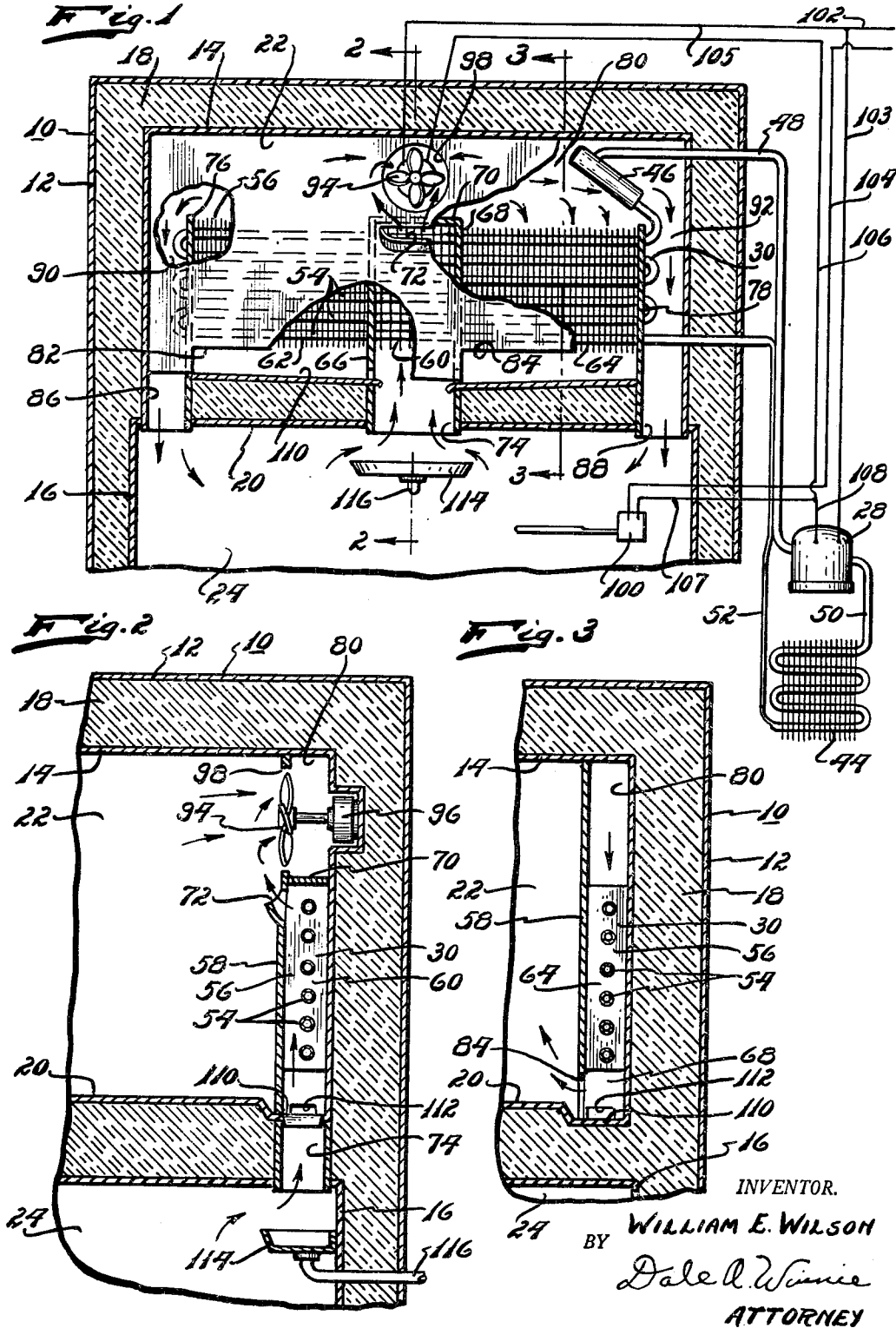


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REFRIGERATING APPARATUS—SINGLE EVAPORATOR

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This invention relates to refrigerating apparatus in general, and more particularly to two temperature refrigerators having a single evaporator.

Almost all refrigerators which have two separate food storage compartments, required to be maintained at different temperatures, make use of completely separate evaporators and refrigerating systems. One reason for doing this is to avoid the problems of frost accumulation and defrost which would otherwise be expected.

An evaporator in the provision compartment of a refrigerator would be subject to more frost accumulation if the temperatures were lower because of the higher humidity of the air in the provision compartment. This is due to liquids and uncovered foods which are kept in the above freezing temperature compartment in comparison to the unopened and well wrapped packages that are stored in a freezer compartment space.

At the same time, the evaporator in a freezer compartment cannot be defrosted between compressor cycles, as the evaporator in the provision compartment can, but special attention is required because of the greater temperature differential necessary to remove accumulated frost.

From just these two general comments, it will be appreciated that the different conditions prevailing in the different compartments of a two temperature refrigerator have made the use of separate evaporators seem most practical.

Despite the seeming obstacles, there is an obvious savings in cost to be realized in having only one evaporator instead of two and additional factors are foreseeable in easier installation, service and maintenance, better utilization of space, the possibilities of circulating and comingling air of different temperatures in the different compartments for certain advantages, etc. Consequently, for these and other reasons the practical use of a single evaporator in a two temperature refrigerator has remained of continuing interest to refrigeration engineers.

It is an object of this invention to provide a single evaporator for use in a two compartment refrigerator and where the compartments are required to be maintained at different temperatures.

It is an object of this invention to provide an evaporator which includes divisional sections that may be used for different purposes.

It is an object of this invention to provide a single evaporator for use in one of two different temperature compartments of a refrigerator and to make use of forced air circulating means for maintaining desired temperatures in the other refrigerator compartment.

More particularly, it is an object of this invention to provide an evaporator which may be disposed in a freezer compartment, and preferably against the back wall, where it takes very little space, rather than directly in either the back wall or compartment dividing wall where insulation thickness must be reduced.

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It is an object of this invention to provide a single evaporator mounted within but separate from the freezer space and which is vertically oriented so that it takes less usable space in a refrigerator, is better situated for forced air circulation therethrough and enables much more convenient condensate drip control.

It is an object of this invention to provide temperature responsive means for control of the flow of refrigerant through the single evaporator within a compartment area of the refrigerator separate and apart from where the evaporator is itself disposed.

It is an object of this invention to provide means for using the warmest air in the coolest compartment of a two temperature two compartment refrigerator to maintain low temperatures in a normally higher temperature compartment.

More particularly, it is an object of this invention to use forced air circulating means, including a vent fan and suitable duct work, for better utilization of the cold and cool air in a two temperature two compartment refrigerator, and for most efficient desiccation and co-mingling thereof for maximum advantage.

It is an object of this invention to provide an evaporator adapted to serve a dual purpose and including parts thereof having the heat dissipating fins spaced differently.

It is an object of this invention to provide an evaporator which may have different parts of different surface area, in a high pressure low temperature area, and other parts in a low pressure and even lower temperature area for certain advantageous purposes later described.

These and other objects and advantages to be gained in the practice of this invention will be better understood and further appreciated upon the reading of the following specification having reference to the accompanying drawings.

In the drawings:

FIGURE 1 is a fragmentary sectional view of the top part of a refrigerator cabinet embodying features of the present invention and showing a schematic arrangement of a refrigeration system used therewith.

FIGURE 2 is a cross sectional view of the part of the refrigerator cabinet shown by FIGURE 1 as seen substantially in the plane of line 2—2 thereof.

FIGURE 3 is a cross sectional view of the part of the refrigerator cabinet shown by FIGURE 1 as seen substantially in the plane of line 3—3 shown thereon.

The refrigerator cabinet 10 is shown to include an outer shell wall 12 and to have a provision compartment forming liner 16 and a freezer compartment forming liner 14 provided therein. Both compartment forming liners are separated from the outer shell wall 12, and from each other, by suitable thermal insulation 18. It will be appreciated that this forms a divider wall 20 between the freezer compartment space 22 and the provision storage compartment space 24.

The refrigerating apparatus 26 is shown schematically to include a motor-compressor 28, and evaporator 30, a condenser 44 and an accumulator 46.

The motor compressor unit 28 is located apart from the two compartment areas, as in the back of the refrigerator, and is connected to the evaporator 30 by a conduit line 48 which has the accumulator 46 connected therein.

The motor compressor unit is connected through another

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conduit 50 to the condenser 44. The evaporator 30 and condenser 44 are connected together through a capillary tube 52.

The evaporator 30 is of a conventionally known type which includes a serpentine coil 54 extending back and forth through spaced thin fin walls 56. It is disposed vertically against the back wall of the freezer compartment 22 and is separated therefrom by a vertically disposed wall 58. The evaporator is divided into essentially two sections which include a center section 60 and a pair of outer disposed sections 62 and 64 which serve the same purpose.

The center section 60 of the evaporator 30 has less fins per inch than the other sections and is enclosed behind the separator wall 58 by side walls 66 and 68 with a top wall 70 connected therebetween. An opening 72 is provided through the separator wall near the top of the enclosed center section space for open communication with the freezer compartment space 22. A passageway 74 is provided through the divider wall 20 for open communication between the lower end of the enclosed mid-section of the evaporator and the provision compartment space 24.

The outer disposed sections 62 and 64 of the evaporator, with closely spaced fins, are provided between walls 76 and 78 about the return bends of the evaporator coil and the mid-section forming walls 66 and 68. They are in open communication with a chamber area space 80 across the top of the evaporator space. They are also in communication with the freezer compartment 22 through openings 82 and 84 provided in the separator wall near the bottom of the compartment space.

In addition to the passageway 74 which connects the freezer and provision compartments, passages 86 and 88 are provided through the divider wall at the far ends of the evaporator space. These communicate with passages 90 and 92 formed by the walls 76 and 78 and the end walls of the evaporator space. They are open at their upper ends to the chamber area 80.

A small fan 94 and motor 96 are provided in a chamber area space 80 with the fan in an opening 98 provided in the divider wall 58 and directly over the opening 72 to the mid-section of the evaporator. The fan motor 96 is connected in series with a temperature responsive control 100 which is operatively disposed in the provision compartment space 24. Both are in turn connected in parallel to the motor-compressor 28.

The electrical leads from the power supply source include conductors 102 and 103 directly to the motor-compressor 28 and electrical leads 104, 105, 106, 107 and 108 to and between the fan motor and the temperature responsive control element.

Referring to the different drawing figures, it will be appreciated that a drip trough 110 is provided under each of the evaporator sections 62 and 64 and that these troughs are inclined towards the center passageway. Further, the drip troughs 110 communicate with the center passageway through openings 112 in the baffle walls 66 and 68. A drain pan 114 is provided under the center passageway and a conduit 116 is connected thereto to carry away any excessive condensation which is collected therein. From the discussion which follows, it will be appreciated that the forced circulation of air from a provision chamber to the freezer compartment is around and over the drain pan 114 for preventing the freezing of any condensate which is collected therein.

The two compartment two temperature refrigerator with the single evaporator which has been shown and described operates in the following manner:

The temperature responsive control element 100 senses a rise of temperature in the provision compartment space 24 and closes electrical contacts to start the fan motor 94 and the motor-compressor 28. The motor-compressor begins cycling refrigerant in the normal manner through the evaporator coils 30 and the condenser coil 44.

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The vent fan 94 draws air from the freezer compartment space 22 and from the center section of the enclosed evaporator space through opening 72 communicating therewith. The different temperature air from the two spaces is co-mingled and mixed in the chamber area space 80 on the high pressure side of the vent fan. From there it is directed outwardly and down over the evaporator sections 62 and 64. Also, part of the mixed provision space and freezer compartment air from the chamber area 80 is directed further outward and down through passages 90 and 92 back into the provision compartment space 24.

Air circulated by the fan 94 is drawn into and over the center section 60 of the evaporator through the passage opening 74 connecting to the provision chamber. The more humid air from the provision chamber space is passed over the center section of the evaporator which has the wider fin spacing so that frost accumulation will not interfere with the air circulation therethrough.

The fan creates a low pressure area on the freezer compartment side thereof which draws both freezer air and air from the evaporator chamber area opening 72. Accordingly, the air from the top of the provision chamber space 24 is mixed with the air in the freezer space, which will be cooler, and then both are passed either over the outer disposed sections of the evaporator coils, for further cooling before being reintroduced to the freezer, or are returned to the provision chamber space through the end passages 86 and 88.

Essentially all of the moisture in the air from the provision chamber space 24 is removed as it passes through the center section of the evaporator 30. However, in defrosting the outer sections of the evaporator coil provision must be made to collect condensate and this is done by the drip troughs which carry drainage through the openings 112 back to the air stream through the center section of the evaporator. The drain pan 114 collects excessive condensate and carries it off through the conduit 116 in the conventional manner.

The provision chamber air is cooled both by passage over the center section of the evaporator coils and co-mingling with some of the freezer air. The freezer air is not, however, appreciably raised in temperature by its mixing with the provision chamber air because it is passed over the outer sections of the evaporator coil before being reintroduced into the freezer space.

From the foregoing it will be appreciated that a single evaporator may be used to service two separate compartments in a refrigerator cabinet and to maintain such compartments at respectively different temperature levels. The arrangement of the single evaporator within the back of the freezer compartment space takes very little room. There is no significant sacrifice of insulation thickness and the vertical disposition enables much easier handling of condensate and defrost problems.

The disposition of the single evaporator in the freezer compartment, with the temperature sensing control in the provision compartment space, precludes activating the system by temperature differences in the freezer compartment which would adversely affect temperature conditions in the provision compartment.

Certain obvious advantages are obtained in the simplified construction and installation afforded by the structure shown and described.

Although a preferred embodiment of this invention has been shown and described, it will be appreciated that certain modifications and improvements therein are foreseeable and are within the scope of the invention set forth and taught herein. Accordingly, such modifications and improvements as are not specifically excluded by the language of the hereinafter appended claims are to be considered as encompassed within such claims.

I claim:

1. A refrigerator having a low temperature zone and a higher temperature zone, and comprising;

means located in the low temperature zone and having high and low heat absorbing characteristics, means for circulating air from the higher temperature zone over the means having low heat absorbing characteristics and for co-mingling said air with other air in said low temperature zone,

said air circulating means also returning part of said co-mingling air directly to said higher temperature zone and passing the other part of said air through said low temperature zone and over the means having high heat absorbing characteristics for lowering the temperature thereof even further.

2. A refrigerator including separate compartments required to be maintained at different temperatures and comprising;

a single heat absorbing means provided in one of said different temperature compartments,

passage means connecting the other of said different temperature compartments to said one temperature compartment,

said passage means including a low temperature air inducting passage, a temperature reducing passage and a return passage,

said low temperature air inducting passage having said heat absorbing means extended laterally there-through,

said heat absorbing means within said air inducting passage being modified for low heat absorbing characteristics,

forced air circulating means provided within said passage means between said low temperature air inducting passage and the other passages thereof for providing low pressure and high pressure conditions on opposite sides thereof, respectively,

said temperature reducing passage having opposite ends opening in said one temperature compartment and the end of said air inducting passage conveying air from the other of said compartments thereto for co-mingling with said one temperature compartment air therein,

said heat absorbing means being extended also through said temperature reducing passage for receiving co-mingled air thereover,

and said return passage being provided in open communication with said temperature reducing passage on the high pressure side of said air circulating means and for conveying said co-mingled air to the other of said compartments.

3. A two temperature refrigerator, comprising;

a refrigerator cabinet having two separate insulated compartments including a low temperature freezer compartment and a higher temperature provision storage compartment,

said freezer compartment being provided vertically over and above said provision storage compartment,

a single fin surfaced evaporator for circulating refrigerant and maintaining desired low temperatures in both of said compartments,

said evaporator being vertically disposed in said freezer compartment next adjacent the back wall thereof and having two different heat absorbing portions provided thereby,

a wall separating said evaporator from said freezer compartment except near the bottom thereof and duct work cooperating therewith in providing separate and distinct passageways over different parts of said evaporator and for communication with said provision storage compartment,

one of said passageways being provided between said freezer and provision compartments near the back wall of the refrigerator cabinet and enclosing one of said two different heat absorbing portions of said evaporator therein,

said enclosed evaporator portion having less heat transfer surface area than the other portion thereof for

relatively less change in the temperature of air passing thereover and maximum frost accumulation thereon,

said one passageway being open to said freezer compartment near the top thereof for introducing air from the top of said provision storage compartment to said freezer compartment,

a chamber area provided over said evaporator behind said separating wall and extending substantially the full width of said freezer compartment,

an air circulating fan mounted in said separating wall and having the high pressure side thereof provided in said chamber area,

said fan being in air suction communication with the open end of the passageway in said freezer which connects to said provision storage compartment and in general air drawing communication with the low temperature air in said freezer compartment,

said chamber area being adapted to receive and co-mingle the provision storage compartment and freezer compartment air prior to continued circulation thereof,

parallel spaced passageways provided part on each side of said last mentioned passageway and enclosing the other of said heat absorbing evaporator portions,

said parallel spaced passageways being open to said co-mingling chamber area and through the bottom of said separating wall to said freezer compartment,

return passageways provided outward of said parallel spaced passageways and having opposite ends in open communication with said co-mingling chamber area and said provision storage compartment,

said air circulating fan distributing part of said co-mingled air through said parallel spaced passageways to said freezer compartment and part thereof to said provision storage compartment,

and temperature responsive means provided in said provision storage compartment and operatively connected to said circulating fan and refrigerant circulating means of said evaporator for responsive temperature surveillance thereby.

4. In a refrigerator having a single evaporator and separate compartments to be maintained at different operating temperatures, the improvement comprising;

passage means for transferring refrigerated air from the higher temperature maintaining one of said compartments to the lower temperature maintaining one thereof,

means for co-mingling the transferred air with air from the lower temperature maintaining compartment,

passage means for returning part of the co-mingled air directly to said higher temperature maintaining compartment and part to the lower temperature maintaining compartment,

and said evaporator being disposed partially within said first mentioned passage means and partially within the passage means for returning co-mingled air to said lower temperature maintaining compartment.

5. The single evaporator refrigerator of claim 4, including;

said evaporator having the center section thereof provided in said first mentioned passage means and the ends thereof in the passage means for returning co-mingled air to said lower temperature maintaining compartment.

6. The single evaporator refrigerator of claim 5, said evaporator being disposed vertically and provided behind the lower temperature maintaining one of said compartments,

and said passage means for returning co-mingled air directly to said higher temperature maintaining compartment being provided over and apart from said evaporator.

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7. The single evaporator refrigerator of claim 4, said co-mingling means including an air circulating fan provided at the intake end of said air returning passage means with the suction side thereof exposed in said lower temperature maintaining compartment. 5
8. The single evaporator refrigerator of claim 7, said transferring passage means terminating in the lower temperature maintaining compartment immediately next adjacent the intake end of said returning air passage means.

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