April 14, 1942. M. G. SHOEMAKER 2,279,928

DOMESTIC REFRIGERATOR

Filed Sept. 21, 1940

Fig. 3.

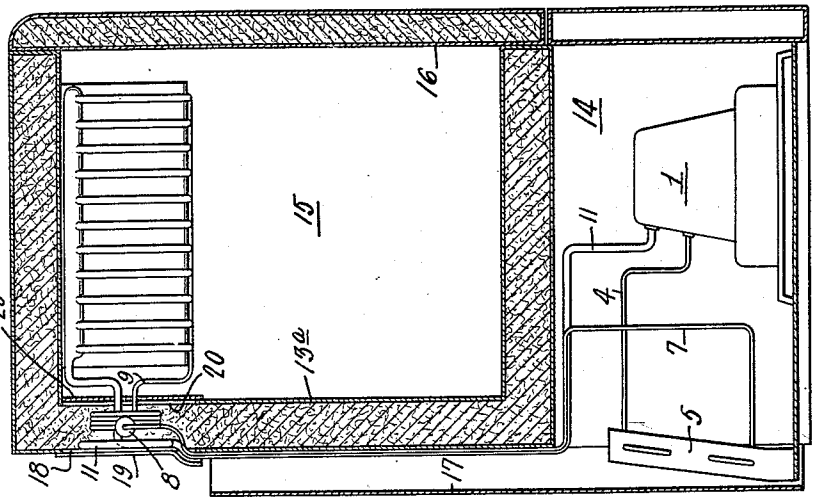


Fig. 2.

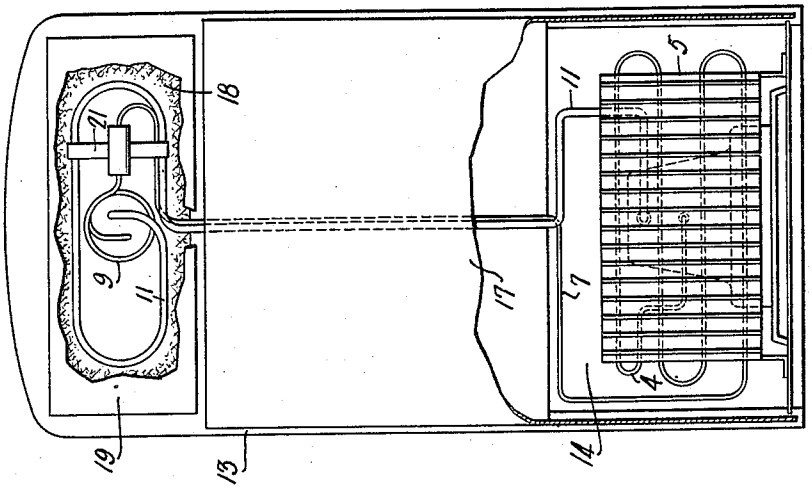


Fig. 1.

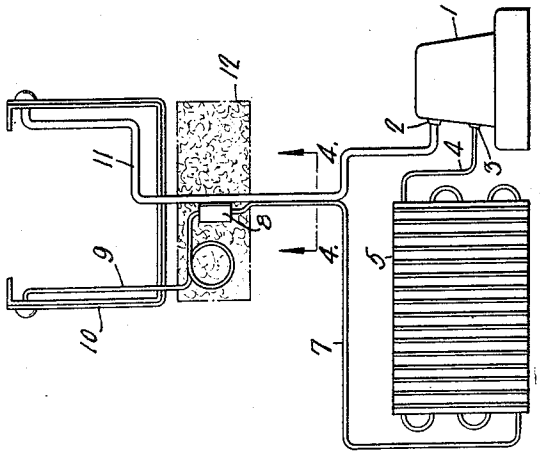
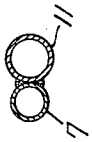


Fig. 4.



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UNITED STATES PATENT OFFICE

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DOMESTIC REFRIGERATOR

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Application September 21, 1940, Serial No. 357,815

4 Claims. (Cl. 62—116)

This invention relates to new and useful improvements in refrigerating apparatus for domestic refrigerators and more particularly to the refrigerant circulation system of such apparatus.

One of the essential elements of refrigerating apparatus of the type described is a drier or like element for dehydrating the refrigerant as the latter passes from the compressor to the evaporator. In the past, these driers or dehydrating elements have usually been located adjacent the refrigerant condenser and within the machinery compartment of the refrigerator cabinet where they are subjected to the heat generated and radiated by the motor compressor unit and the condenser in that compartment with the result that the temperature of the drier or dehydrating element often becomes so high as to render that element inoperative. This is so for the reason that the moisture retaining capacity of driers and like elements containing a dehydrant such as, for example, silica-gel, is somewhat inversely proportioned to their temperature. Furthermore, the temperature to which the refrigerant may be cooled in the condenser is dependent upon the temperature of the circulating air with the result that on hot summer days, and particularly in the case of condensers relying on natural draft cooling, the drier or dehydrating element may be warmed by the refrigerant passing to it from the condenser to an extent that it will give off moisture which it has previously absorbed and this moisture may pass into the capillary refrigerant flow control tube and thereby solidify causing a "block" in the refrigerant circulation system.

With the foregoing in mind, the principal object of the present invention is to provide a refrigerating apparatus for domestic refrigerators wherein substantially improved operating conditions are provided for the refrigerant drier or dehydrating element in the refrigerant circulating system.

Another object of the invention is to provide a novel refrigerating apparatus as set forth embodying in conjunction therewith an improved heat exchanger.

A further object of the invention is to provide a novel refrigerating apparatus of the type set forth whereby there is afforded more efficient and reliable operation of a domestic refrigerator employing a capillary tube as the refrigerant flow control device.

These and other objects of the present invention and the various features and details of the construction and operation thereof are hereinafter more fully set forth and described and shown in the accompanying drawing, in which:

Figure 1 is a diagrammatic representation of the refrigerant circulation system constructed in accordance with this invention;

Figure 2 is a rear elevational view of a refrigerator having a panel broken away to show one embodiment of the invention;

Figure 3 is a sectional view taken on line 3—3, Figure 2; and

Figure 4 is an enlarged section taken on line 4—4, Figure 1.

According to the present invention, I have found that the previously mentioned difficulties and objections encountered in connection with the operation of driers or dehydrating elements in the circulating system of refrigerating apparatus may be eliminated by locating such drier at a point removed from the heat generated by the compression machinery and by interposing a heat exchanger between the drier and the usual refrigerant condenser. By an arrangement such as this the warm condensed refrigerant is subcooled below the condenser temperature and in many cases even below the temperature of the ambient air with the result that the temperature of the drier and of the refrigerant therein is lowered appreciably and the capacity of the drier for retaining moisture may be materially increased.

With this in mind, and referring particularly to Figure 1 of the drawing, reference numeral 1 designates a motor compressor unit having a suction port 2 and a compressed refrigerant discharge port 3 to which is connected the intake 4 of a condenser 5. Refrigerant compressed in the unit 1 and discharged through its port 3 thus passes through the condenser 5 where it is condensed and then fed toward the usual evaporator through a feed line 7, the feed line 7 preferably having a diameter large enough so that no drop in the pressure of the refrigerant will occur therein.

This feed line 7 connects with a drier or like element 8 operable to dehydrate the compressed refrigerant, and this element 8 may be, for example, a cylindrical container having at each end a retaining screen or other perforate member and containing a suitable moisture absorbent such as, for example, silica-gel. Connected to and leaving from the drier 8 is a refrigerant flow restrictor or controlling device 9 of the conventional capillary tube type which leads to the inlet port or opening of an evaporator 10. A suction line 11 is connected between the outlet

opening of the evaporator 10 and the suction port 2 of the motor compressor unit thus providing a closed path for the circulation of refrigerant.

The capillary tube 9 essentially is of considerable length necessitating that it be helically or otherwise coiled, as indicated at 11, for a substantial portion of its length, and both this coiled portion 11 of said capillary 9 and the drier 8 are preferably disposed within suitable insulation 12 as shown which, for example, may represent the insulated rear wall of a domestic refrigerator cabinet as hereinafter more clearly described.

In a refrigerating system such as the foregoing, it is the function of the drier 8 to absorb moisture from the circulating refrigerant, and this is a most important function for if all moisture is not removed from the refrigerant the moisture which is not removed may freeze and solidify in the capillary tube 9 thereby causing a "freeze-up" or stoppage of the circulation through the system.

In accordance with the present invention the condensed refrigerant feed line 7 and the drier 8 are disposed in heat exchange relation with the aforesaid suction line 11 thereby causing the warm condensed refrigerant in said feed line 7 to be sub-cooled below the temperature of the condenser and even the ambient air by the cold refrigerant in the suction line 11, and also causing the drier 8 to be cooled and thereby effect a material increase in the moisture retaining capacity of said drier. The suction line 11 and condensed refrigerant feed line 7 may be disposed in metallic heat exchange relation by soldering, brazing or otherwise securing the two together (see Figure 4) for a substantial portion of their length and terminating after they enter the insulation 12 as shown in Figure 1.

One application of the present invention in a domestic refrigerator is illustrated in Figures 2 and 3 of the drawing, and in the particular embodiment there shown the refrigerator comprises a cabinet structure 13 having a machine compartment 14 and a food storage compartment 15 to which access may be gained by opening the usual door 16. Located within the aforesaid machine compartment 14 is the motor compressor unit 1 and the condenser 5, the latter being disposed across the rear of the said compartment 14 and projecting into a vertical flue 17 upwardly through which air naturally circulates to cool the said condenser 5.

From the condenser 5 the refrigerant feed tube 7 extends upwardly along the exterior of the rear wall of the cabinet 13 and then extends inwardly of the cabinet rear wall structure through an opening 18 which is normally closed by means of a removable panel 19. The inner wall or liner 13a of the cabinet 13 is provided with an opening 20 in alignment with said opening 18, and said opening 20 will normally be closed by a removable panel of suitable form as shown at 20a.

Upon entering the cabinet rear wall structure as aforesaid, the refrigerant feed tube 7 connects with the drier 8, and the capillary tube 9 leads from said drier 8 to the evaporator 10 which is positioned within the cabinet food storage compartment 15 adjacent the aforesaid rear wall openings 18 and 20 as illustrated.

The suction line 11 which connects between the evaporator outlet and the inlet 2 of the compressor unit 1 is preferably coiled at least once within the cabinet rear wall structure intermediate the openings 18 and 20, as shown, before said suction line 11 passes out of the cabinet and downwardly along the exterior of its rear wall to the compressor unit.

As aforesaid, the suction and feed lines 11 and 7, respectively, are disposed in heat exchange relation with respect to each other throughout or along a substantial portion of their length, preferably from the point where they leave the machinery compartment 14 until a relatively short distance after they enter the cabinet rear wall.

As illustrated, the drier 8 is preferably supported by means of a bracket 21 secured across the convoluted portion of the suction line 11, and this bracket 21 serves as a heat exchanging medium between the said drier 8 and the said suction line 11 whereby the former is cooled by the latter. As previously stated, the excess length of the capillary tube 9 is preferably coiled as indicated at 11 and this coil may be positioned within the cabinet rear wall structure as illustrated. It is to be understood, of course, that the various elements of the apparatus that are disposed in the cabinet rear wall structure between the openings 18 and 20 normally are surrounded and covered by suitable heat insulating material which may be packed about and between the parts before securing in place the removable cover panel 19.

From the foregoing it will be seen that the present invention provides a novel refrigerating apparatus wherein the warm condensed refrigerant is sub-cooled below the condenser temperature and even below the temperature of the ambient air. Too, the arrangement provides for cooling the drier element proper with the result that the temperature of the drier and of the refrigerant therein is lowered appreciably and the capacity of said drier for retaining moisture is materially increased. Thus it will be seen that there is obtained more efficient and reliable operation of a domestic refrigerator.

While a particular embodiment of the present invention has herein been illustrated and described, it is not intended that said invention be limited to this disclosure but that changes and modifications may be made and incorporated therein and thereto within the scope of the annexed claims.

I claim:

1. Refrigerating apparatus comprising, in combination, a heat insulated cabinet including a food storage compartment and a mechanism compartment, an evaporator in said food storage compartment, a compressor and a condenser in said mechanism compartment, a suction conduit connecting said evaporator and said compressor, a refrigerant feed line connecting said condenser to said evaporator, and a moisture retaining unit in said feed line and embedded in the insulation of said cabinet, at least a portion of said feed line between said condenser and said unit being in heat exchange relation with said suction line.

2. Refrigerating apparatus comprising, in combination, a heat insulated cabinet including a food storage compartment and a mechanism compartment, an evaporator in said food storage compartment, a compressor, and a condenser in said mechanism compartment, a suction conduit extending between said evaporator and said compressor, and a feed line for conducting refrigerant from said condenser to said evaporator, said feed line including a feed conduit extending from said condenser, a moisture retaining ele-

ment, and a capillary tube extending to said evaporator, said suction and feed conduits being in heat exchange relation and said moisture retaining element and a substantial portion of said capillary tube being embedded in the heat insulation of said cabinet.

3. Refrigerating apparatus comprising, in combination, a heat insulated cabinet including a food storage compartment and a mechanism compartment, an evaporator in said food storage compartment, a compressor and a condenser in said mechanism compartment, a suction conduit extending between said evaporator and said compressor, and a feed line for conducting refrigerant from said condenser to said evaporator, said feed line including a feed conduit extending from said condenser, a moisture retaining element, and a capillary tube extending to said evaporator, a portion of said suction conduit and said moisture retaining element being embedded in the heat insulation of said cabinet and in heat exchange relation with each other.

4. Refrigerating apparatus comprising, in combination, a heat insulated cabinet including a food storage compartment and a mechanism compartment, an evaporator in said food storage compartment, a compressor and a condenser in said mechanism compartment, a suction conduit extending between said evaporator and said compressor, and a feed line for conducting refrigerant from said condenser to said evaporator, said feed line including a feed conduit extending from said condenser, a moisture retaining element, and a capillary tube extending to said evaporator, both said suction and feed conduits extending for a considerable distance outside said cabinet and being in heat exchange relation with each other for a substantial portion of said distance, and a portion of said suction conduit and moisture retaining element and a substantial portion of said capillary tube being embedded in the heat insulated cabinet, said capillary tube and the suction conduit being in non-heat exchange relation with each other.

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