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2,962,875

UPRIGHT REFRIGERATED CABINET WITH UNIMPEDED FRONT ACCESS

Filed Oct. 29, 1959

2 Sheets-Sheet 1

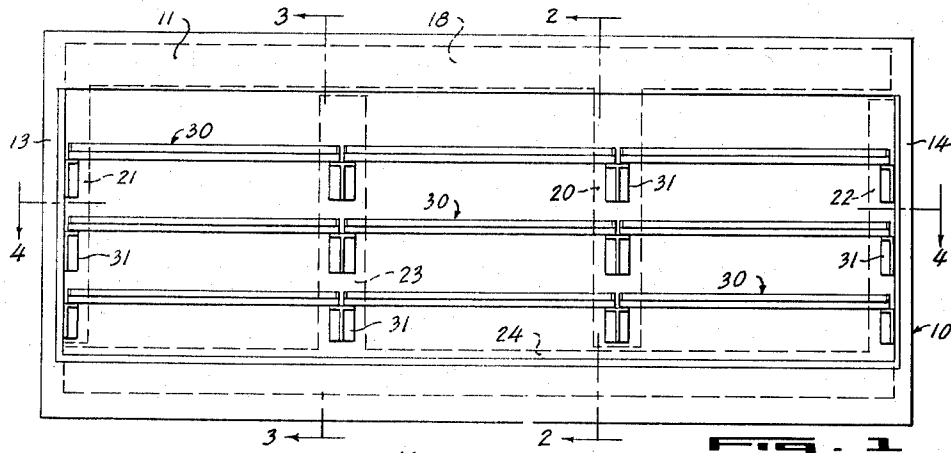


FIG. 1

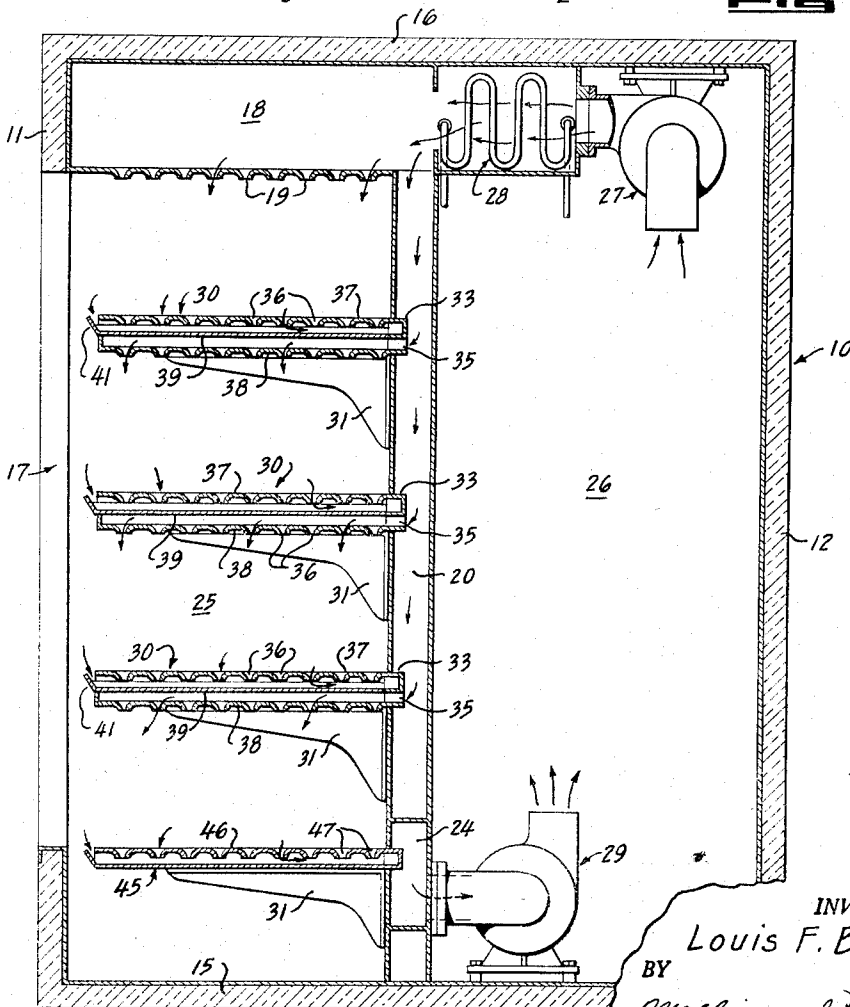


FIG. 2

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2 Sheets-Sheet 2

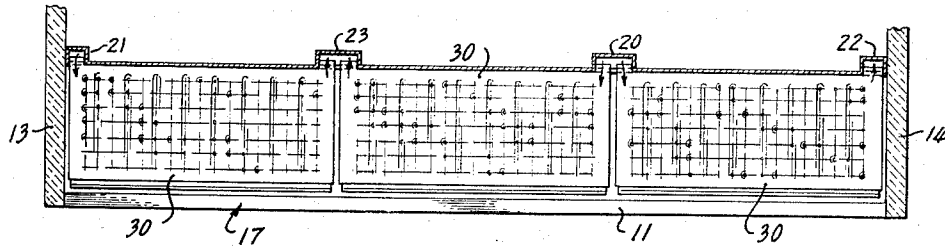


FIG. 4

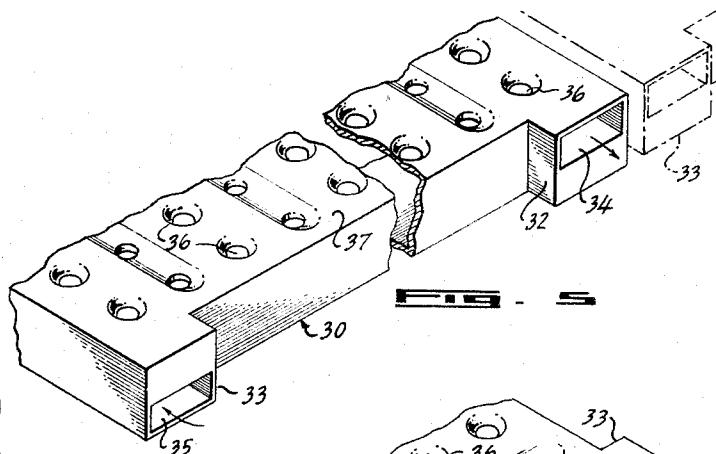
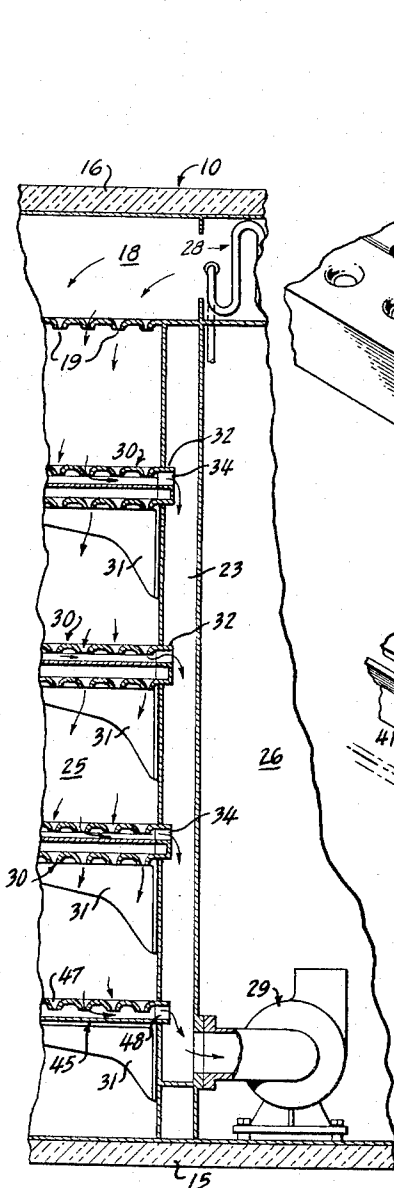


FIG. 5

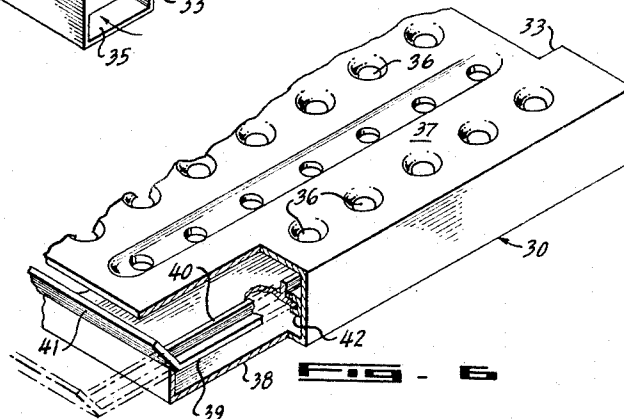


FIG. 6

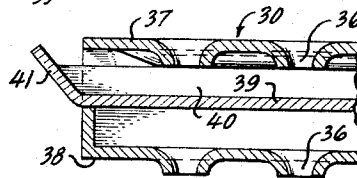


FIG. 7

FIG. 3

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UPRIGHT REFRIGERATED CABINET WITH UNIMPEDED FRONT ACCESS

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Filed Oct. 29, 1959, Ser. No. 849,535

19 Claims. (Cl. 62—256)

This invention relates to refrigerated display cabinets, and more particularly to a refrigerated display cabinet having an open front wall without doors to afford unimpeded access thereto.

This application is a continuation-in-part of my United States application Serial No. 826,356, filed July 10, 1959, now abandoned.

The use of refrigerated cabinets for the display of perishable foods has become almost universal in grocery stores, super-markets, and the like, with the cabinets being divided into two general types, i.e., floor and upright. The floor type has top access thereinto and may be used without doors since the cold air in the cabinet will not rise. From a sales aspect, the unimpeded access into the floor type cabinet is very important since the sight of the displayed item and the immediate access thereto will stimulate a desire in the customer to purchase the item. However, the floor type cabinet has a decided disadvantage in that the items must be displayed at a low level such that the customers often are not attracted to the display. In addition, the vertical space above the cabinet is usually lost to use.

The upright type cabinet overcomes the disadvantages of the floor type cabinet by displaying the items at eye level, and thus has a decided utility in this aspect over the floor type. However, in the wall type cabinets heretofore used it has been necessary to provide doors to close the access openings, for otherwise the cold air within the cabinet will spill out into the room. Even though glass doors are used, the view of the items is impeded, and particularly so if the doors become frost or dew-coated. In addition, studies have shown that the mere interposition of a door or similar barrier between the customer and the food items will in most cases completely stifle an impulse to buy.

The present invention seeks to combine the advantages of the floor and upright type refrigerated cabinets without also combining the disadvantages thereof. Thus, the main object of the invention is to provide an upright type refrigerated cabinet having a front access opening thereinto which does not have doors covering the opening so that access into the cabinet is unimpeded.

A further object of the invention is to provide an unimpeded front access refrigerated cabinet in which a plurality of display shelves is disposed within the cabinet adjacent the access opening and in which refrigerated air is guided downwardly under pressure from the bottom of one shelf to the upper surface of the next lower shelf in such manner as to prevent undue cold air spillage from the cabinet through the open access opening.

A further object of the invention is to provide an unimpeded front access refrigerated cabinet with a pair of vertically spaced apart hollow shelves in which the upper shelf has a perforated bottom surface and the lower shelf has a perforated upper surface and in which blower means are used to blow air into the upper shelf and out through the bottom perforations thereof and are used to suck air through the top perforations of the lower shelf.

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It is another object of this invention to provide an unimpeded front access refrigerated cabinet with vertically spaced apart hollow shelves, each shelf having a perforated supporting surface with a subjacent closure member and defining a circulating air passageway therebetween, said closure member being formed with a front end intake whereby the cold air which may spill from the front end of said shelf will be drawn into said passageway.

Another object is to provide such a refrigerated cabinet with a rear internal storage area, which storage area serves also as a conduit between the interiors of the hollow shelves.

Other objects and advantages will become apparent in the course of the following detailed description.

In the drawings forming a part of this application, and in which like parts are designated by like reference numerals throughout the same,

Fig. 1 is a front view in elevation of an upright refrigerated display cabinet constructed in accordance with the invention.

Fig. 2 is an enlarged sectional view taken on line 2—2 of Fig. 1 illustrating the manner in which refrigerated air is directed into the display portion of the cabinet.

Fig. 3 is a partial enlarged sectional view taken on line 3—3 of Fig. 1 illustrating the manner in which air is removed from the display portion of the cabinet.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1 illustrating the manner in which air flow takes place in the air distribution manifolds.

Fig. 5 is a perspective view of the rear of one of the hollow shelf members with portions cut away illustrating the manner in which air flow is induced into or from the shelves.

Fig. 6 is a detail, in perspective, of a portion of one of the shelf members illustrating the manner in which the imperforate plate between the upper and lower shelf surfaces forms a removable tray.

Fig. 7 is an enlarged section of the front end portion of a shelf, as illustrated in Fig. 2.

Referring now to the drawings, the refrigerated display cabinet 10 is comprised of front and back walls 11 and 12, side walls 13 and 14, floor and ceiling 15 and 16, all formed from thermal insulating material. The front wall 11 is provided with an access opening 17 therethrough. As illustrated, no doors cover the opening 17, thus allowing unimpeded access into the interior of cabinet 10.

A hollow header 18 is formed along the upper front inside portion of cabinet 10 and has a plurality of perforations 19 through the bottom thereof. Vertical manifolds 20 and 21 are connected at their upper ends to header 18 and extend downwardly from the rear thereof. The lower ends of manifolds 20 and 21 are closed.

Vertical manifolds 22 and 23 are also provided in cabinet 10 and have closed upper ends. These manifolds connect at their lower ends to a horizontal conduit 24.

The vertical manifolds 20, 21, 22, 23 divided the interior of cabinet 10 into a forward display space 25 and a rear storage space 26. A suitable door (not shown) can be provided through the back or side walls of the cabinet to allow ready access into the storage space 26 by employees.

A conventional blower 27 has a suction side open to the storage space 26 to draw air therefrom and blows this air through the cooling coils 28 and into the header 18. The cooling coils 28 may be any conventional type and are connected to a suitable source of coolant (not shown). A second blower 29 has its suction side con-

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nected to conduit 24 and discharges air into the storage space 26.

A plurality of hollow shelf members 30 is disposed in the display area of the cabinet, these shelves being supported upon suitable brackets 31 secured to the manifolds 20, 21, 22, and 23. Each shelf member 30 has two rearward projections 32 and 33 which project through suitable openings into adjacent manifolds. As is illustrated in Fig. 5, the rearward projection 32 has a passage 34 therethrough to place the upper interior of the shelf member in fluid communication with the manifold into which projection 32 is inserted. Similarly, projection 33 has a passage 35 to fluidly communicate with the lower interior portion of the shelf member with the manifold into which projection 33 extends.

Fig. 4 illustrates the manner in which the various shelves 30 are connected to the manifolds 20 through 23. It will be noted that each shelf projects into one manifold connected to upper header 18 and into one manifold connected to bottom conduit 24. The important consideration is that the upper interior portions of the shelves 30 are all connected through passages 34 to conduit 23 and that the lower interior portions of the shelves 30 are all connected through passages 35 to header 18. To accomplish this, horizontally adjacent shelves have their passages 34 and 35 arranged in mirror fashion, as indicated by the dotted line shelf in Fig. 5.

Shelves 30 are all provided with a plurality of holes or perforations 36 through their upper and lower surfaces 37 and 38.

If desired, the upper surfaces may be grooved or recessed along each or alternate rows of holes, thereby insuring that the circulated cold air can find passage through said holes, although each hole may itself be surmounted by a supported article. Since the articles will be arranged to allow cold air to circulate therebetween, an open passage will necessarily be provided to random points along each groove. Thus, although each hole may itself be covered, the cold air will pass from the randomly exposed points of a groove along that groove and through the perforations formed therein.

As best shown in Fig. 6, the shelves 30 are divided internally into upper and lower interior portions by an imperforate sheet member 39 which extends completely from front to back and from side to side of the shelves. Upstanding flanges 40 extend around the periphery of member 39 to form a liquid retaining tray. The front edge 41 of member 39 is inclined upwardly so as to provide a liquid retaining lip to the tray. Edge 41 also acts as a louver vane for catching such cold air as may spill from the front of the shelf. The "spilled" air is thereby redirected back into the circulated cold air stream, which is drawn rearwardly from between the upper surface 37 of each shelf and its respective sheet member 39. The tray member 38 is fitted into channels 42 fixed to the side of shelf 30 so that the tray may be readily removed for cleaning. The flange 40 is sufficiently low adjacent the passage 34 in the rear of shelf 30 so as not to impede the flow of air through the passage from the upper interior portion of the shelf, while yet being sufficiently high to retain any liquids which may be spilled upon the upper surface of the shelf and which may flow into the shelf through the perforations 36.

Shelf members 45 are disposed adjacent the lower edge of access opening 17 and are supported upon suitable brackets 31. Shelf members 45 are similar to the upper halves of shelf members 30, that is, the upper surface 46 is perforated at 47, and the interior of the shelf is connected through passage 48 to conduit 24.

As may be seen from the foregoing, the blower 27 will force air through the cooling coils 28 into the header 18. A portion of the cold air will pass through the openings 19 into the display space 25, and the remainder of the cold air will be forced down through manifolds 20 and 22 and will enter through passages 35 into the lower interior portions of all of the shelves 30. This cold air

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will then flow out of the shelves through the perforations 36 in the lower surfaces 38 thereof. By suitable adjustment of the size of the perforations 19 and 36 and the manifolds 20 and 22, uniform air flow out of the shelves 30 and header 18 can be obtained.

The cold air will be blown towards the upper surfaces of the next lower shelf and will be sucked through the perforations 36 in the upper surfaces 37 into the upper interior portions of each shelf by the action of blower 29. Again, suitable choice of dimensions of the perforations 36 and 47 and the manifolds 22 and 23 will insure uniform suction at each shelf.

The cold air sucked back into the shelves by blower 29 is discharged into the storage space 26 of the cabinet and is used to refrigerate any articles stored therein. As is apparent, the entire storage space 26 serves as a conduit between the discharge of blower 29 and the intake of blower 27.

In the above system, it is not necessary that the air flowing downwardly from shelf to shelf be of very great velocity, and indeed, if the velocity is too great, air spillage from the cabinet may result. But as indicated above, a certain amount of air spillage can be tolerated since the front edge 41 will redirect the spilled air back into the circulated cold air stream. In normal operation, as the cold air descends from one shelf to another, the air at the front of the cabinet will tend to spill out into the room through the access opening 17, but is restrained from so doing by the suction in the next lower shelf, which causes the cold air to flow back into the cabinet. The descending mass of cold air effectively prevents the warm air in the room from entering into the cabinet due to the greater density of the cold air, and thus maintains the interior of the cabinet at a low temperature without an undue expenditure of energy in cooling unwanted room air.

The provision of two blowers enables the air flow to be readily adjusted and controlled. For example, the blower 27 may be operated at a slightly greater capacity than blower 29. This would insure that insofar as the display spaces between the shelves 30 and 45 are concerned, more cold air would be forced into these spaces than the amount of air withdrawn by blower 29; and thus this would insure that the very minimum of room air would enter the display spaces. Since more air would be removed from the storage space 26 than is delivered to this space by blower 29, room air would seep into the storage space, as from below shelf 45. This relatively warm air would then have to be refrigerated by coil 28 and thus the efficiency of the system would be somewhat decreased. However, by a suitable adjustment of the capacities of the blowers 27 and 29, the maximum efficiency can be obtained with the desired amount of cooling in the display area 25.

Although the particular embodiment has been shown with four shelves, each three units wide, it is of course to be realized that any number of shelves may be utilized at any desired width and depth. The important thing is that there should be a flow of cold air from the bottom of any shelf member down to the upper surface of the next lower shelf. In this manner the distribution of cold air can easily be made uniform throughout the area between any two shelves; since the bottom shelf surfaces will always be unobstructed, and the entrance of room air through the unimpeded access opening 17 will be at a minimum.

Thus, it is to be realized that the particular embodiment shown and described is to be taken as a preferred embodiment of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the attached claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. Apparatus of the character described comprising

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three vertically spaced apart hollow shelves, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said intermediate shelf having perforated upper and lower surfaces, a first manifold fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, a second manifold fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, means forming a conduit between said manifolds, blower means in said conduit for forcing air from said second manifold to said first manifold, and means for refrigerating the air forced by said blower into said first manifold.

2. Apparatus of the character described comprising three vertically spaced apart hollow shelves, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said imperforate member having an upwardly inclined front edge providing an opening between it and said upper surface, said upper and lower surfaces being perforated, a first manifold fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, a second manifold fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, means forming a conduit between said manifolds, blower means in said conduit for forcing air from said second manifold to said first manifold, and means for refrigerating the air forced by said blower into said first manifold.

3. Apparatus of the character described comprising three vertically spaced apart hollow shelves, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said imperforate member being removably mounted between said surfaces and having upturned edges forming a tray, said upper and lower surfaces being perforated, a first manifold fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, a second manifold fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, means forming a conduit between said manifolds, blower means in said conduit for forcing air from said second manifold to said first manifold, and means for refrigerating the air forced by said blower into said first manifold.

4. Apparatus of the character described comprising three vertically spaced apart hollow shelves, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said imperforate member being removably mounted between said surfaces and having upturned edges including an upwardly inclined front edge providing an opening between it and said upper surface, said upturned edges forming a tray and said upper and lower surfaces being perforated, a first manifold fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, a second manifold fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, means forming a con-

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duit between said manifolds, blower means in said conduit for forcing air from said second manifold to said first manifold, and means for refrigerating the air forced by said blower into said first manifold.

5. Apparatus of the character described comprising a plurality of vertically spaced apart hollow shelves, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface, a plurality of intermediate shelves between said uppermost and lowermost shelves, said intermediate shelves each being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelves, each intermediate shelf having perforated upper and lower surfaces, a first manifold fluidly connecting the interior of said uppermost shelf and the lower interior portions of said intermediate shelves, a second manifold fluidly connecting the interior of said lowermost shelf and the upper interior portions of said intermediate shelves, means forming a conduit between said manifolds, blower means for forcing air from said second manifold through said conduit into said first manifold, and means for refrigerating the air forced by said blower into said first manifold.

6. Apparatus of the character described comprising an insulated cabinet having an access opening through the front wall thereof, three horizontally disposed and vertically spaced apart hollow shelves disposed within said cabinet adjacent said access opening, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface thereof, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said intermediate shelf having perforated upper and lower surfaces, first manifold means fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, second manifold means fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, means forming a conduit between said manifolds, blower means for forcing air from said second manifold through said conduit into said first manifold, and means for refrigerating the air forced by said first blower into said first manifold.

7. Apparatus of the character described comprising an insulated cabinet having an access opening through the front wall thereof, three horizontally disposed and vertically spaced apart hollow shelves disposed within said cabinet adjacent said access opening, the uppermost of said shelves having a plurality of holes through the bottom surface thereof and the lowermost of said shelves having a plurality of holes through the upper surface thereof, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said intermediate shelf having a plurality of holes through the upper and lower surfaces thereof, first manifold means fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, second manifold means fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, first blower means having its discharge side connected to said first manifold, second blower means having its suction side connected to said second manifold, means forming a conduit between the discharge side of said second blower and the suction side of said first blower, and means for refrigerating the air forced by said first blower into said first manifold.

8. In an apparatus as set forth in claim 7 wherein the rear edges of said shelves are vertically aligned and are spaced from the rear wall of said box to form a storage compartment between said rear wall and said shelves,

and wherein said conduit is formed by said storage compartment.

9. Apparatus of the character described comprising an insulated cabinet having an access opening through the front wall thereof, three horizontally disposed and vertically spaced apart hollow shelves disposed within said cabinet adjacent said access opening, the uppermost of said shelves having a plurality of holes through the bottom surface thereof and the lowermost of said shelves having a plurality of holes through the upper surface thereof, the intermediate shelf being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelf, said imperforate member having an upwardly inclined front edge providing an opening between it and said upper surface, said upper and lower surfaces being perforated, first manifold means fluidly connecting the interior of said uppermost shelf and the lower interior portion of said intermediate shelf, second manifold means fluidly connecting the interior of said lowermost shelf and the upper interior portion of said intermediate shelf, first blower means having its discharge side connected to said first manifold, second blower means having its suction side connected to said second manifold, means forming a conduit between the discharge side of said second blower and the suction side of said first blower, and means for refrigerating the air forced by said first blower into said first manifold.

10. Apparatus of the character described comprising an insulated cabinet having an access opening through the front wall thereof, a plurality of horizontally disposed and vertically spaced apart hollow shelves disposed within said cabinet adjacent said access opening, the uppermost of said shelves having a perforated bottom surface and the lowermost of said shelves having a perforated upper surface thereof, a plurality of intermediate shelves between said uppermost and lowermost shelves, said intermediate shelves each having perforated upper and lower surfaces and being provided with an imperforate member between the upper and lower surfaces to form upper and lower interior portions within said intermediate shelves, first manifold means fluidly connecting the interior of said uppermost shelf and the lower interior portions of said intermediate shelves, second manifold means fluidly connecting the interior of said lowermost shelf and the upper interior portions of said intermediate shelves, means forming a conduit between said manifolds, blower means for forcing air from said second manifold through said conduit into said first manifold, and means for refrigerating the air forced by said first blower into said first manifold.

11. Apparatus of the character described comprising an insulated cabinet having an access opening through the front wall thereof, a plurality of horizontally disposed and vertically spaced apart hollow shelves disposed within said cabinet adjacent said access opening, the uppermost of said shelves having a plurality of holes through the bottom surface thereof and the lowermost of said shelves having a plurality of holes through the upper surface thereof, a plurality of intermediate shelves between said uppermost and lowermost shelves, said intermediate shelves each being provided with an imperforate member between the upper and lower surfaces thereof forming upper and lower interior portions within said intermediate shelves, said intermediate shelves each having a plurality of holes through the upper and lower surfaces thereof, first manifold means fluidly connecting the interior of said uppermost shelf and the lower interior portions of said intermediate shelves, second manifold means fluidly connecting the interior of said lowermost shelf and the upper interior portions of said intermediate shelves, first blower means having its discharge side connected to said first manifold, second blower means having its suction side connected to said second manifold, means forming a conduit between the discharge side of said second blower

and the suction side of said first blower, and means for refrigerating the air forced by said first blower into said first manifold.

12. In an apparatus as set forth in claim 9 wherein the rear edges of said shelves are vertically aligned and are spaced from the rear wall of said box to form a storage compartment between said rear wall and said shelves, and wherein said conduit is formed by said storage compartment.

13. Apparatus of the character described comprising a hollow refrigerator support shelf having upper and lower surfaces containing perforations distributed throughout their areas, an imperforate member between said upper and lower shelf surfaces forming upper and lower interior air compartments within said shelf, means forming an air conduit between the interiors of said upper and lower compartments, blower means for moving air through said conduit from the interior of one compartment into said other compartment, and refrigerating means in said conduit for cooling air passing therethrough.

14. Apparatus of the character described comprising an insulated cabinet having top and bottom surfaces and a front access opening therein, a hollow shelf supported intermediate said top and bottom surfaces and dividing said cabinet into upper and lower refrigerating spaces, said shelf having upper and lower compartments bounded by surfaces containing perforations distributed throughout their areas, means forming an air conduit between the interiors of said upper and lower compartments and said upper and lower refrigerating spaces, blower means for moving air through said conduit from the interior of one compartment into the other compartment, and refrigerating means in said conduit for cooling air passing therethrough.

15. Apparatus of the character described comprising an insulated cabinet having top and bottom surfaces and a front access opening therein, a hollow shelf supported intermediate said top and bottom surfaces and dividing said cabinet into upper and lower refrigerating spaces, said shelf having a pair of vertically spaced surfaces, the upper of said surfaces being substantially horizontal and having a plurality of holes distributed throughout its area and extending therethrough, the lower of said surfaces having a plurality of holes distributed throughout its area and extending therethrough, an imperforate member between said upper and lower shelf surfaces forming upper and lower interior air compartments within said shelf, means forming an air conduit between the interiors of said upper and lower compartments including said upper and lower refrigerating spaces, blower means for moving air through said conduit from the interior of one compartment into the other compartment, and refrigerating means in said conduit for cooling air passing therethrough.

16. An apparatus as set forth in claim 15 wherein the rear edges of said hollow shelf are spaced from the rear wall of said cabinet to form a storage compartment between said rear wall and said shelf, and wherein said conduit is partly formed by said storage compartment.

17. Apparatus of the character described comprising a hollow refrigerator support shelf having upper and lower surfaces containing perforations distributed throughout their areas, an imperforate member between said upper and lower shelf surfaces forming upper and lower interior air compartments within said shelf, said imperforate member being removably mounted between said surfaces and having upturned edges forming a tray, means forming an air conduit between the interiors of said upper and lower compartments, blower means for moving air through said conduit from the interior of one compartment into the other compartment, and refrigerating means in said conduit for cooling air passing therethrough.

18. Apparatus of the character described comprising an insulated cabinet having top and bottom surfaces and a front access opening therein, at least one hollow shelf supported intermediate said top and bottom surfaces

dividing said cabinet into upper and lower refrigerating spaces, said hollow shelf having upper and lower compartments bounded by surfaces containing perforations distributed throughout their areas, an imperforate member between said upper and lower shelf surfaces forming upper and lower interior air compartments within said shelf, an air refrigerating unit, a first manifold conduit connecting the upper refrigerating space and said lower interior compartment with said refrigerating unit, a second manifold conduit connecting the lower refrigerating space and said upper interior compartment with said refrigerating unit, and blower means for moving air through said refrigerating unit and circulating air from one of said manifold conduits to the other.

19. Apparatus of the character described comprising an insulated cabinet having top and bottom surfaces and a front access opening thereinto, a hollow shelf supported intermediate said top and bottom surfaces and dividing said cabinet into upper and lower refrigerating spaces,

said shelf having upper and lower compartments bounded by surfaces containing perforations distributed throughout their areas, an imperforate member between said upper and lower shelf surfaces forming upper and lower interior air compartments within said shelf, said imperforate member being removably mounted between said surfaces and having upturned edges forming a tray, means forming an air conduit between the interiors of said upper and lower compartments including said upper and lower refrigerating spaces, blower means for moving air through said conduit from the interior of one compartment into the other compartment, and refrigerating means in said conduit for cooling air passing therethrough.

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