United States Patent

Lichtenberger

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[54] REFRIGERATION APPARATUS

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[51] **Int. Cl.** **F25d 21/00**

[58] **Field of Search** 62/80, 151, 152, 197, 272, 62/275, 276

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[57] **ABSTRACT**

A refrigeration apparatus for chilling a storage chamber comprising air moving means for moving air through an air permeable refrigerant evaporator for chilling air flowing into the chamber and a duct air bypass exteriorly of the evaporator for flowing air around the evaporator in the region of the air entrance thereto and then back into the evaporator prior to the exit thereof in order to provide continuous flow and chilling of air through the exit portion of the evaporator in spite of frost accumulation on the evaporator. A method of chilling air in a storage space comprising directing the air from the space through a subfreezing chilling means having an entrance and an exit and bypassing the air around this entrance and back into the chilling means upon accumulation of frost at the entrance with the result that the chilling of the air is continued during the accumulation of the frost and prior to its eventual removal.

6 Claims, 2 Drawing Figures

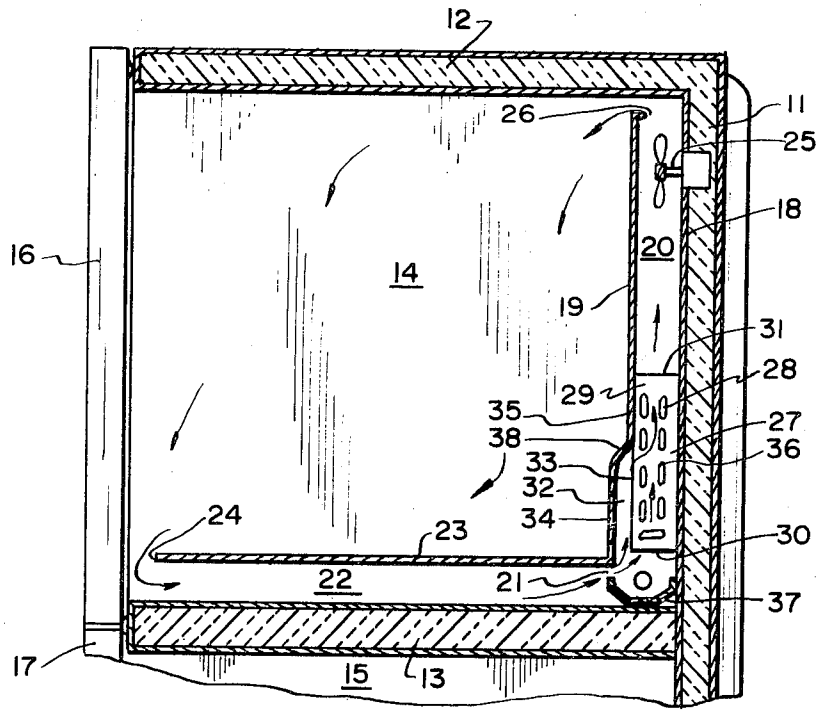


FIG.1

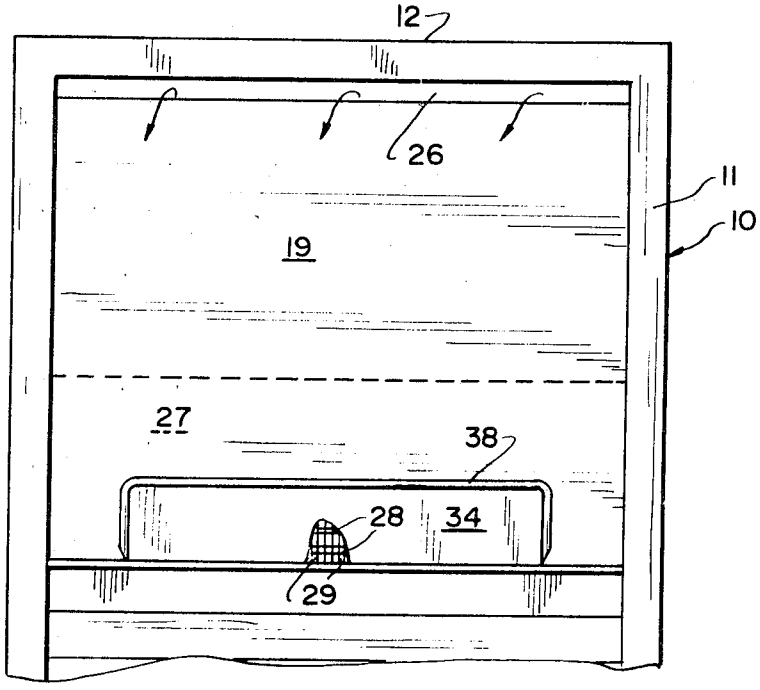
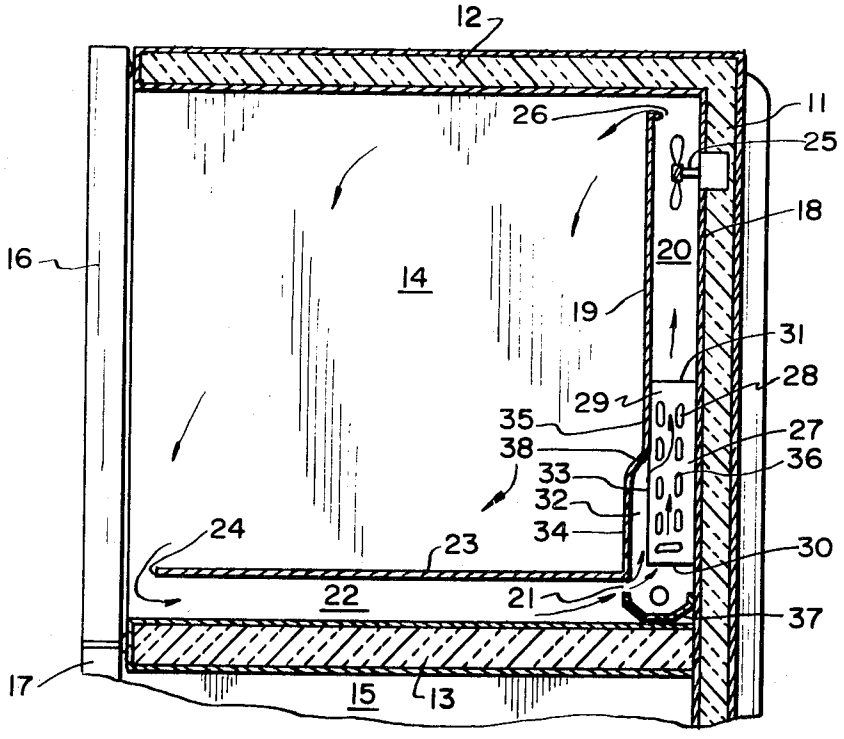


FIG.2



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REFRIGERATION APPARATUS

BACKGROUND OF THE INVENTION

It is common practice in refrigeration apparatus to direct air from the space being chilled through a duct containing a refrigerant evaporator for chilling the air and then from the duct back into the space and from there back into the duct again to complete the circuit. This is a general type of refrigerating apparatus whether the chilling is to a subfreezing temperature in a freezer storage chamber, to an above freezing temperature in a chamber where food is maintained temporarily before use or in an apparatus that combines both types of chambers. In such an apparatus the airflow through the evaporator or chilling means is more or less interrupted by the accumulation of frost on the evaporator.

SUMMARY OF THE INVENTION

One of the features of this invention is to provide an air bypass in the chilling air duct but with this bypass being located only in the region of the entrance of air to the evaporator or subfreezing chilling means and then following this entrance and before the exit of air from the evaporator directing the air back into the evaporator for further chilling prior to passage back into the storage chamber.

As a preferred feature of the invention, the bypass means is provided by an embossment in a panel that defines one side of the chilling air duct with this embossment having an entrance portion spaced from the air entrance to the evaporator to provide the bypass and the adjacent portion of the panel being located against the evaporator so as to direct the air that flows through the bypass back into and through the evaporator in the areas adjacent the exit thereof for further chilling of the air.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top front elevational view of a freezer-refrigerator embodying the invention but with the front doors omitted for clarity of illustration.

FIG. 2 is a vertical transverse sectional view of the apparatus of FIG. 1 and showing the nearer end of the vertically arranged evaporator in end elevation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus illustrated in the accompanying drawings comprises a refrigerator-freezer **10** having the usual side **11** and top **12** insulated walls and a horizontal insulated mullion or divider wall **13** dividing the interior of the unit **10** into a top freezer storage chamber **14** and a bottom refrigerator storage chamber **15**. Each of these chambers **14** and **15** is adapted to be closed by its front opening door **16** and **17** which are of customary construction.

Spaced forwardly of a liner **18** that comprises the inner surface of rear wall **11** is a vertical panel **19** so as to define with this rear liner **18** an airflow duct **20** for chilled air.

This duct **20** has an air inlet **21** at the bottom of the duct communicating with a horizontal air passage **22** above the dividing mullion **13** with the top of this passage **22** being defined by a horizontal plate **23** that provides an air entrance **24** at the front of plate **23** for flow of air from the chamber **14** into the front of the passage **22** and then rearwardly to the inlet **21** and into the bottom of the duct **20**.

Located in the airflow duct **20** adjacent the top thereof is an air moving means here shown as a motor driven fan **25**. The top of the panel **19** is spaced from the top of the freezer chamber **14** so as to provide a duct air outlet **26** above the fan **25**.

Located at the bottom of the duct **20** is an air permeable refrigerant evaporator **27** of the customary type that comprises a serpentine refrigerant tube **28** and spaced vertical fins **29** so that airflow through the evaporator **27** will be between the fins and over the tubes as illustrated by the broken away portion of FIG. 1.

This evaporator is located adjacent the bottom of the duct **20** and has a bottom air entrance **30** adjacent the inlet **21** to the air duct and a top air outlet **31**. As shown in FIG. 1, the evaporator **27** extends substantially the full width of the air duct **20** so that substantially all the air in the duct must pass through the evaporator and practically none around the ends thereof.

The air duct **20** also includes bypass means **32** adjacent its bottom for flowing air around the evaporator entrance **30** and back into the evaporator at a side **33** thereof ahead of the evaporator exit. As can be seen in FIG. 2, this bypass means is substantially parallel in its airflow direction to the airflow through the evaporator **27**. In other words, in both the evaporator and the bypass in the illustrated embodiment the airflow is generally upwardly.

In the illustrated embodiment the bypass means **32** is provided by an inwardly directed (as related to chamber **14**) embossment **34** that is spaced from the adjacent side **33** of the evaporator to provide the bypass passage **32**. This embossment **34** which is located adjacent both the inlet **21** to the air duct **20** and the entrance **30** at the bottom of the evaporator **27** is joined to another panel area **35** immediately above it that is positioned against the side **33** of the evaporator adjacent the outlet **31** thereof so that the shaped panel **19** not only provides for the bypass **32** but also directs the air from the bypass back into the interior of the evaporator **27** ahead of the exit **31** of the evaporator.

The evaporator **27** is of course subjected to frost accumulation or buildup which must be periodically removed for proper operation of the apparatus. This frost removal is at periodic intervals and may be accomplished by an electrically heated wire as illustrated at **36** that is arranged in heat-transfer relationship with the refrigerant tube **28** and the heat-transfer fins **29**.

When the air from the storage chamber **14** is directed through the evaporator **27** from entrance **30** to and through exit **31** the initial accumulation of frost is at the entrance **30**. During the refrigeration portion of the cycle the frost continues to build up to a greater degree not only at the entrance but rearwardly toward the exit **31**. Then, during the defrost portion of the operating cycle this frost is melted and removed in the form of water which is conveyed outwardly by means of a collecting trough **37**. The bypass passage **32** of this invention directs the air in the air circulation system around this entrance **30** when the frost accumulation reaches the stage where it could seriously interfere with airflow.

However, in order that chilling of the air will not be interrupted materially prior to the defrosting portion of the operating cycle the bypass terminates approximately intermediate entrance **30** and exit **31** of the evaporator as indicated by the inclined top boundary portion **38** of the bypass **32** so that this bypass air is directed back into the evaporator nearer the exit end thereof where the frost accumulation is relatively small. Thus with this arrangement not only is the airflow volume maintained by flowing the air through the bypass **32** around the frost clogged entrance **30** but this air is also chilled by passing it through the portion of the evaporator that has a lesser amount of frost accumulation even at the end of the refrigeration portion of the cycle.

Thus in the method of this invention the air is directed from the storage space through an air permeable subfreezing chilling means having an entrance and an exit for the air and then back into the space thereby accumulating frost on the chilling means initially at the entrance, periodically removing this frost from the chilling means and bypassing the air around this entrance and back into the chilling means prior to the exit therefrom after the frost accumulation and prior to its removal. The apparatus and method of this invention therefore provides for continuing the chilling of the air even during the accumulation of the frost in an efficient manner because the air is chilled and simultaneously maintained at a high volumetric flow rate even during periods of frost accumulation.

Having described my invention as related to the embodiments shown in the accompanying drawings, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Refrigeration apparatus, comprising: a cabinet including a plurality of walls defining a storage chamber; a panel spaced from one said wall defining one side of an airflow duct having an air inlet for air from said chamber and an air outlet to said chamber spaced from said inlet; air moving means for moving air in said duct between said inlet and outlet; and air permeable refrigerant evaporator in said duct having an air entrance and air exit for chilling air flowing in said duct and through the evaporator; and means defining an air bypass passage exposed to a side of said evaporator extending from said entrance and having flow conducting characteristics correlated with the flow conducting characteristics of said evaporator at said entrance such that air flows around said entrance and into the evaporator at said side thereof substantially only upon frost buildup at said entrance, said bypass means having its inlet adjacent said evaporator entrance and being elongated substantially parallel to the airflow in said evaporator to have the area of the bypass passage exposed to said evaporator side be substantially greater than the cross-sectional area of the inlet to said bypass passage at said evaporator entrance.

2. The apparatus of claim 1 wherein said bypass means comprises an embossed area of said panel spaced from said evaporator side.

3. The apparatus of claim 2 wherein said embossed area is adjacent another panel area that is positioned against the side of said evaporator, thereby directing bypass air into the evaporator.

4. The apparatus of claim 1 wherein said evaporator extends substantially the full width of said duct.

5. The apparatus of claim 1 wherein said evaporator entrance and bypass are located at said duct inlet.

6. The apparatus of claim 5 wherein said bypass means comprises an embossed area of said panel spaced from said evaporator, and said embossed area is adjacent another panel area that is positioned against the side of said evaporator, thereby directing bypass air into the evaporator.

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