

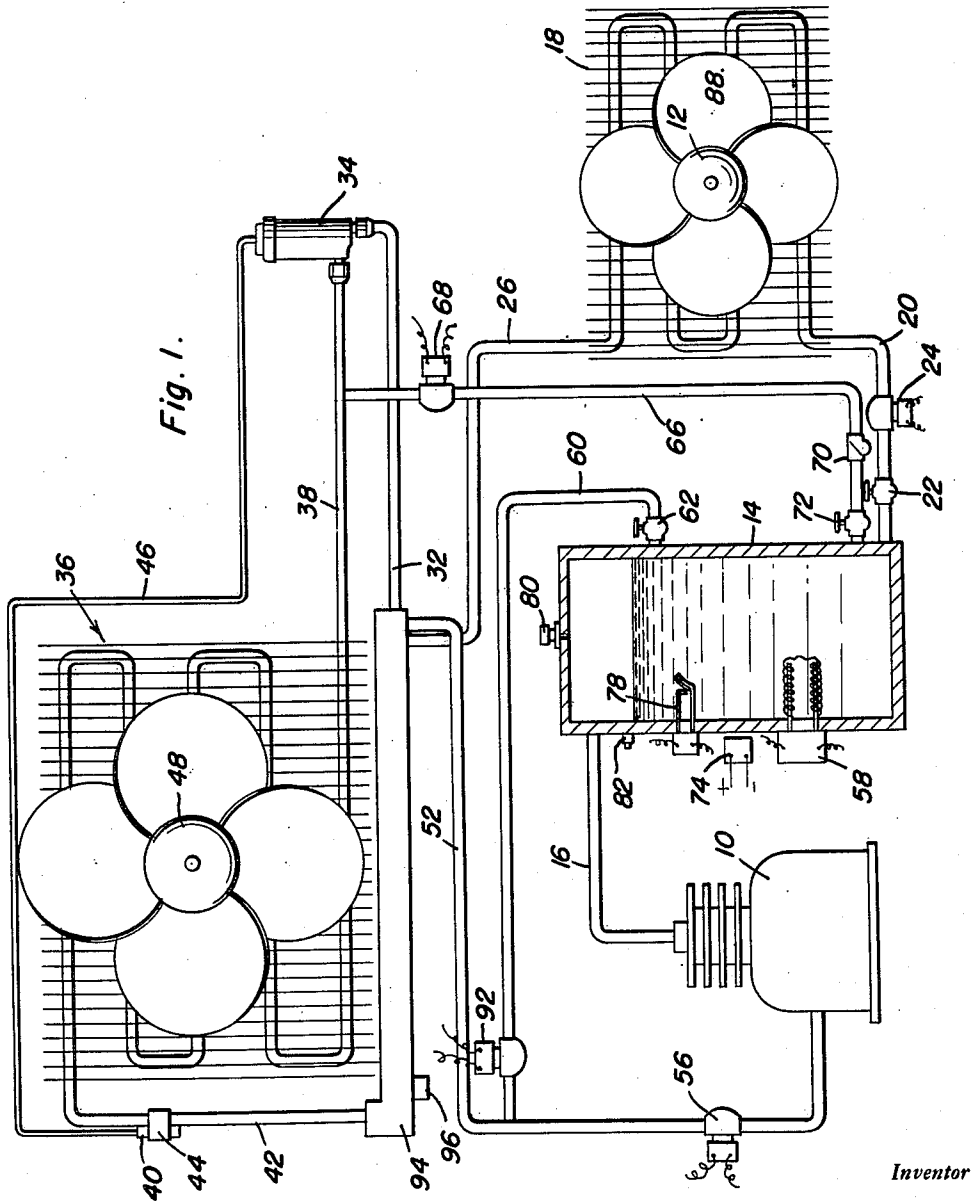
April 21, 1953

F. J. SCHORDINE
LIQUID DEFROSTING UNIT

2,635,433

Filed March 16, 1949

2 SHEETS—SHEET 1



Inventor

Fred J. Schordine

By

Clarence A. O'Brien
and Harvey B. Jacobson
Attorneys

April 21, 1953

F. J. SCHORDINE
LIQUID DEFROSTING UNIT

2,635,433

Filed March 16, 1949

2 SHEETS—SHEET 2

Fig. 2.

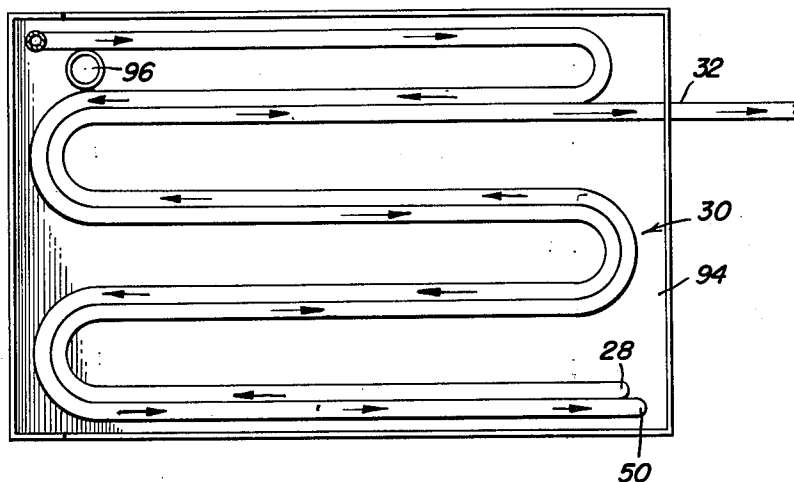
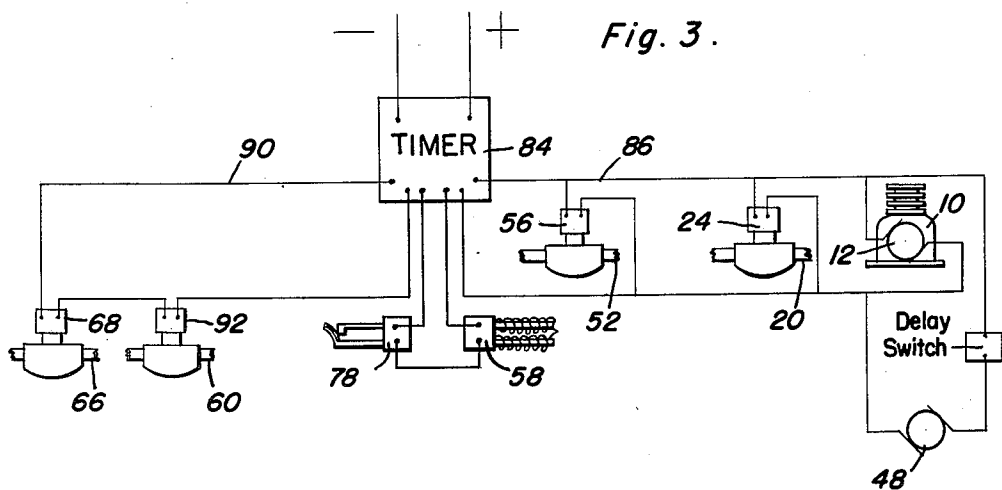


Fig. 3.



Inventor

Fred J. Schordine

By

Clarence A. O'Brien
and Harvey R. Jacobson
Attorneys

UNITED STATES PATENT OFFICE

2,635,433

LIQUID DEFROSTING UNIT

Fred J. Schordine, Patchogue, N. Y.

Application March 16, 1949, Serial No. 81,673

3 Claims. (Cl. 62-4)

1

This invention relates to novel and useful improvements in refrigeration apparatus.

An object of this invention is to refrigerate and defrost an evaporator or other similar unit by means of an apparatus which has provision for pressure operated refrigerant flow through an expansion valve and then through the evaporator and a gravity flow defrost cycle of operation, this cycle taking advantage of the rise of heated fluid through the evaporator for defrosting purposes and then normal downward flow to the starting point of the heated fluid which in this instance is a receiver.

Another object of this invention is to refrigerate by means of a system which includes a compressor connected with a receiver for cooling fluid flow, the fluid flowing through a pre-cooler and then through a heat exchanger which is incorporated in the drip pan beneath the evaporator, whence the fluid flows through an expansion valve to transfer it to the vapor spray, thereafter flowing through the evaporator and then again through the heat exchanger to the compressor, the defrost cycle of the same apparatus utilizing the gravity flow principle having the same fluid heated by means of a heater disposed in or adjacent the receiver, the said heated fluid then rising and flowing through suitable tubing which connects with the heat exchanger and then through the evaporator for flow partially through the tubing utilized in connection with the cooling cycle and then through a suitable check valve into the receiver, there being supplied in the system a number of solenoid operated valves which close various conduits and tubing allowing the flow to take proper channels during both the defrost and the cooling cycles of operation; the valves being operated in response to thermal changes or in response to the passage of preselected intervals of time.

A feature of the present invention is the utility of a fusible plug in the receiver as a safety feature to insure minimum damage to the equipment in the event that the heat in the receiver becomes excessive.

Another object of this invention is to provide a commercially feasible installation which is relatively inexpensive as compared to devices serving the same purpose and which is satisfactorily and smoothly operative.

Ancillary objects and features of novelty will become apparent in following the description of the preferred form of the invention, illustrated in the accompanying drawings, wherein:

Figure 1 is a schematic view of the refrigeration apparatus;

2

Figure 2 is a plan view of the drip pan having the heat exchanger therein; and,

Figure 3 is a schematic wiring diagram of one circuit used in conjunction with and forming a part of the invention.

Refrigeration units and apparatus operate on many principles. In the majority of commercially successful devices there is a compressor used, a receiver connected with the compressor for fluid flow, various tubes and conductors with an expansion valve properly interposed therein, upstream of an evaporator or similar unit such as cooling coils. The present invention utilizes all of this conventional apparatus, but rearranges the parts and the equipment to produce what I believe to be a new and useful system, utilizing the flow principle of heated fluid rising and cooler fluid descending, during the defrost cycle of operation.

There has been considerable difficulty involved in defrosting the evaporator or other suitable equivalent element in commercial installations. Too rapid change in temperature causes excessively rapid expansion in the evaporator causing obvious harm such as breaking joints and the like. Defrosting rapidly is harmful and also, defrosting too frequently or not frequently enough results in inefficient operation.

Now, after a refrigeration apparatus is installed, it is relatively easy for the refrigeration engineer to determine the average use and requirements of a particular installation. Accordingly, by the utility of time controlled defrost cycle operation, a single apparatus may be regulated, whereby although the demands on the apparatus vary during the day, the net result at the end of each day is substantially similar. Hence, in the present invention a timer which will be referred to as the controller is utilized in order to operate both the defrost and the cooling cycle. The said controller may be regulated by a mechanic or engineer after studying the characteristics of the particular installation so that defrost cycle will take place at the most advantageous intervals.

In utilizing the system disclosed herewith it is possible and contemplated to obviate the timer and use a different type of controller such as a thermo switch. The removal of the timer type controller for the thermo type controller would of course obviate the attendant inherent advantages of the timer as above outlined.

Advances have been made in view of the difficulties involved in defrosting with various types of defrosting fluids such as alcohol, water and alcohol solutions, and others. It is also known in the art to simply reverse the cycle of operation from the cooling cycle to the refrigerating cycle by

3

means of a multiple valve thereby reversing the flow of refrigerant and causing the necessary defrosting. My invention improves these systems by utilizing the same fluid as a coolant and as a heating medium without the necessity of a reversing valve. For the defrost cycle the fluid refrigerant in the receiver is heated so that it will rise through the evaporator and return by gravity, no pumps or the like being necessary and it being unnecessary to tax the compressor during this operation. The compressor at this time is rendered inoperative. For large installations and in instances wherein a more expensive apparatus is desired, a small circulation pump may be used.

Heated fluid from the receiver impinging directly on the interior of the coils of the evaporator could quite possibly cause too rapid expansion and resulting injury to the equipment. Accordingly, the initial charge of heated fluid from the receiver is passed through a heat exchanger which is preferably disposed in the drip pan beneath the evaporator, in order that a small part of the heat contained in this initial charge is removed. Soon however, the heat exchanger itself will become substantially the same temperature as the fluid flowing from the receiver and will have little effect thereon. But, it is the initial charge which is of importance since this passes through the evaporator first thereby raising the temperature of the evaporator preparatory to receiving the hotter fluid in the defrost cycle of operation.

Cooling cycle structure

A conventional compressor 10 is provided with a motor 12 for operation thereof. A receiver 14, which also acts as a condenser, is interconnected with the compressor 10 by means of a conduit 16 utilized for high pressure fluid flow. A precooler 18 is connected with the lower part of the receiver 14 by means of tubing 20. A manually operative valve 22 is provided in the tubing in order to close the system for repair. A solenoid operated valve 24 to be described more in detail subsequently is provided in this tubing upstream of the precooler 18 but downstream of the receiver 14.

Tubing 26 extends from the precooler 18 to the inlet 28 of a heat exchanger generally indicated at 30 (Fig. 2). The said heat exchanger 30 consists of two or more tubes which are joined together by soldering or simply placed in side by side relationship or may be connected together by clamps or any other means. The coolant fluid flows through the tubing 26 whence it enters the heat exchanger 30 on the inlet side 28 and circulates through the heat exchanger, finally extending from the heat exchanger through the outlet side conduit 32.

The conduit or tubing 32 has a conventional expansion valve 34 therein, whereby the fluid passes therethrough and extends into the evaporator 36 by means of the tubing 38, also connected with the expansion valve 34.

The expansion valve is controlled by means of a feeler bulb 40 which is attached to a line 42 extending from the evaporator by means of a clamp 44. A capillary tube 46 extends from the feeler bulb as is conventional and terminates in the expansion valve in order to serve its usual office.

As the fluid flows through the tubing 38, it is in the gaseous state since it has passed through the expansion valve to serve its purpose in the evaporator. A fan 48 is disposed in juxtaposition

4

with respect to the evaporator, as shown in Figure 1.

After the cooling fluid has passed through the evaporator 36 it again passes through the heat exchanger 30 and through the outlet side 50 of the said heat exchanger. The said outlet side 50 is connected with a return line 52 which is terminated at the inlet of the compressor 10. A solenoid valve 56 is provided in the return line 52 and is open during the cooling cycle of operation.

Defrost cycle structure

The defrost cycle of operation utilizes in part the various tubes and conduits which are utilized for the cooling cycle. During the defrost cycle the compressor 10 is inoperative as is the motor 12 and the fan 48. A heater 58 is disposed in the receiver 14 and may be of the electrically operative type. By heating the fluid in the receiver, the heated fluid rises through a heated fluid line 60 which has a manual service valve 62 therein. This heated fluid line terminates in the return line 52 between the heat exchanger 30 and the solenoid valve 56. During the defrost cycle of operation the solenoid valves 56 and 24 are closed by means which will be described subsequently.

The heated fluid for defrosting flows through the return line 52 and into the previously termed outlet side of the heat exchanger 30. Since the coils in the heat exchanger were cooled by conduction, the coils being in juxtaposition to each other, the initial charge of defrosting fluid is cooled slightly. Accordingly, after passing through the heat exchanger the defrost liquid rises through the line 42 and circulates through the evaporator. Accordingly, the heated liquid flows through the tubing 38 and through a return conduit 66 which is attached to the tubing 38 between the expansion valve 34 and the evaporator 36. There is a solenoid valve 68 disposed in the return line 66 which is open at this time but closed during the cooling cycle of operation of the apparatus. To prevent backflow a check valve 70 is supplied in the line 66 and there is a manually operative valve 72 also provided in this line adjacent the receiver 14 whereby this line may be closed thereby shutting down the system for repair purposes. In view of the valve 70, the valve 68 may be omitted, if desired.

Heater for defrost cycle fluid

Referring to Figure 3 there is illustrated a circuit which includes a timer 84 of conventional description. This timer has a line leading therefrom which is an electrical conductor and has the heater 58 therein in series with a thermostat 78. The thermostat is disposed within the receiver 14 in order that the temperature of the liquid within the receiver may be maintained at a certain preselected value. Hence, by the electrical arrangement at a predetermined time the heater is energized thereby heating the fluid in the receiver. But, the amount of current supplied to the heater 58 is regulated by means of the thermostat 78 which is disposed in the said receiver 14.

Hence, shortly before the controller sets forth the conditions whereby the defrost cycle of operation is possible, the timer renders the heater 58 operative which increases the heat content of the liquid in the receiver. If this heat content exceeds a safe value or limit, the thermostat 78

operates to reduce the heat output of the heater 58.

In the event that the heat of the liquid within the receiver becomes too excessive, a fusible plug 80 which serves in the capacity of a safety device is melted thereby relieving the pressure built up in the receiver 14. The said safety device 80 is disposed in a suitable opening preferably at the top of the receiver so that the pressure will be relieved.

A small valve 82 is disposed in the side wall of the receiver 14 above the junction of the line 60 and the receiver. Accordingly, the system is charged with fluid but should be charged an amount so that the fluid level is above the junction of the line 60 and the receiver but below the junction of the line 16 and the receiver. In this manner the fluid will not back into the compressor 10 but will flow through the line 60. In the event that some fluid does back into the compressor, the conventional check valve provided in the compressor as standard equipment will prevent damage.

Cooling and defrost cycle operation

The timer 74 is in the illustrated instance (Fig. 3) a timer which is electrically operative. Two circuits extend from the timer and are controlled thereby. The first circuit is energized while the second circuit is deenergized. For cooling purposes the circuit viewed on the right side of Figure 3 is energized and includes a line 86 having various elements in parallel therein. The elements have been shown in parallel for facility but other wiring systems may be employed as found desirable. The compressor motor 12 which has the fan 88 for the precooler thereon, and fan motor 48 are in this circuit. Accordingly, during the cooling cycle these elements will be operated. Two solenoid operated valves are also provided in this circuit, these valves being open when this circuit is energized. The two referred to valves are seen at 24 in the tubing 20 and 56 in the return line 52. Accordingly, when the compressor 10 is operated the two fans in the illustrated system are rendered operative and the fluid is pumped throughout the system.

When the above described circuit is rendered inoperative, the other circuit shown in Figure 3 is operative. This last named circuit includes a wire 90 which has two solenoid valves in series disposed therein. The first valve is in the line 66 and is illustrated at 68, while the second solenoid operated valve is indicated at 92 and disposed in the line 60, utilized for conducting the heated fluid into the heat exchanger 30. Accordingly, when the circuit which includes the wire 90 is energized, the valves 68 and 92 are open thereby permitting free flow through the described heating cycle portion of the apparatus. The other valves being closed, prevent undesired and harmful flow through the other portion of the system.

The tray or drip pan 94 which is disposed beneath the evaporator 36 has a drain plug 96 illustrated which of course, may be removed for attachment with a drain line to terminate in a usual and suitable sump.

It is apparent that variations may be made without departing from the spirit of the invention.

Having described the invention, what is claimed as new is as follows:

1. A cooling and defrost cycle refrigeration apparatus which includes a compressor, a receiver, a conduit connecting the compressor and the receiver, an evaporator, a drip pan beneath said evaporator and a heat exchanger having an inlet and an outlet disposed in said drip pan, cooling fluid conducting tubing connecting said receiver and the heat exchanger inlet and extending from said heat exchanger to said evaporator, an expansion valve interposed in said tubing upstream of said evaporator, a cooling fluid return line having a valve therein and extending from said heat exchanger outlet to said compressor, a valve in said tubing upstream of said heat exchanger, means opening both of said last-named valves during the cooling cycle, and a gravity flow system for defrosting said evaporator including a heated fluid line extending from said receiver to said cooling fluid return line and having a valve therein with means opening said valve during the defrost cycle whereby heated fluid flows through said heat exchanger and said evaporator, means extending from said tubing between said heat exchanger and said expansion valve for conducting heated fluid from said evaporator to said receiver, a valve interposed in said last mentioned means with means opening said valve during the defrost cycle, and a thermostat controlled heater for heating the fluid in said receiver.

2. The combination of claim 1, a precooler disposed in said tubing upstream of said heat exchanger, and a controller for operating each of said valve opening means whereby the cooling and defrost cycles are operated after predetermined time intervals.

3. The combination of claim 1 wherein said controller includes a timer operatively connected with said thermostats controlled heater rendering said heater operative periodically preparatory to operation of the defrost cycle.

FRED J. SCHORDINE.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,819,510	Hebeler -----	Aug. 18, 1931
2,430,938	Leeson -----	Nov. 18, 1947
2,430,960	Soling -----	Nov. 18, 1947
2,451,682	Lund -----	Oct. 19, 1948
2,463,027	Frie -----	Mar. 1, 1949
2,487,662	McCloy -----	Nov. 8, 1949