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H. T. JONES

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STILL CHILLED REFRIGERATOR

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FIG. 1.

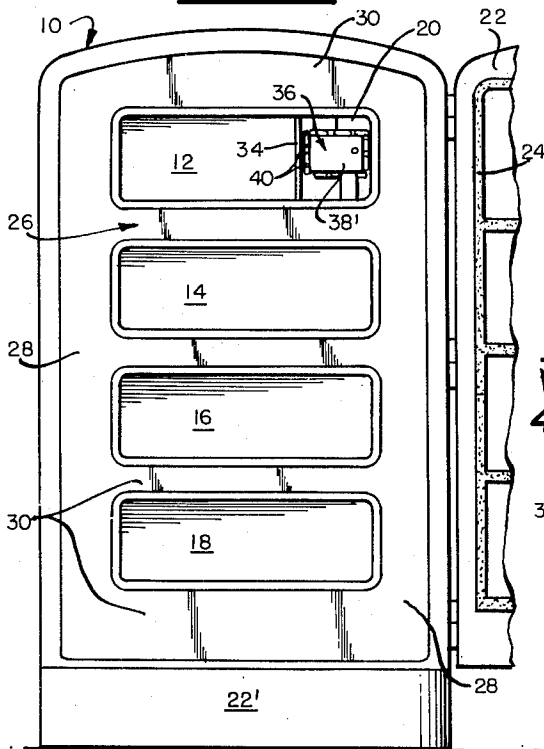


FIG. 2.

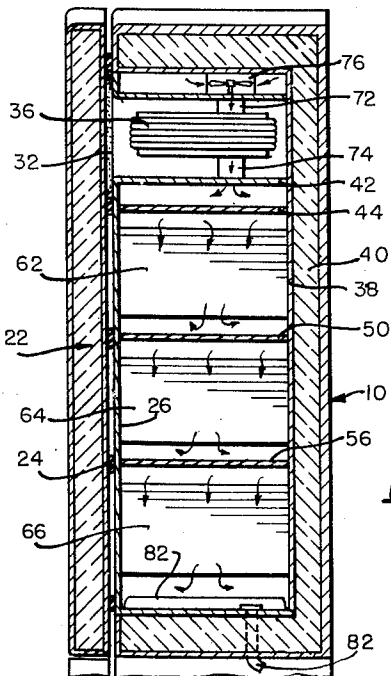
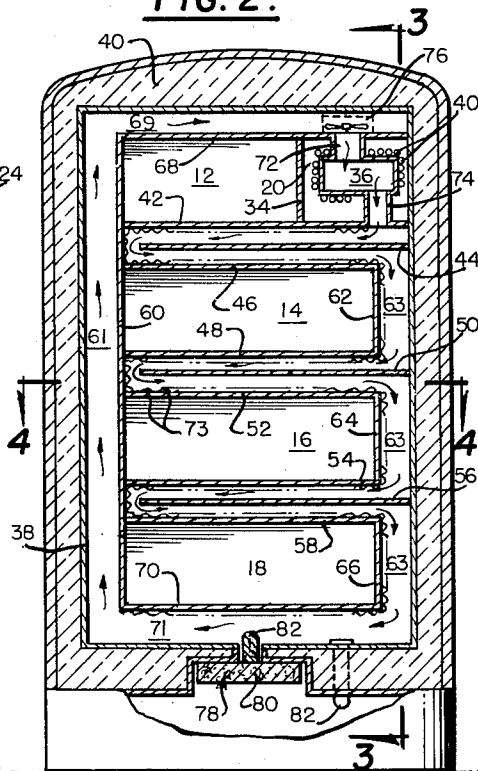
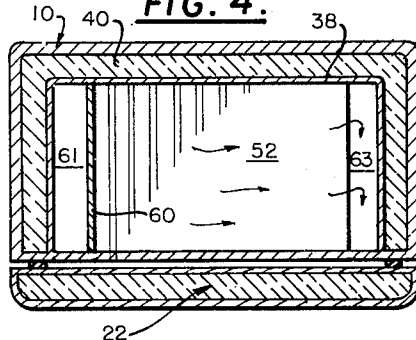


FIG. 3.

FIG. 4.



INVENTOR

HERBERT T. JONES

BY

Hall & Longtin

ATTORNEYS

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STILL CHILLED REFRIGERATOR

Herbert T. Jones, Harrisburg, Pa.

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9 Claims. (Cl. 62—102)

This invention relates to a refrigerator and more particularly to a refrigerator which utilizes air as a heat transfer medium, and which has an air flow path isolated from the food storage compartments.

By far the majority of the prior art refrigerators have a single large food storage compartment divided by foraminous shelves and a freezer compartment which is either separate from or located within the food storage compartment. In such refrigerators there is a natural flow of air within the food storage compartment over and in contact with the foodstuffs placed therein. Air toward the bottom of the compartment absorbs heat from the foodstuffs and rises, being displaced by cooler air, which in turn absorbs more heat and rises. While the circulation of air over the food may aid in ensuring uniform refrigeration, it has certain deleterious effects, the most noteworthy of which are dehydration of the food and transfer of flavors from one food to another. Attempts have been made to overcome the first of these effects by placing humidifying units within the food compartment, but the addition of moisture to the air in the food compartment creates additional frosting on the inner walls of the food compartment and does not accomplish the desired purpose. A few prior art refrigerators utilize a forced or controlled flow of air within the food storage compartment, but such refrigerators are subject to the same defects as the others.

The present invention obviates the defects of prior refrigerators by providing an endless air circulation path which is separate from but intimately associated with the food storage compartment.

Accordingly, it is a primary object of the invention to provide a unique refrigerator which overcomes the disadvantages of the prior art.

Another object of the invention is to provide a refrigerator having an air flow path which is closed from the food storage compartment.

A further object of the invention is to provide a refrigerator in which the food storage compartment is conveniently subdivided into separate smaller compartments.

An additional object of the invention is to provide a refrigerator having shelves which are impervious to air within the food storage compartments but which are hollow for the circulation of cooling air therethrough.

Still another object of the invention is to provide a unique air circulation passage for a refrigerator, the passage including means for dehydrating air passing therethrough.

A still further object of the invention is to provide a refrigerator having an air flow passage which may be defrosted quickly without substantially affecting the food within the food storage compartments.

Yet another object of the invention is to provide a refrigerator having an air flow path closed from the food storage compartments and which may be utilized in conjunction with natural or forced air feed.

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These and other objects of the invention will become more readily apparent in the following detailed description of the invention taken in conjunction with the accompanying drawing wherein:

5 Figure 1 is a front elevation view of the refrigerator of the present invention shown with the door open;

Figure 2 is a view similar to Figure 1 with the front panel of the refrigerator broken away so as to reveal the air path and associated apparatus;

10 Figure 3 is a longitudinal sectional view taken along line 3—3 in Figure 2; and

Figure 4 is a transverse sectional view taken along line 4—4 in Figure 2.

Briefly, the refrigerator of the present invention comprises a freezer compartment and several food storage compartments, all of which are substantially isolated from one another when the refrigerator door is closed. The shelves which divide the food storage compartments from one another are hollow to allow the flow of cooling air therethrough, and a tortuous air path is formed by the shelves in conjunction with a heat exchange chamber and side channels formed in the refrigerator body.

Referring to Figure 1, the refrigerator of the present invention, in a preferred embodiment, comprises a shell or body generally designated 10, which may be formed of enameled metal, and which may be divided into food storage compartments respectively designated 12, 14, 16, and 18, and a freezer compartment 20. The refrigerator may include a motor compartment 22', which may be located at the bottom of the body or elsewhere in accordance with conventional practices. The motor compartment may include the conventional compressor, condenser, expansion valve or capillary tube and associated apparatus. It is to be understood, however, that the construction of the present invention is not limited to a particular type of refrigeration system, and any of the conventional refrigerants and refrigerating systems may be employed.

The door 22, hinged to one side of the refrigerator shell, preferably is provided with a multi-part gasket 24. The gasket has portions which correspond to and engage the vertical extremities 28 of the front wall 26 of the refrigerator as well as the horizontal portions 30 of the front wall. The gasket also may have a vertical portion 32 shown in Figure 3 which engages the front edge of a vertical wall 34 dividing the food storage compartment 12 from the freezer compartment 20.

The freezer compartment 20 encloses, in the form shown, an inner chamber 36, which may be provided with a tightly fitting door 38' and may be surrounded with refrigeration coils 40, which constitute the evaporator of the refrigeration system. While the chamber 36 may be utilized for the making of ice cubes and may be formed to receive ice cube trays, its primary purpose is to provide a heat exchange chamber for the cooling air.

Figure 2 illustrates the air flow path. The outer extremity of the air flow path is formed by the inner casing 38 of the refrigerator, which is suitably mounted within the outer shell 10 and thermally insulated therefrom by blankets of insulation 40. The inner casing may be divided by a plurality of horizontal walls 42 through 58. Walls 42 and 46 constitute a hollow shelf separating compartments 12 and 20 from compartment 14. Walls 48 and 52 similarly form a shelf separating compartments 14 and 16, while walls 54 and 58 form a shelf separating compartments 16 and 18. Walls 44, 50 and 56 extending into the respective hollow shelves from one side of the inner casing, but ending short of the other side, form baffles within the shelves so as to constitute in each shelf a reversed or folded back air path. Each of chambers 12, 14, 16, and 18 preferably has one side constituted by

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a single vertical wall 60 spaced from the corresponding side wall of the inner casing 38 so as to form a vertical air channel 61 therewith. Each of chambers 14, 16 and 18 preferably has an individual opposite side wall 62, 64, 66 spaced from the adjacent side wall of the inner casing to constitute a series of vertical air channels 63 interrupted by the baffles 44, 50 and 56. The top wall 68 of chambers 12 and 20 is preferably spaced from the adjacent top wall of the inner casing 38 to constitute a horizontal air channel 69 while the bottom wall 70 of chamber 18 is spaced above the adjacent bottom wall of the inner casing to constitute another horizontal air channel 71.

As shown in Figure 3, each of the walls constituting the compartments and the air passage extend to the rear wall of the inner casing and are joined thereto. It will be appreciated that suitable spacers (not shown) are provided to ensure the structural rigidity of the walls. The air path is completed through chamber 36 by a pair of ducts 72, 74 which communicate with the adjacent horizontal air channels. In the form shown, forced, rather than natural air flow, is contemplated, and a suitable motor driven impeller 76 is located at some point along the air flow path, exemplified by the mounting of the impeller 76 at the mouth of the duct 72.

With the arrangement shown, maximum cooling is effected of the upper chambers 12 and 14 with slightly less cooling of the lower chambers 16 and 18 to offset the fact that the air closer to the floor in a kitchen is usually not as warm as that higher in the room. When desired, however, the circulation in the duct and spur-tube shelf arrangement may be reversed, and especially when the thermo-syphon principle is to be relied on to augment the air circulation, or effect it without use of an impeller such as 76, the duct 74 may deliver to a vertical channel extending uninterruptedly down at least one side of the inner casing to the bottom thereof, and the spur shelves may extend from and interrupt the upflow channel, this arrangement being similar to that illustrated when the fan is operated to reverse the flow except for reversal of the communications of the ducts 72 and 74.

The inner surfaces of the members which constitute the air flow passages and which contact the air are preferably corrugated as indicated at 73 to increase the heat exchange area and to create turbulence. The walls of the food storage compartments and the air flow channels may be formed of any suitable material, for example, metal or molded plastic.

The flow of cooling air of the illustrated embodiment is indicated by the arrows in Figures 2 and 3. Heat transferred from the food articles within the storage compartments to the air passage walls by conduction and radiation is transferred to the air within the passage, and by virtue of forced feed or convection currents, is ultimately transferred to the refrigerating medium within the coils 40. It will be observed that the air passes in close contact with the walls of the food storage compartments but is prevented from flowing into the compartments and contacting the foodstuffs therein. When the refrigerator door is closed, the compartments are isolated from each other by virtue of the gasket means 24.

Since it is not practical to seal the air flow path completely, and since in some instances the air flow path may be accessible from the outside, as where the chamber 36 is used for making ice cubes, the air within the channels may gradually pick up moisture which may ultimately be deposited at the coldest portions within the air passage. To alleviate this condition, a dehumidifying element is preferably placed in communication with the air passage. In a preferred form this element comprises a T-shaped porous clay block 78 having a horizontal flange portion 80 and a vertical web portion 82 extending into channel 71. Moisture absorbed in the web is transferred to the flange, where it may be evaporated in the motor compartment or elsewhere.

Defrosting of the air passage may be accomplished

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periodically by turning off the refrigeration system and allowing the frost formed on the inner surfaces of the air passage to melt. The horizontal surfaces within the air passage upon which defrost water may collect may be sloped downwardly slightly so as to allow the defrost water to run downwardly along the normal air flow path until it reaches the bottom of the inner casing, at which point it may be dissipated by the dehumidifying element 78, or a plugged drain 82 may be provided for removal of the water to a receptacle (not shown). In normal use the heat capacity of the food within the food storage compartments will be sufficient to allow quick defrosting of the air passage with substantially no effect upon the food. A heating element may be used in conjunction with impeller 76 to hasten defrosting, if desired.

While preferred embodiments of the several features of the invention have been shown and described, it will be apparent to those skilled in the art that many modifications may be made without departing from the principles of the invention. Accordingly, the embodiments shown and described are to be considered exemplary rather than restrictive, and such modifications are intended to be included within the meaning and range of equivalency of the appended claims.

What I claim as my invention is:

1. A refrigerator comprising an outer shell, a casing spaced within said shell, wall elements defining a plurality of food storage compartments within said casing spaced each from the other vertically, wall means defining in conjunction with said wall elements a continuous air flow passage reversely folded between the top and bottom wall elements of adjacent compartments and along at least one side of said compartments but closed therefrom, and refrigeration means in heat exchange relationship with the air in said passage.

2. A refrigerator comprising an outer shell, wall elements defining a plurality of vertically spaced food storage compartments within and insulated from said shell, wall means defining in conjunction with said wall elements a continuous substantially closed air passage having straight horizontal portions near the top and bottom of said shell respectively, having reversely folded horizontal portions between the top and bottom wall elements of adjacent compartments, and having straight vertical portions on respective sides of said compartments, the vertical portion on at least one of said sides being interrupted by said reversely folded portions.

3. A refrigerator comprising an outer shell, a substantially rectangular casing spaced within said shell, wall elements defining at least two food storage compartments within said casing, said compartments being spaced one above the other and being spaced from the top, bottom, and side walls of said casing, a pair of corresponding side walls of said compartments being continuous, a baffle extending from one side of said casing between and spaced from said compartments and terminating before said continuous side walls, said compartment wall elements defining in conjunction with said baffle and said casing walls a continuous substantially closed air passage extending along the top of the upper compartment and along one side thereof, between said baffle and the bottom of said upper compartment, between said baffle and the top of said lower compartment and along the corresponding side thereof, along the bottom of said lower compartment and along said continuous side walls to the top of the upper compartment.

4. The refrigerator of claim 1, further comprising a door having gasket means for isolating said compartments when the door is closed.

5. The refrigerator of claim 1, further comprising a dehumidifying device having a moisture collecting portion within said passage and a moisture disposal portion outside said passage.

6. The refrigerator of claim 1, further including means

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located at the lowermost portion of said passage for draining defrost water therefrom.

7. The refrigerator of claim 1, further including means for force feeding air through said passage.

8. The refrigerator of claim 1, the internal surfaces 5 of said passage being corrugated.

9. The refrigerator of claim 1, said refrigeration means

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including a heat exchange chamber forming a part of said passage.

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