March 2, 1943. G. L. C. EARLE 2,312,326

REFRIGERATOR

Filed Nov. 9, 1940 2 Sheets-Sheet 1

FIG. 2

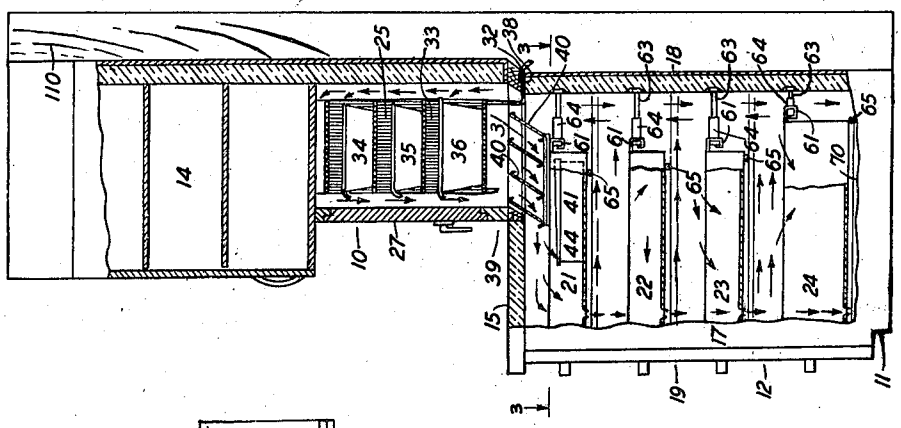


FIG. 5

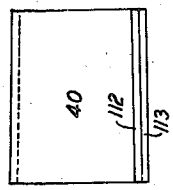


FIG. 6

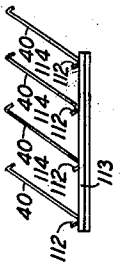
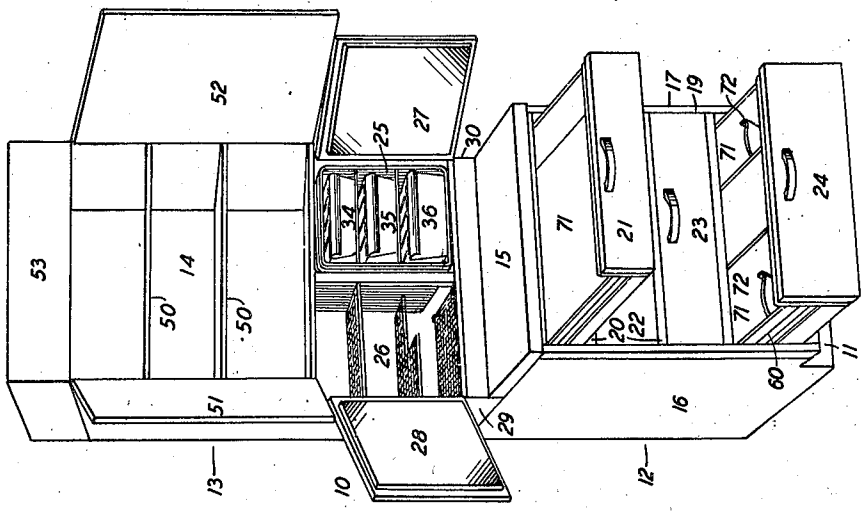


FIG. 1



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REFRIGERATOR

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FIG. 7

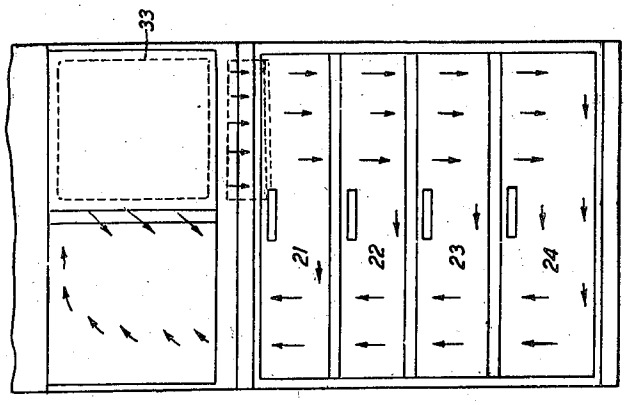


FIG. 3

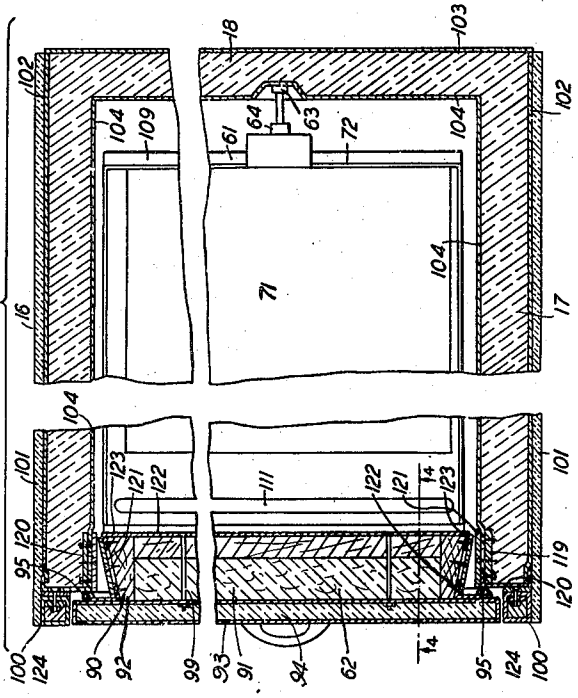
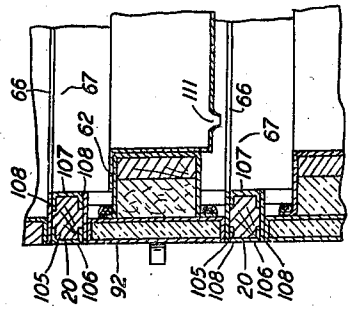


FIG. 4



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UNITED STATES PATENT OFFICE

2,312,326

REFRIGERATOR

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Application November 9, 1940, Serial No. 365,029

5 Claims. (Cl. 62—89)

This application relates to insulated cabinet structures and more specifically to refrigerators.

This application is a continuation in part of copending applications of Guyon L. C. Earle, Serial Nos. 318,223 and 318,224, filed February 10, 1940.

In each of the above-mentioned Earle applications, there is disclosed a refrigerator of the "set-back" type, that is a refrigerator which has a deep lower refrigerated portion and a more shallow upper refrigerated portion the front surface of which is set-back from the front surface of the lower refrigerated portion. A table-top member is arranged above the lower portion and in front of the upper portion. The lower portion contains a plurality of drawers each comprising one or more racks or trays for the support of food and other articles to be refrigerated. The present invention relates primarily to the promotion of cold air circulation through refrigerators having lower portions containing drawers, and also to novel means for catching the water of defrosting without interfering with the cold air circulation.

It is an object of this invention to provide novel apparatus for promoting the circulation of cold air in refrigerators, particularly in "set-back" refrigerators having drawers in the lower portion thereof.

In the usual box-type refrigerator, the circulation of cold air is from the bottom of the evaporator, down one side to the bottom of the refrigerator, across the bottom surface, and then up the other side to the evaporator where it strikes the top and sides thereof. If this circulation only were provided for the set-back refrigerator, not sufficient cold air would reach the front part of the refrigerator (where it is needed most), as the evaporator is located at the rear portion of the refrigerator and the cold air circulation would tend to take place only in the rear of the refrigerator leaving a warm spot in the front. In Patent 2,180,460, issued November 21, 1939, to Guyon L. C. Earle, a "set-back" refrigerator is disclosed in which a deflecting or air-circulation member is provided to circulate some of the cold air into the front portion of the lower part of the refrigerator, which lower part comprises a single chamber closed by a door. As pointed out in the copending Earle applications referred to above, there are many advantages inherent in a refrigerator structure having drawers to hold the food and other articles to be refrigerated that are not present in the single-chamber type of refrigerator. With a drawered structure, difficulty has been encountered in obtaining adequate cold air circulation, especially in the lower drawers. In accordance with this invention, adequate circulation can be assured by providing one or more apertures in the bottoms of each of the upper ones of the drawers (and possibly also in the lower drawer). It can also be improved by making the lower drawers somewhat longer than the top one or ones to permit a portion of the cold air to be deflected into the top drawer and allow other portions to be guided into the rear portions of the lower drawers. Inasmuch as none of the drawers extends the full depth of the well, there is thus provided a comparatively clear space for rapid air circulation in the rear of the drawers. One or more of the drawers however may have a lip at the rear thereof to guide cold air into the drawer, or a sloping rear.

In the arrangement according to this invention, it can be considered that there is a "double" circulation of cold air, (1) the conventional one where the cold air goes downward in substantial vertical paths from the evaporator, across the bottom of the refrigerator and then up the other side thereof to the top and side of the evaporator, and (2) that caused by the circulation of air in a generally horizontal direction through each of the drawers, and more especially through the top drawer, which can be caused by providing this drawer with a sheet bottom with a slot across the front portion thereof to carry the cold air largely to the extreme front of the upper drawer. By actual test this "double" circulation has been found to be very effective in providing an even degree of cold in the refrigerator and it is even possible to make the front part of the refrigerator as cold as the upper rear. It has been discovered by these tests that if this rear circulation is interrupted or cut off, the temperature of the box mounts seriously showing that the rear circulation makes the set-back refrigerator with drawers efficient.

A problem encountered in properly insulating the drawer structures if metal is used is that of breaking the metal-to-metal contact between the inside and the outside of the unit. This has been accomplished in each drawer comprising an inside hollow insulated drawer front and an outside hollow insulated drawer front (each front comprising sheet metal fastened to a framework of poor conducting material) by so constructing the inside drawer front that the sheet metal on the back of this drawer front does not touch the sheet metal on the front thereof. The hol-

low drawer front frames of poor conducting material are preferably filled with insulation, enameled and baked. A gasket is placed between the two drawer fronts of each drawer.

As the soft gasketing will not stand high temperatures, it is put on after the baking process. The gasketing rests against horizontal mullions between the drawers and vertical mullions at the sides of the drawers when the drawers are closed. These mullions may comprise hollow metallic structures filled with an insulating material or they may comprise an inner member of an insulating material, such as wood, covered with two spaced apart sheet metal caps to break the metal-to-metal contact. The mullions may be made of plastic material on plywood which will make them waterproof, strong and insulating. If desired, metal gasketing may be used.

There may be provided in the refrigerator of this invention a double-walled or insulated frozen-food container in the upper drawer of the lower refrigerated portion. The deflecting means (either one or more angularly arranged plates or angularly biased connecting strips between the upper and the lower portions of the refrigerator) for guiding the cold air from the evaporator in the upper portion to the lower portion, "spills" cold air over the rear part of the frozen food container, thus making the inside of this container very cold and making it suitable for keeping meats, ice cream, etc. in a more frozen condition. The deflecting means is arranged to permit some of the air to pass down through the rear of the refrigerator while deflecting the rest of the air from the evaporator in such a manner that it is deflected to the front of the refrigerator. If desired, the above-mentioned container may be used as a defrosting tray to catch the water from the coils, it being guided from the evaporator to the front portions of the deflecting members and thence to the container.

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

Fig. 1 is a perspective view of a refrigerator embodying my invention;

Fig. 2 is a side elevation view in partial cross-section of the refrigerator of Fig. 1 with the drawers closed;

Fig. 3 is a plan cross-sectional view taken along line 3—3 of Fig. 2;

Fig. 4 is a partial cross-sectional elevation view taken along line 4—4 of Fig. 3;

Fig. 5 is a front view of a deflecting member used in the structure shown in Fig. 2;

Fig. 6 is a side view of the deflecting members of Fig. 5 and a gutter member used as a guide for water droplets produced in defrosting; and

Fig. 7 is a front elevation view of the refrigerator of this invention with arrows superimposed to indicate air circulation within and dotted portions indicating the positions of the deflecting members with respect to the container for the water of defrosting.

Referring more particularly to the drawings, there is shown in Fig. 1 for purposes of illustration to point out the features of novelty of this invention, a refrigerator 10 of the "set-back" type generally shown in Patent 2,180,460, issued November 21, 1939, to Guyon L. C. Earle (with drawers substituted for the lower door), and in copending applications Serial No. 318,223, filed February 10, 1940, and Serial No. 318,224, also filed on February 10, 1940. The refrigerator unit 10 comprises a base member 11, a lower refrigerated portion 12, and an upper refrigerated portion 13. Above the upper portion 13 may be placed, if desired, a cabinet section 14. A table top member 15 preferably covers that portion of the lower refrigerated portion 12 which is in front of the upper portion 13. The refrigerator 10 is particularly adapted to be used in a kitchen unit which also comprises a stove, a sink, a dish drainer and cabinets, the table top member serving as a drain board for the sink. Such a kitchen unit is shown in Earle Patent 2,180,459, issued November 21, 1939, and in copending applications Serial No. 314,402, filed January 18, 1940, Serial No. 318,224, filed February 10, 1940, and Serial No. D-91,998, filed April 27, 1940, which is now Design Patent 132,010, issued April 14, 1942.

The lower portion 12 of the refrigerator comprises side walls 16 and 17, a back wall 18, and a front wall 19 which is broken up to provide mullions 20 for a plurality of drawers 21, 22, 23 and 24, the lower one of which is preferably larger than the others so as to accommodate a large number of bottles, a large roast, etc. The upper portion 13 of the refrigerator preferably comprises an evaporator compartment 25 and an upper refrigerated compartment 26 at the side thereof. The compartments 25 and 26 are preferably closed by doors 27 and 28 respectively.

The upper portion 13 of the refrigerator has side walls 29 and 30 which may be the upper portions of the side walls 16 and 17, if desired, but preferably the upper and lower portions of the refrigerator are made as separate entities and connected together in the kitchen by means of a suitable gasket 31; the connections or pipes 32 from the evaporator coils 33 preferably passing out the side of the refrigerator through the gasket, although in some arrangements these connections may pass out through the gasket at the rear of the refrigerator or through a hole in the wall of the refrigerator cabinet. The compressor of the refrigerator is preferably located under the sink of the unit, as shown in certain of the above-identified Earle applications.

Located within the evaporator coils 33 are a plurality of ice cube trays 34 to 36 inclusive, the lower tray 36 preferably being larger than the others. The evaporator is placed snugly within the frame to eliminate the necessity for an inner door but with enough space to prevent the door 27 from being frozen shut. There is space at the sides and back for better circulation of cold air around the evaporator. If desired the tray 36 may be used as a means to freeze food, the grid member for the ice cubes being removed for this purpose. Or, if desired, the tray 36 may be removed entirely and replaced by a drawer front or even a door. As another alternative a frozen food compartment (not shown) may be located under the drawer 36 (assuming the upper portion has sufficient height for the purpose) the food to be supercooled being placed on a mesh shelf (not shown) beneath the evaporator coils 33. Also beneath the coils 33 may be removably arranged one or more deflecting members 40 which may be used to "spill" part of the cold air from the evaporator 33 into the top drawer and thence to the upper front and lower front portions of the refrigerator. Some of the cold air passes through the space between the deflecting members 40 to reach the lower rear portion of the refrigerator. The front portion of the refrigerator really needs more cold air than the rear because the

rear is built-in and not so exposed to room temperature but a rapid circulation necessary for the efficiency of the evaporator takes place in the rear—behind the drawers. Layers of insulation in back of the refrigerator and for the drawer fronts may be provided and similar layers of insulation (not shown) provided for the sides.

The angularly arranged connecting strips **38** and **39** between the upper and lower portions of the refrigerator, in cooperation with the deflecting members **40**, "spill" the cold air into the drawer **21** and also into the container **41** which may be double-walled or otherwise insulated and which may be mounted in or carried by the top drawer **21**. The member **41** serves as an extra cold food container and also can be used to catch the drip from the evaporator when the refrigerator is being defrosted. In defrosting (and at other times also, if desired), the deflecting members **40** (see Figs. 2 and 6) may be used to guide the drip water. The turned-up ends **112** of the deflecting members **40** catch the water of defrosting and direct this drip water from the evaporator coils **33** away from the air circulation spaces **114** between the members **40** and into a gutter (or gutters) **113** which leads into the container **41**. The members **40** may be so spaced that every drop of water of defrosting strikes one of the deflecting members **40**. The container **41** may be slidably mounted so that it may be moved under the deflector drip or out in the front of the drawer **21**, as desired. If desired, one slotted deflecting member **40** may be provided and arranged so that when not defrosting it may be removed or not, as desired. The water of defrosting is guided through the slots or apertures to the container **41**. The container **41** may have a cover **44** which is preferably lower at the front than the back so that it may act as part of the deflecting means to carry the cold to the front of the refrigerator. The top **44** of the container **41** may be fixedly attached to the drawer frame or it may rest on the container **41**. In either event provision may be made for making slidable adjustment between the top **44** and the container **41** so that more or less of the rear portion of the container **41** may be left partly open at the top to allow the cold air from the evaporator to "spill" into the container **41** or it may be completely closed or opened. If desired, the rear part of the upper refrigerated portion **13** may overhang the rear part of the lower refrigerated portion **12** and may project into the wall **110** of the room, as in the arrangement shown in application Serial No. 318,224, filed February 10, 1940, by Guyon L. C. Earle, and as shown in the drawings. If desired, the container **41** (or another one like it) may be located in the upper portion of the refrigerator under the evaporator **33**.

Above the upper refrigerated portion **13** of the refrigerator there may be provided a cabinet member **14** provided with a number of shelves **50** and closed by doors **51** and **52**. A molding or boxed-down ceiling **53** may be located above the cabinet section. For a more detailed description of a suitable sectional cabinet member for a complete kitchen unit, reference may be made to an application of Guyon L. C. Earle, Serial No. 336,698, filed May 23, 1940.

Referring now to the lower portion of the refrigerator, each of the drawers **21**, **22**, **23** and **24** is preferably mounted from its well by telescopic extension members **60**. In one arrangement the top drawer may be made shortest and the lower ones may increase progressively in length, the bottom drawer being longest, thus assisting the circulation of the cold air into each drawer. If desired, all drawers may be the same length or all except the bottom one the same length. This latter arrangement is shown by way of example in the drawings. Each drawer preferably comprises a drawer frame **61** on the front portion of which is attached the inner drawer front **62** and on the rear portion of which may be attached a bumper **63** which is part of an air cushion arrangement **64** for checking the inward movement of the heavily laden drawer. Rollers **65** (preferably two per drawer) engage tracks **66** (see Fig. 4) which are supported from bands **67** which extend around the entire inside periphery of the refrigerator, each band being located between two drawers. The band **67** beneath the lower drawer **24** may be omitted and the tracks **66** may be attached to the bottom **70** of the refrigerator, if desired. The rear portion of each of the tracks is preferably inclined downwardly and rearwardly to provide a gravity operated drawer closure. Each of the drawer frames **61** supports one, two, three or more trays **71** which may be open bottomed (as in those shown in drawer **24**) or partly perforated (at the front), as shown in drawer **21**, or having a plurality of apertures therein (as shown in the copending Earle applications referred to above). The outer trays **71** in the drawer **24** preferably have inclined support members **72** therein which are curved or otherwise bent to keep the bottles from rolling and which have bent lower portions **73** to support the bottoms of the bottles at the opposite side placed in the racks. The drawer structure described up to this point forms per se no part of the present invention and is more fully described in an application of Guyon L. C. Earle, Serial No. 318,223, filed February 10, 1940. With the top drawer being shorter than the others, cold air from the evaporator can get into the back of the lower drawers without passing through the top drawer, although cold air also reaches the lower drawers through the top one. The air is circulated to the front of each drawer. By locating a single aperture **111** in the front of the top drawer (as in the drawer shown in Fig. 3), the air is drawn to the front of the drawer where it then slides down (cold air travels in a very similar manner to water) into the next lower drawer. The lower drawers (and also the upper one) may have a single aperture or a plurality of smaller ones so that air may circulate to the drawers below.

Reference will now be made to Figs. 2 and 7 wherein arrows are superimposed on the structure to show the cold air circulation. As will be seen from these figures, there is a circulation at the rear of the refrigerator including the space behind each of the drawers (due to the fact that none of the drawers occupies the full depth of its well) which is due to the cold air from the evaporator coils **33** dropping to the lower portion of the refrigerator and being deflected sideways and upward by the sides and bottom of the refrigerator. This circulation is shown by the arrows in Fig. 7 and will be designated for the purposes of identification the "rear circulation." It is closely analogous to the circulation taking place in the ordinary "box-type" refrigerator except that it is free as there are no shelves or stored articles to impede this "rear circulation." In addition, because of various factors (all of which supplement each other and which include the sloped

connecting members 38 and 39, the deflecting members 40, the different lengths of the drawers 21, 22, 23 and 24 which fact permits air from the "rear circulation" to be deflected into each drawer (preferably from a lip 109, which may be sloped at the top rear of each drawer), and the apertures 111 in the drawers), there is a "front circulation" of air as shown schematically by the arrows in Fig. 2. One or more of the above-mentioned factors may be omitted if desired. It might be considered that each drawer reaches into the "rear circulation" and takes some cold air for itself, but actually the cold air pushes its way into and the warm air is pushed or drawn out of each drawer by the rapid "rear circulation."

Reference will now be made to Fig. 3 which is an enlarged cross-sectional plan view of a portion of one of the drawer fronts. As an example of a suitable structure, the inner drawer front 62 comprises a hollow member formed by a wooden frame 90 which is filled with insulation 91, preferably of the non-inflammable block type for refrigerators which can stand relatively high and low temperatures. The outer drawer front 92 preferably comprises a hollow frame member 93 (preferably of wood) filled with sheet insulation 94. After the drawer fronts 62 and 92 have been enameled and baked at a temperature of from about 300 degrees F. to 400 degrees F. (although these temperatures are not critical), they are assembled and filled with insulation. They are then welded, or otherwise sealed. A gasket member 95 which comprises an elliptical portion with a wide lip is then placed with respect to the two members 62 and 92 so that the lip passes between them, the gasket being also held in place by any suitable means such as screws. The inner drawer front member 62 may be fastened to the outer drawer front member 92 by toggle or ordinary bolts 99 although other means may be employed, if desired. For example, each drawer front may be fastened to a wooden frame. Mullion members 100 are fastened to the sides of the refrigerator, each of which sides preferably comprises an outer wall or layer of insulation 101, a metal outside wall 102, an inner thick layer 103 of insulation and an inner metal wall 104. The walls 102 and 104 are separated and likewise held in place by a wooden framework. The mullion 100 may be extended around between the drawers if desired to form the mullions 20. Each of the mullions 20, by way of example, comprises a wooden or composition framework member 105 having two caps 106 and 107 thereon spaced apart to break the metal-to-metal contact between the inside and outside of the refrigerator. Thin layers 108 of Bakelite or similar material cover the side surfaces of the caps 106 and 107. Similar Bakelite strips 119 cover the breaks in the metal-to-metal contact of the two pairs of metallic members 120 and 104 while Bakelite strips 121 serve the same function for the metallic members 122 and 123. Each mullion 20 serves the double purpose of breaking the metal-to-metal contact between inside and outside of the refrigerator and also serves as a guiding member for two drawers (except of course for the lower mullion 20). The inside surface 124 of the mullions 20 are the contact members for the gaskets 95 to close against.

Various modifications are possible in the arrangements herein described without departing from the spirit of the invention, the scope of which is indicated by the appended claims. For example, pressed plywood or similar material covered with Bakelite may be used as material for walls and mullions. The invention is applicable to both gas and electric refrigerators.

In the claims, the term "drawer" is intended to include a drawer framework and the term "drawer side" to include the side of the framework or the side of a tray or rack carried by said framework.

What is claimed is:

1. In a refrigerator having a lower deep refrigerated portion and an upper set-back refrigerated portion, an evaporator in said upper portion, a deflecting means having spaces between portions thereof to deflect a portion of the cold air from said evaporator to the front part of said lower portion and to allow another portion of said cold air to pass through the spaces in said means to cool the rear part of said lower portion, and a container, said deflecting means having guide means to conduct the water of defrosting into said container.

2. In a refrigerator having a lower relatively deep refrigerated portion and an upper relatively shallow set-back refrigerated portion, means including an evaporator in said upper portion for producing a current of cold air which flows downwardly and then upwardly in the rear part of said lower portion, and a plurality of drawers arranged one above another in said lower portion, each having a horizontal member, a major portion, at least, of which is impervious, extending from the front part of said lower portion into the cold air current by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal air current above each of said horizontal members in addition to the cold air current in the rear part of said lower portion, at least one drawer under the top one being longer than the top one.

3. In a refrigerator having a lower relatively deep refrigerated portion and an upper relatively shallow set-back refrigerated portion, means including an evaporator in said upper portion for producing a current of cold air which flows downwardly and then upwardly in the rear part of said lower portion, and a plurality of drawers arranged one above another in said lower portion, at least one drawer under the top one having a horizontal member, a major portion, at least, of which is impervious, extending from the front part of said lower portion into the cold air current by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal air current above said horizontal member in addition to the cold air current in the rear part of said lower portion, at least one drawer under the top one being longer than the top one.

4. In a refrigerator having a lower relatively deep refrigerated portion and an upper relatively shallow set-back refrigerated portion, means including an evaporator in said upper portion for producing a current of cold air which flows downwardly and then upwardly in the rear part of said lower portion, and a plurality of drawers arranged one above another in said lower portion, at least one drawer under the top one having a horizontal member, a major portion, at least, of which is impervious, extending from

the front part of said lower portion into the cold air current by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal air current above said horizontal member in addition to the cold air current in the rear part of said lower portion, at least one drawer under the top one being longer than the top one and at least one drawer above the bottom one having an aperture in the front part thereof to allow the cold air therein to reach a lower level.

5. In a refrigerator having a lower relatively deep refrigerated portion and an upper relatively shallow set-back refrigerated portion, means including an evaporator in said upper portion for producing a current of cold air which flows downwardly and then upwardly in the rear part of said lower portion, and a plurality of drawers arranged one above another in said lower portion, at least one drawer under the top one having a horizontal member, a major portion, at least, of which is impervious, extending from the front part of said lower portion into the cold air current by an amount sufficient to deflect cold air from said current toward the front part of said lower portion of the refrigerator but not sufficient to cut off said current, whereby there is produced a generally horizontal air current above said horizontal member in addition to the cold air current in the rear part of said lower portion, at least one drawer under the top one being longer than the top one and at least one of said drawers comprising metallic material, whereby cold is carried forward from said cold air current in the rear part of said lower portion by conduction through said material in addition to said horizontal cold air current.

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