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3,522,712

SNOW FREE FORCED AIR REFRIGERATOR

Filed July 5, 1968

FIG. 1

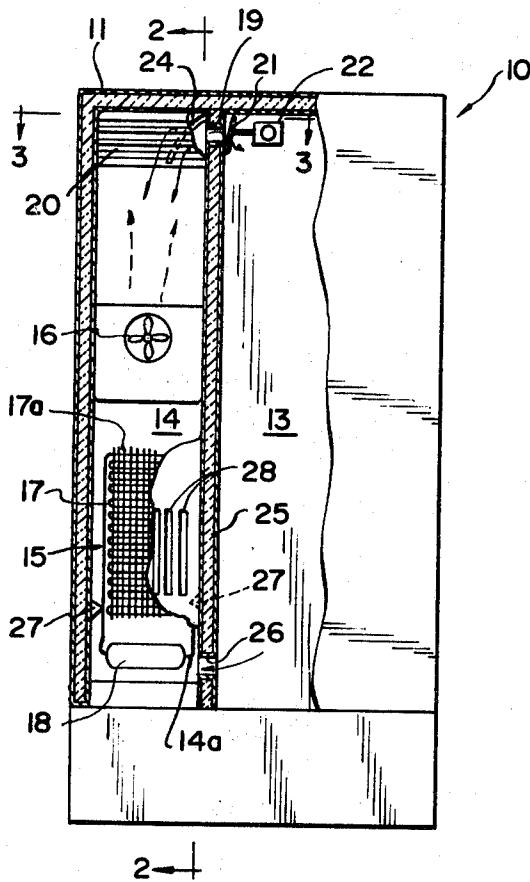


FIG. 2

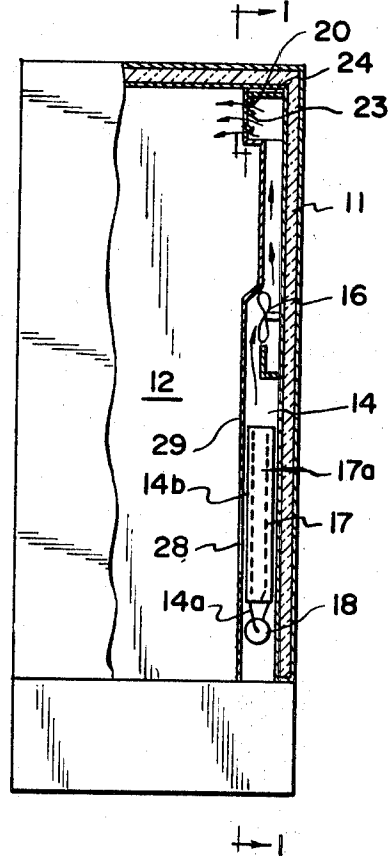


FIG. 3

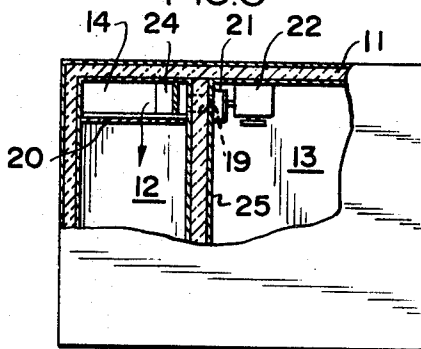
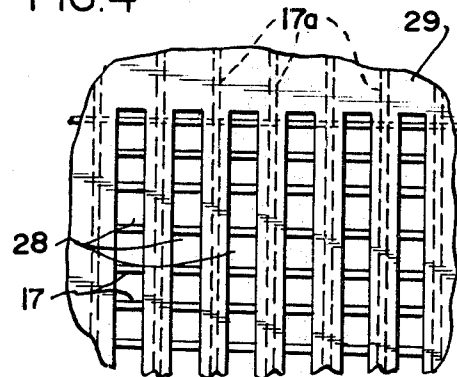


FIG. 4



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SNOW FREE FORCED AIR REFRIGERATOR

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14 Claims

ABSTRACT OF THE DISCLOSURE

A combination side-by-side freezer-refrigerator having a forced air circulation system wherein the moist refrigerator air is firstly cooled by a portion of the evaporator and secondly mixed with colder, dry freezer air to pass therewith in heat transfer association with the remainder of the evaporator for recirculation to the freezer and refrigerator spaces.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to refrigeration apparatus, and, in particular, to combination freezer-refrigerator appliances of the side-by-side type.

Description of the prior art

A number of refrigeration apparatuses of the side-by-side freezer-refrigerator type have been developed utilizing forced air circulation means for refrigeration of the freezer and refrigerator spaces. An example of such an apparatus is that disclosed in the U.S. Pat. No. 3,364,696. A problem arising in such freezer-refrigerator apparatuses is the production of snow-type frost as a result of mixing relatively moist refrigerator space air with substantially colder freezer space air as it is delivered to the evaporator space. Such snow formations build up front rapidly on the evaporator thereby requiring frequent defrosting and causing an overall reduction in efficiency of the apparatus.

Such frosting, for example, may occur in the structure of the above indicated exemplary Maxwell patent apparatus as a result of the delivery of the relatively moist air from the refrigerator space 14 into the lower end of the evaporator chamber where it is contacted by the relatively cold air delivered into the evaporator space through the lowermost opening 58 comprising the inlet to the evaporator space from the freezer space 16.

A further disadvantage of prior art refrigeration systems using forced air cooling is that air from the freezer compartment is often drawn immediately into contact with the cold evaporator structure. This, of course, promotes localized frost build-up where the moist air first contacts the evaporator.

SUMMARY OF THE INVENTION

The present invention comprehends an improved freezer-refrigerator apparatus effectively minimizing undesirable snow-type frosting such as occurring in the known freezer-refrigerator apparatuses as disclosed above. The invention comprehends providing means for effectively drying the relatively moist refrigerator space air before permitting it to mix with the colder freezer space air and, thereby, effectively reducing snow formation and consequently, substantially improving the efficiency of operation of the apparatus.

The invention further provides an air flow structure insuring that moist air from the freezer compartment is not allowed to immediately contact the evaporator fins. This tends to prevent localized frost build-up on said evaporator.

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BRIEF DESCRIPTION OF THE DRAWING

Other features and advantages of the invention will be apparent from the following description in connection with the accompanying drawing wherein:

FIG. 1 is a fragmentary vertical transverse section taken substantially along the line 1—1 of FIG. 2 illustrating the relationship of the evaporator space to the refrigerator space in a freezer-refrigerator apparatus embodying the invention;

FIG. 2 is a fragmentary vertical section thereof taken substantially along line 2—2 of FIG. 1;

FIG. 3 is a top plan view thereof with a portion shown in section taken substantially along the line 3—3 of FIG. 1; and

FIG. 4 is an enlarged view of the grill structure through which air is drawn from the freezer compartment in a refrigerator-freezer embodying the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the exemplary embodiment of the invention as disclosed in the drawing, a refrigerator apparatus generally designated 10 is shown to comprise a combination side-by-side freezer-refrigerator having a cabinet wall means 11 defining a freezer space 12, a refrigerator space 13 and a vertical flow passage 14 in which a heat transfer apparatus 15 is provided to have heat transfer association with air circulated through the several spaces by means of an air translating apparatus 16 disposed in passage 14 superjacent the heat transfer apparatus 15.

More specifically, the heat transfer apparatus 15 herein comprises an evaporator of conventional construction well known in the art having a serpentine cooling coil 17 passing several times through a set of spaced, parallel fins 17a and a lowermost accumulator 18. The apparatus 10 also includes means for providing a cooling refrigerant to the evaporator which are well known in the art and require no further description herein. A portion of the air which has been cooled by being passed in heat transfer association with evaporator 15 is deflected from flow passage 14 by a scoop-shaped divider duct 24 through a first outlet opening 19 to refrigerator space 13. A second outlet opening 20 passes air from duct 14 to freezer space 12 as illustrated in FIGS. 1 and 2 respectively. Opening 19 may be suitably controlled by a damper 21 which may be automatically adjusted by a conventional thermostat control 22 as well known to those skilled in the art, for regulating the amount of cold air circulated from the flow passage 14 to the refrigerator space 13. The opening 20 may be provided with suitable louvers 23 for directing the air from the flow passage 14 to freezer space 12 at the upper portion thereof.

The air translating means 16 may comprise a conventional fan or blower as well known to those skilled in the art.

As shown in FIG. 1, the cabinet 11 includes an upright divider wall 25, in the upper end of which the opening 19 is provided. In the lower end of wall 25, an inlet opening 26 is provided for conducting refrigerator space air into the lower end of the flow passage 14. As shown in FIG. 1, the opening 26 may be adjacent the accumulator 18 so as to direct the air substantially directly thereagainst. Heat transfer between the refrigerator space air and the accumulator cools the refrigerator space air to effectively dry the same prior to its movement upwardly through passage 14 past the heat transfer coil 17 and fins 17a of the evaporator. A pair of deflectors 27 are provided on the side walls of the flow passage 14 adjacent the lower end of the evaporator for constricting the flow passage and directing the refrigerator space air into improved

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heat transfer engagement with the coil 17 and associated fins 17a.

As shown in FIG. 2, the inlet to flow passage 14 from the freezer space 12 comprises a series of parallel vertical slots 28 in the rear panel 29 defining the forward wall of the flow passage 14. Slots 28 are disposed substantially above the level of opening 26 so that the freezer space air is delivered into the flow passage 14 at a point substantially upstream of the inlet to the flow passage from the refrigerator space. Thus, the refrigerator space air may be effectively dried before contact by the relatively cold freezer space air, effectively minimizing snow formation and thus, effectively maximizing efficiency of operation of the refrigerator apparatus 10. The mixed freezer space and refrigerator space air is then drawn by the fan 16 and delivered through the openings 19 and 20 and duct 24 as described above.

Thus, opening 26 effectively defines a first transfer passage from the refrigerator space 13 to a first portion 14a of the flow passage 14 at the lower end of the heat transfer means 15, and slots 28 effectively define a second transfer passage from the freezer space 12 to a second portion 14b of the flow passage 14 spaced vertically above the first portion 14a in the straight-through flow path of the passage 14. The improved positive circulation of the air through the vertical flow passage 14 is thusly obtained with effectively minimized need for defrosting of the evaporator as is required in the conventional freezer-refrigerator apparatuses.

Referring now to FIG. 4, which shows an enlarged view of a portion of rear panel 29, it is noted that slots 28 are spaced with relation to fins 17a such that air drawn there-through will not contact the leading edge of the fins. Instead, the air is directed between the fins where it blends with refrigerator space air which has been predried. Thus, by positioning fins 17a between and behind slots 28 as shown in FIG. 4, localized frost build-up, which would occur if the freezer space air immediately contacted the leading edge of the fins 17a, is prevented.

This arrangement of fins 17a relative to slots 28 also solves a further problem attendant to prior art structures as follows. Note that if fins 17a were located directly behind slots 28, localized frost formation would result as indicated above. Assuming such a frost formation has built up on the leading edge of the fins, it is apparent that should the door to freezer compartment 12 be opened, the in-rush of warm air from the outside would melt the frost on the fins. Upon reclosing the door, this melted frost would refreeze and thus an "icicle" would build up on the fin's leading edge. This deposit of solid ice is extremely hard to melt off during a normal defrost cycle thus leading to the necessity for a prolonged defrost cycle. With the structure of the instant invention, this ice build-up is prevented for two reasons. First, the localized frost build-up which precedes the ice build-up due to refreezing is prevented; and, second, any warm air rushing through slots 28 when the freezer compartment door is opened does not immediately strike fins 17a. Thus, it is precooled sufficiently as it passes near the fins so that it is ineffective in melting frost formed on the fin structure.

While we have shown and described one embodiment of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

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

1. In a combination side-by-side freezer-refrigerator apparatus having wall means defining a freezer space, a refrigerator space, and a vertical flow passage, heat transfer means in said flow passage for refrigerating air circulated upwardly therethrough to said freezer and re-

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frigerator spaces, means for preventing undesirable snow-frosting in the apparatus as from mixing of moist refrigerator space air with lower temperature freezer space air comprising:

means defining an air circulation first transfer passage from the refrigerator space to a first portion of said flow passage at a lower portion of said heat transfer means; and

means defining an air circulation second transfer passage from said freezer space to said flow passage for delivering said freezer space air to said flow passage solely at a second portion thereof spaced above said first portion, whereby all moist air circulated from said refrigerator space to said flow passage passes at least a portion of said heat transfer means prior to mixing with said lower temperature freezer space air circulated from said freezer space.

2. The apparatus of claim 1 wherein said flow passage defines a straight-through flow path.

3. The apparatus of claim 1 wherein said heat transfer means includes an evaporator and an accumulator at the lower end of said evaporator for initial heat transfer association of said refrigerator space air.

4. The apparatus of claim 1 wherein said flow passage means includes means constricting said flow passage intermediate said first and second portions to direct said refrigerator space air into heat transfer engagement with said heat transfer means.

5. The apparatus of claim 1 wherein a plurality of vertically spaced transfer passages from said freezer space to said second portion of said flow passage are provided.

6. The apparatus of claim 1 wherein means are provided for controlling the volume of refrigerator space air circulated through said first transfer passage.

7. The apparatus of claim 1 wherein said heat transfer means includes an evaporator and an accumulator at the lower end of said evaporator for initial heat transfer association of said refrigerator air, said first transfer passage being arranged to discharge said refrigerator space air into said flow passage directly against said accumulator.

8. In a combination side-by-side freezer-refrigerator apparatus having wall means defining a freezer space, a refrigerator space, and a flow passage, heat transfer means in said flow passage for refrigerating air circulated therethrough to said freezer and refrigerator spaces including a plurality of substantially parallel spaced fins extending in the direction of the air circulated through said flow passage, means for preventing undesirable snow-frosting in the apparatus as from mixing of moist refrigerator space air with lower temperature freezer space air comprising:

means defining an air circulation first transfer passage from the refrigerator space to a first portion of said flow passage at one portion of said heat transfer means; and

means defining an air circulation second transfer passage from said freezer space to said flow passage for delivering said freezer space air to said flow passage solely at portions thereof intermediate said spaced fins and spaced from said first portion, whereby moist air circulated from said refrigerator space to said flow passage passes at least a portion of said heat transfer means prior to mixing with said lower temperature freezer space air circulated from said freezer space, and prior to contacting said fins.

9. The apparatus of claim 8 wherein said second transfer passage means includes a portion of said wall means defining slots opening to said flow passage intermediate said fins.

10. The apparatus of claim 8 wherein said flow passage is substantially vertical and said one portion of said heat transfer means comprises a lower portion thereof.

11. Heat exchanger apparatus comprising:
a heat exchange space;

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a plurality of spaced, parallel fins in said heat exchange space;

means for causing heat transfer relative to said fins; and means for directing a fluid in heat exchange relationship with said fins comprising means for directing substantially all said fluid to have a preselected mixing flow between said fins prior to contact with said fins.

12. The heat exchanger apparatus of claim 11 wherein said directing means comprises a wall having at least one slot opening toward the space between said fins in said heat exchange space.

13. The heat exchanger apparatus of claim 11 wherein said means for causing heat transfer comprises means for cooling said fins.

14. The heat exchanger apparatus of claim 11 wherein said means for causing heat transfer comprises an evaporator having a coil contacting said fins for cooling the fins, said coil being disposed in said heat exchange space.

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15 WILLIAM J. WYE, Primary Examiner

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