Jan. 16, 1951 C. B. SHREVE 2,538,660

REFRIGERATOR DEFROSTER

Filed June 30, 1947 2 Sheets-Sheet 1

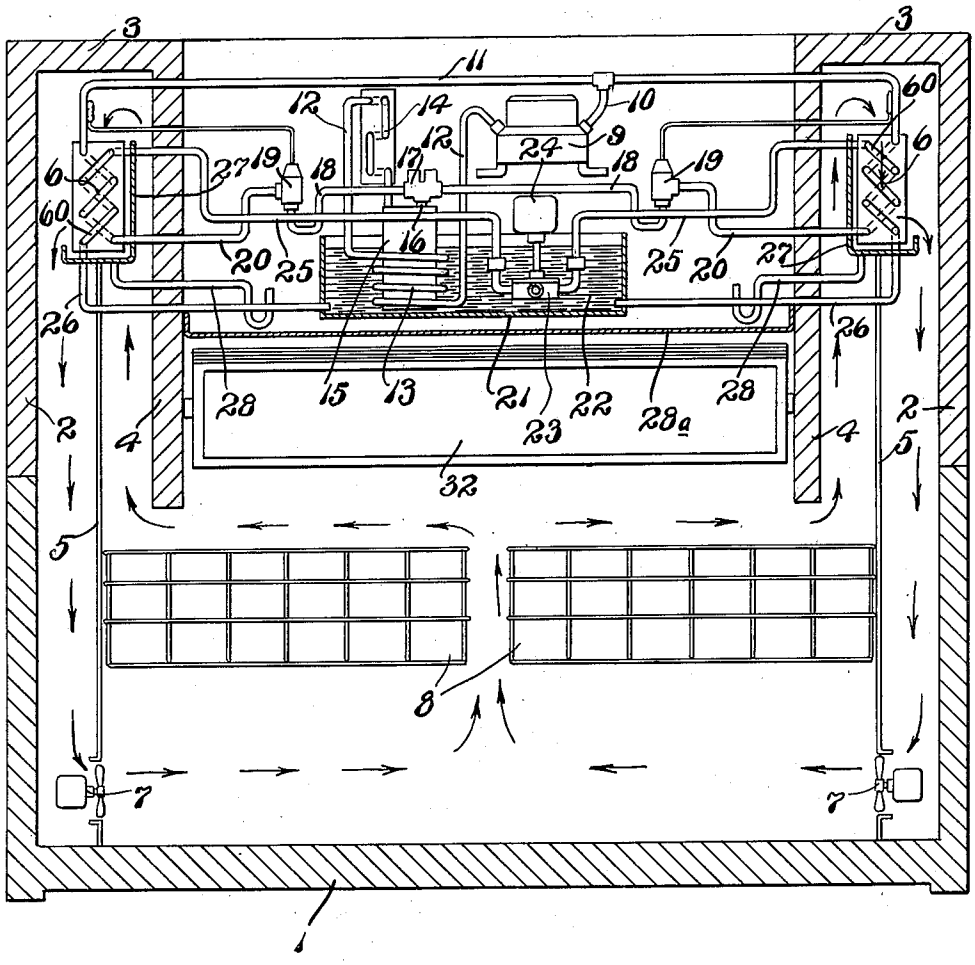


FIG. 1.

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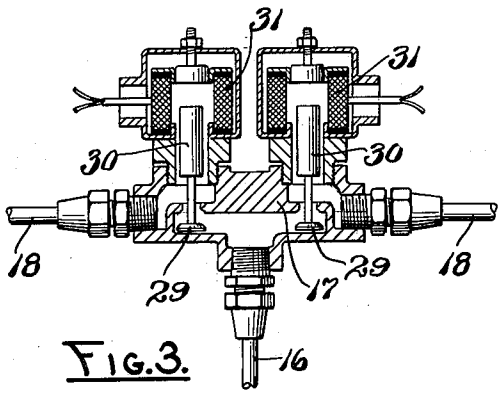


FIG. 3.

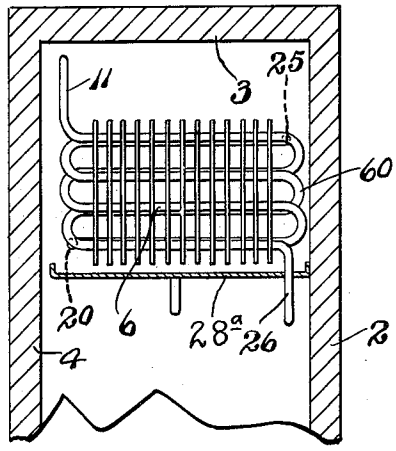


FIG. 2.

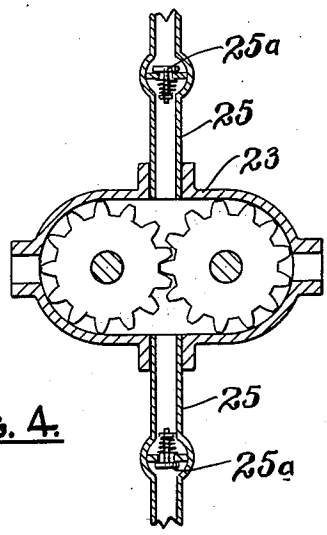


FIG. 4.

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UNITED STATES PATENT OFFICE

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REFRIGERATOR DEFROSTER

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3 Claims. (Cl. 62—116)

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This invention is concerned with refrigeration, and more particularly, with a refrigerating construction which is particularly adaptable to open display frozen food cabinets, to maintain the merchandise therein at a desired low temperature, while readily accessible to the customer who may select and serve himself from the articles of merchandise which are kept at a desired low temperature in an open display compartment.

With my invention, the evaporator coils of the refrigeration construction are located remotely from the merchandise display compartment, and the air from the display compartment is picked up and first carried through the evaporator where its moisture will condense and be deposited. Thus the cooled air, before being discharged to contact the merchandise, is first dried, that is, has the major portion of its water vapor removed therefrom.

One major object of the present invention is to provide a novel structure and apparatus for defrosting the evaporator coils on which the condensed moisture collects. Preferably, and also forming a part of my invention, two evaporators are used, which are alternately defrosted. In each of these evaporators there is the usual and normal refrigerating evaporating coil, together with which is a second coil, which may be of similar structure, through which a defrosting fluid of relatively high temperature is pumped and rapidly circulated for quickly and efficiently defrosting the evaporators and adjacent parts upon which frozen moisture has been deposited.

Many other objects and purposes, and novel structure for the attainment thereof, will appear and be understood from the disclosure of the invention, described in the following description, and illustrated in the accompanying drawings, in which:

Fig. 1 is a vertical section through a cabinet with which my invention is used, and showing a structural embodiment of my invention,

Fig. 2 is a fragmentary transverse vertical section toward one side and through the upper end portion of the display cabinet,

Fig. 3 is an enlarged vertical section of the valves and their operating mechanisms used for controlling the refrigerant and the defrosting fluid flows, and

Fig. 4 is an enlarged horizontal section through the reversible pump used for pumping the warm defrosting fluid.

Like reference characters refer to like parts in the different figures of the drawings.

The cabinet in Fig. 1 has a bottom 1 and in

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practice, though the invention is not limited solely thereto, is of the open display type or character, similar to that shown in Design Letters Patent #140,198, issued upon the application of Jerry Tyler, January 30, 1945. In the lower part, and projecting forward from the upper part, there is a merchandise holding compartment, which is open at its top for access by a customer at the front when selecting the merchandise which is to be purchased. The vertical ends 2 of the cabinet, also at the vertical back and at the front upper part of the cabinet, are joined with horizontal, relatively narrow, top sections 3, from the inner edge portions of which vertical walls 4 extend downwardly, providing a well in which a part of the refrigerator mechanism used is located.

The evaporator coils 6 and 60 are located in the upper portions of the spaces between the ends 2 and the walls 4, inwardly thereof, as shown in Fig. 1. Vertical partitions 5 extend from the evaporators to the bottom of the cabinet, which at their lower portions have openings in which motor driven fans 7 are positioned. The merchandise racks 8 are located in the lower part of the cabinet, below the open upper side of the forwardly extending lower cabinet section. The two evaporator coils 6 and 60, two series of which are used, as shown, are substantially identical in structure (Fig. 2). Through the evaporator coils 6 the refrigerant fluid is circulated. The warm defrosting fluid is circulated through the coils 60, as hereafter described.

The compressor 9 of the refrigerating system is located in the described well and suitably supported, the refrigerant fluid being conducted thereto through a branch pipe 10 connected with a pipe 11, which connects at opposite ends with the outlet ends of the two refrigerant evaporator coils 6. The compressor forces the refrigerant fluid out through an outlet pipe 12 and thence through a coil 13, which is interposed in the length of the pipe 12, to the condenser 14, the refrigerant being delivered to a tank 15 around which the coils 13 are wound, as shown.

The refrigerant goes from the tank 15 through a connecting pipe 16 (Fig. 3) to a valve housing 17 which has two outlet lead pipes 18 connected therewith.

The valves in housing 17 and their operations in connection with the housing will be hereinafter described. When the valves are open, as shown in Fig. 3, the refrigerant passing through the pipe 16 will go through both of the outlet pipes 18 to automatic temperature controlled valves at 19,

one for each outlet pipe, which at all times supply the correct amount of refrigerant to the evaporators. The refrigerating fluid passes from the valves at 19 through pipes 20 to the entrance ends of the evaporator coils 6. The structure described is substantially standard in essentials in the usual refrigerating systems, except that the valves shown within the valve housing 17, in Fig. 3 are not used, but there is a direct open communication from a pipe at 16 to the outlet pipe or pipes at 18 without any intervening valve housing.

It is evident that air from the display compartment will enter below the lower edges of the walls 4 and pass upwardly and come in contact with the cold refrigerator evaporator coils 6 and its vapor moisture condensed and deposited on the coils. Defrosting is a well known necessary operation in conjunction with mechanical refrigerators. With refrigerators of the open display type mentioned, such defrosting, in general, will be required more frequently than, for example, with household refrigerators. It is very desirable that the defrosting be rapidly accomplished and with my invention, such rapid defrosting is attained.

Above the bottom of the well, a receptacle 21 is positioned within which, in the disclosure, a liquid 22 is held. The coil 13 is submerged in the liquid and also the tank 15 is partly submerged. Heat from the refrigerating fluid passing through the coil 13 is given off to the liquid, also heat from such fluid in the tank 15 raises the temperature of the liquid 22.

A gear pump 23 (Figs. 4 and 1) is submerged in the liquid 22 having inlet ports for the liquid to come to the gears. The pump is driven by an electric motor 24. Two outlet pipes 25, with suitable check valves 25a therein, lead from the tank 21 to the entrance ends of the two defrosting coils 60. From the outlet ends of the defrosting coils, pipes 26 return the liquid to the tank. The motor 24 is a reversible motor. In one direction of turning it circulates the defrosting liquid through one of the defrosting coils 60. Upon reversal it circulates the liquid through the other defrosting coil. The check valves 25a prevent circulation through the defrosting coil to which the liquid is not directly pumped.

The water from the melted frost which has deposited on the evaporator coils 6, upon defrosting, is caught by pan-like members 27 and drained through pipes 28 into the well mentioned, the lower side of which is shown as a pan 28a in Fig. 1. From the pan it may be drained to outside the cabinet.

As shown in Fig. 3, the valve housing 17 has two valves 29 which may close openings between the inlet pipe 16 and the outlets 18 when moved to upper positions. With each of said valves an armature 30 is connected, which is moved upwardly on passing an electric current through a solenoid winding 31, one associated with each of the armatures. The electric circuits leading to the two solenoid windings are independent circuits and each is adapted to be closed or opened by a suitable switch. The motor 24 is likewise controlled as to its starting and direction of turning by suitable manually or automatically controlled switch means for the purpose. The fans 7 also have their driving motors each in an independent circuit so that each may be independently controlled. The fans 7 when operating draw cold air downwardly outside of the vertical partitions 5 and deliver it below the merchandise

holding racks 8, the air circulating upwardly between the walls 4 of the well and said partitions, and thus over the refrigerating and defrosting coils. Warm air entering from the outside in front of the reflector or mirror 32, which is mounted below the bottom of the well, first must circulate around and through the coils 6 and 60 and will have its water vapor condensed and deposited on the coils.

It is apparent that the accumulation of frost on the evaporator and defrosting coils may be relatively rapid, and that a frequent defrosting should take place.

In the operation, one of the refrigerating coils is continued in operation while the other is defrosted. The solenoid winding 31 for lifting one of the valves 29 is energized by closing its solenoid winding circuit, whereupon the circulation of the refrigerant fluid to one of the refrigerating coils 6 is stopped. For example, if the valve 29 at the right in Fig. 3 was lifted to close the opening above it, refrigerating fluid would thereupon pass from the inlet pipe 16 outward only through the outlet pipe 18 at the left. After the selected valve 29 has been moved to closed position, the motor 24 is started in the proper direction of rotation to pump warm liquid 22 from the tank 21 through the defrosting coil 60 which is associated with and in close proximity to the refrigerating coil 6, the circulation of refrigerant fluid through which has been cut off. The warm liquid 22 circulated rapidly through the selected defrosting coil 60, gives off heat which melts the frost deposit on the refrigerant coil which, for the time, has no refrigerating fluid passing through it.

When a coil at one side has been defrosted, the closed valve 29 is released to move to its normal lower position, and the other valve 29 lifted by closing the circuit of its associated winding 31. This cuts off the refrigerating fluid from the coil 6, which has been operating while the defrosting of the other coil 6 took place. The motor is reversed, and the same circulation of the warm defrosting liquid through the other defrosting coil 60 occurs.

Of course, it is to be understood that if one end of the display case in which the apparatus is installed should be more subject than the other to the accumulation of deposited frost on its refrigerating coil, it can be more frequenly defrosted than the other, and there is no necessity of defrosting one refrigerating coil immediately after the other. Each is independently controlled as to its time of defrosting.

Defrosting may be done at any time during the day while the cabinet is open at the front and in use, with a continuous maintenance of the merchandise at a desired low temperature. If the defrosting liquid should be pumped through a defrosting coil 60 without closing one or the other of the valves 29, through inadvertence in operation, no damage would occur beyond a loss of refrigeration. But in the best operation, and the one which should be used, a valve 29 should be closed to stop refrigerant circulation to the evaporator coil 6 which is being defrosted, and the warm defrosting fluid pumped through its associated defrosting coil 60, while the other refrigerating coil continues in normal functional operation.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. In a structure as described, a merchandise

holding cabinet having a portion of the space therein adapted to contain merchandise, said merchandise holding portion being in the lower part of the cabinet, a mechanical refrigeration system including, a compressor, condenser, and two evaporators spaced from each other, each remote from the merchandise holding portion, with pipes for carrying a fluid refrigerant from the compressor through the condenser and to said evaporators and thence back to the compressor, means for circulating air to and over said evaporators, thence to the lower merchandise holding portion and back to the evaporators, valve control means between the condenser and said evaporators in the conduit leading to the evaporators selectively operable to stop fluid refrigerant circulation to a selected evaporator and continue such circulation to the other evaporator, a fluid holding receptacle, a pump therein, means to drive the pump, two conduits leading from the pump to said evaporators and back to the receptacle, said conduits at each evaporator having portions in close heat-exchange proximity to the evaporators, and means for controlling the pump operation to pump the fluid in said receptacle selectively through one only of said conduits leading from said pump.

2. A structure as defined in claim 1, the pipe connecting the compressor and condenser including a coil, and said fluid in said receptacle comprising a liquid in which the coil is submerged to raise the temperature of the liquid.

3. A structure as defined in claim 1, said means for driving and controlling the pump operation comprising a reversible electric motor.

CLIFFORD B. SHREVE.

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