United States Patent

Grinups

[15] **3,702,544**

[45] **Nov. 14, 1972**

[54] **REFRIGERATOR**

[72] Inventor: **George Grinups**, Penndel, Pa.

[73] Assignee: **Unitec Industries, Inc.**, York, Pa.

[22] Filed: **Sept. 25, 1970**

[21] Appl. No.: **75,334**

[52] **U.S. Cl.** **62/414,** 62/416, 62/418, 62/419

[51] **Int. Cl.**.....**F25d 17/06**

[58] **Field of Search**.....62/413, 414, 415, 416, 426, 62/419, 441, 255, 185

[56] **References Cited**

UNITED STATES PATENTS

1,608,956	11/1926	Posson	62/415
2,270,407	1/1942	Blood	62/449
2,484,310	10/1949	Philipp	62/453
2,532,816	12/1950	Kurtz	62/419
2,538,660	1/1951	Shreve	62/415
2,576,208	11/1951	Benson	62/444
2,727,363	12/1955	Fenner	62/289
3,005,321	10/1961	Devery	62/186
3,020,733	2/1962	Hubacker	62/414
3,475,920	11/1969	Jacobs	62/273
3,609,988	10/1971	Bright	62/187
1,964,822	7/1934	Klippel	62/414
2,331,002	10/1943	Small	62/414
3,078,688	2/1963	Petkwitz	62/419
3,104,533	9/1963	O'Connell	62/414
3,455,119	7/1969	Bright	62/419

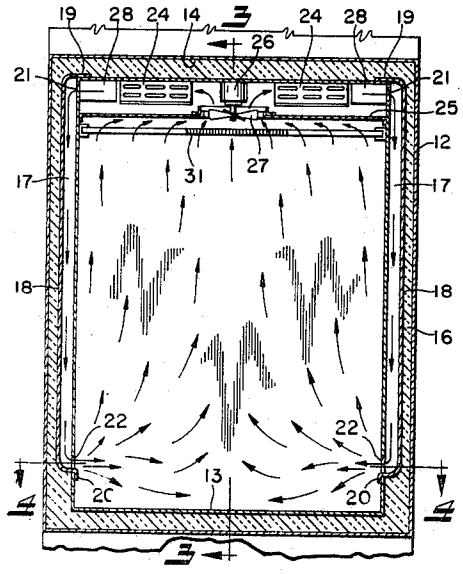
Primary Examiner—William J. Wye

Attorney—Oberlin, Maky, Donnelly & Renner

[57] **ABSTRACT**

Cooled air is circulated upwardly through an insulated liner forming the food chamber by a top fan, evaporator coils at the respective sides of the fan, and conduit means extending from the coils and including ducts which extend exteriorly at the sides of the liner from the top portion to the bottom portion of the same. The cooled air streams from such ducts are discharged into the liner at horizontal shielded openings in the respective sides at relatively small spacing above the liner bottom. The liner and a surrounding spaced outer shell are single molded plastic shapes, with insulation therebetween foamed in place and about the ducts.

5 Claims, 7 Drawing Figures

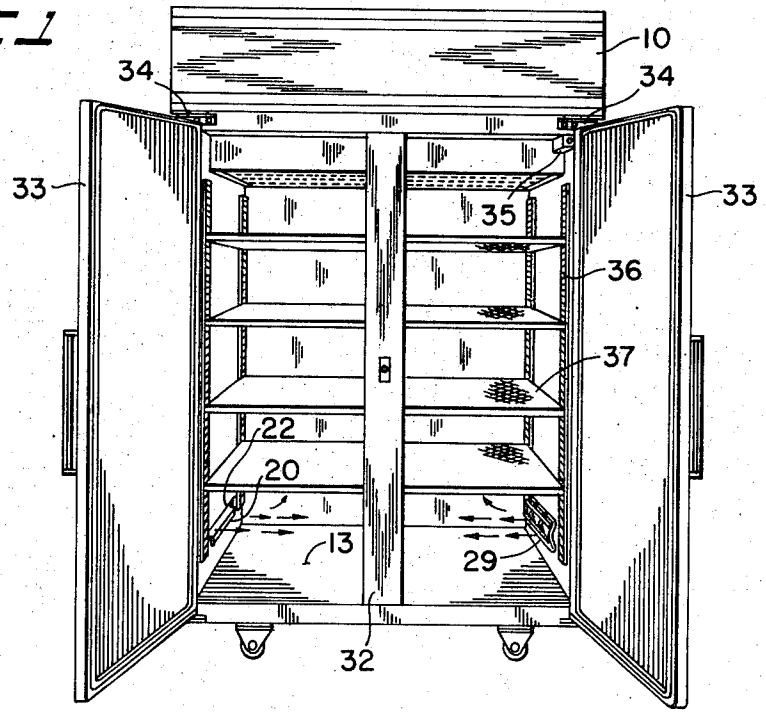


PATENTED NOV 14 1972

3,702,544

SHEET 1 OF 2

FIG. 1



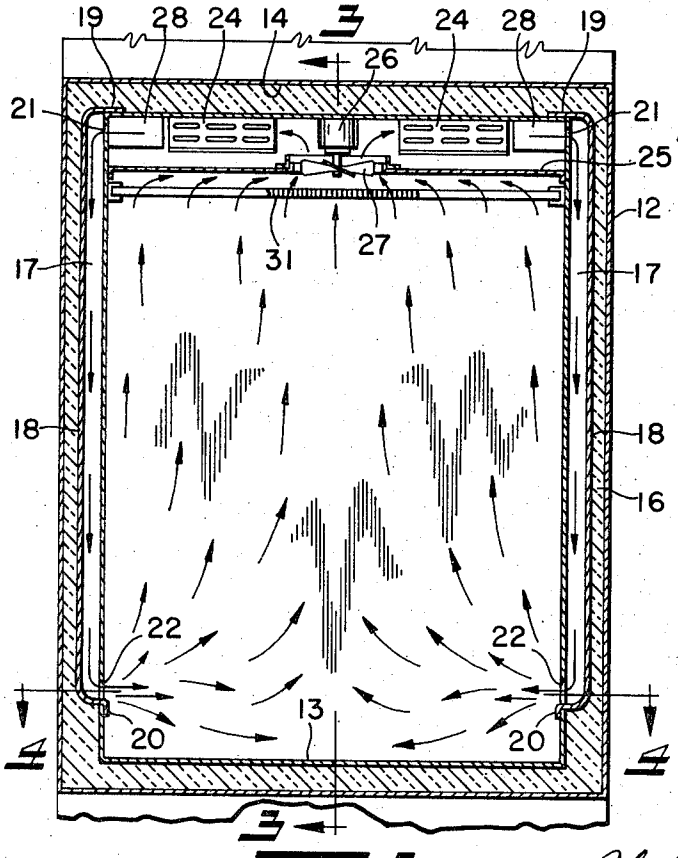


FIG. 2

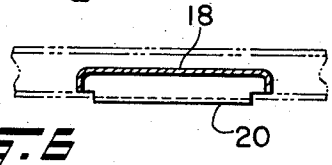


FIG. 6

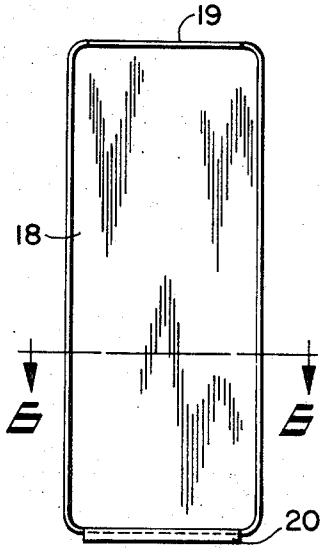


FIG. 5

INVENTOR.
GEORGE GRINUPS
BY

Oberlin, Maky, Donnelly & Renner
ATTORNEYS

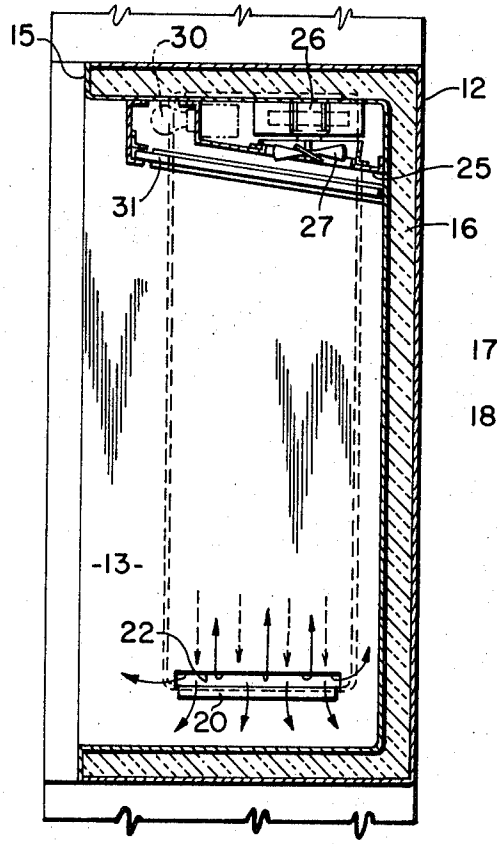
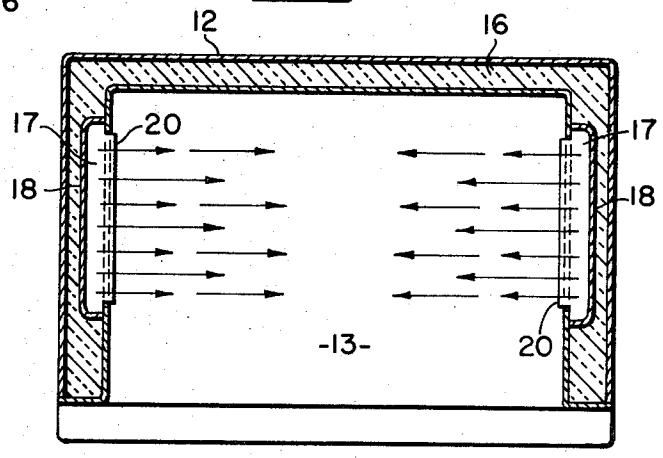


Fig. 3

Fig. 4



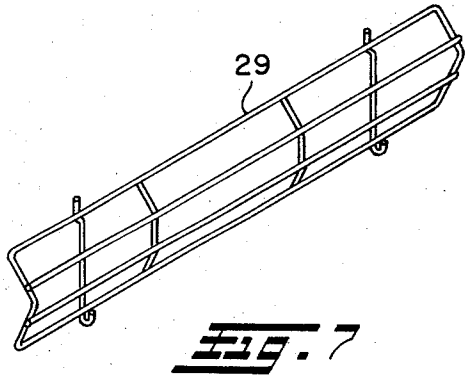


Fig. 7

INVENTOR.
GEORGE GRINUPS
BY
Oberlin, Maky, Donnelly & Renner
ATTORNEYS

REFRIGERATOR

The present invention relates to refrigerators of the type in which cooled air is forcibly circulated through the storage chamber for food or other articles to be refrigerated.

More particularly, the circulation is such that the cooled air flows upwardly through the chamber, with cooling of the air at the top for maximum convection assist. Improvement in this circulation or distribution of the cooled air to maintain unrestricted uniform flow throughout the chamber is a principal object of the invention.

Another object is to provide such a refrigerator in which the flow of cooled air from the refrigerating system is contained in its delivery to the article storage chamber for discharge to the bottom portion of the latter in a manner which makes it a more efficient working fluid. The way in which the cooled air is discharged into the chamber is also significant and contributes to the overall improved circulation through the chamber.

It is also an object of this invention to provide a construction for such a refrigerator which can readily be reproduced at cost advantage, while giving the user a unit which is structurally trouble-free and easy to clean and otherwise maintain.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

Briefly, the new refrigerator utilizes an inner liner and an outer shell each in the basic form of a single molded plastic shape. Refrigerating elements and a motor-driven fan assembly are located in the top portion of the inner liner and cooperate to establish flows of cooled air to the respective sides which penetrate the liner and enter closed vertical ducts in the side spaces between the liner and the shell. The air returns to the chamber through elongated discharge openings at the respective liner sides near the bottom, through distributor or screen means, and there is an air screen at the top which assists in establishing the vertical movement of the flow through the storage chamber over substantially the full depth and the full width of the same. The void in the outer shell about the inner liner is filled with thermal insulating foam.

Referring now to the drawings in detail:

FIG. 1 is a front elevation of a refrigerator in accordance with the present invention;

FIG. 2 is a vertical section of the refrigerator at a plane parallel to the front, with certain parts omitted for convenience of illustration;

FIG. 3 is a transverse vertical section as viewed from the plane of the line 3—3 in FIG. 2;

FIG. 4 is a horizontal section the plane of which is indicated by the line 4—4 in FIG. 2;

FIG. 5 is an elevation, partly broken away, of one of the air ducts used in the refrigerator;

FIG. 6 is a horizontal section as viewed from the plane of the line 6—6 in FIG. 5; and

FIG. 7 is a perspective view of one of the discharge screens used in the assembly.

Referring now to the drawings in detail, the illustrated refrigerator is a top mounted model, that is, the refrigerating system, except for the refrigerant evaporating section, is enclosed within a top housing **10** and, being fully conventional, need not be illustrated and described in any detail. Moreover, it will be apparent from the following that the improvements which form the subject matter of the present invention can as well be employed with bottom or any other mountings for the system.

These improvements as indicated at the outset concern primarily the construction of the food chamber or compartment designated generally by reference numeral **11** and basically defined by an outer shell **12** and an inner liner **13**. The shell and liner are preferably each formed as a single molded piece of glass fiber reinforced polyester resin open only at the front. All dimensions of the liner are smaller than the corresponding dimensions of the shell to define a void **14** fully about the former when placed within the shell, as shown, with the respective fronts of the two in the same plane.

The void is closed by a front wall **15** formed in any suitable manner, for example, by flanging the front edges of one or both of the shell and liner and bonding thereof, and preferably filled with a polyurethane composition **16** foamed in place. This intervening material has been used in the same manner in other refrigerating structures and provides with the shell and liner a structurally rigid, thermally insulated enclosure for the food or other articles to be refrigerated.

However, in accordance with the present invention, the space between the liner and shell is equipped with ducts **17** respectively against the liner sides before the addition of the foamed insulation. Each such duct in the illustrated embodiment comprises a separately formed rectangular aluminum pan **18** applied against the side to form therewith a substantially fully closed shallow conduit of a length sufficient to extend from the top almost fully to the bottom of the liner side. The pans can be formed with top flange extensions **19** and bottom flanges **20** and may be held in place adhesively during the insulation foaming operation. Flexible reinforcing strips, not shown, are preferably temporarily suspended within the ducts during foaming of the insulation to preclude deformation or collapse of the same and are subsequently withdrawn.

The liner side walls within the ducts are provided with horizontal outlet and inlet slots **21** and **22** respectively adjacent the upper and lower ends of the ducts, so that there is communication between the top and bottom portions of the liner interior or the food chamber exteriorly through the two side ducts **17** over substantially the full height of the chamber.

The initial placement of the duct forming aluminum pans is assisted by the flanges **19** and **20** as shown, with the latter engaged over the bottom edges of the inlets **22** and the former over the liner top wall **23**.

The refrigerant evaporating section of the refrigerating system comprises two finned coils **24** mounted against the inner top of the liner **13** within a housing **25**

at the respective sides of the center and connected to the system by suitable fluid connections, not shown. Between these coils, at the top center, there is a vertical fan-motor assembly **26** having its impeller **27** positioned in an opening in the bottom of the housing **25** and designed to draw air upwardly through such opening and force it laterally through the evaporator coils at both sides.

Such lateral flows of air proceed between the fins of the evaporator coils **24** over the turns of the latter and enter small horizontal chutes **28** which lead to the top liner side openings **21** and hence the upper ends of the exterior ducts **17**.

The air flows are of course cooled by such heat exchange contact with the coils and proceed downwardly through the ducts for return to the liner interior at its bottom horizontal openings **22**. A spacer and distributor screen **29** is applied at each opening **22** with sufficient openwork projection into the chamber to preclude blockage of the opening by articles stored in the chamber. Screens **29** may be made of plated or plastic coated wire or the like and their specific configuration is not critical, except to the extent that the protection against obstruction of the flows laterally into the liner must be assured.

A light indicated by phantom outline **30** is provided for illuminating the interior of the chamber, and an air distributing foraminous light shield **31** is removably suspended below the light and the top housing **25** containing the evaporator coils and the fan motor assembly.

A center mullion **32** is attached at the front of the unit, and two doors **33** on outer edge vertical pivot hinges **34** are provided for closing the front of the refrigerator, with suitable latching, not shown, at the center mullion. A door operated light switch **35** is illustrated in FIG. **1**, and it will be understood that other controls which have been conventional can be provided, for example, a temperature control preferably with an alarm to indicate a dangerously improper temperature condition.

The liner walls are shown in FIG. **1** as having rack supporting strips **36** applied thereto, with a number of openwork racks **37** supported by the same.

The arrows in the drawings indicate the upflow of the cooled air through the food chamber which has been established in the disclosed structure, with substantial uniformity or evenness of the same over the full width and depth of such chamber.

It is also significant to note that the cooled air conducted by the ducts to the bottom portion of the chamber is separated and hence insulated from the interior of the same by liner side walls of the polyester resin. The formation of localized cold spots, for example, at the upper corners of the liner, is avoided and the transfer is very efficiently accomplished.

I, therefore, particularly point out and distinctly claim as my invention:

1. A refrigerator comprising an inner liner forming a chamber for storage of the articles to be refrigerated, a foraminous air distribution shield in said chamber slightly below the liner top wall, such shield being substantially coextensive with the width and depth of said chamber, an outer shell enclosing said liner in spaced relation, thermal insulation between the liner and shell, conduit means consisting of two ducts positioned in said insulation, said ducts extending from a common inlet opening substantially in the center of the liner top wall to two outlet openings in opposite side walls of the liner closely adjacent the liner bottom wall, fan means in the common inlet opening to draw air upwardly through the food chamber and air distribution shield into the conduit means for circulation back to the duct outlet openings, said air being divided into substantially equal air streams in both of said ducts, and evaporating coils positioned within each said duct to cool the air for reentry into the food chamber.

2. A refrigerator as set forth in claim **1**, wherein the opening in the liner wall through which the cooled air is discharged from the duct is horizontal and extends over more than half of the corresponding dimension of said wall.

3. A refrigerator as set forth in claim **1**, wherein said thermal insulation is foamed in place between the liner and outer shell and about said duct.

4. A refrigerator as set forth in claim **1**, wherein said liner is made of a heat insulating material.

5. A refrigerator as set forth in claim **1**, wherein an openwork spacer is applied to the interior of said liner wall at the opening therein to preclude blockage of the latter by articles stored in the chamber.

* * * * *