

May 17, 1960

J. H. RAINWATER

2,936,596

FROZEN FOOD DISPLAY CASE

Filed June 4, 1959

2 Sheets-Sheet 1

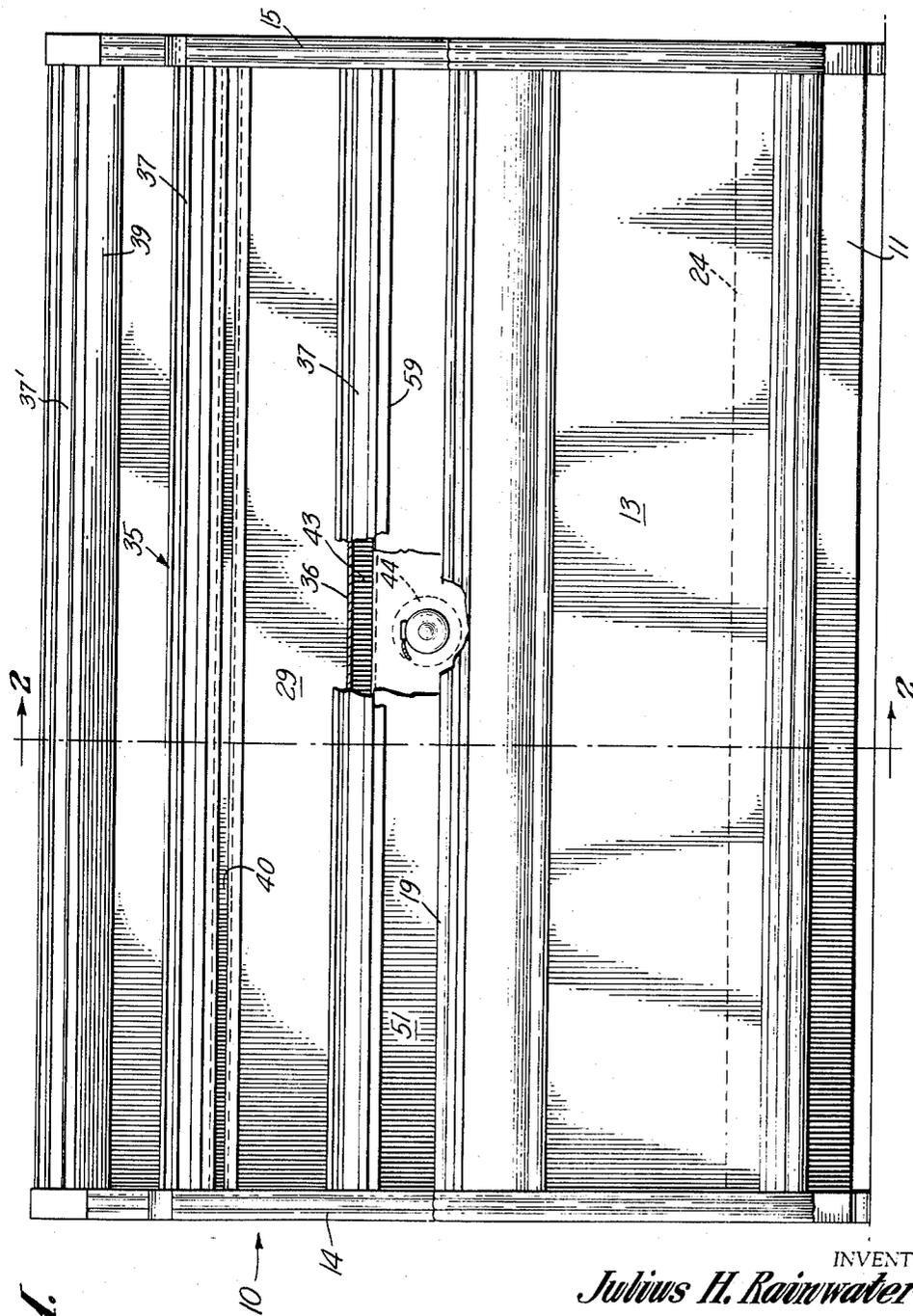


Fig. 1.

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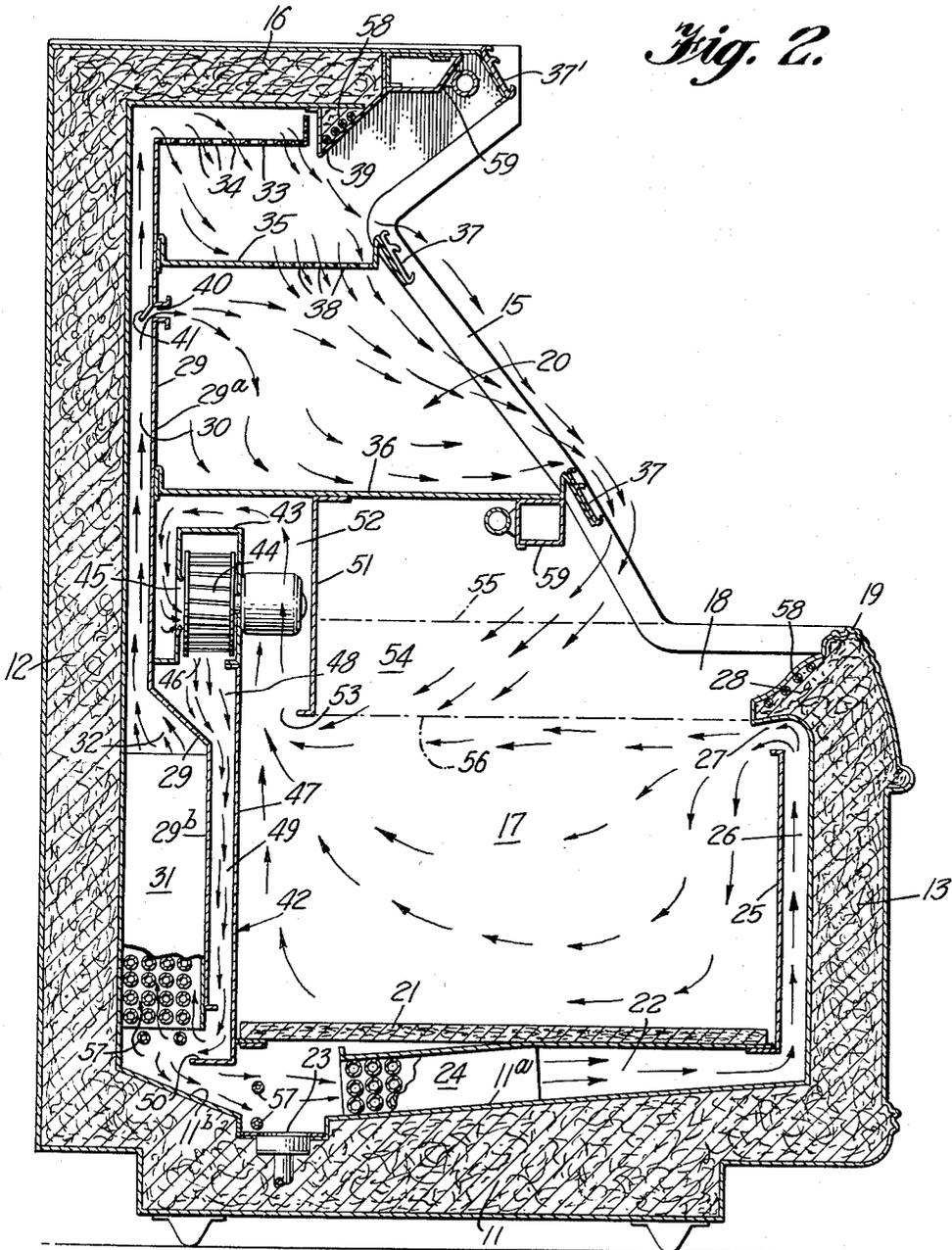


Fig. 2.

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1

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FROZEN FOOD DISPLAY CASE

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4 Claims. (Cl. 62—251)

The present invention relates in general to the art of refrigeration, and more particularly to open-top frozen food display cases.

While open-top refrigerated display cases have come into rather common commercial use, many of such display cases have been found to possess certain disadvantages, for example in the provision of abnormally high glass barriers above the front wall for retaining the refrigerated air within the cases, which decrease the accessibility of the produce within the cases and obstruct the view of the product. It has also been difficult to effectively provide suitable air flow within such open-top refrigerated display cases to insure effective cooling of the frozen food compartment to sub-zero temperatures and particularly to provide appropriate distribution of refrigerated air to maintain the desired temperatures at elevated display shelves incorporated in the display case.

An object of the present invention is the provision of a novel open-top frozen food display case wherein refrigerated air currents and air return inlets are so located as to greatly retard spill-over or loss of refrigerated air over the front wall of the display case, and wherein the use of glass barriers between the purchaser and the product may be eliminated.

Another object of the present invention is the provision of an open-top frozen food display case wherein refrigerated air flow is so directed as to tend to sweep refrigerated air from the area of elevated shelves in the display case into the air return inlet to increase the efficiency of the cooling effect.

Another object of the present invention is the provision of a novel open-top frozen food display case wherein the refrigerated air ducts and inlets are so located as to prevent icing of the rear panel of the frozen food storage compartment and to prevent heated defrost air from thawing the product.

Another object of the present invention is the provision of an open-top frozen food display case having dual coils, one provided for the low section or frozen food storage compartment and the other for the upper section or elevated shelf areas together with air channels arranged to control the proportionate amounts of air flowing to the two sections.

Another object of the present invention is the provision of a novel open-top frozen food display case having a lower frozen food compartment and an upper shelf area, and having a stratified air zone at the top of the lower frozen food compartment together with means to cause refrigerated air from the shelf region to pass through the stratified air zone and be reclaimed, and thereby minimize loss of refrigerated air from the upper shelf zone to the room.

Other objects, advantages and capabilities of the present invention will become apparent from the following detail description taken in conjunction with the accompanying drawings illustrating one preferred embodiment of the invention.

In the drawings:

Figure 1 is a front elevation of an open-top frozen food display case embodying the present invention; and

Figure 2 is a vertical transverse section view taken along the line 2—2 of Figure 1.

2

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, the frozen food refrigerated display case of the present invention comprises a horizontally elongated cabinet, generally designated by the reference character 10, which includes an insulated bottom wall 11, an upright insulated back wall 12, a low upright insulated front wall 13, insulated upright end walls 14 and 15, and an insulated horizontal top wall 16. The low front wall 13 and the lower portions of the back wall 12 and end walls 14, 15 enclose an upwardly opening frozen food storage compartment 17 which is accessible through the opening 18 disposed immediately rearwardly of the upper edge 19 of the front wall 13. The portions of the back wall 12 and end walls 14, 15, disposed above the storage compartment 17, together with the top wall 16 form a forwardly opening enclosure for an upper section or shelf zone 20.

The structure of the frozen food compartment 17 includes an insulated bottom panel 21 spaced above the bottom wall 11, providing a chamber 22 between the compartment 17 and the bottom wall 11. The upper surfaces 11a, 11b, of the bottom wall 11 incline downwardly to a drain well 23 located near the back of the case 10, and a cooling coil 24 of a closed refrigerating system (not shown) is disposed in the chamber 22 between the drain well 23 and the forward end of the chamber 22. A front inner panel 25 is spaced inwardly from the inner surface of the front wall 13 to define a front air supply duct 26 which communicates with the chamber 22 at its lower end and has an outlet 27 at its upper end beneath the inwardly projecting lip 28 at the top of the front wall 13 to deliver rearwardly directed refrigerated air to the top of the frozen food compartment 17.

A rear inner panel 29 is spaced forwardly from the back wall 12 and extends from a point near the bottom wall surface 11b to a point near the top wall 16 to define a rear air supply duct 30 having a cooling coil 31 at the lower end thereof. It will be noted that the panel 29 has an upper portion 29a that lies near the back wall 12 and a forwardly stepped lower portion 29b that is spaced farther from the wall 12 to provide a narrow upper duct portion and a deeper lower chamber of sufficient size to accommodate the coil 31. The area between the inclined portion of the panel 29 joining the portions 29a and 29b thereof and the back wall 12 forms a plenum 32 immediately above the coil 31. A perforated top inner panel 33 extends forwardly along the top wall 16 from the top end of the rear duct 30 and has a plurality of scattered air outlet openings 34 therein to supply refrigerated air downwardly from the top of the upper section 20 of the case.

Located within the upper section 20 are a top shelf 35 and a lower shelf 36 extending forwardly from the rear panel 29 to points near the front of the upper portions of the side walls 14, 15 and terminating in price-tag rails or moldings 37. An additional price tag rail 37' may be located at the front end of the top wall 16. The top shelf 35 has scattered openings 38 in the front region thereof to permit refrigerated air to flow there-through onto the products on lower shelf 36 when the shelf 35 is not fully loaded with products. A deflector 39 depends from the top wall 16 at the front end thereof and forward of the front end of panel 33 to assist in directing the refrigerated air downwardly on the products in the upper section 20. An air outlet opening 40 extending the length of the case is formed in the rear inner panel 29 a short distance below the top shelf 35 to deliver refrigerated air forwardly onto the product on the lower shelf 36, and an air deflector 41 is disposed within the duct 30 immediately above the opening 40 to direct the

desired proportion of refrigerated air through the opening 40.

A partition member 42 is spaced forwardly of the rear inner panel 29 and comprises a fan housing section 43 at the upper end thereof encasing a fan or blower 44 and having an inlet opening 45 and an outlet opening 46 therein and a vertical panel portion 47 forming the rear wall of the frozen food storage compartment 17 descends vertically from the fan housing portion 43. The panel portion 47 of the partition member 42 defines, with the forwardly stepped portion 29b of the rear inner panel 29, a common plenum 48 and common duct 49 extending from the fan housing outlet opening 46 to a point at the rear of the chamber 22 where the air discharged by the fan 44 is divided into a front circuit including the cooling coil 24 and front supply duct 26 and a rear circuit including the cooling coil 31 and rear supply duct 30. An air deflector 50 which projects rearwardly from the lower end of the panel portion 47 facilitates distribution of the desired quantities of air to the two circuits. Lips at the lower ends of the partition member 42 and the front inner panel 25 project toward the compartment 17 to support the bottom panel 21.

A depending partition 51 descending from the lower shelf 36, together with the rear portion of the shelf 36, the fan housing 43 and part of the rear inner panel 29, define an inverted U-shaped low pressure plenum 52 having an inlet 53 substantially at the level of the front supply duct outlet 27 and which communicates with the fan housing inlet 45. Due to the extension of the partition 51 a substantial distance below the upper edge 19 of the front wall 13 and the arrangement of air flow in the case, a safety zone 54 for stratification of cold air is provided between the boundaries generally indicated by the broken lines 55, 56 to retard spilling of refrigerated air over the low front wall 13.

Conventional electric defrost heaters 57 are disposed in the path of air discharged from the common duct 49 toward both cooling coils 27 and 31 to effect defrost of the case, and anti-sweat heaters 58 may be associated with the lip 23 of the front wall, which is usually capped with a metallic liner, and with the deflector 39, to retard the accumulation of moisture from ambient air on these surfaces. Florescent light fixtures 59 may also be provided at convenient locations, as on the top wall 16 and lower shelf 36 to illuminate the product areas of the cases.

The fan 44, or a number of such fans spaced along the display case, recirculates cooling air throughout the fixture by drawing air through the inlet 53 and low pressure plenum 52 and into the inlet 45, and discharging the air under pressure through the common plenum 48 and common duct 49 to the air deflector 50, where the air is divided into the front circuit through coil 24 and the rear circuit through coil 31. In the front circuit, the air is cooled to sub-zero temperatures by the cooling coil 24 and moves to the front of the fixture through the chamber 22, up the front supply duct 26 and through the supply outlet 27 which is designed to stratify air immediately below the safety zone 54 as it moves horizontally across the product in the frozen food storage compartment 17. It will be noted that this air discharged through the supply outlet 27 moves from the front to the back of the compartment 17, where the air is reclaimed by the air inlet 53. By the location of the air inlet 53 on a level with the air supply outlet 27 and below the upper edge 19 of the low front wall 13, a safety zone 54 is left for stratification of cold air to minimize losing refrigerated air whenever this flow and stratification are distributed by outside forces.

In the rear air flow circuit, the air discharged from the common duct 49 is cooled to sub-zero temperature by the cooling coil 31, and passes into the plenum 32 immediately above the cooling coil 31 and up through the

rear duct 30. The air deflector 41 directs a metered portion of this air through the opening 40, which extends the length of the case, to insure even refrigeration of the product on the lower shelf 36. The refrigerated air in the rear duct 30 which by-passes the air deflector 41 continues to the top of the rear duct 30 and is distributed through the scattered openings 34 in the top inner panel 33 to fall vertically on the product on the top shelf 35, this air being partially directed by the inner surface of the deflector 39. If the top shelf 35 is not fully loaded, the air discharged through the openings 34 is allowed to flow through the openings 38 in the top shelf 35 directly onto the product on the lower shelf 36. If the top shelf 35 is loaded, the refrigerated air falls of its own increased weight over the front of the top shelf 36 falls over the front of the lower shelf 36 and passes through the safety zone 54 to be reclaimed by the inlet opening 53. The air forced rearwardly from the front supply duct outlet 27 is of sufficient velocity to tend to sweep the refrigerated air which falls over the front of the lower shelf 36 into the inlet opening 53 and thereby increases the efficiency of the cooling effect. The forced air flow from the front supply duct opening 27 and from the upper section 20 over the front of the lower shelf 36 to the inlet 53 at a single protected area tends to greatly retard spill-over or loss of refrigerated air over the low front wall 13 and obviates the necessity of providing a barrier of metal or glass between the purchaser and the product, even in a refrigerator specifically designed for frozen foods requiring sub-zero temperatures. The location of the common duct 49 between the cooling coil 31 and the storage compartment 17 prevents icing of the rear panel 47 of the storage compartment 17 which would occur if the rear panel of the storage compartment where the front wall of the chamber housing the cooling coil 31 and this arrangement also prevents heated defrost air from thawing the product.

While but one specific embodiment of the invention has been specifically shown and described, it is apparent that various modifications may be made therein without departing from the spirit and scope of the invention and it is desired, therefore, that only such limitations be placed on the invention as are imposed by the prior art and set forth in the appended claims.

I claim:

1. A refrigerated display case comprising a low front wall, a high back wall, side walls, and a bottom wall, means defining an upwardly opening, lower frozen food storage compartment located below the upper edge of said front wall between said front and back walls and said end walls and an upper, forwardly opening shelf compartment above the upper edge of said front wall between said back and end walls, a top shelf and a lower shelf spaced vertically from each other in said shelf compartment and projecting forwardly of said back wall, said top and lower shelves having their forward edges located rearwardly of the forward edges of said end walls along said shelf compartment, forced air recirculating means located at the back of said storage compartment including a fan and duct means having a return inlet, a common supply duct section forming the rear wall of said frozen food storage compartment, and an air divider outlet located adjacent the bottom and back of the display case, means defining a back refrigerated air supply circuit extending from said air divider outlet vertically along said back wall to a point above said top shelf and having air outlet openings for supplying refrigerated air downwardly onto said top shelf, said back supply circuit means having intermediate air outlet opening means between said top shelf and said lower shelf and having deflector means associated therewith for directing a selected portion of refrigerated air forwardly onto said lower shelf, means forming a front refrigerated air supply circuit extending from said air divider outlet forwardly below said storage compartment and upwardly

along said front wall having a rearwardly directed outlet opening spaced a selected distance below the upper edge of the front wall, air cooling means located in each of said supply circuits, said outlet openings and said intermediate outlet opening means of said rear supply circuit being arranged to supply refrigerated air forwardly over said top and lower shelves, which refrigerated air falls over the front edges of the shelves and into the upwardly opening storage compartment, and said return inlet and said outlet opening of said front supply circuit being located and arranged to produce refrigerated air flow from the front to the back of said storage compartment at a level to establish a safety zone for air stratification between the level of the upper edge of said front wall and the level of said outlet opening of said front supply circuit means and to tend to sweep refrigerated air falling downwardly over the front edge of said lower shelf into said return inlet.

2. A refrigerated display case comprising a low front wall, a high back wall, side walls, and a bottom wall, means defining an upwardly opening, lower frozen food storage compartment located below the upper edge of said front wall between said front and back walls and said end walls and an upper, forwardly opening shelf compartment above the level of the upper edge of said front wall between said back and end walls, a plurality of shelves in said shelf compartment projecting forwardly of said back wall, a bottom panel spaced from said bottom wall defining the bottom of said frozen food storage compartment, means defining a back refrigerated air supply circuit having an entrance end located adjacent the lower rear corner of the display case and rising substantially the full height of the display case along said back wall and including air cooling means adjacent the entrance end of said back supply circuit and having air outlet means for directing refrigerated air forwardly onto said shelves, means forming a front refrigerated air supply circuit having an entrance end below said bottom panel adjacent the lower rear corner of the display case and including air cooling means adjacent said entrance end for directing refrigerated air forwardly below said bottom panel to said front wall and upwardly along said front wall, said front air supply circuit means having a rearwardly directed outlet opening at the front of said storage compartment and spaced a selected distance below the upper edge of said front wall, common duct means disposed at the rear of said storage compartment and forwardly of said back supply circuit means having an air return inlet at substantially the level of the outlet opening of said front supply circuit means, an air circulating fan, and a common supply duct for supplying air from said fan to the entrance ends of said back and front supply circuit means, said outlet opening for said front supply circuit means including means for directing air rearwardly from said front wall to said return inlet at a level to establish a safety zone for air stratification between the level of the upper edge of said front wall and the level of said outlet opening of said front supply circuit means.

3. A refrigerated display case of the open-top type comprising a low front wall, a high back wall, side walls, and a bottom wall, a top wall extending forwardly from said back wall a predetermined distance, a plurality of shelves located beneath said top wall and above the level of the top of said front wall, said shelves being located one above the other and projecting forwardly from said back wall, a frozen food storage compartment located below the upper edge of said front wall between said front and back walls and said end walls and having a bottom panel spaced from said bottom wall, means forming a first air supply duct extending from an entrance end below and near the rear of said bottom panel vertically along said back wall to said top wall and having a plurality of air outlet openings for admitting air onto said shelves to flow outwardly along the shelves and downwardly over the front edges thereof, means forming

a second air supply duct extending from an entrance end below and near the rear of said bottom panel forwardly to said front wall and upwardly along said front wall and having an air outlet opening directed toward said back wall and located adjacent and spaced below the top edge of said front wall, air cooling means in said first and second air supply ducts near the entrance ends of said ducts, means forming a common duct between said first air supply duct and said storage compartment including a low pressure common return section having a return inlet disposed at the rear of said storage compartment at the level of said air outlet opening of said second duct, an air circulating fan, and a common supply section extending from said fan to the entrance to said first and second air supply ducts to provide air movement in said first and second ducts, and means providing a safety zone for air stratification between the level of the upper edge of said front wall and the level of said second duct supply opening and said common return inlet overlying said storage compartment to retard spilling of refrigerated air over said low front wall.

4. A refrigerated display case comprising a low front wall, a high back wall, side walls, and a bottom wall, a top wall extending forwardly from said back wall a predetermined distance, means defining an upwardly opening lower frozen food storage compartment located below the upper edge of said front wall between said front and back walls and said end walls, and an upper, forwardly opening shelf compartment above the level of the upper edge of said front wall between said back, end and top walls, a bottom panel spaced above said bottom wall to provide a chamber below said storage compartment having an air divider zone at the back of said chamber adjacent said back wall, a rear panel spaced from said back wall to provide a back supply duct in communication with said air divider zone, a top shelf and a lower shelf supported on said rear panel within said shelf compartment and having forward edges disposed rearwardly of the front edges of the end wall portions bounding said shelf compartment, said rear panel having a forward extension at the top thereof having top air outlet opening for supplying air downwardly onto said top shelf and an intermediate air outlet opening between said top and lower shelves for supplying air forwardly and downwardly onto said lower shelf, a front panel spaced from said front wall and communicating at its lower end with said chamber to provide a front air supply duct, said front duct having a rearwardly opening outlet opening spaced below the upper edge of said front wall for directing air rearwardly over said storage compartment, air cooling means in said back and front ducts, common air recirculating means disposed forwardly of said rear panel at the rear of said storage compartment including a high pressure common duct having a duct wall spaced forwardly of said rear panel and forming the rear wall of said storage compartment, a low pressure duct section bounded forwardly by a depending partition from said lower shelf depending to the level of said front duct outlet opening and having a return inlet at said level, and an air circulating fan intermediate said duct sections for drawing refrigerated air through said return inlet and discharging the same through said high pressure duct section to said air divider zone, said front duct outlet opening including means for directing air rearwardly to said return inlet at a level below the upper edge of said front wall to establish a safety zone therebetween for air stratification and to tend to sweep refrigerated air falling over the front edge of said lower shelf into said return inlet.

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