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REFRIGERATOR WITH AIR CIRCULATION OUTSIDE OF LINER

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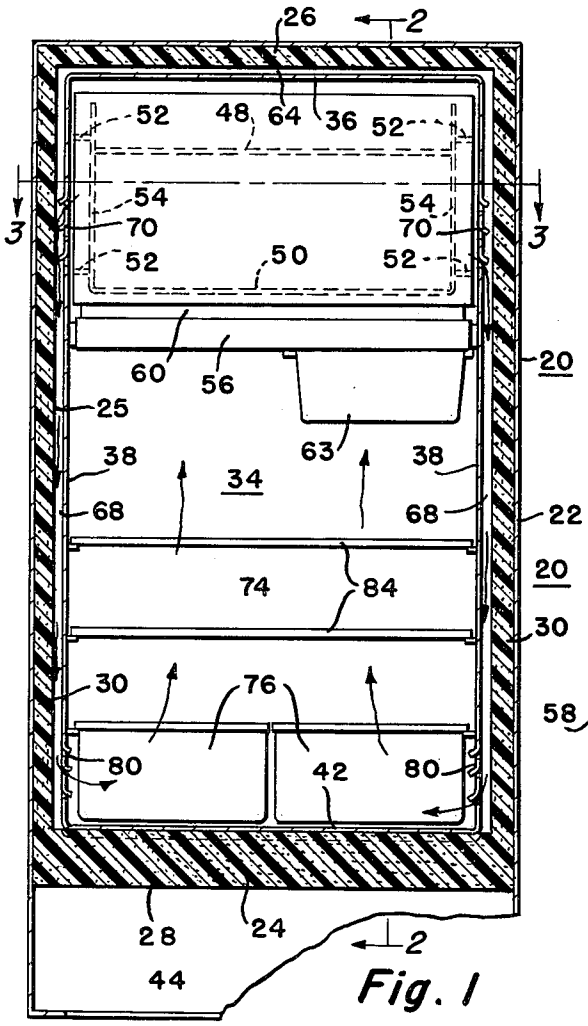


Fig. 1

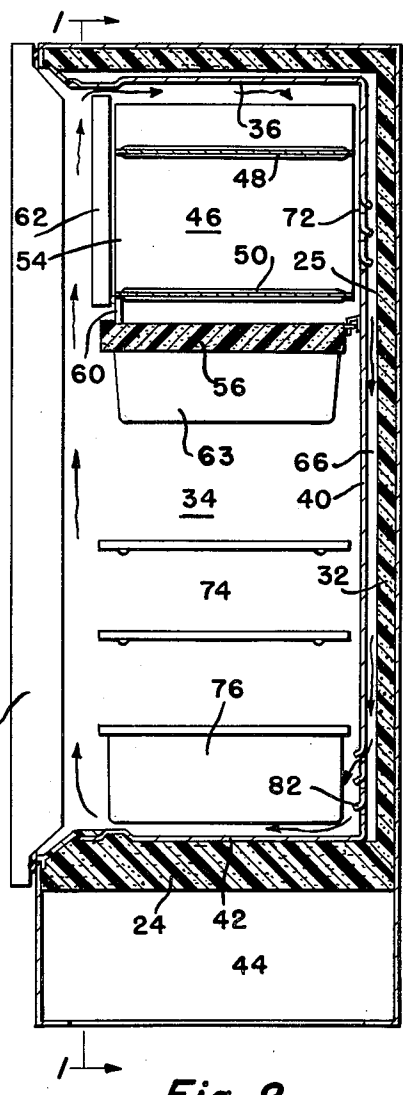


Fig. 2

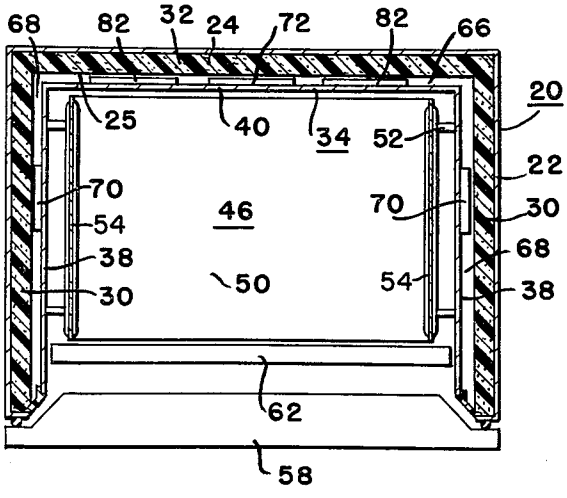


Fig. 3

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REFRIGERATOR WITH AIR CIRCULATION OUTSIDE OF LINER

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This invention pertains to refrigerating apparatus and more particularly to a simple household refrigerator provided only with a single evaporator.

The quality of food preservation depends not only upon the temperature but also upon the relative humidity and the amount of air circulation. The optimum of temperature, humidity and air circulation varies with different foods and also whether the foods are wrapped or unwrapped. Ice provides refrigeration at undesirably high temperatures with high humidities and slow circulation. Early mechanical refrigerators provided cold dry air. Under such conditions, unwrapped food became dehydrated in several days. The reaction to this was the cooling of the food storage compartment through the walls thereof. This provided a minimum of air circulation and high humidity and substantially prevented dehydration. However, it was found that mold formed on some foods under such conditions. The reaction to this was the return to the circulation of cold dry air which causes dehydration.

It is an object of this invention to provide a refrigerator in which the humidity is kept sufficiently high and the air circulation sufficiently low to minimize dehydration but the humidity and temperature are also kept sufficiently low and the air circulation sufficiently high to prevent molding and spoilage.

It is another object of this invention to provide a simple refrigerator with a single evaporator which will maintain desirable temperatures, desirable humidities and desirable air circulation and to prevent undesirable molding and dehydration.

It is another object of this invention to provide a simple refrigerator with a single evaporator in which some of the air is circulated by natural convection around the inner liner and joins the other air circulating within the liner to maintain desirable temperatures, humidities and air circulation.

It is another object of this invention to provide a simple refrigerator with a single evaporator with an arrangement by which the food storage compartment is cooled both by air circulation around it and through it.

These and other objects are attained in the form shown in the drawings in which the outer insulated walls of the cabinet are provided with an interior opening which is greater than the outer dimensions of the inner liner so as to provide a space between the inner liner and the top, sides and rear walls. The inner liner is provided with air inlet openings at the upper portion of this space above the baffle which is located below the evaporator in the top of the inner liner. Outlet openings are provided in the inner liner from this space directly at the sides of the closed vegetable container or hydrators which are located in the bottom of the cabinet well beneath the baffle.

By this arrangement, some of the air contiguous to the spaces surrounding the evaporator flows downwardly through the spaces surrounding the inner liner through the upper openings and out through the lower openings where the cold air provides ample cooling for the vegetable storage containers or hydrators provided at the bottom of the storage space. Other air flows through the openings between the baffle beneath the evaporator and the side and rear walls of the inner liner and aids in

cooling the upper portion of the storage compartment. The air flowing downwardly through the inside and the outside of the inner liner returns primarily up the front of the storage compartment and over the front door of the evaporator and thence back into contact with the evaporator cooling unit.

Further objects and advantags of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a front vertical sectional view taken substantially along the line 1—1 of FIGURE 2;

FIGURE 2 is a side vertical sectional view taken substantially along the line 2—2 of FIGURE 1; and

FIGURE 3 is a horizontal sectional view taken along the line 3—3 of FIGURE 1.

Referring now to the drawings, there is shown a refrigerator cabinet 20 including a metal outer shell 22 within which is cast a foamed plastic resin insulation 24 forming top wall 26, a bottom wall 28, side walls 30 and a rear wall 32. The inner surface of the insulation 24 has a surface of polyethylene sheet 25 which remains from the inner mold of the casting operation. The interior dimensions of the inner liner 34 are small enough so that there is a space provided between the top wall 36 of the inner liner and the inner face of the top wall 26 of the insulation and similarly the outer face of the side walls 38 of the inner liner are sufficiently small to provide an air space 68 between them and the inner face of the insulation 24 of the side walls 30. Likewise, the rear wall 40 of the inner liner is spaced away from the front face of the insulation 24 of the rear wall 32 providing an air space 66. The bottom wall 42 of the inner liner may rest on the insulation 24 of the bottom wall which is made thicker so as to provide a good heat barrier to prevent heat from the machinery compartment 44 from leaking into the interior of the liner 34.

A cooling unit 46 in the form of a refrigerant evaporator having an upper ice tray shelf 48 and a lower package storage shelf 50 is suspended upon side brackets 52 in the upper portion of the inner liner 34. The sides of the evaporator 54 are spaced away from the side walls 38 of the inner liner so that air can circulate completely around the evaporator or cooling unit 46. The brackets 52 do not substantially obstruct the air flow. Beneath the evaporator is supported an insulating baffle 56 which is widely spaced at the front from the door 58 which closes the front of the cabinet. Its side and rear edges are spaced more closely from the inner liner so as to provide relatively narrow air passages on the sides and rear of the baffle. The baffle 56 also has an upwardly extending projection 60 extending into contact with the bottom of the evaporator and against which the lower edge of the inner freezer door 62 seals and contacts in the closed position. Beneath the baffle 56 there is slidably mounted a meat container 63.

The spacing of the inner liner 34 away from the insulated walls provides a top passage 64 between the top walls 26 and 36, a rear wall passage 66 between the rear walls 32 and 40 and side wall passages 68 between the side walls 38 and 30. Three louvered entrance openings 70 are provided in the side walls 38 of the inner liner and three louvered entrance openings 72 are provided in the center of the rear wall 40 of the inner liner to give the cold air surrounding the evaporator 46 access to the upper portion of these air spaces 68 and 66 respectively. These air inlet openings 70 and 72 are provided above the baffle 56 adjacent the lower portion of the side walls 54 of the evaporator and the rear of the evaporator 46.

In the bottom of the inner liner 34 in the storage compartment 74 below the baffle 56, there are provided two vegetable containers 76 which are slidably mounted and suspended above the bottom wall 42 to provide a space therebeneath. These containers are also spaced away from the side walls 38. The side walls 38 and the rear wall 40 are each provided with exit openings and louvers 80 and 82, each of which are three in number and provide openings for the escape of cool air from the air spaces 68 and 66 into contact with the side walls and the rear walls of the vegetable containers 76 which are commonly called hydrators. This circulation of cold air cools the vegetable containers 76 to keep them at a sufficiently cold temperature to keep vegetables fresh and moist without dehydration or molding. The air in returning rises in the front of the storage compartment 74 by natural convection and passes in front of the baffle 56 along the door 58 and between the doors 62 and 58 and thence around the top and the sides of the door 62 into contact with the side walls 54 and the shelves 48 and 50 of the evaporator 46 where this air is again cooled and again flows downwardly.

Part of this air flows downwardly as before described through the openings 70 and 72 into the air passages 68 and 66 and flows downwardly on the outside of the liner walls 38 and 40, respectively, and within the insulated side and rear walls 30 and 32 down to the air outlet openings 80 and 82 from which it flows into the spaces surrounding the vegetable containers 76 and is there warmed and rises again in the storage compartment 74. Another part of this cold air flows from the cold surfaces of the evaporator around the sides and rear of the baffle 56 through the spaces of predetermined width between the baffle 56 and the walls 38 and 40 which control the cold air flow down into the storage compartment 34 and prevents condensation of moisture upon the cold side and rear walls 38 and 40. This condensation would otherwise take place since the walls 38 and 40 are cooled by the flow through the passages 66 and 68 of cold air below the temperature in the storage compartment 74 and therefore cause moisture to be drawn to them by the migration to the point of coldest temperature. This, however, is prevented by the circulation around the side and rear edges of the evaporator 56.

The relative humidity and the air circulation within the compartment 34 is controlled and proportioned by the spacing of the side and rear edges of the baffle 56 away from the side walls 38 and the rear wall 40 of the inner liner 34. The circulation of the air around the baffle 56 on the inside of the liner is made small enough to prevent undesirable dehydration and undesirably high humidity while the circulation of the air on the outside of the liner is made sufficient to prevent undesirably low humidity and undesirable dehydration. Thus, the humidity can be increased by reducing the space between the edges of the baffle 56 and the side and rear walls 38 and 40 and it can be lowered by increasing the space. The flow of cold air in the passages 66 and 68 removes the heat leaking through the insulation 24 from the room and thus is heated in its downward movement thereby preventing excessive circulation by natural convection. The interior surface of the plastic insulation 24 is made sufficiently large that the inner liner may be readily removed and inserted. Food is stored on the shelves 84 located between the baffle 56 and the vegetable containers 76 in the storage compartment 74.

This arrangement therefore makes a form of refrigerator which is relatively easy to assemble and is simple in that it has only one evaporator and yet provides excellent control of humidity through the controlled circulation of air around the inner liner and also the controlled circulation of air around the baffle 56 within the inner liner.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A refrigerator including an inner liner having top and bottom and rear and side walls, insulated walls surrounding said inner liner having substantially entire wall portions spaced from said side and rear walls of said inner liner to form a space therebetween, a cooling unit located within the upper portion of said inner liner, a baffle in the form of an incomplete dividing wall beneath said cooling unit within said liner separating the interior of the liner into a cooling unit compartment above and a storage compartment below, a container in the lower portion of said storage compartment spaced from the side and rear and bottom of said inner liner, said side and rear walls having inlet openings above said baffle and outlet openings opposite said container.

2. A refrigerator including an inner liner having top and bottom and rear and side walls, insulated walls surrounding said inner liner having substantially entire wall portions spaced from said side and rear walls of said inner liner to form a space therebetween, a cooling unit located within the upper portion of said inner liner, a baffle in the form of an incomplete dividing wall beneath said cooling unit within said liner separating the interior of the liner into a cooling unit compartment above and a storage compartment below, said refrigerator being provided with a front door providing access to said storage compartment and said cooling unit, a separate door for said cooling unit extending between and closely adjacent said side walls but spaced from said front door and top wall a sufficient distance to provide an air flow passage from said storage compartment to the upper portion of said cooling unit, said baffle being also spaced from said front door and provided with means adjacent its front cooperating with said separate door for substantially preventing flow of air from said passage between said baffle and cooling unit, means forming a natural convection air circulation from the surfaces of said cooling unit down through the space between the sides and rear wall of said inner liner and up through said storage compartment and between said front door and said baffle and separate door and between said top wall and said separate door back to said cooling unit including inlet openings in said side and rear walls above said baffle and outlet openings in said side and rear walls below said baffle adjacent the lower part of said storage compartment.

3. A refrigerator including an inner liner having top and bottom and rear and side walls, insulated walls surrounding said inner liner having substantially entire wall portions spaced from said side and rear walls of said inner liner to form a space therebetween, a cooling unit located within the upper portion of said inner liner, a baffle in the form of an incomplete dividing wall beneath said cooling unit within said liner separating the interior of the liner into a cooling unit compartment above and a storage compartment below, said cooling unit being spaced from said rear and side walls a greater distance than said baffle is spaced from said walls, said side and rear walls having air inlet openings above said baffle providing for the flow of cold air from the space contiguous to said cooling unit to said space between the inner liner and said insulated walls, the lower portion of said side and rear walls having air outlet openings below said baffle providing for the flow of cold air from said space between the inner liner and said insulated walls into the lower portion of said storage compartment, said refrigerator being provided with a front door providing access to said storage compartment and said cooking unit, a separate door for said cooling unit extending between and closely adjacent said side walls but spaced from said front door and top wall a sufficient distance to provide an air flow passage from said storage compartment to the upper portion of said cooling unit, said baffle being also spaced from said front door and provided with means

adjacent its front cooperating with said separate door for substantially preventing flow of air from said passage between said baffle and cooling unit, said air flowing upwardly through said storage compartment and between said front door and said baffle and separate door and between said top wall and said separate door back to said cooling unit.

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