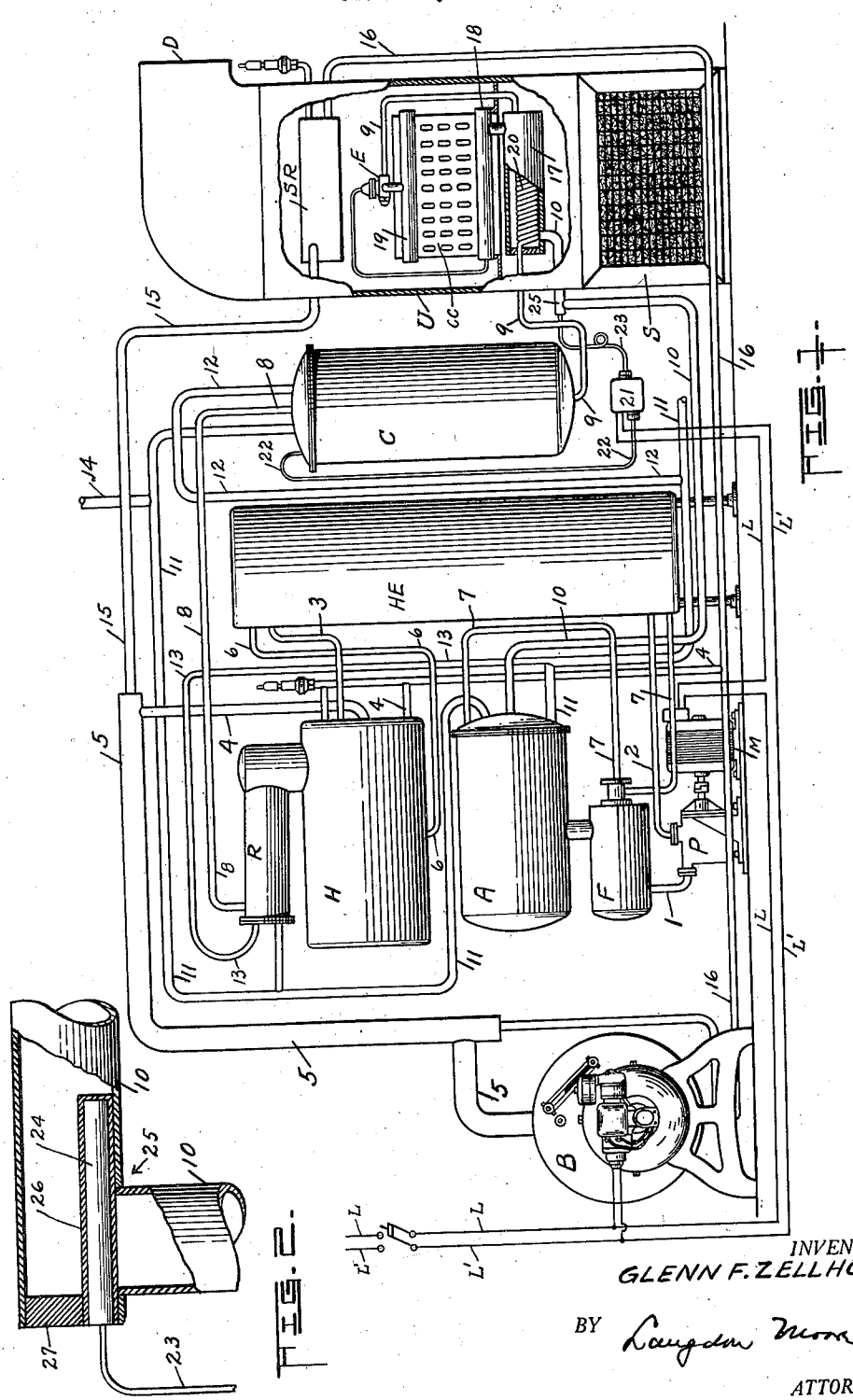


FIG. 1.

FIG. 2.

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ELECTRICALLY OPERATED AND CONTROLLED REFRIGERATING APPARATUS

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3 Claims. (Cl. 62—5)

This invention relates to improvements in electrically operated and controlled refrigerating apparatus and more particularly to the control of an absorption type of refrigerating apparatus employing an electrically driven pump for circulating the solution through the apparatus.

It is the object of this invention to provide means for stopping the operation of the circulation pump when the temperature of the low pressure refrigerant vapor, traveling through the so-called suction line between the evaporator or cooling coil and the absorber, becomes excessively low and thereby preventing the flooding of the liquid refrigerant through the cooling coil into the said suction line.

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

In the drawing:

Figure 1 is a view in side elevation, including a wiring diagram, and with parts broken away, illustrating the application of this invention to a preferred form of absorption type refrigerating apparatus such as employed in air conditioning systems.

Figure 2 is an enlarged detail view partly in side elevation and partly in section, illustrating the installation of the temperature responsive fluid bulb in the pipe conducting the low pressure refrigerant vapor from the cooling coil to the absorber.

The particular type of absorption refrigerating apparatus illustrated is disclosed in my prior co-pending application Serial No. 736,232, filed July 20, 1934, and inasmuch as this particular type of refrigerating apparatus is merely illustrative of the application of this invention, the following description will be sufficient to a complete understanding of this invention.

In the said apparatus, the refrigerant and solvent form a solution in the absorber A. The solution is conveyed from the absorber through the casing F and pipe 1 to the circulating pump P, driven by the electric motor M, and from there circulated through pipe 2 and heat exchanger HE and conveyed by pipe 3 to the heater H where the refrigerant is distilled or boiled off the solution by the passage of steam through the heater within pipe 4 leading from the steam pipe 5 of the boiler B. The gaseous refrigerant so distilled or boiled off the solution in the heater H passes through the rectifier R, while the solvent is returned by pipe 6 through the heat exchanger HE and pipe 7 to the absorber A. The high pressure refrigerant vapor is conducted from the rectifier R by pipe 8 to the condenser C from which it is discharged through pipe 9 to the evaporator or cooling coil CC. The low pressure refrigerant vapor is returned from the cooling coil CC by pipe 10 to the absorber A, preferably by gravity, the illustration of pipe 10 in Figure 1 being merely diagrammatical.

The cooling fluid or water necessary to the operation of the system is circulated from pipe 11 and its branches 12 and 13 through the absorber A, condenser C, and rectifier R, to the outlet water pipe 14. If desired, steam from the boiler B may be conducted by the pipe 15 leading from the steam pipe 5 through a steam radiator SR, hereinafter described, and the condensate therefrom returned by pipe 16 to the boiler B, which is joined by pipe 4 for returning the condensate collecting therein, as the said pipe leaves the heater H.

In this embodiment illustrated, the cooling coil CC and the steam radiator SR are shown located in an air conditioning unit U, which, as closed in this applicant's said prior application Serial No. 736,232, filed July 20, 1934, includes a fan blower, not shown, in the bottom of the unit for circulating air drawn through the fitter S at the bottom of the casing of the air conditioning unit U, shown in the drawing through the cooling coil CC and steam radiator SR and into the duct D communicating with the air circulating system.

It is preferable to provide the cooling coil CC with a refrigerant heat exchanger as disclosed in this applicant's prior co-pending application Serial No. 7,662, filed Feb. 23, 1935. This refrigerant heat exchanger includes a cylindrical casing 17 interposed between the discharge manifold 18 of the cooling coil CC and the pipe 10 returning the low pressure refrigerant vapor therefrom to the absorber A. The pipe 9 leading the high pressure refrigerant vapor from the condenser C to the intake manifold 19 of the cooling coil CC is provided with a closely wrapped coil 20 within and of less diameter than the cylindrical casing 17.

It has been discovered that when ethyl ether of diethylene glycol acetate is employed as the solvent, and dichloromonofluoromethane as the refrigerant, in an apparatus of the character described, excessively low temperature of the low pressure refrigerant, accompanied by flooding the absorber, will occur under certain conditions in the so-called suction line formed by the pipe

10 leading from the cooling coil CC to the absorber A as a result of either the circulation of the cooling water through the apparatus at a temperature lower than that for which the machine is designed; the failure of the blower in the air conditioning unit to function, a reduction of the volume of air passed over the cooling coil on account of resistance offered by a dirty filter upon the intake side of the air conditioning unit; a reduction in the temperature of the air passed through the cooling coil CC below that for which the machine is designed; or the improper functioning of the expansion valve E controlling the introduction of the high pressure liquid refrigerant from pipe 9 into the intake manifold 19 of the cooling coil. The creation of an excessively low temperature in the said suction line results in a flooding of the liquid refrigerant through the cooling coil CC and refrigerant heat exchanger 17 into the suction line pipe 10 and causes the apparatus to operate at a low efficiency. The flooding of the cooling coil under these conditions decreases the pressure within the absorber, decreasing the volume of the solution formed therein so that the solution available to the circulating pump P is less than the pump's capacity. Therefore, the pump alternately receives liquid and vapor with the result that not only is its efficiency reduced but the vibration developed thereby is injurious to the pump.

As disclosed in this applicant's said co-pending application Serial No. 736,232, filed July 20, 1934, a pressure of predetermined range is maintained within the condenser C by a control responsive to the pressure therein to control the operation of the pump. Such a control 21 is shown in Figure 1 and is a commercial product, such as manufactured by the Penn Electric Switch Company and disclosed in Patent No. 1,791,839, dated February 10, 1931. The control 21 is connected by the pipe 22 to the interior of the condenser C. The motor M is connected in series with the commercial line L and to one terminal of the switch responsive to the pressure conditions of the condenser C, not shown, forming a part of the control 21, the other terminal of said switch being connected to the return line L' to the commercial source. It is preferable to so adjust the control 21 that upon the development of a predetermined pressure per square inch within the condenser, the control will be operated to open the switch in the circuit to the motor M and maintain it open until the pressure returns to a lower predetermined pressure per square inch to maintain the pressure within the condenser as designed for the particular apparatus. This particular control 21 is termed a dual control and the other side of the control is connected by a tube 23 to a bulb 24 located within the low pressure refrigerant vapor pipe 10 returning the vapor to the absorber A. The bulb 24 is filled with a thermal liquid which will respond to a decrease in temperature of the said refrigerant vapor below a predetermined degree to operate the control to open the motor circuit and hold it open until the temperature of said vapor returns to normal, thereby discontinuing the operation of the circulating pump as long as this condition exists. While for convenience sake the control 21 is illustrated as a dual control, two separate controls may be substituted therefor. A single control of this character is manufactured by the Penn Electric Switch Company and is disclosed in Patent No. 1,791,896. In fact, the use of two separate controls of this character give a much wider adjustment than the dual control.

It is preferable to locate the bulb 24 within the pipe 10 adjacent the refrigerant heat exchanger 17 by forming an elbow 25 therein and inserting the bulb 24 within a casing 26 inserted within one portion of the pipe 10 forming the elbow 25 as by mounting the casing 26 upon a closure 27 forming a part of the elbow 25, preferably with the casing 26 in engagement with the bottom of the pipe 10, as shown in detail in Figure 2.

A control responsive to pressure within the absorber to discontinue the operation of the circulating pump when the pressure is excessively low would not accomplish the desired result, because the pressure in the absorber will not ordinarily build up sufficiently to close the circuit even though the temperature in the suction line returns to normal.

What I claim is:

1. In an absorption refrigerating apparatus, including a heater, a condenser, a cooling coil, an absorber, a source of heat for the heater, an electrically driven pump for circulating a solution of refrigerant and solvent, a return for the gaseous refrigerant from the cooling coil to the absorber, and means in the pump circuit responsive to temperature of the returning refrigerant below a desired degree for the efficient operation of the apparatus to open the pump circuit to discontinue the circulation of the solution.

2. The structure of claim 1, wherein said means closes the pump circuit upon establishment of the desired temperature.

3. The structure of claim 1, wherein said means includes a pressure-operated switch connected by a line to a bulb located in said return adjacent the cooling coil, and wherein said line contains a thermal fluid.

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