

Dec. 12, 1950

P. KOLLSMAN

2,534,032

REFRIGERATOR DEFROSTING SYSTEM

Filed Aug. 19, 1944

Fig. 1

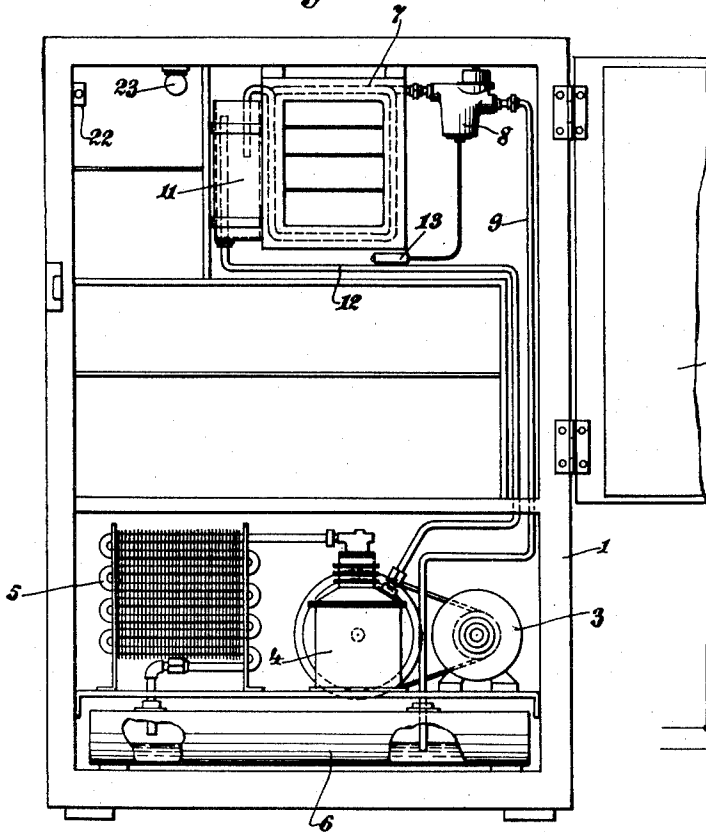


Fig. 3

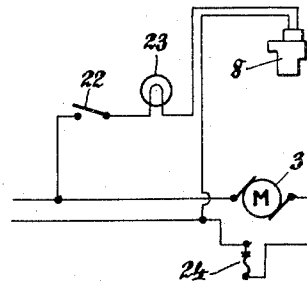


Fig. 2

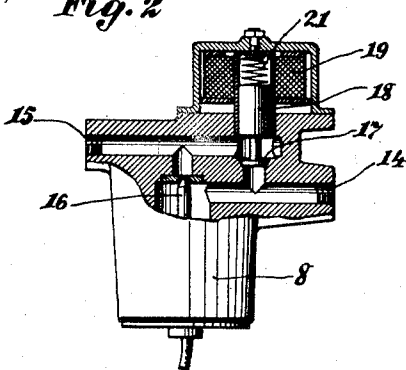
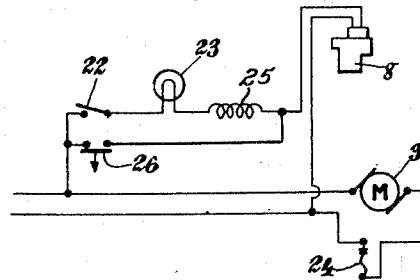


Fig. 4



INVENTOR.
Paul Kollman,

BY *Myron J. Grubbold*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,534,032

REFRIGERATOR DEFROSTING SYSTEM

Paul Kollsman, New York, N. Y.

Application August 19, 1944, Serial No. 550,166

10 Claims. (Cl. 62—3)

1

This invention relates to mechanical refrigeration and refrigerators, and more particularly to the automatic defrosting of the evaporator coils of such refrigerators.

One object of the invention is to provide a mechanical refrigerator of the compressor, condenser, receiver, evaporator type with means for automatically passing warm refrigerant fluid from the receiver into the evaporator so as to quickly raise the temperature thereof and effect the removal of frost accumulation thereon.

Another object of the invention is to effect an automatic quick defrosting of the evaporator coils of a refrigerator each time that the refrigerator enclosure is opened.

Another object of the invention is to provide for quick defrosting of the evaporator of a mechanical refrigerator by by-passing the expansion valve and passing the warm refrigerant fluid directly into the evaporator.

Other objects and features of the invention will be readily apparent to those skilled in the art from the specification and appended drawings illustrating certain preferred embodiments in which:

Figure 1 is a diagrammatic front elevational view of a mechanical refrigerator according to the present invention.

Figure 2 is a detailed view, partly in section, of a combined expansion and by-pass valve for controlling the flow of refrigerant fluid to the evaporator.

Figure 3 is a simplified wiring diagram of the control circuit for the by-pass valve through the conventional refrigerator door switch.

Figure 4 is a simplified wiring diagram similar to Figure 3 but including a time delay relay for maintaining defrosting operation for a predetermined time interval after the door is closed.

The refrigerator as represented in Figure 1 comprises a cabinet 1 having an openable door 2 for the refrigerated compartment. Within the lower compartment of the cabinet are disposed an electric motor 3 driving a compressor 4 whose pressure outlet is connected to condenser coil 5. The outlet of the condenser 5 is connected to a receiver 6 for the refrigerant fluid. Within the refrigerated compartment is disposed the evaporator coil 7 having its inlet connected through expansion valve 8 and conduit 9 to the receiver 6. The outlet of the evaporator coil 6 leads to a liquid trap 11 which in turn is connected through conduit 12 to the intake of the compressor 4.

The expansion valve 8, as shown in Figure 1, is of the temperature control type having a tem-

2

perature responsive bulb 13 responsive to the outlet of the evaporator. Conventionally, an automatic expansion valve, pressure controlled, can be substituted for the thermostatically controlled expansion valve.

According to the present invention, a by-pass valve for the expansion valve is provided and, as herein specifically disclosed, these are combined into a unitary structure as shown in Figure 2. The valve inlet at 14 is connected through conduit 9 to the receiver 6. The valve outlet 15 is connected to the evaporator coil 7. The expansion valve control for normal cooling operation is indicated at 16. There is also provided for the quick defrosting operation, according to the present invention, the solenoid controlled by-pass valve indicated at 17 operated by movement of an armature or core 18 under the control of a solenoid coil 19 against the bias of a spring 21.

Figure 3 illustrates one form of electric circuit for the control according to this invention. The switch 22 may be the conventional door operated switch used to control the illumination within the refrigerated chamber and the light controlled thereby is indicated at 23. However, in series with this circuit there is disposed the solenoid coil 19 operating the by-pass valve 17. The motor control thermostatic switch is indicated at 24.

The control circuit of Figure 4 is similar to that of Figure 3 but includes a time delay relay having an operating coil 25 and contacts 26 which close instantaneously but open after a predetermined time interval after deenergization of the coil 25.

In the operation of the defrosting system, according to this invention, when the door 2 to the refrigerated chamber is opened, the switch 22 is closed to complete a circuit through the solenoid coil 19 which attracts the core 18 and opens the by-pass valve 17. This permits the warm refrigerant fluid from the receiver 6 to pass directly into the evaporator 7 to quickly raise its temperature and to remove the frost accumulation. With the normal frequency of operation of the door 2, the normal interval of door opening and increase in the temperature of the evaporator will be sufficient to remove the frost accumulation; however, under abnormal conditions, it may be desirable to maintain the heating and defrosting cycle for a greater period of time and this may be accomplished by the circuit of Figure 4 by the setting of the time delay relay so that if the switch 22 is again opened by closing of the door 2, the solenoid 19 is maintained energized through the delayed opening of the contacts 26. When the solenoid 19 is de-

energized, the by-pass to the valve 17 closes and the control of the flow of refrigerant from the receiver 6 is again placed in the normal action of the expansion valve whereupon the cooling cycle within the evaporator 7 will be resumed.

The trap 11 shown in Figure 1 will ordinarily not be required since even in the defrosting cycle the refrigerant fluid within the evaporator 7 will be in the form of a gas due to its lowered pressure. However, in certain installations or under extreme conditions, it is conceivable that the refrigerant fluid may be present in the evaporator as a liquid and the function of the trap 11 is to insure that such liquid will not be carried over into the compressor intake. If any refrigerant in liquid form is caught in the trap it will, upon the resumption of the normal cooling cycle, be changed into a gas and will pass to the compressor intake in the usual manner.

While the invention has been disclosed as controlling the action of the by-pass valve for the expansion valve by the opening of the refrigerated compartment, it is clear that any other desired motivating condition may be used for automatically effecting the opening of the by-pass valve to effect the quick defrosting cycle.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. In a refrigerator, a compressor for the refrigerant fluid, a condenser for the fluid, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid between the condenser and the evaporator and means for automatically by-passing the expansion valve in response to an operating condition to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation.

2. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid from the compressor is cooled, a receiver in which the fluid from the condenser is stored, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid from the receiver into the evaporator, and means for by-passing the expansion valve to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and to effect a defrosting operation.

3. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid from the compressor is cooled, a receiver in which the fluid from the condenser is stored, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid from the receiver into the evaporator, and means for automatically by-passing the expansion valve in response to an operating condition to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation.

4. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid

from the compressor is cooled, a receiver in which the fluid from the condenser is stored, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid from the receiver into the evaporator, and means for by-passing the expansion valve in response to opening of the refrigerated compartment to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation.

5. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid from the compressor is cooled, a receiver in which the fluid from the condenser is stored, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid from the receiver into the evaporator, means for opening a by-pass around the expansion valve in response to opening of the refrigerated compartment to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation, and means for maintaining said by-pass open for a predetermined time interval after closing of the refrigerated compartment.

6. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid from the compressor is cooled, a receiver in which the fluid from the condenser is stored, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the passage of refrigerant fluid from the receiver into the evaporator, a solenoid operated valve providing a direct by-pass around said expansion valve, a switch operated to closed position by each opening of the refrigerator door and connected to effect energization of said solenoid valve whereby opening of the refrigerator door effects a by-pass of the expansion valve to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation.

7. In a refrigerating system, a compressor in which the refrigerant fluid is compressed, an evaporator in which the refrigerant expands to reduce the temperature, and means for automatically passing through the evaporator refrigerant fluid without passing through its normal cooling cycle so as to raise the evaporator temperature to effect a defrosting operation, and means for effecting said automatic passage each time the refrigerator enclosure is opened.

8. In a refrigerating system, a compressor in which the refrigerant fluid is compressed, an evaporator in which the refrigerant expands to reduce the temperature, and means for automatically passing through the evaporator refrigerant fluid without passing through its normal cooling cycle so as to raise the evaporator temperature to effect a defrosting operation, means for effecting said automatic passage each time the refrigerator enclosure is opened, and means for continuing said automatic passage for a predetermined time interval after closing of the refrigerator enclosure.

9. In a refrigerator, a compressor for the refrigerant fluid, a condenser in which the fluid from the compressor is cooled, an evaporator in which the fluid expands to perform a cooling operation, an expansion valve controlling the

5

passage of refrigerant fluid between the condenser and evaporator, and means for by-passing the expansion valve each time the refrigerator enclosure is opened to pass the warm refrigerant fluid directly into the evaporator in the same direction as in the cooling operation to quickly raise the evaporator temperature and effect a defrosting operation.

10. A defrosting device for a refrigerator, comprising a compressor for the refrigerant fluid; a condenser into which the fluid is fed by the compressor and in which it is cooled; a receiver in which the cooled fluid leaving the condenser is stored; an evaporator in which the fluid performs a cooling operation; means forming a passage between said receiver and said evaporator, said passage including a throttling means for reducing the pressure of the fluid entering the evaporator to perform its cooling cycle, said condenser and the receiver in line with said condenser providing the sole path through which during the cooling and defrosting cycle fluid from said compressor reaches said passage; means forming a return passage leading from said evaporator to

6

said compressor; and a by-pass for said throttling means to pass the fluid from said receiver directly into the evaporator, in the same direction as during the cooling cycle, without passage through throttling means so as to quickly raise the evaporator temperature and effect a defrosting operation.

PAUL KOLLSMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,128,386	Warren -----	Aug. 30, 1938
2,145,773	Muffy -----	Jan. 31, 1939
2,281,770	Hoesel -----	May 5, 1942
2,351,140	McCloy -----	June 13, 1944
2,384,210	Sunday -----	Sept. 4, 1945

FOREIGN PATENTS

Number	Country	Date
119,584	Australia -----	Feb. 14, 1945