

Dec. 29, 1942.

C. H. HERTER

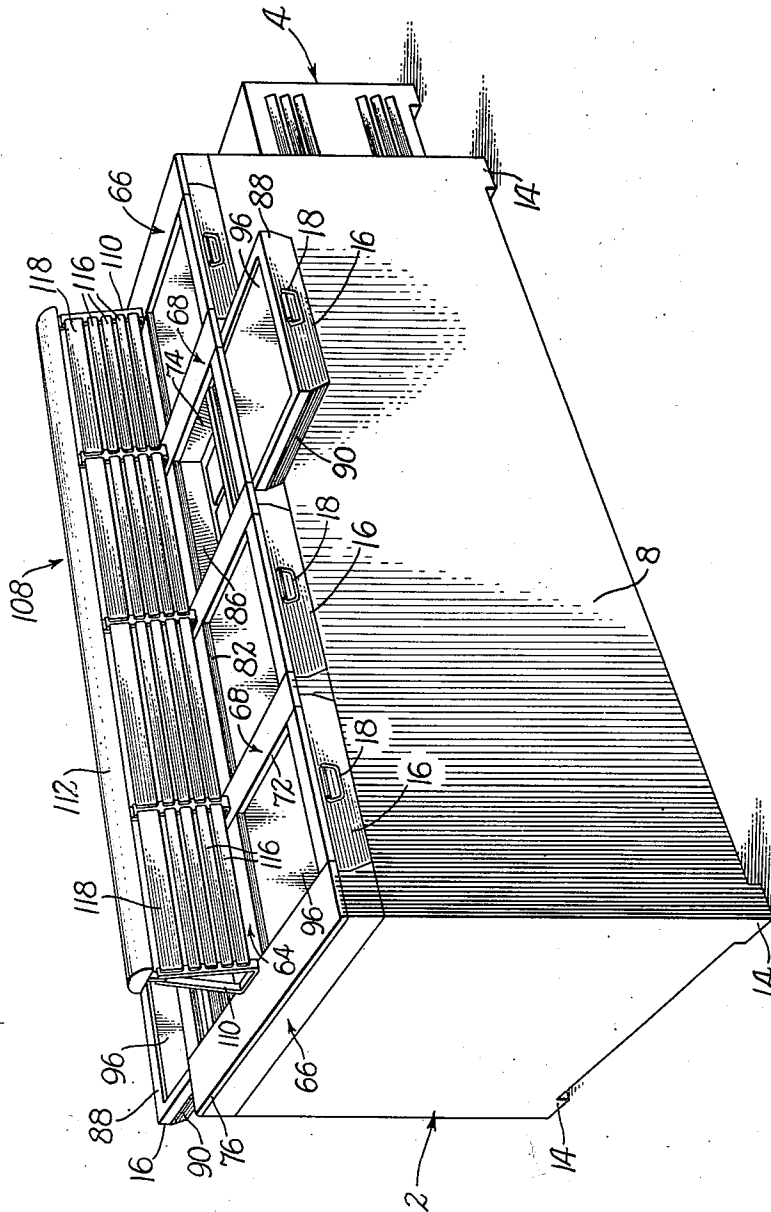
2,306,385

REFRIGERATION APPARATUS

Filed May 29, 1940

5 Sheets-Sheet 1

Fig. 1.



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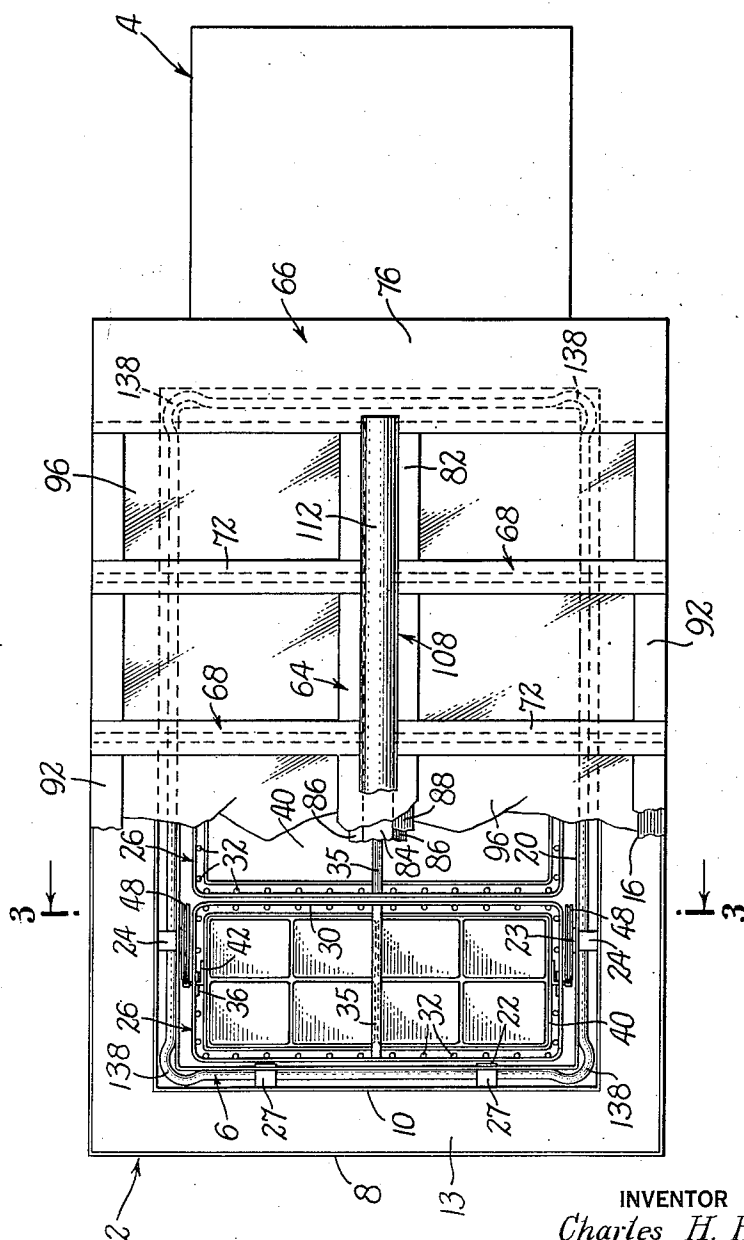
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5 Sheets-Sheet 2



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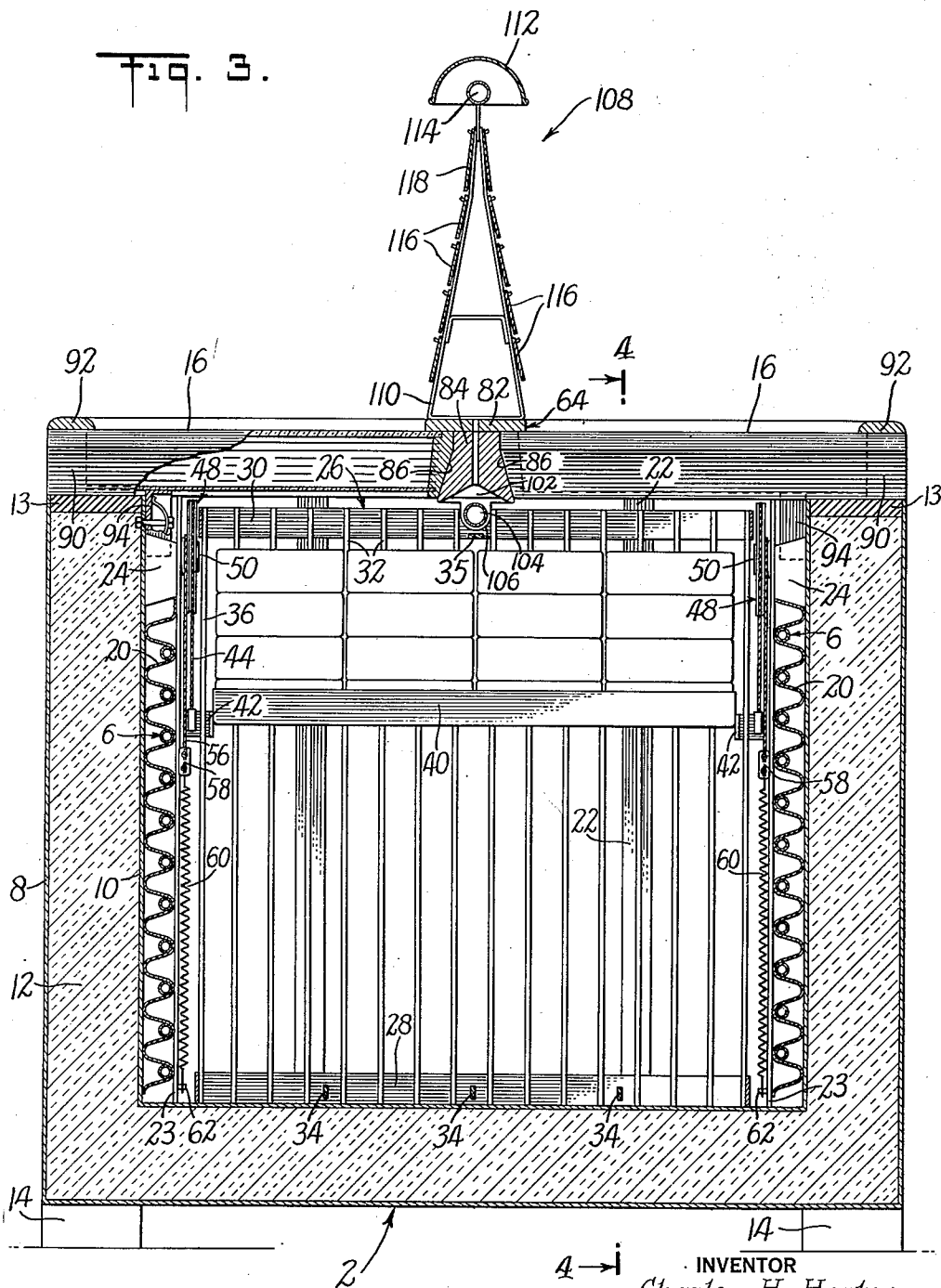
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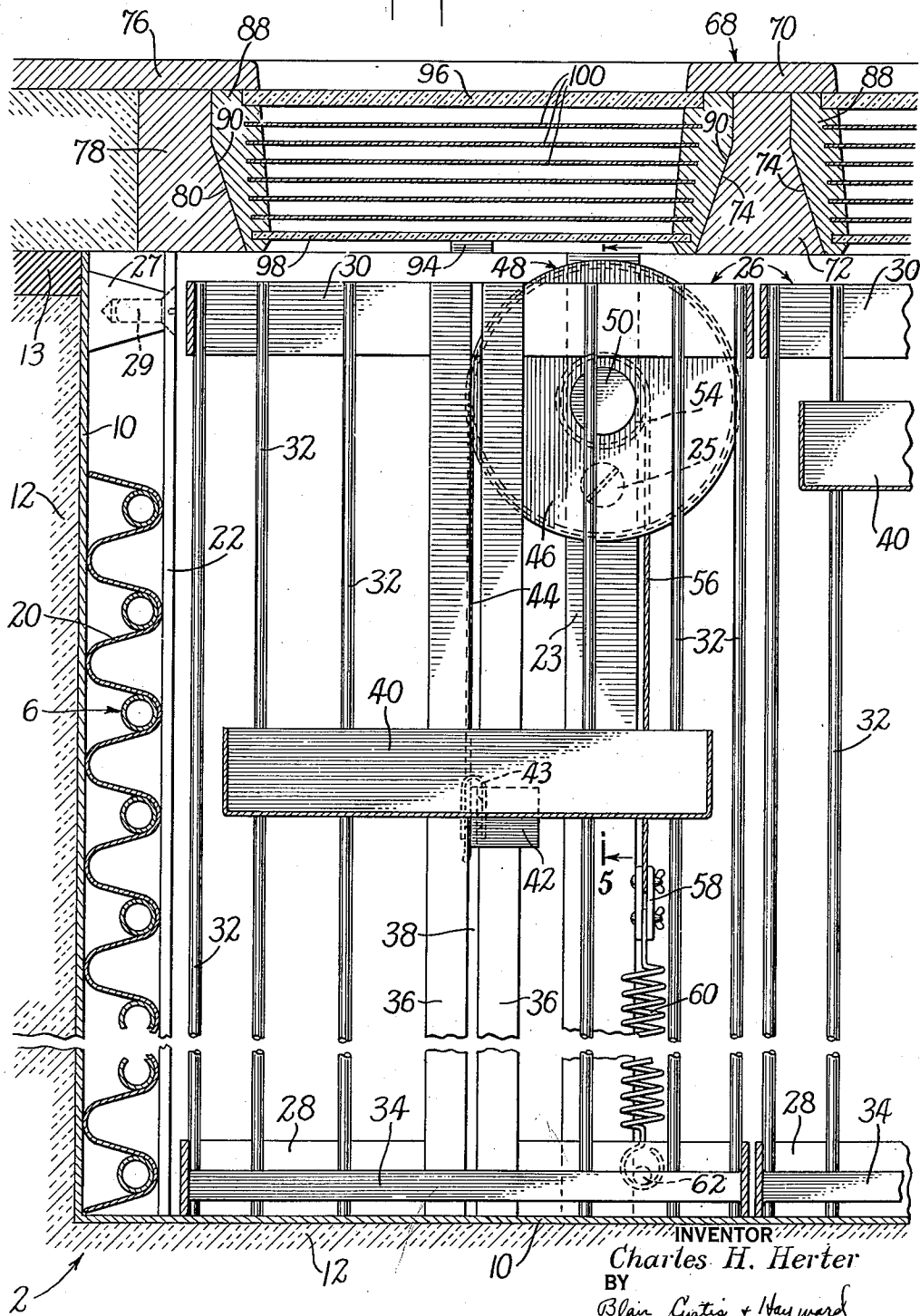
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5 Sheets-Sheet 4

Fig. 4.



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Fig. 5.

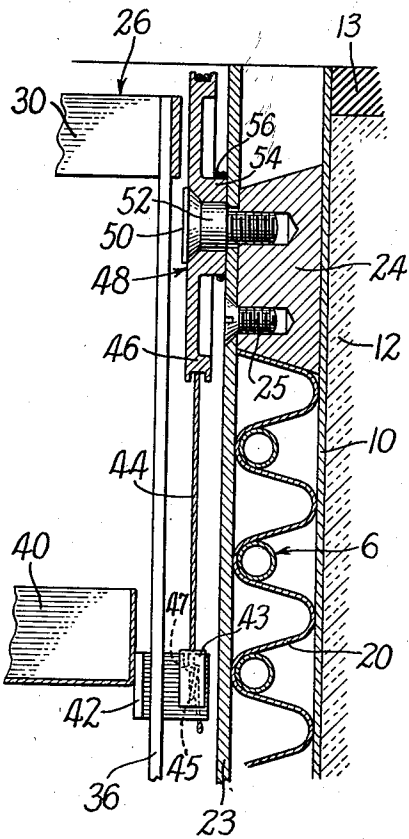


Fig. 6.

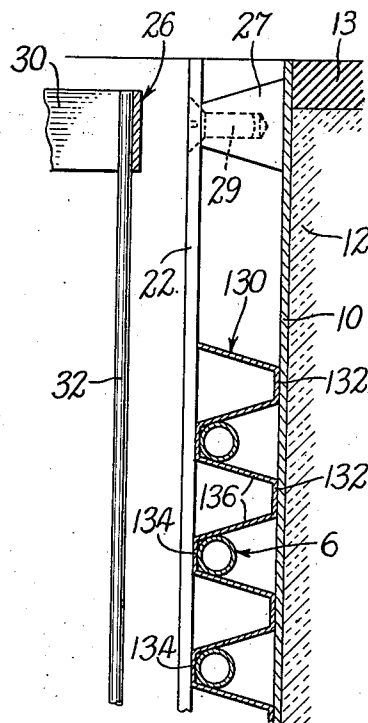
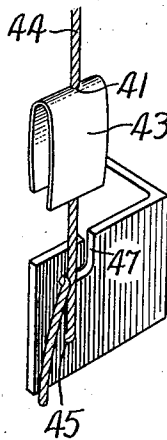


Fig. 7.



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REFRIGERATION APPARATUS

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Application May 29, 1940, Serial No. 337,767

12 Claims. (Cl. 62—39.5)

This invention relates to refrigeration and more in particular to a flat-top self-service refrigerator display cabinet for storing quick-frozen packaged foods at low temperatures.

An object of this invention is to provide a refrigerator cabinet where products, such as packaged frozen foods, may be stored, displayed and easily removed, all without injury to the products in any way. A further object is to provide a self-service cabinet which may be opened with one hand, and which may be easily closed after the product has been removed. A still further object is to provide a store fixture which will constantly present to the customer products to be sold. Another object is to provide an insulating transparent structure. A further object is to provide apparatus of the above character which is sturdy in construction, economical to build and operate, and which will give satisfactory results under varying conditions of use. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the drawings—

Figure 1 is a perspective view of one embodiment of my invention;

Figure 2 is a top plan view thereof with portions of the top structure broken away and with certain parts in section;

Figure 3 is a vertical section on the line 3—3 of Figure 2;

Figure 4 is a view on the line 4—4 of Figure 3, with the center portion of the cabinet omitted;

Figure 5 is a view on the line 5—5 of Figure 4;

Figure 6 is a view similar to Figure 5, showing a modified construction and omitting certain of the elements, and

Figure 7 is an enlarged view of the cord attaching means shown in Figure 5.

In distributing products such, for example, as quick-frozen packaged foods, difficulty has been encountered in providing proper refrigeration and at the same time displaying the products. In fact, even when frozen foods are attractively packaged, it is sometimes difficult to sell them because they cannot be properly displayed. In the past, when the available display cabinets have been used for frozen foods, the cost of operation has been excessive, with the result that the distribution costs have been high. In addition

to this, the foods have been constantly subjected to the possibility of premature thawing and refreezing, which results in food spoilage and thus increases the cost and difficulties of distribution. It is an object of this invention to provide a display cabinet for frozen foods which will reliably maintain the foods at a safe temperature while, at the same time, the foods will be displayed and will be easily accessible. These and other highly desirable results are obtained without excessive cost.

In the illustrative embodiment of this invention, the foods are stored in a flat-top display cabinet having horizontally sliding doors or lids. Packaged frozen foods are carried within the cabinet upon vertically movable trays or elevators, and these trays are properly positioned at all times so that the top packages upon each tray are held adjacent the lids. The cabinet is of the self-service type, and the customer may open the cabinet by pulling the lid outwardly, and may then remove one or more packages of the food and reclose the lid by merely pushing it inwardly. By providing a horizontal opening in the top of the cabinet, the heavy cold air tends to remain in the cabinet even though the lid is open, and as a result, a very small amount of warm air enters the cabinet. Furthermore, when the cabinet is partially filled, most of the air space is below the packages, and the packages themselves form a cover or lid for this air space when the sliding lid is open. In this manner, the cold air within the cabinet is protected and is not replaced by warm air. This materially reduces the possibility of the temperature within the cabinet rising to a point where the food will be partially thawed.

Furthermore, when warm air enters the cabinet, it carries with it a large amount of moisture, and when this air is cooled, this moisture condenses and forms frost upon the refrigerating surfaces. The forming of frost in cabinets of this character is a very serious problem, as the frost insulates the refrigerating surface, and in maintaining the proper cabinet temperature, an extra load is placed upon the refrigerating equipment. Such a coating of frost may even cause the temperature within the cabinet to rise to a point where the food will be damaged. It is thus seen that by preventing the entry of warm air into the cabinet, many of the difficulties normally encountered during operation are materially reduced, and the products are maintained in proper condition.

In this embodiment, the top wall of the cabinet

is provided with horizontal windows through which the contents of the cabinet may be readily seen. These windows are in the form of sliding lids, each of which covers an opening through which access may be had to the cabinet. Each of these lids is in the form of a frame which holds a large number of closely spaced, parallel sheets of transparent material. These sheets divide the space within the frame into a number of horizontal sheet-like dead-air spaces, and due to the fact that the air spaces are thin and are positioned horizontally, they provide an excellent insulating medium.

In this connection, it should be noted that heat is transmitted by three different actions, that is, by conduction directly through a substance, by radiation directly through a transparent substance, and by convection through gas-filled spaces in which the gas, such as air, is heated and rises from or along a warm surface to replace cooler and heavier air. With the present type of window, conduction is very small as heat is not readily transferred in this manner through either the transparent insulating material or the air. Likewise, radiation is small as the normal light radiates very little heat.

Furthermore, convection is largely eliminated as the basic conditions necessary for convection are not present. That is, with the horizontal top window, the heat must move downwardly from the warm outside wall to the cold inside wall, and the temperature drop through the window results in each air space having a bottom wall which is colder than its top wall. Thus, the air in the bottom of each air space is colder than the air in the top of this space, and due to the cooler air being heavier, there is no tendency for vertical circulation of the air. It has been found that convection is largely eliminated by making these air spaces of a thickness of three-eighths of an inch or less. With an air space of this thickness, the air throughout the space is effectively stratified, so that the warm film of air covers the top wall and the cooler film of air covers the bottom wall. In this manner, a transparent insulating medium is provided which maintains heat transfer at a minimum and also avoids the difficulties encountered in providing a vacuum chamber.

Passing now to a more detailed discussion of the present embodiment and the specific details thereof, the entire unit is shown in Figure 1 of the drawings with the cabinet indicated at 2, and a refrigerating unit indicated at 4. This refrigerating unit includes a motor-driven compressor, a condenser and a receiver, and control means is provided which operates the compressor in accordance with the temperature within cabinet 2. The evaporator of the refrigerating unit is in the form of a coiled pipe unit which extends around the inner side walls of the cabinet (see Figures 2 to 6), indicated at 6, and will be discussed more in detail below.

Referring particularly to Figure 3, cabinet 2 is formed by an outer metallic shell 8 and an inner metallic shell 10, and these two shells are spaced apart with the space therebetween filled by a rigid insulating material 12, illustratively compressed cork-board. The top edges of the shells are joined at the top by a strip 13 of heat-insulating composition board so that the space occupied by the insulating material is effectively sealed and the inner shell is insulated from the outer shell. The cabinet is supported at each

corner (Figure 1) by four legs 14, there being one leg at each corner.

The top wall of the cabinet is in the form of a frame which carries eight sliding lids 16, with four lids upon each side of the cabinet, and in this embodiment, each lid is provided with a handle 18 by which it may be pulled outwardly in drawer fashion to permit access to that particular portion of the cabinet. Referring again to Figure 3, extending along and in contact with the inner side walls of inner shell 10 is a corrugated liner 20 having horizontal corrugations. This corrugated liner forms a plurality of elongated recesses between itself and the adjacent walls of the inner shell, and the coiled pipe unit 6 extends through these recesses. The coiled pipe unit and the liner form a heat-transfer unit whereby the heat is effectively withdrawn from the cabinet, and by providing this construction, the unit is sturdy and cooperates with the shell structure to form a sturdy cabinet. At each end, this heat-exchange unit is provided with two vertically extending strap members 22, and spaced along each side of the cabinet are four similar strap members 23. Each strap member 23 is reinforced at its top by a metallic block 24 and is held thereto by a screw 25, shown best in Figure 5. Block 24 fills the space between the top of the strap member and the wall of the inner shell and extends along the adjacent top portion of the liner 20. Each strap 22 is attached to a similar block 27 by a screw 29.

The interior of cabinet 2 is divided into four compartments by means of four guard frames or baskets 26 which are removably positioned transversely within the cabinet. The construction of baskets 26 is best shown in Figures 3 and 4, there being at the bottom a rectangular frame 28 and at the top a similar rectangular frame 30, and extending between these frames are vertical bars 32. The bottom of the basket is formed by three cross straps 34 which are equally spaced and extend transversely of frame 28. Extending across the top of each basket at the center is a brace strap 35. At the center of each end of the basket are two vertical straps 36 (Figure 4) which are spaced apart to provide a vertical slot 38 to be referred to below.

Positioned within each of baskets 26 is a tray 40 having a flat bottom and upturned side and end walls, which is supported at its ends by a pair of angle brackets 42. Each of angle brackets 42 has one side welded to the central lower portion of the end wall of the tray, and the other portion of the angle brackets extends through the adjacent slot 38 between straps 36. As shown best in Figure 5, the right-hand end of bracket 42 is removably attached to a supporting cord 44 which extends upwardly with its upper end coiled about and attached to a large sheave 46 of a pulley generally referred to at 48. The particular adjusting means for attaching cord 44 to bracket 42 is shown partially assembled in Figure 7. Bracket 42 is provided with a hole 45 through which cord 44 extends, and above the hole is a slot which extends downwardly from the top edge of the bracket and then extends horizontally. A resilient inverted-U clamp member 43 has a hole 41 through which the cord 44 extends. The end of cord 44 is pulled through hole 45 until cord 44 is of the right length, and the end of the cord is then pulled upwardly and slipped into slot 47 to the position shown. In this position, the end of the cord is dropped downwardly and clamp 43 is pushed down over

the cord and the bracket. Clamp 43 holds itself in place and prevents cord 44 from slipping.

Pulley 48 is supported on block 24 by a stud bolt 50 which has a bearing portion 52 which fits against strap member 23 and assists in holding the strap member in place. At the right, pulley 48 is provided with a small sheave 54 about which is coiled a cord 56 with the end of the cord attached to the sheave. As shown in Figure 4, the other end of cord 56 extends downwardly and is adjustably attached by means of a buckle 58 to a coil spring 60. Coil spring 60 is hooked at its lower end to a pin 62 (see also Figure 3) which is riveted to the lower end of strap member 23. Thus, the two springs 60, acting through cords 56, pulleys 48 and cords 44, resiliently support the tray, and the tray moves up and down depending upon how much load it is carrying. That is, when the tray is empty, it is at the top of the cabinet, and as packages are piled onto the tray, the tension on the springs 60 is gradually increased so that the springs are stretched out and the tray moves downwardly. The tension of springs 60 and the ratio between the sizes of the two sheaves of the pulleys 48 are so adjusted that the weight of one layer of packages moves the tray downwardly the thickness of the layer of packages. Thus, the top layer of packages is always at the top of the cabinet. The initial adjustment of the tension of each of springs 60 is obtained by adjusting the lengths of cords 44 and 56. Each of cords 56 is adjusted at its buckle 58, and each of cords 44 is adjusted by pulling the end of the cord downwardly through its bracket 42 and putting clamp 43 in place. Such an adjustment is normally sufficient even under varying conditions, but when conditions change sufficiently, readjustment is not difficult.

As indicated above, the top of the cabinet is formed mainly by eight windows in the form of lids 16, and these lids are carried by a frame structure which is removably attached to the top of the side walls. This frame structure comprises a longitudinal frame member 64, a transverse end frame member 66 at each end, and three intermediate transverse frame members 68. As shown best in Figure 4, transverse frame members 68 extend over the side edges of the baskets 26, and one of the lids on each side of the cabinet is over each of the baskets. Thus, the products within each compartment may be viewed through a window and removed through an opening on either side of the cabinet.

Each of lids 16 is formed by a frame of moulded material which rigidly holds a number of sheets of transparent insulating material. Referring particularly to Figure 4, each of the side walls 88 of the frame is provided with an angular side face 90, and as shown in Figure 3, the end of the frame which is at the center of the cabinet is similarly shaped. The walls surrounding the opening which is covered by the lid are shaped to snugly receive the lid, and these walls securely support the lid as it is slid outwardly away from the center of the cabinet. Accordingly, each of frame members 68 is provided with a top board 70 and a brace 72 which is narrow at the top and which flares outwardly toward the bottom with two angular side faces 74, and each of end frames 66 is provided with a similar top board 76 and a brace member 78 which has an angular side face 80. Longitudinal frame 64 is similarly constructed (see Figure 3) with a top board 82 and a brace member 84

having angular side faces 86. Thus, each lid is mainly supported on the angular faces so that the weight of the lid aids in maintaining a heat-tight seal around the lid. As shown best in Figure 1, extending along the edge of the cabinet and over the top of each lid is a top board 92 which braces the lid-supporting structure. In use, a lid may be pulled out with one hand, and after a package has been removed the lid may be pushed shut by either the hand or the body. Thus, the act of removing a package may be a one-hand operation.

In this embodiment, the transparent insulating material carried by the lids is in the form of a thick pane of glass 96 at the top, a thin pane 98 at the bottom and a number of sheets of Cellophane 100 equally spaced between the two panes. The panes and the Cellophane are rigidly held at their edges and are positioned so that the air space between the two panes is divided into seven thin layers of equal thickness, each air space being approximately three-eighths of an inch thick. As has been pointed out above, it has been found that by providing horizontal air spaces of substantially the thickness disclosed, the entire body of air in each space becomes stratified, thereby forming an excellent heat-insulating medium.

The lower pane 98 is of Lucite which is a synthetic composition which is transparent and rigid, and which has low heat absorbing ability. Thus, pane 98 provides excellent heat insulation, and when the lid is pulled out and the pane is exposed to the warm air, it will not become fogged. The upper pane 96 is of glass and thus will not be scratched or damaged during normal use.

Referring to Figure 3, at the upper left-hand edge of the cabinet, a vertically sliding stop 94 is provided (see also Figure 4) which normally extends upwardly beyond the lower edge of the lid frame to a point adjacent the pane 98. Thus, as the lid slides outwardly, the stop prevents movement of the lid beyond the edge of the opening. Stop 94 may be slid downwardly away from the lid when the lid is to be removed.

In this embodiment, provision is made to light the interior of the cabinet without placing an undue load upon the refrigerating equipment. Accordingly, as shown in Figure 3, the bottom of longitudinal frame 64 is provided with an upwardly extending trough or channel 102, and positioned beneath this channel are suitable tubular fluorescent lights 104. The top frame 30 of each basket 26 is cut away on its two sides at 106 so that one light tube may extend over two baskets. The surfaces of channel 102 provide a reflector for the light and straps 35 protect the light from being hit by packages or otherwise injured. In addition to this, straps 35 act as stops to prevent the trays from moving a package against the light if the packages should become piled in the center of a tray. Furthermore, if for any reason the springs 60 holding a tray should be out of adjustment, the strap 35 extending over the particular basket would prevent the springs from lifting the packages against the lids.

Extending throughout the length of longitudinal frame 64 is an illuminated signboard indicated at 108. This signboard includes five triangular brackets 110 which carry at the top a reflector 112 into which are mounted suitable tubular lights 114. Mounted upon these brackets above each lid are four removable strips 116 and a similar but larger strip 118. These strips bear notations listing the products which may be had by opening that particular lid, with strip 118

bearing the type of product such as "Vegetables," "Meat," "Fish," etc., and each of the smaller strips 116 bearing the name of a particular product with the price.

With the corrugated liner of Figures 1 to 5, inclusive, a smooth inner surface is provided which is free from sharp corners and which may be easily cleaned. Furthermore, the structure is rigid, and at the same time, the evaporator pipes are sufficiently in contact with the liner to provide for satisfactory heat transfer between the pipes and the liner. A modified form of this construction is shown in Figure 6 wherein a corrugated liner 130 is provided with flat side portions 132 and 134, with cross-webs 136. In this embodiment, the spaces between the inner shell 18 and the liner are filled with a holdover solution in the form of brine. Each of the pipes contacts two of the cross-webs 136 and one of the side portions 134. With both of these embodiments, the surface area exposed is much greater than the surface area which would be obtained by use of the pipe unit alone. This surface area may be easily increased by increasing the depth of the corrugations.

In the embodiment of Figures 1 to 5, inclusive, the pipe unit 6 is a continuous pipe so that the individual loops of the pipe are in the nature of a "square helix," and referring to Figure 2, at each corner, the pipe unit is bulged outwardly and rounded as at 138 to permit the pipe unit to expand and contract with changes in temperature. In the embodiment of Figure 6, a similar construction is used, though the pipe unit is formed by a plurality of horizontally disposed rectangular pipes which are connected to one another at one corner by vertically extending headers (not shown).

It will thus be seen that I have provided a practical and efficient apparatus for accomplishing the several objects hereinabove mentioned as well as many others in a successful manner.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In refrigeration apparatus of the class wherein materials are stored in a chamber having a top opening permitting access thereto, the combination of; a cabinet construction including an outer shell and an inner shell with heat-insulating material therebetween; refrigerating and supporting means upon the side walls of said inner shell and providing reinforcing means therefor including, a sheet-metal construction having horizontally extending corrugations, refrigerant pipes extending along the corrugations, and vertically extending brace means; a tray within said cabinet construction; and supporting means for said tray comprising, pulley means mounted at the top of said inner shell, and counterbalancing means positioned within said inner shell and mechanically connected through flexible cable means and said pulley means to said tray.

2. In a refrigeration cabinet construction of the type wherein packaged materials are stored in a flat-top cabinet having door means in the top thereof, the combination of, means forming a vertically extending chamber from which the materials may be removed at the top thereof, a tray means to support the materials within said cham-

ber, and counterbalancing means to automatically position said tray means so that the top of the materials upon said tray means is substantially at said opening, said counterbalancing means comprising a pair of spring-pulley units each unit of which includes a vertically extending coil spring with its lower end rigidly attached to said cabinet and with its upper end connected to a flexible member which extends around and is attached to the smaller sheave of a double-sheave pulley, and each of said units also including a flexible means having one end attached to said tray means and the other end extending around and attached to the larger sheave of said pulley.

3. In a refrigeration cabinet construction of the type wherein packaged materials are stored in a flat-top cabinet having door means in the top thereof, the combination of: means forming a vertically extending open-top chamber from which materials may be removed; a tray means to support the materials within said chamber; and counterbalancing means to move said tray means upwardly within said chamber as the materials are removed from said tray means comprising, a plurality of spring-pulley units each of which comprises, a spring means connected to the cabinet wall, a double-sheave pulley rotatably mounted adjacent the top of said chamber and having a small sheave and a large sheave, a first flexible member having one end attached to said pulley and coiled about said small sheave, a second flexible member having one end attached to said pulley and coiled about said large sheave, a first adjustable attaching means attaching the other end of said first flexible member to said spring means, and a second adjustable attaching means attaching the other end of said second flexible member to said tray means.

4. In refrigeration apparatus of the class wherein materials are stored in a chamber having a top opening permitting access thereto, the combination of: a cabinet construction including an outer shell and an inner shell with heat-insulating material therebetween; and refrigerating and supporting means upon the side walls of said inner shell and providing reinforcing means therefor including, a sheet-metal construction having horizontally extending corrugations, refrigerant pipes extending along the corrugations, and vertically extending brace means to provide support at the top of said inner shell for materials being stored.

5. In a refrigerator cabinet construction, a cabinet having an inner shell forming an open topped well and having a bottom wall and side wall construction along the outer surfaces of which extends heat insulating material, said side wall construction including an inner corrugated metallic sheet member having horizontally extending corrugations of substantial depth, and a refrigerant pipe assembly extending along said corrugations to provide for the cooling of said chamber with said sheet member acting as a heat transfer device and with said pipe assembly also providing reinforcement for said side wall construction.

6. Apparatus as described in claim 5 wherein said corrugations are smooth corrugations with said pipes being in intimate contact with a substantial area of said sheet member.

7. Apparatus as described in claim 5 wherein said corrugations are provided with corners with extended flat surfaces at the extreme portions of the corrugations which flat surfaces are rigidly secured to supporting means.

8. Apparatus as described in claim 2 wherein

said chamber is provided with a top cover means which may be removed to provide access to the chamber and wherein the materials on said tray means substantially close the opening to said chamber beneath said top cover means so that when said top cover means is open there is a minimum of circulation of air into and out of said chamber.

9. In a refrigeration cabinet construction of the type wherein packaged materials are stored in a flat-top cabinet having door means in the top thereof, the combination of, means forming a vertically extending chamber from which the materials may be removed at the top thereof, a tray means to support the materials within said chamber, counterbalancing means to automatically position said tray means so that the top of the materials upon said tray means is substantially at said opening, wherein the tray means includes a plurality of individual trays positioned in side-by-side relationship, and an individual wire basket positioned in said chamber and surrounding each of said trays so that the tray may move vertically within the basket and the basket prevents materials from falling from the tray.

10. In a refrigeration cabinet construction of the type wherein packaged materials are stored in a flat-top cabinet having door means in the top thereof, the combination of, means forming a vertically extending chamber from which the materials may be removed at the top thereof, a tray means to support the materials within said chamber, counterbalancing means to automatically position said tray means so that the top of the materials upon said tray means is substantially at said opening, wherein basket means surrounds said tray means, and a plurality of outwardly extending brackets which extend through the sides of said basket means and support said tray means, said basket means having at each

bracket a pair of vertically extending parallel guide bars which hold said bracket means in alignment.

11. In a refrigeration cabinet construction of the type wherein packaged materials are stored in a flat-top cabinet having door means in the top thereof, the combination of, means forming a vertically extending chamber from which the materials may be removed at the top thereof, a tray means to support the materials within said chamber, counterbalancing means to automatically position said tray means so that the top of the materials upon said tray means is substantially at said opening, and removable cover means for said chamber, said chamber having its top substantially horizontal so that the materials on the tray means substantially close the opening to said chamber beneath said cover means so that when said cover means is open there is a minimum of circulation into and out of said chamber.

12. In a refrigerator cabinet construction, a cabinet having a heat insulated wall structure and an inner metallic shell extending along said wall structure within the cabinet, said inner metallic shell comprising a corrugated metallic sheet construction having a plurality of substantially parallel corrugations with the result that alternate strips of the shell are positioned adjacent the heat insulated wall structure and outwardly from the heat insulated wall structure to thereby present exposed ridged surfaces defining the enclosed refrigerated chamber, and rigid refrigerant pipes extending along the corrugations on the side of the shell opposite the enclosed refrigerated chamber but in intimate contact with the strips of the shell positioned away from the heat insulated wall structure, whereby the refrigerant pipes provide rigid backing for the portions of the shell which are most exposed.

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