Feb. 27, 1968 J. W. JACOBS 3,370,437

DEFROSTING SYSTEM

Filed June 14, 1966 2 Sheets-Sheet 1

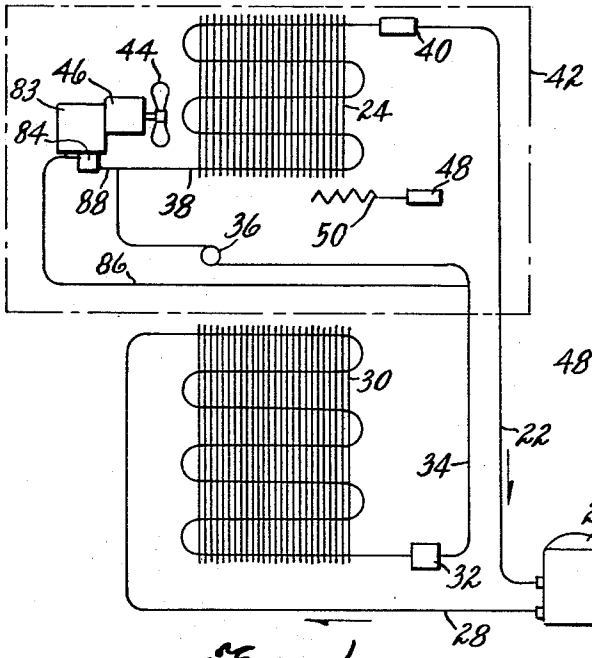


Fig. 1

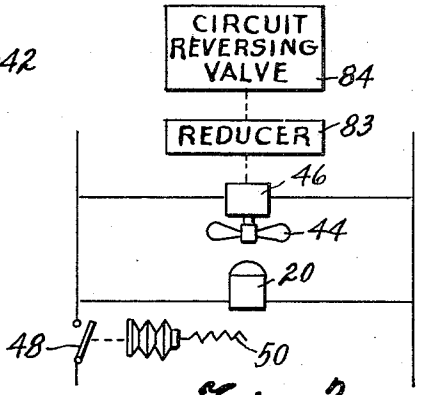


Fig. 3

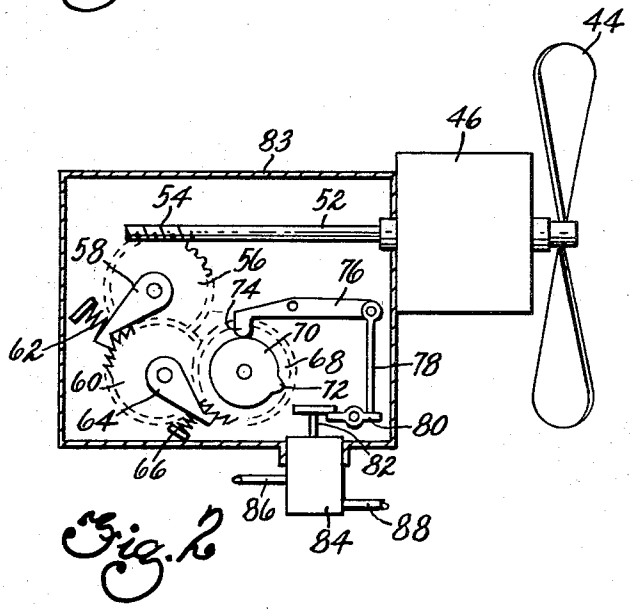


Fig. 2

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Feb. 27, 1968 J. W. JACOBS 3,370,437

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Filed June 14, 1966 2 Sheets-Sheet 2

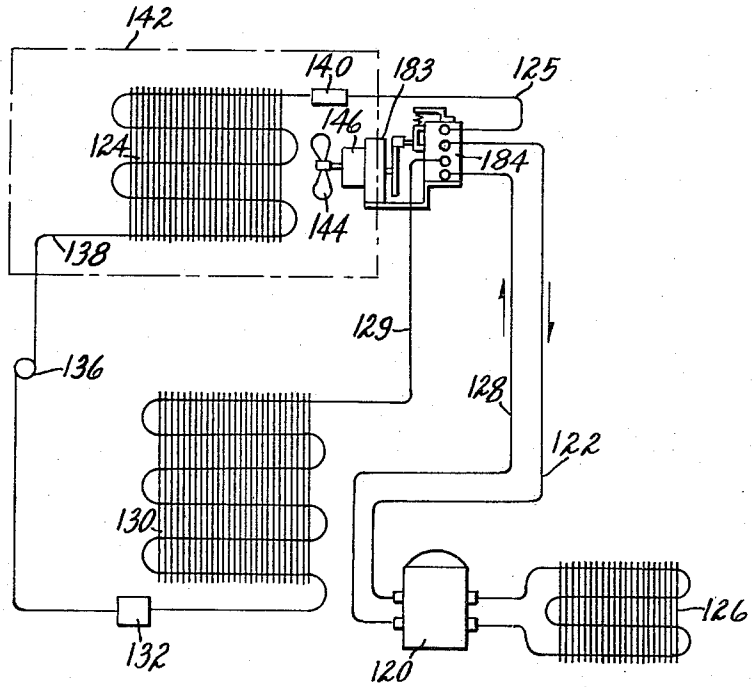


Fig. 4

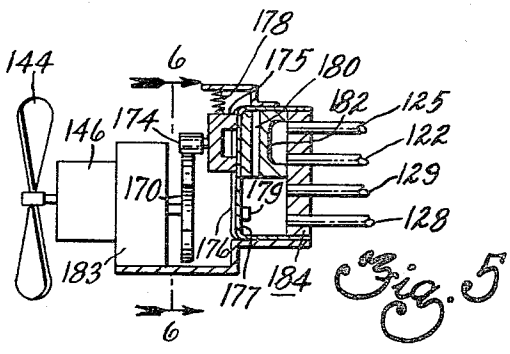


Fig. 5

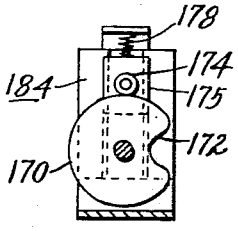


Fig. 6

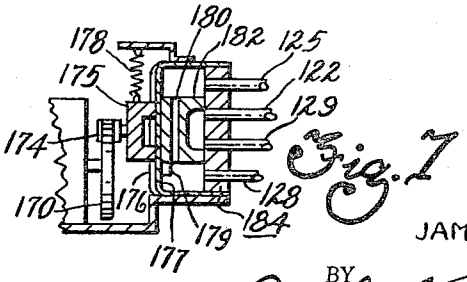


Fig. 7

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DEFROSTING SYSTEM

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4 Claims. (Cl. 62—160)

This invention pertains to the defrosting of refrigerating systems wherein a fan motor is used to periodically provide the power to move a valve to defrost position periodically to deliver hot gas to the interior of the evaporator.

The defrosting of an evaporator can be quickly and efficiently accomplished by the delivery of hot gas periodically thereto to internally heat the evaporator. A valve is required to control the delivery of the hot gas to the evaporator. It has been customary to use a solenoid valve for controlling a gas pressured operated valve or a solenoid valve alone for controlling the periodic delivery of the hot gas to the evaporator. The cost of either of these arrangements has been sufficiently high to severally restrict their use.

It is an object of this invention to provide a reliable, inexpensive system providing for the periodic delivery of hot gas within an evaporator to accomplish defrosting thereof.

It is another object of this invention to provide a simple arrangement by which a fan motor used for circulating air over the condenser or evaporator also drives a mechanism for periodically operating a valve to deliver hot gas to the interior of the evaporator for defrosting it.

These and other objects are attained in the forms shown in the drawings in which a fan (primarily used for circulating air in heat transfer with an evaporator) drives a mechanism which periodically opens a by-pass valve to bypass the restrictor between the condenser and the evaporator to deliver hot liquid or gas to the evaporator for defrosting it periodically. In the second form of the invention the fan motor operates a reversing valve to reverse position periodically to interchange the connections between the motor compressor unit and the condenser and the evaporator; also to deliver hot fluid to the evaporator for defrosting it periodically.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a diagrammatic illustration of a refrigerating system provided with a fan and a fan motor operated by-pass valve embodying one form of my invention;

FIGURE 2 is a view in elevation and partly in vertical section illustrating the fan and fan drive motor together with the mechanism driven thereby for periodically opening the bypass valve;

FIGURE 3 is a wiring diagram for the refrigerating systems shown in FIGURES 1 and 4;

FIGURE 4 is a diagram of a refrigerating system providing reverse cycle defrosting embodying another form of my invention;

FIGURE 5 is a view in elevation, part in section of the fan motor and reversing valve shown in the normal refrigerating position;

FIGURE 6 is a transverse vertical section view taken along the line 6—6 of FIGURE 5; and

FIGURE 7 is a sectional view of the reversing valve shown in the reversing position for defrosting the evaporator.

Referring now to the drawings and more particularly to FIGURE 1, there is shown diagrammatically a refrigerating system including a sealed motor compressor unit 20 which withdraws through the suction line 22 evaporated refrigerant from an evaporator 24, and first circulates the compressed refrigerant through a superheat removing coil 26 and thence though the supply conduit 28 to a condenser 30 where the refrigerant condenses and flows into the receiver 32. From the receiver the liquid refrigerant flows through a supply conduit 34 and through a capillary tube restrictor 36 to the entrance 38 at the bottom of the evaporator 24. The outlet at the top of the evaporator 24 may be provided wih an accumulator 40 between it and the suction conduit 22. The evaporator 24 is associated with a compartment 42 to be cooled. The medium within the compartment 42 such as air, is circulated into heat transfer with the evaporator 24 by the fan 44 driven by the electric motor 46. The system is controlled by a thermostatic switch 48 having a thermosensitive tube 50 located in the compartment 42 for controlling the operation of the sealed motor compressor unit 20 and the fan motor 46 in accordance with the temperature of the air or medium therein or the temperature of the evaporator 24 to normally keep the evaporator 24 at temperatures below freezing and to keep the medium or air in the compartment 42 at a desired temperature.

When the evaporator 24 is operated at the low freezing temperatures in a moisture laden gas such as air, it will gradually accumulate frost thereon. Since this frost serves as an insulator and also clogs the air passages in the evaporator, it is necessary to periodically remove the frost therefrom to maintain its efficiency. This frost is economically, rapidly removed by the discharge of a hot fluid through its interior. According to my invention, the fan motor 46 through a rear extension 52 of its drive shaft, operates within a reducer casing 83 a worm 54 which slowly turns a worm wheel 56. This worm wheel 56 has eccentrically mounted thereon a pawl 58 held by the spring 62 in engagement the teeth on the ratchet wheel 60 and periodically advances the ratchet wheel 60, one tooth for each revolution of the worm wheel 56. The ratchet wheel 60 is also provided with an eccentrically mounted pawl 64, spring pressed by the spring 66 into engagement with a second ratchet wheel 68. This pawl 64 also advances the ratchet wheel 68 one tooth for each revolution of the ratchet wheel 60.

The ratchet wheel 68 is provided with a cam 70 having a single projection 72 which periodically engages the follower 74 to operate the rocker arm 76. The rocker arm 76 when operated moves the link 78 downwardly to operate the rocker arm 80 to engage and lift the valve operator 82 to open the valve 84. The opening of the valve 84 allows hot fluid from the condenser 30 and the receiver 32 to flow from the supply conduit 34 through the bypass conduits 86 into the conduit 88 connecting with the evaporator inlet 38. The projection 72 will hold open the valve 84 a sufficient period of time to allow a flow of the hot fluid through the evaporator 24 a sufficient period of time to heat the evaporator 24 internally so as to melt rapidly and completely the frost coating on the outer surfaces thereof. The fluid for defrosting may be either warm liquid or gas or a mixture of liquid and gas.

In FIGURE 4 is diagrammatically illustrated a reversing refrigerating system which employs a reversing valve 184 to reverse the connections between the motor compressor unit 120 and the condenser 130 and the evaporator 124 to heat and defrost the evaporator. In this form the sealed motor compressor unit 120 withdraws evaporated refrigerant through the suction conduit 122 and delivers compressed refrigerant first through the superheat coil 126 and thence to the supply conduit 128. The suction conduit

122 and the supply conduit 128 both connect to the reversing valve 184. The reversing valve is shown in detail in FIGURE 5 and shows the D-shaped slide valve 182 in its upper normal refrigerating position connecting the supply conduit 128 to the second supply conduit 127 and the outlet conduit 125 to the suction conduit 122. When the valve 184 is in its normal position, the supply conduit 128 will deliver the compressed refrigerant through the second supply conduit 129 into the condenser 130 where the refrigerant will condense and collect in the receiver 132. The liquid refrigerant will then flow through a capillary tube restrictor 136 to entrance 138 of the evaporator 124. The liquid refrigerant evaporates at reduced pressure in the evaporator 124 to cool the medium surrounding it. This evaporated refrigerant then flows through the accumulator 140, the conduit 125, the valve 184 and the conduit 122.

The system is controlled by an electric circuit similar to that shown in FIGURE 3 and similarly includes a fan 144 driven by an electric motor 146 which circulates a medium such as air within the compartment 142 into heat transfer with the evaporator 124. As in the first embodiment, the evaporator 124 is maintained at temperatures below freezing so that frost will accumulate on its outer surfaces. In this form, the fan motor 146 drives a reducing mechanism 183 which in turn drives a cam 170. This cam normally holds the cam follower 174 in the position shown in FIGURE 5 to provide normal operation of the refrigerating system by normal flow through the refrigerant circuits. The cam 170 has a single notch 172 which periodically moves a D-shaped magnetic operator 175 from the position shown in FIGURES 5 and 6 to the position shown in FIGURE 7. This operator 175 operates in a slide-way 176 upon one side of a thin stainless steel non-magnetic wall 177. A spring 178 normally holds the roller follower 174 in contact with the cam 170. The magnetic operator 175 is a highly magnetized permanent magnet and magnetically attracts and moves the D-shaped side valve 182 on the opposite side of the wall 177.

The valve 182 magnetically follows the movement of the magnetic operator 175 so that it is similarly positioned and normally held in its upper position against the top wall for normal circulation through the refrigerant circuit. When the notch 172 periodically receives the roller follower 174 to lower the D-shaped permanent magnet operator 175, the D-shape slide valve 182 is also lowered to its reversing position illustrated in FIGURE 7. The D-shaped slide valve 182 is stopped in its reversing position against the stop 179 and has a passage 180 through it for providing passage to the outlet conduit 125 from the supply conduit 128.

When the slide valve 182 is moved down to the position shown in FIGURE 7 periodically for defrosting, the valve causes the compressed gas to be delivered through the supply conduit 128, the outlet conduit 125 and the accumulator 140 into the top of the evaporator 124. This hot compressed gas will internally heat the evaporator 124 to quickly and efficiently melt the frost from its outer surfaces. The hot gas will be cooled by the melting of the frost and some will be condensed. This fluid will flow through the conduit 138 and the restrictor 136. After passing through the restrictor 136, the fluid will flow through the receiver 132, the condenser 130 and the conduit 129, and through the reversing valve 184 and the conduit 122 to the suction inlet of the sealed motor compressor unit 120. This will continue for the brief period that the notch 172 is operative to hold the slide valve 182 in the reversing position to provide a defrost period long enough to defrost the evaporator 124.

While the embodiments of the present invention as herein disclosed constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. Refrigerating apparatus including a refrigerant circuit comprising a motor compressor unit and a condenser means and an evaporator means, fan means for circulating a medium in heat transfer relation with one of said means, a fan motor for driving said fan means, means including a valve for defrosting said evaporator means, and periodic operating means connected to and operated by said fan motor for periodically moving said valve from one position to another for defrosting said evaporating means.

2. Refrigerating apparatus as defined in claim 1 in which the circuit includes a flow control means between the condenser means and the evaporator means and a bypass means containing the valve is provided for bypassing the flow control means.

3. Refrigerating apparatus as defined in claim 1 in which the valve is in the form of a reversing valve having means for reversing the refrigerant flow from the motor compressor unit to the condenser means and the evaporator means.

4. Refrigerating apparatus as defined in claim 1 in which the valve is located in a valve housing having a thin non-magnetic wall and in which the periodic means has a magnetic operator on one side of said thin wall and the valve has a magnetic follower on the opposite side of said thin wall operatively connected to said valve and magnetically associated with said magnetic operator.

No references cited.

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