

Jan. 18, 1966

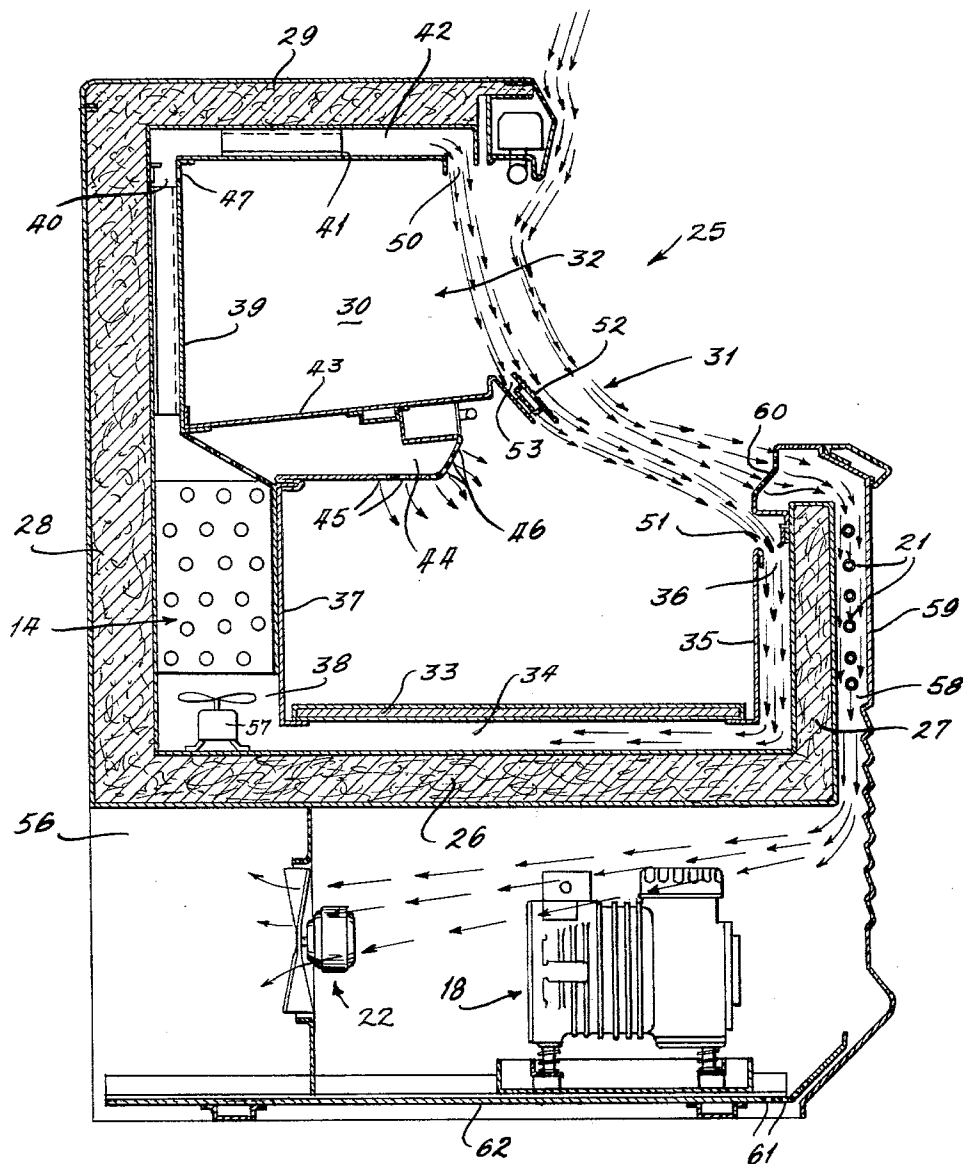
J. BALK ET AL

3,229,475

REFRIGERATED DISPLAY CASE

Filed July 5, 1963

4 Sheets-Sheet 1



INVENTORS:

Joseph Balk.

Theodore E. Weber, Deceased,
Florence P. Weber, Legal Representative.

BY *Gravelly, Lieder & Woodruff*
ATTORNEYS.

Jan. 18, 1966

J. BALK ET AL

3,229,475

REFRIGERATED DISPLAY CASE

Filed July 5, 1963

4 Sheets-Sheet 2

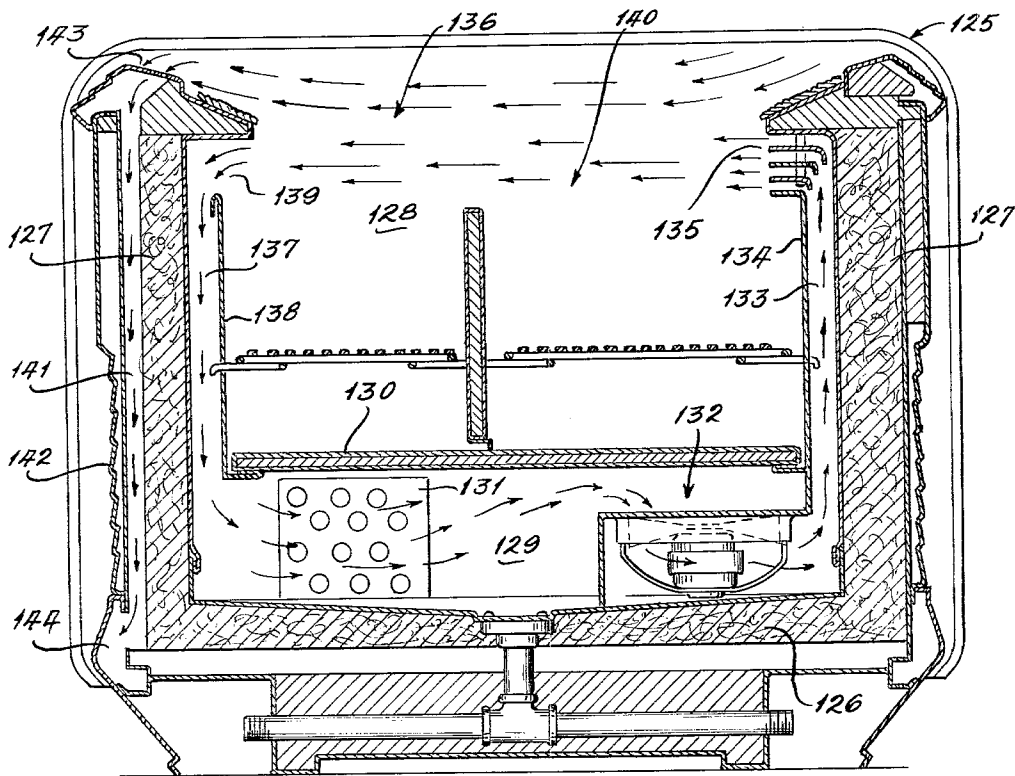


FIG. 5

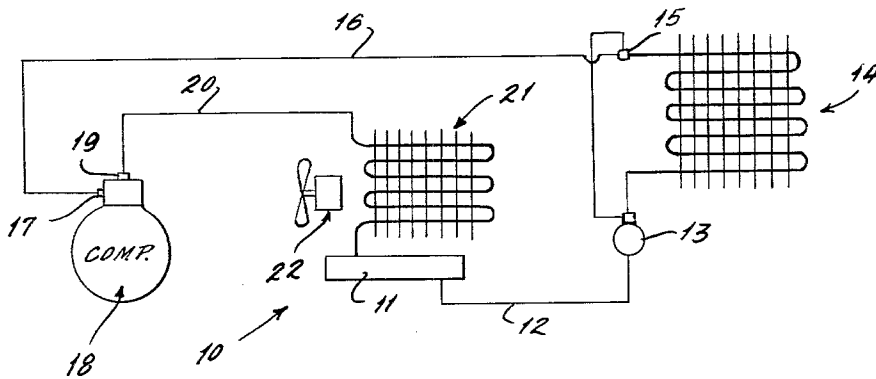


FIG. 2

INVENTORS:
Joseph Balk.
Theodore E. Weber, Deceased,
Florence P. Weber, Legal Representative.

BY *Gravely, Lieder & Woodruff*
ATTORNEYS.

Jan. 18, 1966

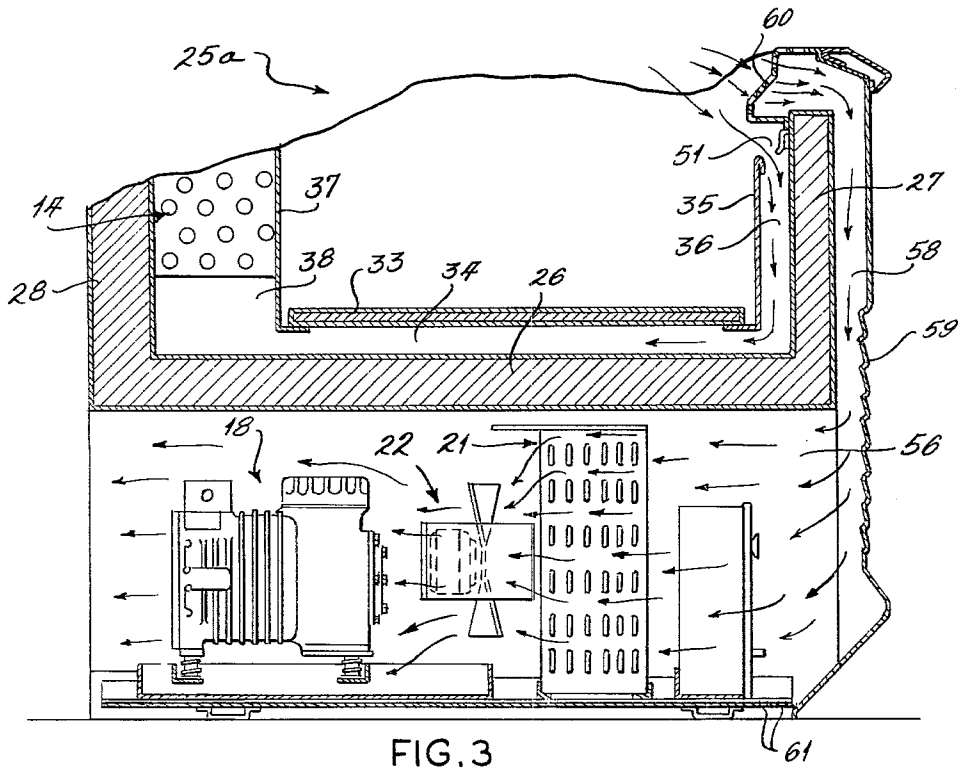
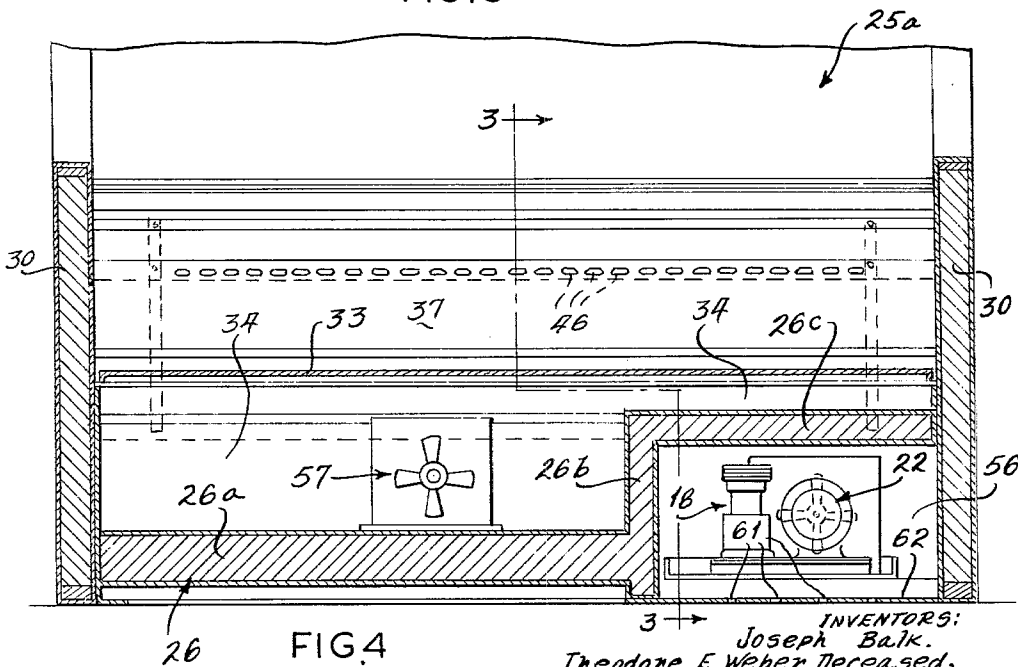
J. BALK ET AL

3,229,475

REFRIGERATED DISPLAY CASE

Filed July 5, 1963

4 Sheets-Sheet 3



INVENTORS:
Joseph Balk,
Theodore E. Weber, Deceased,
Florence P. Weber, Legal Representative
BY Gravelly, Lieder & Woodruff
ATTORNEYS.

Jan. 18, 1966

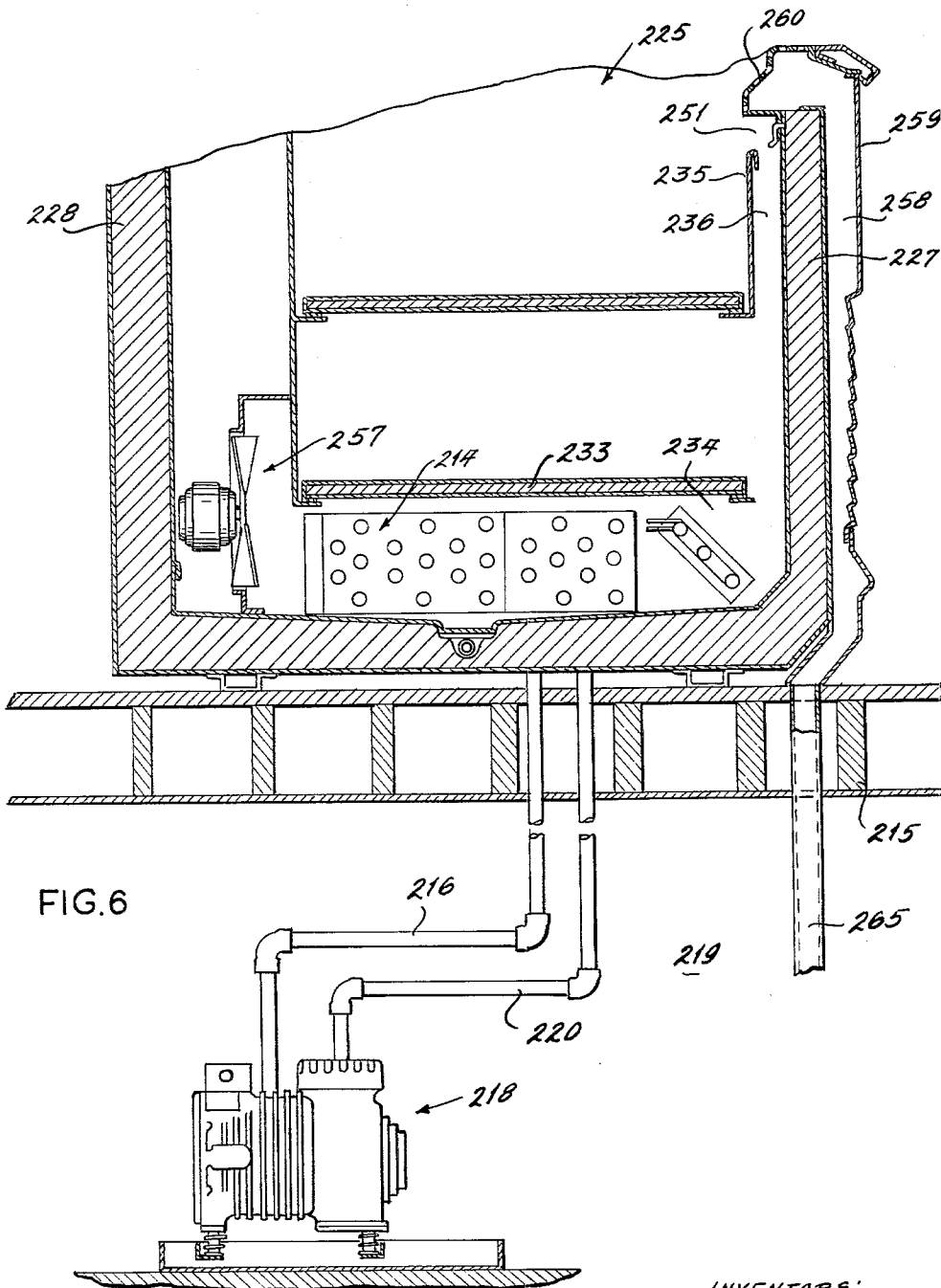
J. BALK ET AL

3,229,475

REFRIGERATED DISPLAY CASE

Filed July 5, 1963

4 Sheets-Sheet 4



INVENTORS:
Joseph Balk
Theodore E. Weber, Deceased,
Florence P. Weber, Legal Representative.
BY Gravelly, Lieder & Woodruff
ATTORNEYS.

1

3,229,475

REFRIGERATED DISPLAY CASE

Joseph Balk, Creve Coeur, Mo., and Theodore E. Weber, deceased, late of Affton, Mo., by Florence P. Weber, legal representative, Affton, Mo., assignors, by mesne assignments, to Embart Corporation, Bloomfield, Conn., a corporation of Connecticut

Filed July 5, 1963, Ser. No. 293,205

6 Claims. (Cl. 62—256)

This invention relates generally to the refrigeration art, and more particularly to refrigerated display cases.

The principal object of the present invention is to provide for the removal of cooled ambient air flow resulting from the inherent operation of an open-type refrigerated case. A further object is to utilize the removed cooled air to increase the capacity of the condensing unit or permit a smaller condenser to be used. Another object of the invention is to eliminate the visible fog or condensation of moisture over the exterior of a refrigerated display case. These and still other objects and advantages will become more apparent hereinafter.

The invention is embodied in a refrigerated display case having a display area with an opening for access thereto, means for discharging refrigerated air across the display area opening and returning the refrigerated air for recooling and recirculation, and means to entrap ambient air entrained and cooled by the refrigerated air to prevent the flow of this ambient air over the exterior of the refrigerated display case.

The invention also consists in the parts and in the combinations and arrangements of parts hereinafter described and claimed. In the accompanying drawings which form a part of the specification and wherein like numerals refer to like parts wherever they occur:

FIG. 1 is a vertical cross-sectional view of an open front refrigerated case embodying the present invention,

FIG. 2 is a diagrammatic view of a typical refrigeration system,

FIG. 3 is a fragmentary cross-sectional view of an open front case showing a modification of the present invention, as taken substantially along line 3—3 of FIG. 4,

FIG. 4 is a vertical sectional view of the longitudinal dimension of the case shown in FIG. 3,

FIG. 5 is a vertical cross-sectional view of an open top display case embodying the invention, and

FIG. 6 is a fragmentary vertical sectional view illustrating another modification of the display case shown in FIG. 1.

Application of the present invention to a "self-contained" display case is illustrated in FIGS. 1 and 3 and to "remote" case in FIGS. 5 and 6. A "self-contained" case is a fixture which houses within its own cabinet a complete refrigeration system for operation of the case. A "remote" case is a fixture which houses within its cabinet only the evaporator and associated valving portions of a refrigeration system, and the remainder of the system is located in a remote location within the store and connected by suitable refrigerant lines to the fixture.

Referring first to FIG. 2 wherein a simplified refrigeration system 10 is illustrated, the system 10 includes a receiver 11 or source of liquid refrigerant connected by a liquid header 12 to an expansion valve 13 for controlling the flow of liquid refrigerant into an evaporator coil 14. The outlet of the evaporator coil 14 is provided with a

2

temperature-pressure responsive expansion valve control 15 positioned in a suction header 16 connecting the outlet of the evaporator coil 14 to the low or suction side 17 of a compressor 18. Refrigerant gas is drawn into the compressor 18 through the suction side and is compressed and discharged to the pressure or high side 19 of the system 10 in a hot compressed gaseous state, and the hot refrigerant flows through a conduit 20 to a condenser 21 in which the heat is given up and the refrigerant condenses to a liquid and is delivered to receiver 11 to complete the circuit. It is manifest that the efficiency of a refrigeration system, in part, depends upon the ability of the condenser 21 to remove heat from the refrigerant, the dissipation of such heat away from the refrigeration system 10 and the prevention or reduction of heat loads on the evaporator coil 14 other than those imposed in cooling products. Fan means 22 are also provided for circulating air over the compressor 18 to dissipate heat and maintain efficiency thereof.

Referring now to FIGS. 1, 3 and 4 of the drawings wherein essentially similar display cases 25 and 25a are shown for purposes of disclosure, the cases include an insulated cabinet having a horizontal base wall 26, a low front wall 27, a high rear wall 28, a top wall 29 extending forwardly from the rear wall 28, and end walls 30. A front opening 31 is provided between the front of the top wall 29 and the top of the front wall 27 for direct access to a display area 32 located within the insulated cabinet. The display area 32 is defined by an inner casing extending longitudinally between the end walls 30 of the outer cabinet and including a bottom plate or shelf 33 spaced above the horizontal partition or bottom wall 26 to form a space 34, a front panel 35 spaced from the front wall 27 to provide a cold air return flue or duct 36 therebetween, a lower rear panel 37 spaced from the rear wall 28 to define an enlarged refrigeration chamber 38 housing the evaporator 14, an upper rear panel 39 spaced from the rear wall 28 to form a delivery duct or flue 40, and an upper panel 41 spaced below the top wall 29 to form a forwardly extending air delivery duct or flue 42 forming part of the air delivery system.

A shelf 43 may be provided in the display area 32, and a forwardly extending duct 44 may be formed integral with the shelf forming part of the air delivery system. The air delivery system includes suitable openings 45, 46, and 47 in the duct 44 and rear panel 39 through which refrigerated air is discharged into the display area 32 for cooling products stored therein. The refrigerated air distribution system of the case 25 also includes a discharge opening 50 through which refrigerated air is discharged from the top duct 42 and flows across the open front 31 of the case 25 and is received in an intake opening 51 to the return duct 36 for recirculation and recooling of the refrigerated air. This wall of air formed across the front opening 31 of the case 25 is directed, in part, by a price tab moulding 52 mounted in spaced relation with the front of the shelf 43 to provide a flue 53 therebetween.

Referring to FIG. 4, it will be seen that the bottom wall 26 extending longitudinally of the case adjacent to the base thereof, at 26a, and is stepped adjacent to one end 30 to provide a vertical insulated wall 26b and an upper horizontal insulated partition 26c defining a chamber 56 for housing components of the refrigeration system for these self-contained cases 25 and 25a. The

3

space 34 communicating the return flue 36 with the refrigeration chamber 38 is enlarged through the major longitudinal extent of the case and may be utilized as a refrigerated storage area for products. A suitable fan or other air moving means 57 is provided in the cases 25 and 25a within the space 34 to effect circulation of air over the evaporator 14 to cool the display area 32 and to form the wall of refrigerated air across the open front 31 and returning this refrigerated air from the display area and wall of air into the return flue 36.

From the foregoing it will be apparent that refrigerated air is utilized to cool products in the display area 32 of the display cases 25 and 25a, and that this air is circulated by fan means 57 located within a closed air duct system extending from an air return flue 36 through an air passage or storage space 34 to a refrigeration chamber 38 housing evaporator coils 14. The air is distributed from the refrigeration chamber through duct means 40, 42 and 44 and discharged both into the display area at predetermined locations and from a discharge opening 50 at the top of the case to form the wall of refrigerated air across the front opening 31. The refrigerated air passing over and removing heat from the product in the display area 32 gives up this heat in passing across the evaporator 14 causing the refrigerant to be vaporized and returned to the compressor 18 for compression and thence to the condenser 21 for dissipation of heat to the cooling medium of the condenser. In FIGS. 1, 3 and 4, the self-contained case 25 has the compressor and condenser-receiver means 18 and 21, 11 isolated from the interior of the case by insulated walls. The fan means 22 draws ambient air over the condenser 21 as the cooling medium to remove heat of compression from the refrigerant, and discharges air across the compressor 18 to dissipate heat therefrom and increase its efficiency.

In addition to the product heat load imposed on the refrigeration system 10, heat exchange between refrigerated air streams and ambient room air creates a continuous heat burden particularly in open top and open front types of refrigerated fixtures. It is therefore important to minimize turbulence and intermixture of ambient air, and various means have been devised to meet this objective. It is also known that the flow of refrigerated air in a curtain or wall of cold air across the opening induces an entrainment or movement of ambient room air in a corresponding or similar flow path adjacent to, but outwardly of the air curtain, and that an inherent heat exchange occurs whereby the entrained ambient air is cooled substantially. This cooled ambient air flowing into contact with the front of the case has caused condensation problems and has spilled over the front wall onto the floor in front of the case and created discomfort to customers in supermarkets.

According to the present invention, the front of the case 25 is provided with a separate flue 58 defined by the insulated front wall 27 and the uninsulated exterior front casing panel 59 of the case 25. This flue 58 has an upper inlet defined by a perforated covering 60 positioned above or adjacent to the return air opening 51, and the lower end of the flue 58 is in communication with the chamber 56. As shown in FIG. 1, the preferred embodiment, the condenser 21 is arranged vertically in a single or double row coil and positioned in the flue 58 thereby minimizing space requirements of the case 25 and producing a more efficient operation.

In operation of the FIG. 1 arrangement, the air curtain flowing between the discharge 50 and the return opening 51 induces a movement of ambient room air as shown by the arrows. As this room air moves adjacent to the air curtain it is cooled to a temperature intermediate the display area temperature and the temperature of the room. A balance of negative pressures of the fans 57 and the fan 22 is important so that display case air is returned through the return flue 36 for re-cooling and recirculation while the compressor fan 22 creates a suction

4

pressure in the front flue 58 to draw a substantial volume of cooled ambient air into this flue 58 and across the condenser 21. The control or balance of negative pressures may be provided by openings 61 formed in the base panel 62 adjacent to the front of the case providing communication between the chamber 56 and ambient.

The capacity of the condenser 21 is substantially increased by the flow of cooled ambient air therepast, or a smaller condenser may be used in the case. Furthermore, the cooler ambient air resulting from the operation of other refrigerated fixtures as in a supermarket will tend to settle to the floor, and this air is drawn through the openings 61 and circulated over the compressor 18 with the air drawn over the condenser 21. The so-called spill-over air, i.e., the cooled air that would have spilled or cascaded down the case front onto floor except for this invention, and the other air drawn over the compressor 18 is discharged to the rear of the case or taken through suitable ducts (not shown) to some remote location.

Referring to FIG. 3, a modified arrangement shows the condenser 21 positioned in the chamber 56 in advance of the compressor 18 whereby the spill-over air (cooled ambient air) is drawn into the flue 58 and through the condenser 21. Openings 61 may also be provided for controlling the suction pressure in the front flue 58.

Referring now to FIG. 5, it will be seen that the invention may be applied to an open-top type of refrigerated fixture 125, also called a reach-in case. The case 125 has a base wall 126, opposed vertical side walls 127 and opposed vertical end walls 128. The refrigerated air system includes a refrigeration chamber 129 defined by the bottom wall 126 and a panel 130 and houses an evaporator coil 131 and fan means 132. A delivery duct 133 is defined by one side wall and a spaced side panel 134, and has a discharge opening 135 through which cold air is discharged across the open top 136 of the case 125. An air return duct 137 is formed between the opposed side wall 127 and a panel 138 and has a return opening 139 along the top of the side wall opposite to the discharge opening 135. A product refrigeration or display area 140 is defined by the end walls 128 and panels 130, 134 and 138.

Induced movement of ambient air across the open top 136 and cooling of this air is accommodated by providing a separated duct or flue 141 extending vertically between the insulated side wall 127 having the return duct 137 interiorly thereof and an exterior case facing or panel 142. A perforated air inlet plate 143 forms the top of the flue 141 for receiving the cooled ambient air therein, and a duct 144 may be provided at the lower end of the flue 141 for removal of the cooled ambient air.

In FIG. 6 a typical remote case 225 is illustrated showing diagrammatically a compressor 218 positioned in a basement room 219 and connected by suction and pressure conduits 216 and 220 through the floor 215 to the evaporator 214 and condenser (not shown) within the case 225. The refrigerated case 225 may be similar to the case 25 shown in FIG. 1 and similar parts are identified by similar numbers in the "200" series. The flue 258 for receiving cooled ambient air is shown connected to a duct 265 for removing this air away from the fixture location; and a similar duct may also be provided in connection with the duct 144 in FIG. 5.

From the foregoing, it will be seen that the objects and advantages hereinbefore enumerated are met by the present invention.

This invention is intended to cover all changes and modifications of the embodiments herein disclosed, and is to be limited only by the claims which follow.

What we claim is:

1. A refrigerated case having a product area with an access opening, comprising a refrigeration system having evaporator means for refrigerating air, air distribution means including a delivery duct from said evaporator means to said product area and a return duct from said

product area to said evaporator means, and air moving means for circulating refrigerated air across said evaporator means and through said delivery duct to cool said product area and for forming a wall of air across said access opening to protect said product area from ambient air external of said case and for returning said air from said product area and access opening to said evaporator means for recooling and recirculation, a flue separated from said return duct means by an insulated wall, said return duct and said flue having adjacent inlet ends, and fan means for creating a negative pressure in said flue to draw into said flue ambient air that is entrained and cooled by said wall of air, said refrigeration system including a condenser positioned in heat exchanging relation with the ambient air entrained and cooled by said wall of air, there being an air inlet opening through which additional ambient air may flow to the negative pressure side of said fan means to obviate interference with the circulation of said refrigerated air to said return duct.

2. A refrigerated case having a product area with an access opening, comprising a refrigeration system having evaporator means for refrigerating air, air distribution means including a delivery duct from said evaporator means to said product area and a return duct from said product area to said evaporator means, and air moving means for circulating refrigerated air across said evaporator means and through said delivery duct to cool said product area and for forming a wall of air across said access opening to protect said product area from ambient air external of said case and for returning said air from said product area and access opening to said evaporator means for recooling and recirculation, a flue separated from said return duct means by an insulated wall, said return duct and said flue having adjacent inlet ends, and fan means for creating a negative pressure in said flue to draw into said flue ambient air that is entrained and cooled by said wall of air, said refrigeration system including a compressor and condenser, said condenser positioned in said flue whereby said cooled ambient air comprises the heat exchange medium for said condenser, said case having a chamber therein insulated from the product area and provided with an air inlet through which additional ambient air may enter said chamber, said compressor being located in said chamber and said fan means being arranged to circulate cooled ambient air from said flue and additional ambient air from said air inlet over said compressor.

3. A refrigerated case having a product area with an access opening, comprising a refrigeration system having evaporator means for refrigerating air, air distribution means including a delivery duct from said evaporator means to said product area and a return duct from said product area to said evaporator means, and air moving means for circulating refrigerated air across said evaporator means and through said delivery duct to cool said product area and for forming a wall of air across said access opening to protect said product area from ambient air external of said case and for returning said air from said product area and access opening to said evaporator means for recooling and recirculation, a flue separated from said return duct means by an insulated wall, said return duct and said flue having adjacent inlet ends, said refrigeration system including a compressor and condenser contained within the case, and means for creating a negative pressure in said flue comprising fan means for drawing into said flue ambient air that is entrained and cooled by said wall of air, an inlet positioned to admit additional ambient air to the negative pressure side of said fan means for circulating said cooled ambient air across said condenser and compressor.

4. A refrigerated case having a product area with an access opening, comprising a refrigeration system having evaporator means for refrigerating air, air distribution means including a delivery duct from said evaporator

means to said product area and a return duct from said product area to said evaporator means, and air moving means for circulating refrigerated air across said evaporator means and through said delivery duct to cool said product area and for forming a wall of air across said access opening to protect said product area from ambient air external of said case and for returning said air from said product area and access opening to said evaporator means for recooling and recirculation, a flue separated from said return duct means by an insulated wall, said return duct and said flue having adjacent inlet ends, said refrigeration system including a compressor and condenser contained within the case, and means for creating a negative pressure in said flue comprising fan means for drawing into said flue ambient air that is entrained and cooled by said wall of air and for circulating said cooled ambient air across said condenser and compressor, and other means for controlling the negative pressure produced by said fan means in said flue to substantially obviate interference with the normal circulation of said refrigerated air of said case.

5. A refrigerated case having a product area with an access opening, comprising a refrigeration system having evaporator means for refrigerating air, air distribution means including a delivery duct from said evaporator means to said product area and a return duct from said product area to said evaporator means, and air moving means for circulating refrigerated air across said evaporator means and through said delivery duct to cool said product area and for forming a wall of air across said access opening to protect said product area from ambient air external of said case and for returning said air from said product area and access opening to said evaporator means for recooling and recirculation, a flue separated from said return duct means by an insulated wall, said return duct and said flue having adjacent inlet ends, said refrigeration system including a compressor and condenser contained within the case, said compressor being housed in a chamber insulated from said product area, evaporator means and air distribution system, means for creating a negative pressure in said flue comprising fan means for drawing into said flue ambient air that is entrained and cooled by said wall of air and for circulating said cooled ambient air across said condenser and compressor, and other means for controlling the negative pressure produced by said fan means in said flue to substantially obviate interference with the normal circulation of said refrigerated air of said case, said other means comprising an opening between said chamber and ambient to admit ambient air to said chamber on the suction side of said fan means.

6. A refrigerated case having a product area therein with an opening for access to the product area, said product area having an insulated front wall presenting an edge adjacent the access opening to the product area, a refrigeration system including a compressor, a condenser and an evaporator, an air passage having an inlet opening adjacent said edge of said insulated front wall and on the interior thereof, means for circulating air through said air passage, said evaporator being located in heat exchanging relation with the air thus circulated to refrigerate the same, means for directing air refrigerated by the evaporator across said access opening toward said inlet opening in the form of a wall of cooled air so as to cool the product area and protect it from ambient air adjacent the access opening, an air duct located on the exterior of said insulated front wall of the product area and having an air inlet in position to receive ambient air cooled by said wall of cooled air and flowing past the upper edge of said insulated front wall, the condenser and compressor of said refrigeration system both being housed within the refrigerated case and insulated from said product area, fan means for directing cooled ambient air from said air duct over the condenser, and means for admitting additional ambient air to the case and to

said fan means for circulating both said additional ambient air and the cooled ambient air from said air duct over the compressor to cool the same.

References Cited by the Examiner

UNITED STATES PATENTS

2,066,312	1/1937	Bales	62—256
2,882,696	4/1959	Hermann	62—256

3,063,253	11/1962	Dickson	62—256
3,063,254	11/1962	Dickson	62—256
3,063,256	11/1962	Lamb	62—256
3,094,851	6/1963	Beckwith	62—256
5 3,125,864	3/1964	Ural	62—256

WILLIAM J. WYE, *Primary Examiner*.
ROBERT A. O'LEARY, *Examiner*.