May 12, 1970 H. F. W. BODCHER 3,511,060
DEFROSTING DEVICE FOR A REFRIGERATING MACHINE
Filed July 1, 1968 3 Sheets-Sheet 1

FIG_1

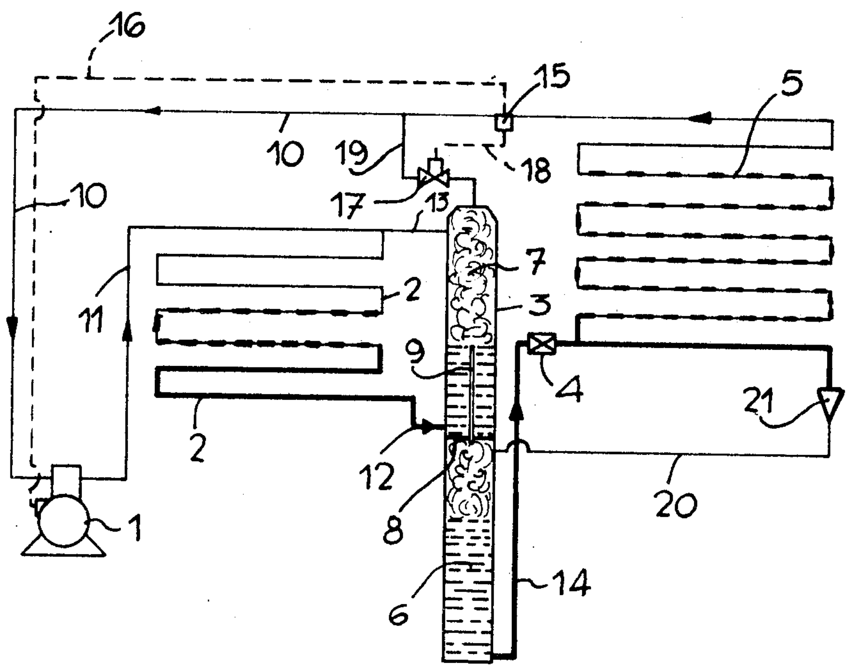
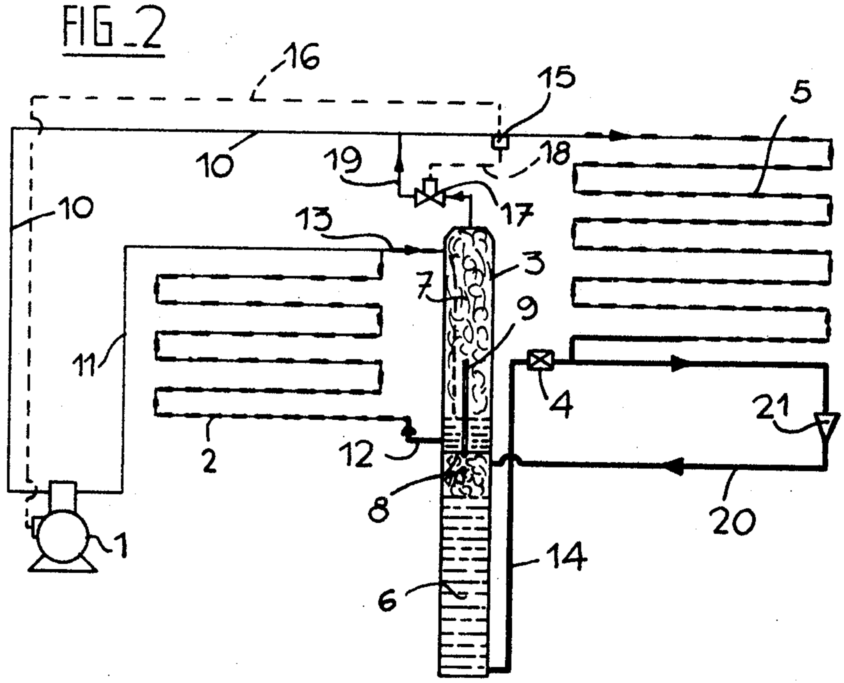


FIG_2



DEFROSTING DEVICE FOR A REFRIGERATING MACHINE

Filed July 1, 1968

3 Sheets-Sheet 2

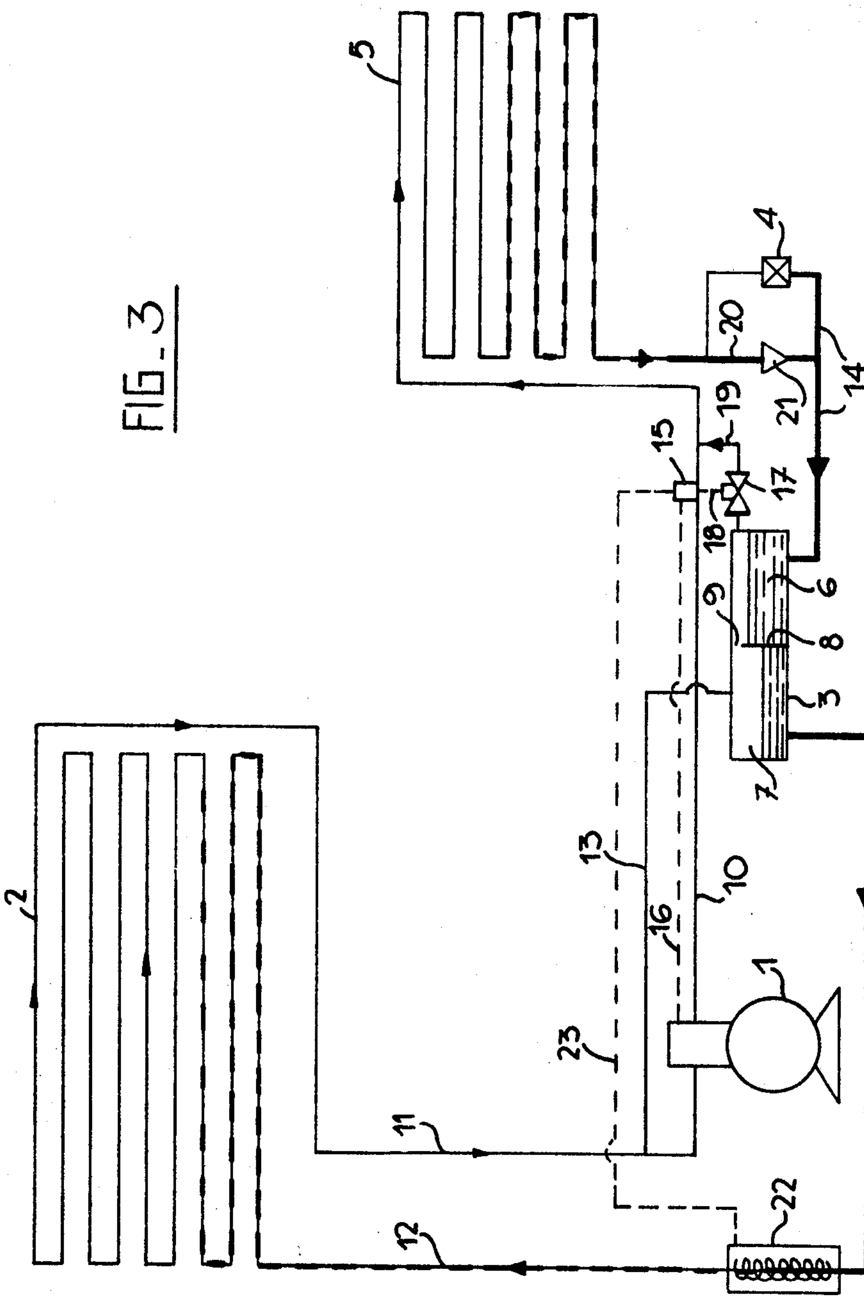


FIG. 3

May 12, 1970 H. F. W. BODCHER 3,511,060

DEFROSTING DEVICE FOR A REFRIGERATING MACHINE

Filed July 1, 1968 3 Sheets-Sheet 3

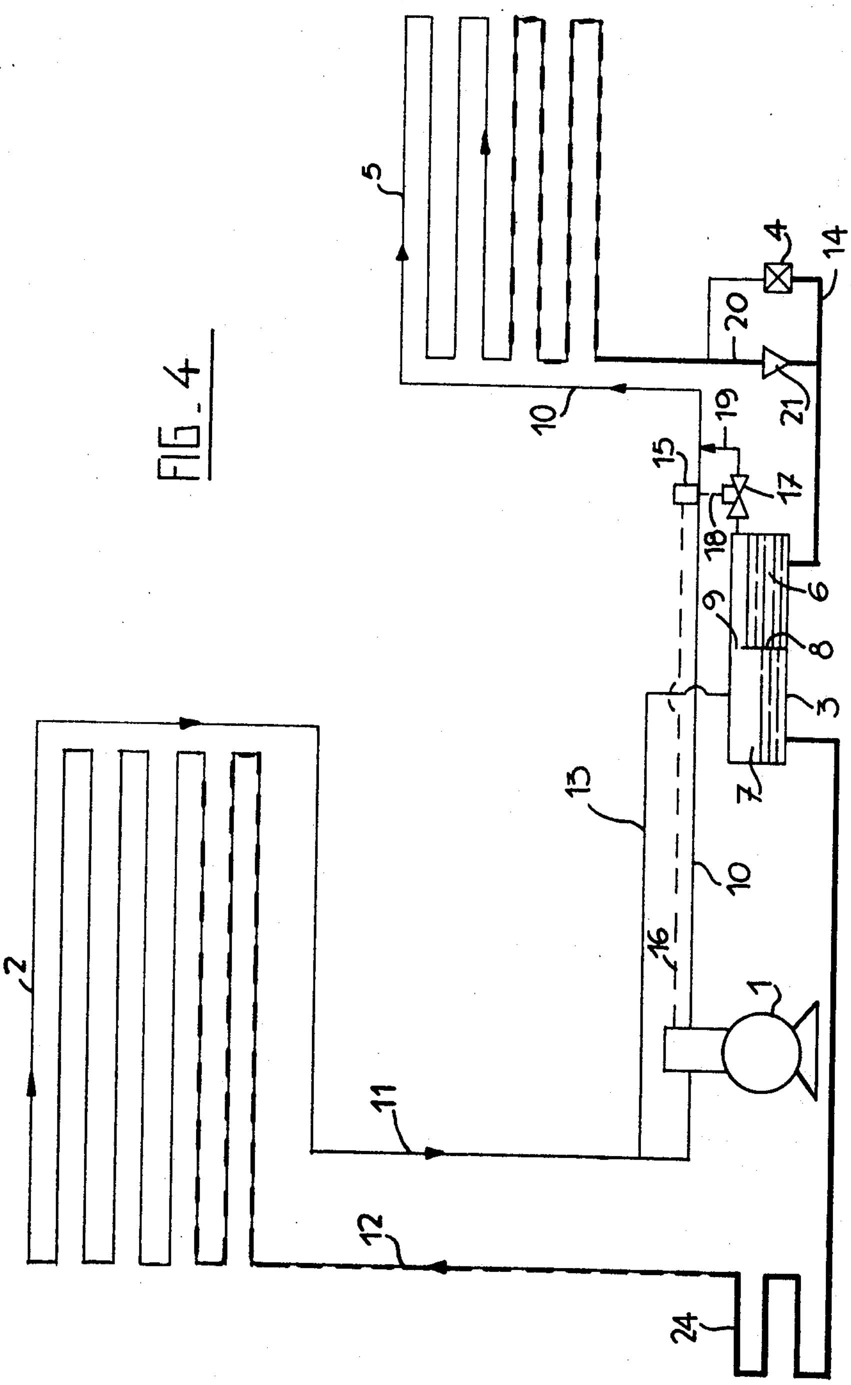


FIG. 4

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3,511,060

DEFROSTING DEVICE FOR A REFRIGERATING MACHINE

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Int. Cl. F25d 21/02
U.S. Cl. 62—140 5 Claims

ABSTRACT OF THE DISCLOSURE

A device for defrosting the evaporator of a compression refrigerating machine comprising a defrosting reservoir with its upper part containing constantly gaseous refrigerant fluid and connected, on the one hand, to the upper part of the evaporator by a defrosting pipe provided with a defrosting valve open only during the defrosting period, during which the compressor is stopped, and, on the other hand, constantly to the upper part of the condenser, and with its remaining part containing constantly liquid refrigerant fluid and connected, on the one hand, to the lower part of the evaporator by a delivery pipe for the refrigerant liquid provided with an expansion device and by a return pipe for this liquid provided with a check-valve, and, on the other hand, constantly to the lower part of the condenser.

The present invention relates to a defrosting device for the evaporator of a compression refrigerating machine comprising, inter alia, a compressor, a condenser, an expansion device and an evaporator.

In known refrigerating machines, the defrosting device consists of electric resistances independent of the refrigerating machine and producing a determined quantity of heat transmitted to this machine to defrost the surfaces of its evaporator. This electrical defrosting device has, on the one hand, the disadvantage of heating the interior and useful volume of the refrigerating machine and, on the other hand, of producing deposits of particles of carbonized oil occasioning stops in the functioning and breakdowns of the machine.

The present invention has as an object, a new drefrosting device which obviates the aforementioned disadvantages of the known devices, while being more efficient and less expensive than these latter.

To this end, the new defrosting device comprises a defrosting reservoir. The upper part of this defrosting reservoir constantly contains refrigerant fluid in gaseous phase and is connected, on the one hand, to the upper part of the evaporator by a defrosting pipe provided with a defrosting valve open only during the defrosting period, during which the compressor is stopped, and, on the other hand, constantly to the upper part of the condenser. The remaining part of the defrosting reservoir constantly contains refrigerant fluid in liquid phase and is connected, on the one hand, to the lower part of the evaporator by a refrigerant liquid delivery-pipe, provided with an expansion device and by a return-pipe for this liquid, provided with a check-valve, and, on the other hand, constantly to the lower part of the condenser.

According to a characteristic of the invention, the new defrosting device comprises a detection apparatus for frost or ice formed on the surfaces of the evaporator during the normal running of the refrigerating machine, this detection apparatus regulating the defrosting valve mentioned above. This characteristic allows automatic regulation of the defrosting and, in particular, the stopping of the compressor at the beginning of the defrosting period and the re-starting thereof at the end of this period.

According to another characteristic of the invention, the new defrosting device comprises a means for evaporating during defrosting at least a part of the refrigerant liquid situated in the lower part of the defrosting reservoir, which only functions during defrosting. This characteristic allows any mutual arrangement of the condenser, the evaporator and the defrosting reservoir in the refrigerating machine.

The invention will now be described with reference to the accompanying drawings, which show three embodiments of the invention but in no restrictive sense.

FIG. 1 is a diagram illustrating a first embodiment of a refrigerating machine with a defrosting device according to the invention, this machine running normally.

FIG. 2 is an analogous diagram illustrating the same machine during the defrosting period.

FIGS. 3 and 4 are further diagrams illustrating two further embodiments of a refrigerating machine with a defrosting device according to the invention.

In these different figures, the same reference numbers indicate identical components, while the thick unbroken lines, the dotted lines over fine unbroken lines and the thin unbroken lines indicate respectively the pipes for the refrigerant fluid in liquid phase, those for the refrigerant fluid in saturated gaseous phase and those for the refrigerant fluid in gaseous phase of the superheated vapour, the dotted lines indiacting, in addition, electrical conductors.

The refrigerating machine comprises essentially a compressor **1**, a condenser **2**, a defrosting reservoir **3**, an expansion device **4** and an evaporator **5**.

The defrosting reservoir **3** presents two chambers **6** and **7** which are adjacent. In the first embodiment, these chambers **6** and **7** are superposed while in the second and third embodiments the said chambers **6** and **7** are horizontally adjacent.

The chambers **6** and **7** of the defrosting reservoir **3** are separated from one another by a dividing plate **8** but they intercommunicate by a vertical tube **9** in the first chosen example or by an opening **9'** in this plate in the two latter cases.

As can be seen in the figures, the defrosting reservoir **3** contains, on the one hand, refrigerant fluid in liquid phase in the lower parts of its chambers **6** and **7**, and, on the other hand, refrigerant fluid in gaseous phase in the upper parts of the said chambers.

In normal running of the refrigerating machine, refrigerant fluid in gaseous phase is sucked up by the compressor **1** from the upper part of the evaporator **5** to that of the condenser **2**, through a suction pipe **10** and a delivery pipe **11**. During its passage through the condenser **2**, the refrigerant fluid is cooled and passes into liquid phase. At the outlet of the condenser **2**, the refrigerant fluid in liquid phase is admitted to the defrosting reservoir **3** in which it can pass from one chamber to the other through the tube **9** or the opening **9'** of the plate **8**. Under the action of the compressor **1**, refrigerant fluid in liquid phase is carried through a connecting-pipe **14** as far as the expansion device **4** where a pressure-drop is produced. From there, the refrigerant fluid is introduced in the lower part of the evaporator **5** in which it continues its evaporation and then supplies units of cold to the refrigerating machine. Having ensured the desired cooling of this machine, the refrigerant fluid in gaseous phase is sucked up by the compressor **1** to the upper part of the evaporator **5** to recommence the same cycle.

After a certain time of normal running, there is formed on the surfaces of the evaporator **5** a coating of frost or ice, the thickness of which is detected by an appropriate detection means such as a pressostat **15**, a thermostat or a time-switch. When the thickness of this coating reaches a limited value, the pressostat **15** acts and ensures the necessary defrosting period for the surfaces of the evaporator **5**.

The pressostat **15** is connected to the electric supply-circuit of the motor component of the compressor **1** by electrical conductors **16**. In addition, the pressostat **15** is connected electrically to a defrosting valve **17**, hitherto closed, by electrical conductors **18**. The defrosting valve **17** is connected to a defrosting pipe **19** which extends from the upper part of one of the chambers of the defrosting reservoir **3** to the aforementioned suction-pipe **10**. The pressostat **15** having registered a given pressure corresponding to a given coating of ice or frost, brings the compressor **1** to a stop and opens the defrosting valve **17**. Thus there is then established a uniform stabilized pressure in the refrigerating machine. The cooling agent of the condenser acts this time as a source of heat for the refrigerant liquid. The refrigerant fluid in liquid phase situated in reserve in the chambers of the defrosting reservoir **3** is gradually vaporized in the condenser **2** which plays the role of an evaporator. This vaporized refrigerant fluid then passes through the defrosting pipe **19** via the valve **17**, then open, into the evaporator **5** where it is condensed, transferring its vaporization heat to the coating of ice or frost which melts. The refrigerant fluid thus condensed is led into the lower part of the evaporator **5** and is evacuated by gravity through the return-pipe **20**, provided with a check-valve **21**, into the lower part of the chamber **6** of the defrosting reservoir **3** to pass next into the chamber **7** of this reservoir and to be recycled through the condenser **2** and the evaporator **5**.

When the defrosting is finished, the pressostat simultaneously closes the defrosting valve **17** and restarts the compressor **1**. The level of refrigerant fluid in liquid phase rises again in the defrosting reservoir **3**. In addition, during the resumption of normal running, the high pressure prevailing in the defrosting reservoir **3** is re-established, which brings about the closing of the check-valve **21**.

The other two embodiments of the refrigerating machine differ from the preceding one not so much by the mutual arrangement of the chambers **6** and **7** of the defrosting reservoir **3** but, above all, by the presence of a means for evaporating, during the defrosting of this machine, at least a part of the refrigerant fluid in liquid phase situated in this reservoir.

In the second embodiment, this means consists of an electrical resistance **22** surrounding a section of the pipe **12**. This resistance, fed with current by electrical conductors **23**, produces by the JOULE effect the necessary heat for the aforementioned evaporation of the refrigerant fluid in liquid phase.

In the third embodiment, the similar means is a heat-exchanger **24** formed by a section of the aforementioned pipe **12** and by another pipe heated by an external agent, specifically with ambient air.

At the moment when the coating of frost or ice on the surfaces of the evaporator **5** reaches a limited thickness, the pressostat **15** simultaneously effects the stopping of the compressor **1**, the opening of the defrosting valve **17**, the supplying of the electrical resistance **22** or the heat-exchanger **24**. This action has the effect of establishing in the whole circuit of the refrigerating machine, a medium

pressure between the high pressure and low-pressure parts put in communication by the defrosting valve **17**. The cooling agent of the condenser acts this time as an agent providing heat to the refrigerant fluid in gaseous phase brought into the condenser **2**, due to the evaporation of the refrigerant fluid in liquid phase situated in the heated part of the pipe **12**. This refrigerant fluid in liquid phase heated by the electrical resistance **22** or the heat-exchanger **24** rises in droplets as far as the condenser **2** where they are gasified, the condenser playing the role of an evaporator. The refrigerant fluid situated in the condenser **2** is thus continually vaporized and passes through the aforementioned pipe **13** into the upper part of the defrosting reservoir **3**. This vaporized refrigerant fluid then passes through the defrosting pipe **19** through the defrosting valve **17**, then open and reaches the evaporator **5** where it condenses, which has the effect of defrosting the evaporator **5**. The liquid refrigerant fluid thus produced by condensation in the evaporator **5** flows therefrom and passes through the return-pipe **20** into the defrosting reservoir **3** as already stated above.

It is obvious that the invention is not exclusively limited to the three embodiments represented and that many modifications can be made in the form, arrangement and construction of certain components involved in its embodiment.

What I claim is:

1. A defrosting device for a compression refrigerating machine, making use of a refrigerant fluid and comprising a compressor for compressing the refrigerant fluid in gaseous phase and conveying the fluid in a refrigerating circuit; a condenser receiving the refrigerant fluid in gaseous phase from the compressor and condensing said fluid; a liquid-to-gas defrost reservoir receiving the refrigerating fluid in liquid phase from the condenser and constantly containing refrigerant fluid in liquid and in gaseous phase; an expansion device in said circuit and traversed by refrigerant fluid in liquid phase furnished from the liquid-to-gas reservoir; an evaporator for receiving refrigerant fluid in liquid phase from the expansion device and evaporating said refrigerant fluid which is then again received by the compressor; a defrosting pipe joining the top portion of the gas-to-liquid reservoir to the top portion of the evaporator; a defrosting valve in the defrosting pipe for opening and closing the same; detector means for frost or ice formations on the evaporator, and means operatively connecting said detector means and said compressor such that at the beginning of the defrosting of the evaporator, the defrosting valve is opened and simultaneously the compressor is stopped, whereas at the end of defrosting the defrosting valve is closed and the compressor is simultaneously restarted, whereby the amount of refrigerant fluid in gaseous phase for defrosting is drawn continuously from the liquid-to-gas reservoir and is conveyed to the evaporator in a defrosting circuit without intervention by the compressor.

2. A defrosting device according to claim **1** wherein said liquid-to-gas reservoir comprises means for keeping the refrigerant fluid in liquid phase at a prescribed level while the refrigerating means is running.

3. A defrosting device according to claim **2** comprising means for evaporating at least a part of the liquid refrigerant in the bottom of the liquid-to-gas reservoir, during the defrosting of the refrigerating machine.

4. A defrosting device according to claim **3** comprising a pipe joining the liquid-to-gas reservoir at the bottom thereof to the bottom of the condenser, said means for evaporating at least a part of the liquid refrigerant in the bottom of the liquid-to-gas reservoir comprising an electrical resistance for heating the pipe which joins the bottom of the liquid-to-gas reservoir to the bottom of the condenser.

5. A defrosting device according to claim **3** comprising a pipe joining the liquid-to-gas reservoir at the bottom thereof to the bottom of the condenser, said means for evaporating at least a part of the liquid refrigerant in the bottom of the liquid-to-gas reservoir comprising a pipe fed by a heating agent and in heat exchange relation with the pipe connecting the bottom of the liquid-to-gas reservoir to that of the condenser.

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