May 21, 1946. G. L. C. EARLE 2,400,634

REFRIGERATOR

Filed Jan. 15, 1944

Fig. 1.

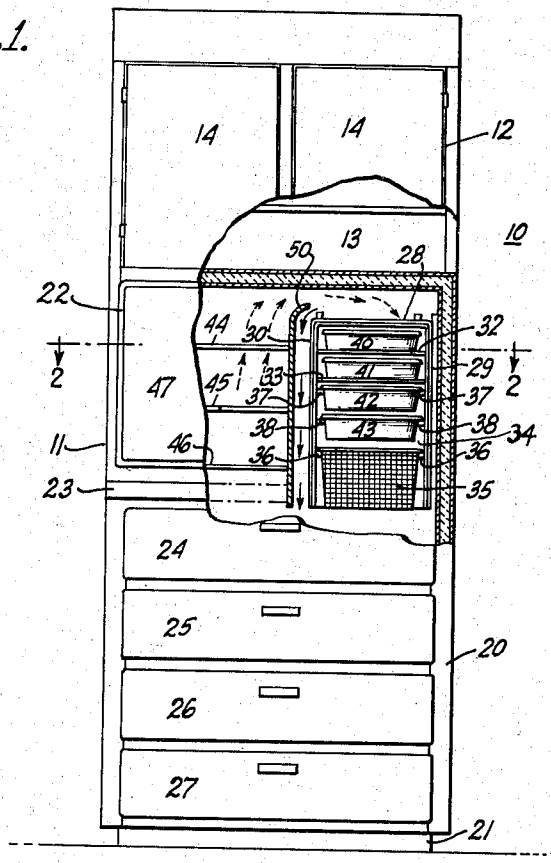


Fig. 2.

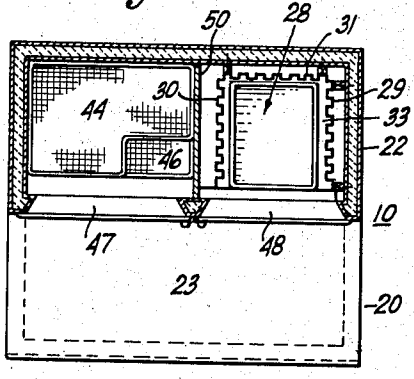
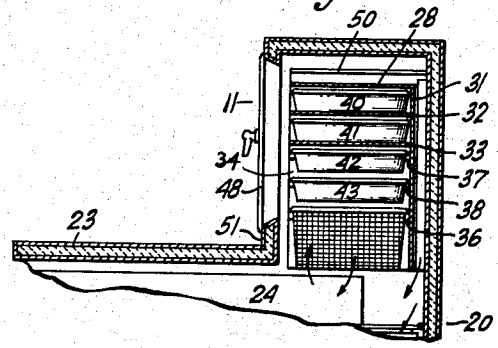


Fig. 3.



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UNITED STATES PATENT OFFICE

2,400,634

REFRIGERATOR

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Application January 15, 1944, Serial No. 518,388

6 Claims. (Cl. 62—89)

This invention relates to refrigerators and more specifically to means for improving the efficiency thereof.

It is an object of this invention to provide an improved mechanical refrigerator.

It is another object of this invention to provide a refrigerator in which novel means for improving the circulation of cold air therewithin are provided.

It is a further object of this invention to provide a novel frozen food container of large capacity.

In the usual refrigerator, an evaporator member, containing a number of coils through which a suitable refrigerant is caused to flow, is positioned in the upper portion of the insulated box or casing member. The cold air produced by the evaporator flows (like water, but more slowly) downwardly through the shelves or drawers of the refrigerator, cooling the articles placed thereon or therein but during this process gradually having its temperature raised to such a point that the warmed air rises until it reaches the evaporator where it is cooled again. There is thus at all times that the refrigerator is operating as such a downwardly flowing current of cold air and a rising current of warm air. (The terms "cold" and "warm" are used for comparative purposes only as even the "warm" air in the refrigerator is cold compared to room temperature.) In the "ideal" case, the cold air flows downwardly under the evaporator and, after touching the bottom of the box, crosses over to the other side, if the evaporator is located at one side thereof, or to both sides if the evaporator is placed in the center of the upper portion of the refrigerator. The presence of articles on the shelves or in the drawers, however, causes this "ideal" circulation of the air in the refrigerator to be disturbed as the articles deflect the cold air to such an extent that the flow thereof to certain parts of the refrigerator is prevented. Moreover, the warm air in some cases mixes with the cold air, withdrawing cold therefrom, and thus prevents certain parts of the refrigerator from becoming as cold as they would were not this "mixing" taking place. The present invention in one of its primary aspects is concerned with the mitigation or prevention of this "mixing" of the cold air with the warmer air and, in general, with the improvement of the circulation of cold air in refrigerators.

The above-mentioned and other objects are attained in accordance with the present invention by providing means for guiding the cold air from the evaporator to a point below the evaporator before it can contact any of the rising warmer air. This is accomplished in an illustrative embodiment of the invention, given by way of example, by providing a baffle member at the side of the evaporator but spaced therefrom. This baffle member is in general parallel to the vertical plane bisecting the evaporator and extends, by way of example, the entire height of the evaporator, or more. The top of this baffle member is curved so that the warm air outside the member is directed to the top of the evaporator and not down in the space between the baffle member and the evaporator within which space the flow of cold air is unimpeded by either articles placed in the refrigerator or by warm air.

The invention is described below, by way of example, in connection with a refrigerator of the "set-back" type, that is, one in which the plane of the front of the upper portion of the refrigerator (containing the evaporator) is behind or set back from the plane of the front of the lower portion of the refrigerator but it is to be understood that the principles of the invention are applicable to any type of refrigerator. When the baffle is provided in a refrigerator of the set-back type the baffle and the evaporator are placed in the upper part thereof and preferably extend down as far as the upper part of the lower portion of the refrigerator, thus providing a large space for ice cube trays and for a frozen food compartment.

The invention will be more readily understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which:

Fig. 1 is a front elevation view with portions broken away of a combined refrigerator and cabinet involving the invention;

Fig. 2 is a horizontal view partially in cross-section, taken along the line 2—2 in Fig. 1; and

Fig. 3 is a partial side view partly in cross-section of the refrigerator of Fig. 1.

Referring more specifically to the drawing, Figs. 1, 2 and 3 show, by way of example to illustrate the invention, a combined refrigerator and cabinet unit 10 employing means (to be hereinafter described) within the refrigerator to increase the efficiency of operation thereof in accordance with the invention. The unit 10 comprises a refrigerator 11, preferably of the "set-back" type disclosed in Earle Patents 2,180,460, issued November 21, 1939, and 2,312,326, issued March 2, 1943, and a cabinet 12 located above the refrigerator. The cabinet 12, comprising a shelved enclosure 13 closed by one or more doors 14, serves no function

in the improvement of the refrigerator operating efficiency so further description thereof is unnecessary.

The refrigerator 11 preferably comprises a lower refrigerated portion 20 supported on a recessed base 21, an upper refrigerated portion 22 located above the lower portion 20 but the front plane of which is set back from the front plane of the lower portion, and a table top member 23 of stainless steel, Monel metal or aluminite, for example, positioned above that part of the lower portion 20 which juts out in front of the upper portion 22.

The lower portion 20 is preferably provided with a plurality of drawers 24, 25, 26 and 27 to hold food and other articles to be refrigerated. If desired, one or more of the lower drawers can be longer than the top one in order to provide better circulation of cold air to the lower drawers. For a more complete description of set-back refrigerators employing drawers, reference is made to the above-identified Earle Patent 2,312,326.

The upper portion 22 is provided with an evaporator 28 comprising a shell or container for supporting evaporator coils (not shown) and having, by way of example, and as shown in Fig. 2, corrugated sides 29 and 30 and back 31 of any suitable form to provide maximum exposed area. Coils containing the cooling medium pass through or are supported by the back 31 and the sides 29 and 30 (or one or more of them) and are connected to the compressor-condenser unit preferably located outside the refrigerator unit. Within the shell of the evaporator 28 are two shelves 32 and 33 to support ice cube trays 40 and 41, respectively, or other articles to be frozen. If desired, cooling coils may pass through these shelves. Below the shelves is a relatively large chamber 34 which is suitable for retaining frozen foods of relatively large size. This chamber extends down almost as far as the top of the uppermost drawer 24 in the lower portion of the refrigerator and thus utilizes the space between the sill 51 of the door 48 and the top of the drawer 24 which would otherwise not be used. Additional coils may run around the sides, back or front of the chamber 34 (or any one or ones of them) to make this chamber colder than the rest of the refrigerator. In the lower portion of this chamber 34 a mesh basket 35 which may have either a solid or a mesh base is supported by lips 36 attached to and projecting inwardly from the sides 29 and 30. Two additional ice cube trays 42 and 43 can be supported from lips 37 and 38, respectively, similar to lips 36, after the mesh basket has been placed into position within the chamber 34. The lips 36, 37 and 38 may be parts of strong flanges or seats running around the inside of the chamber 34. They are made strong enough so that levers can be used to force the ice cube trays 42 and 43 and the mesh basket 34 from the adjacent lips if they should become frozen thereto. The shell 34 may have a bottom or not, as desired. Positioned at the side of the evaporator 28 in the upper portion are mesh shelves 44, 45 and 46 for the support of food. The two upper shelves preferably have a cut-out portion, as shown in Fig. 2, so that bottled drinks, milk or other articles having a height greater than the distance between shelves can be accommodated without turning them over on their sides. Doors 47 and 48 are provided as closure members for the upper refrigerated portion 22.

As is well known, heat is taken from the interior of the refrigerator by the refrigerant circulating through the coils of the evaporator 28. Thus the temperature of the air immediately surrounding the coils is lowered. In order to provide means for conducting this cold air directly to the lower portion of the refrigerator before it can be mixed with the warmest air in the refrigerator (that returning to the evaporator coils), the baffle member 50 is provided which extends, for example, horizontally from front to rear in the upper portion of the refrigerator and vertically from the region of the top of the evaporator to the region of the bottom thereof. Preferably the upper part of the baffle member is curved towards the evaporator so as to allow the "warm" air (indicated by the dotted arrows) to pass over the top of the baffle member without encountering the colder air (indicated by the full line arrows) between the baffle member and the evaporator. The cold air in the back of the lower portion of the refrigerator sets up a fairly rapid circulation of current of refrigerated air. The drawers project into this current and remove some of it, thus permitting a slower horizontal circulation of cold air in each drawer.

It will be apparent that by providing a baffle member 50 as described above, cold air can reach the lower portions of the refrigerator more directly than in the refrigerators of the prior art wherein milk and other bottles and other large articles prevented the direct flow of cold air to the bottom of the refrigerator and the cold air became mixed with warmer air returning to the evaporator coils. The circulation of cold by convection, conduction and radiation is otherwise similar to that in the arrangements of the above-identified Earle patents. Moreover, by providing a frozen food compartment having flanges 36, 37 and 38 upon which ice cube trays or food baskets can rest (instead of shelves, the space between the level of the lower sill of the door 48 and the top of the drawer 24 can be used for frozen food purposes or for additional ice cube containers.

Obviously, the invention is not limited to the specific form or position of the means for separating the cold air from the warmer air shown in the drawing, as will be apparent from the appended claims.

What is claimed is:

1. A refrigerator comprising a lower refrigerated portion, an upper refrigerated portion, the front of which is set back from the front of said lower portion, a table top member above said lower portion and in front of said upper portion, a door in said upper portion pivoted about a vertical axis, an evaporator in said upper portion having a shell which extends both above and below the level of the bottom of said door, a container adapted to rest within said shell, and means for supporting said container within said shell at such a level that at least a part of said container extends below the level of the bottom of said door.

2. A refrigerator comprising a lower refrigerated portion, an upper refrigerated portion, the front of which is set back from the front of said lower portion, a table top member above said lower portion and in front of said upper portion, a door in said upper portion pivoted about a vertical axis, an evaporator in said upper portion having a shell which extends both above and below the level of the bottom of said door, a container adapted to rest within said shell, and means for supporting said container within said

shell at such a level that at least a part of said container extends below the level of the bottom of said door, said last-mentioned means comprising lips mounted on the inside of said shell.

3. The combination of elements as in claim 1 and being further characterized in that the lower portion of said refrigerator includes a plurality of drawers and said evaporator extends down almost to the top of the uppermost one of said drawers.

4. A refrigerator comprising a lower refrigerated portion, an upper refrigerated portion, the front of which is set back from the front of said lower portion, a table top member above said lower portion and in front of said upper portion, a door in said upper portion, an evaporator in said upper portion having a shell which extends below the level of the bottom of said door, a container adapted to rest within said shell, means for supporting said container within said shell at such a level that at least a part of said container extends below the level of the bottom of said door, said last-mentioned means comprising lips mounted on the inside of said shell, and a baffle member at the side of said evaporator and spaced therefrom for separating downwardly flowing air from rising warmer air.

5. A refrigerator comprising a lower refrigerated portion, an upper refrigerated portion, the front of which is set back from the front of said lower portion, a table-top member above said lower portion and in front of said upper portion, a door in said upper portion pivoted about a vertical axis, an evaporator in said upper portion having a shell which extends both above and below the level of the bottom of said door, a container adapted to rest within said shell, means for supporting said container within said shell at such a level that at least a part of said container extends below the level of the bottom of said door, and a baffle member at the side of said evaporator and spaced therefrom for separating downwardly flowing air from rising warmer air.

6. A refrigerator comprising a lower refrigerated portion, an upper refrigerated portion, the front of which is set back from the front of said lower portion, a table-top member above said lower portion and in front of said upper portion, a door in said upper portion pivoted about a vertical axis, an evaporator in said upper portion having a shell which extends both above and below the level of the bottom of said door, a container adapted to rest within said shell, means for supporting said container within said shell at such a level that at least a part of said container extends below the level of the bottom of said door, and a baffle member at the side of said evaporator and spaced therefrom for separating downwardly flowing air from rising warmer air, said baffle member being generally parallel to the sides of said refrigerator and having its upper end terminate short of the top of said refrigerator and curve inwardly towards said evaporator, whereby rising warmer air passes over the top of the baffle member without interfering with the flow of colder air between the evaporator and the baffle member.

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