A refrigerated merchandiser including a case defining a product display area, and a shelf supported by the case within the product display area. The case includes a base that is disposed below the product display area and a canopy that is disposed substantially above the product display area. The shelf includes an air discharge duct that is configured to direct a first air curtain generally downward from the shelf into the product display area toward the base, and an air return duct that is configured to receive at least a portion of a second air curtain discharged into the product display area from above the shelf.
REFRIGERATED MERCHANDISER WITH DUAL AIR CURTAIN

RELATED APPLICATIONS


BACKGROUND

[0002] The present invention relates to a refrigerated merchandiser that includes an air curtain. More particularly, the present invention relates to a refrigerated merchandiser that includes a product display area, a primary air curtain, and a secondary air curtain.

[0003] In conventional practice, supermarkets and convenience stores are equipped with refrigerated merchandisers that have open display portions for presenting fresh food or beverages in a product display area to customers while maintaining the fresh food and beverages (i.e., food product) in a refrigerated environment. Typically, refrigerated merchandisers include a curtain of cool, refrigerated air that passes downward across the open face portion of the merchandiser to form a flowing boundary of air between the product display area and the rest of the store. The air curtain is generated by an airflow through a passageway of the refrigerated merchandiser that is cooled by one or more evaporators disposed in the passageway, and that is discharged from an outlet in a canopy of the merchandiser. The air curtain assists in keeping refrigerated air within the product display area to cool the food product and protects the product display area from ambient air in the surrounding store. Warmer ambient conditions surrounding the refrigerated merchandiser increase cooling requirements of the merchandiser and can undesirably increase the temperature of the food product in the product display area.

[0004] Some refrigerated merchandisers incorporate multiple air curtains to limit entrainment of ambient air that can occur in a single air curtain refrigerated merchandiser, and to maintain the product display area at desired temperatures. Refrigerated merchandisers with two or more adjacent air curtains include an outer air curtain that has a slightly higher temperature than the inner air curtain, so as to protect the colder, inner air curtain from the impact of ambient air surrounding the merchandiser. These multiple air curtain refrigerated merchandisers are designed to limit problems of entrainment of ambient air into the colder, inner air curtain. However, such designs are still susceptible to the intrusion of ambient air into the refrigerated air curtain.

SUMMARY

[0005] In one construction, the invention provides a refrigerated merchandiser including a case defining a product display area, and a shelf supported by the case within the product display area. The case includes a base that is disposed below the product display area and a canopy that is disposed substantially above the product display area. The shelf includes an air discharge duct that is configured to direct a first air curtain generally downward from the shelf into the product display area toward the base, and an air return duct that is configured to receive at least a portion of a second air curtain discharged into the product display area from above the shelf.

[0006] In another construction, the invention provides a refrigerated merchandiser including a case defining a product display area, and a plurality of shelves supported by the case within the product display area. The case includes a base that is disposed below the product display area and a canopy that is disposed substantially above the product display area. The canopy is configured to discharge a first air curtain toward the base. The plurality of shelves include an upper shelf that has an air discharge duct, and a lower shelf that is positioned vertically below the upper shelf and that has an air return duct. At least one of the canopy and the upper shelf is configured to discharge a second air curtain substantially vertically through the product display area such that the second air curtain is at least partially received by the air return duct of the lower shelf.

[0007] In yet another construction, the invention provides a method of conditioning a product display area of a refrigerated merchandiser. The method includes providing a case that includes a base disposed below the product display area and a canopy that is disposed substantially above the product display area, and providing a shelf that is supported by the case within the product display area. The method also includes discharging a first air curtain generally downward from the shelf into the product display area toward the base, discharging a second air curtain generally downward into the product display area from above the shelf, and receiving at least a portion of the second air curtain via an air return duct of the shelf.

[0008] Other aspects of the invention will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a schematic side view of a refrigerated merchandiser embodying the present invention.

[0010] FIG. 2 is an enlarged schematic side view of a portion of the refrigerated merchandiser of FIG. 1.

[0011] FIG. 3 is a section view of a portion of the refrigerated merchandiser of FIG. 1.

[0012] FIG. 4 is a section view of a shelf of the refrigerated merchandiser of FIG. 1.

DETAILED DESCRIPTION

[0013] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” or “having” and variations thereof herein is meant to encompass the items listed therefrom and equivalents thereof as well as additional items.

[0014] FIG. 1 shows a refrigerated merchandiser 10 that may be located in a supermarket or a convenience store (not shown) for presenting fresh food, beverages, and other food product (not shown) to customers. The refrigerated merchandiser 10 includes a case 15 having a base 20, a rear wall 25, and a canopy 30. The area partially enclosed by the base 20, the rear wall 25, and the canopy 30 defines a product display
area 35 that stores food product in the case 15 and that is accessible by customers through an opening 37 adjacent the front of the case 15.

[0015] The base 20 is disposed substantially below the product display area 35 and can be supported by a floor or support surface (not shown) of the supermarket. The base 20 defines a lower portion of the product display area 35 and can support a portion of the food product in the case 15. The base 20 further defines a lower discharge flue 40, a lower circulation flue 45, and a lower return flue 50, and includes a primary inlet 55 and a secondary inlet 60 that is located outward from the primary inlet 55 adjacent the opening 37.

[0016] The lower discharge flue 40 is in fluid communication with the primary inlet 55 and conducts an airflow 70 substantially horizontally through the base 20 from the primary inlet 55. The lower circulation flue 45 is in fluid communication with the secondary inlet 60 and conducts a circulated airflow 75 substantially horizontally through the base 20 from the secondary inlet 60. The primary and secondary inlets 55, 60 are positioned to receive surrounding air in a substantially vertical direction to direct the surrounding air into the lower discharge flue 40 and the lower circulation flue 45, respectively.

[0017] The lower return flue 50 is in fluid communication with the lower discharge flue 40 in the base 20 adjacent the front of the case 15 to direct a return airflow 80 from the lower return flue 50 into the lower discharge flue 40 downstream of the primary inlet 55. In the illustrated construction, the lower discharge flue 40 is positioned above the lower return flue 50, although other relative positions of the lower discharge flue 40 and the lower return flue 50 are possible and considered herein. The lower circulation flue 45 is generally located below the lower discharge flue 40 and the lower return flue 50.

[0018] FIGS. 1 and 2 show that the rear wall 25 defines a rear portion of the product display area 35 that includes a rear circulation flue 85, a rear discharge flue 90, and a rear return flue 95. In the illustrated refrigerated merchandiser 10, the rear wall 25 also includes apertures 100 that fluidly couple the rear discharge flue 90 with the product display area 35 and that allow at least some of the airflow 70 in the rear discharge flue 90 to enter the product display area 35. In other constructions, the rear wall 25 does not include the apertures 100.

[0019] The rear circulation flue 85 is in fluid communication with the lower circulation flue 45, and is positioned adjacent the back of the case 15 behind the rear discharge flue 90 and the rear return flue 95 to direct the circulated airflow 75 in a substantially vertical direction toward the canopy 30. The rear discharge flue 90 is in fluid communication with the lower discharge flue 40 to direct the airflow 70 in a substantially upward direction. The rear return flue 95 is in fluid communication with the lower return flue 50 to direct the return airflow 80 in a substantially vertically downward direction.

[0020] In the construction of the refrigerated merchandiser 10 that is illustrated in FIG. 1, the rear discharge flue 90 and the rear return flue 95 are generally offset from each other such that the rear discharge flue 90 is located in front of the rear return flue 95 relative to the front of the case 15 (i.e., the rear discharge flue 90 is horizontally closer to the product display area 35). In other constructions, the rear discharge flue 90 can be behind the rear return flue 95.

[0021] FIG. 3 shows another construction of the rear discharge flue 90 and the rear return flue 95. In this construction, the rear discharge flue 90 and the rear return flue 95 are separated from each other by wall members 105 that extend vertically between the base 20 and the canopy 30, and that further extend from the wall that partially defines the rear circulation flue 85 to the interior portion of the rear wall 25 that partially defines the product display area 35. The wall members 105 are positioned in the rear wall 25 to define a plurality of rear discharge flues 90 and a plurality of rear return flues 95 such that the rear discharge flues 90 and the rear return flues 95 are oriented vertically in the rear wall 25 and are alternatingly positioned across a horizontal length of the case 15. In other words, each of the wall members 105 is located between and shared by one rear discharge flue 90 and one rear return flue 95. In other constructions, the rear discharge flue 90 and the rear return flue 95 can be arranged in the rear wall 25 in other ways.

[0022] The canopy 30 is disposed substantially above the product display area 35 and defines an upper portion of the product display area 35 that has an upper discharge flue 110 and an upper circulation flue 115 that is positioned outward from the upper discharge flue 110. The canopy 30 includes a primary outlet 120 that is disposed adjacent the product display area 35, and a secondary outlet 125 that is located outward from the primary outlet 120 adjacent an end of the canopy 30. The upper discharge flue 110 is in fluid communication with the rear discharge flue 90 and conducts the airflow 70 substantially horizontally through the canopy 30 toward the primary outlet 120. The upper circulation flue 115 is in fluid communication with the rear circulation flue 85 and conducts the circulated airflow 75 substantially horizontally through the canopy 30 toward the secondary outlet 125.

[0023] FIGS. 1 and 2 show that the merchandiser 10 also includes shelves 130 that are disposed within the product display area 35 to support the food product. Each shelf 130 is attached to the rear wall 25 at one end, and extends outward from the rear wall 25 toward the front of the case 15. FIGS. 2 and 4 show that each shelf 130 defines a discharge duct 135 and two return ducts 140, and includes a discharge outlet 145 and a return inlet 150. The discharge duct 135 is in fluid communication with the rear discharge flue 90 and the discharge outlet 145, and directs the airflow 70 substantially horizontally toward the rear discharge flue 90 toward the discharge outlet 145. The discharge duct 135 in each shelf is located substantially below the return duct 140, and the discharge outlet 145 is located below the associated return inlet 150 adjacent the free or suspended ends of each shelf 130 at the front of the case 15. The return ducts 140 are in fluid communication with the rear return flue 95 and the return inlet 150, and direct the return airflow 80 substantially horizontally from the return inlet 150 toward the rear return flue 95. In some constructions, each shelf 130 can include one or more than two return ducts 140. Similarly, each shelf 130 can include more than one discharge duct 135.

[0024] The lower discharge flue 40, the rear discharge flue 90, and the upper discharge flue 110 define a first portion of a primary air passageway that directs the airflow 70 from the primary inlet 55 to the primary outlet 120. The lower discharge flue 40, the rear discharge flue 90, and the discharge ducts 135 of the shelves 130 define a second portion of the primary air passageway that directs the airflow 70 from the primary inlet 55 to the discharge outlets 145. The airflow 70 that is discharged from the primary outlet 120 and the airflow 70 that is discharged from each of the discharge outlets 145 define primary air curtains 155.
[0025] The return duct 140 of each shelf 130, the rear return flue 95, and the lower return flue 50 define a return air passageway that directs the return airflow 80 from the associated return inlet 150 to the lower discharge flue 40. The return airflow 80 in the return air passageway is fluidly combined or amalgamated with the airflow 70 in the primary air passageway in the lower discharge flue 40 adjacent to the front of the case 15 and downstream of the primary inlet 55.

[0026] Each of the primary air curtains 155 that is discharged from the primary outlet 120 and the discharge outlets 145 are defined as short throw or modular air curtains that travel generally downward from the associated outlet 120, 145 into the product display area 35 a relatively short distance. For example, the primary air curtain 155 that is discharged from the primary outlet 120 of the canopy 30 travels generally downward toward the uppermost shelf 130 in the product display area 35. In the illustrated construction, the return inlet 150 of the uppermost shelf 130 receives at least a substantial portion of the primary air curtain 155 that is discharged from the primary outlet 120. Any remaining portion of the primary air curtain 155 that is not received by the return inlet 150 of the uppermost shelf 130 continues in a generally downward direction.

[0027] Similarly, the primary air curtain 155 that is discharged from each shelf 130 is at least substantially received by the respective inlet (i.e., the primary inlet 55 or the return inlet 150) that is located directly below the discharge outlet 145 from which the primary air curtain 155 is discharged. Thus, the primary air curtains 155 travel relatively short distances between the canopy 30 and the uppermost shelf 130, between adjacent shelves 130, and/or between the lowermost shelf 130 and the base 20. In some constructions, the primary and return inlets 55, 150 receive substantially all of the short throw primary air curtains 155 that are discharged from the associated outlet 120, 145 that is located directly above the respective inlet 55, 150. Generally, any remaining portion of each short throw primary air curtain 155 that is not received by the return inlet 150 of the shelf 130 that is directly below the associated discharge outlet 145 continues in a generally downward direction through the product display area 35.

[0028] The lower circulation flue 45, the rear circulation flue 85, and the upper circulation flue 115 define a secondary air passageway that directs the circulated airflow 75 from the secondary inlet 60 to the secondary outlet 125. The circulated airflow 75 that is discharged from the secondary outlet 125 is in the form of a secondary air curtain 160, and is generally defined as a long throw air curtain that travels generally downward from the secondary outlet 125 toward the secondary inlet 60. In the illustrated construction, the primary air curtains 155 and the secondary air curtain 160 are directed generally downwardly across the front of the case 15 adjacent the product display area 35 to cool the food product. In other constructions, the refrigerated merchandiser 10 may not include the lower circulation flue 45, the rear circulation flue 85, and the upper circulation flue 115 that define the secondary air passageway. In these constructions, the refrigerated merchandiser does not include the secondary air curtain 160.

[0029] The secondary air curtain 160 is located adjacent and outside of the primary air curtains 155 to assist in forming a barrier between ambient air surrounding the case 15 and the product display area 35. In some constructions, the secondary air curtain 160 may be warmer than the primary air curtains 155 and cooler than the surrounding ambient air. Generally, the secondary air curtain 160 is directed downward outside of the primary air curtains 155 to buffer the primary air curtains 155 from the relatively warm ambient air surrounding the case 15.

[0030] The primary and secondary air curtains 155, 160 cooperate to define a dual air curtain adjacent the front of the case 15. Portions of the dual air curtain may be drawn into one or both of the primary and secondary inlets 55, 60 for recirculation. The dual air curtain, among other things, helps to maintain the air temperature in the product display area 35 within a standard temperature range. For example, for medium temperature cases the temperature range is 32 to 41 degrees Fahrenheit as determined by the Food and Drug Administration ("FDA") Food Code.

[0031] The refrigerated merchandiser 10 also includes some components of a refrigeration system (not entirely shown) therein. As shown in FIG. 1, one or more fans 165 can be located in the primary and/or secondary air passageway to generate the airflow 70 and the circulated airflow 75 by drawing air into the primary and secondary air passageways from the primary and secondary inlets 55, 60 and forcing the air through the remaining portions of the respective air passageways. An evaporator 170 is disposed in the primary air passageway to refrigerate the airflow 70. As is known in the art, the evaporator 170 is configured to receive a saturated refrigerant that has passed through an expansion valve (not shown). The saturated refrigerant is evaporated as it passes through the evaporator 170 as a result of absorbing heat from the airflow passing over the evaporator 170. The absorption of heat by the refrigerant allows the temperature of the airflow to decrease as it passes over the evaporator 170. The heated or gaseous refrigerant then exits the evaporator 170 and is pumped back to one or more compressors (not shown) for re-processing into the refrigeration system. In other constructions, the evaporator 170 could be replaced with another heat exchanger (e.g., secondary heat exchanger, etc.) that allows the absorption of heat from the circulated air into a refrigerant or other heat-transfer fluid within the heat exchanger.

[0032] Various features and advantages of the invention are set forth in the following claims.
duct, and a rear return flue in communication with the shelf to receive a second airflow from the air return duct.

5. The refrigerated merchandiser of claim 4, wherein the case includes a plurality of rear discharge flues and a plurality of rear return flues alternatingly positioned across a horizontal length of the case such that one rear discharge flue is positioned adjacent at least one rear return flue.

6. The refrigerated merchandiser of claim 1, wherein the shelf defines one air discharge duct and at least two air return ducts.

7. The refrigerated merchandiser of claim 6, wherein the air discharge duct is located substantially lower than the air return ducts.

8. The refrigerated merchandiser of claim 1, further comprising an evaporator coupled to the case and configured to refrigerate an airflow within the case, and wherein the case defines a primary passageway having a first portion configured to direct the airflow toward the canopy, and a second portion configured to direct the airflow toward the shelf.

9. The refrigerated merchandiser of claim 1, wherein the first air curtain discharged from the shelf and the portion of the second air curtain received by the shelf are defined as short throw air curtains configured to travel through the product display area a distance less than the full height of the product display area.

10. A refrigerated merchandiser comprising:

a case defining a product display area and including a base disposed below the product display area and a canopy disposed substantially above the product display area, the canopy configured to discharge a first air curtain toward the base; and

a plurality of shelves supported by the case within the product display area, the plurality of shelves including an upper shelf having an air discharge duct, and a lower shelf positioned vertically below the upper shelf and having an air return duct, at least one of the canopy and the upper shelf configured to discharge a second air curtain substantially vertically through the product display area such that the second air curtain is at least partially received by the air return duct of the lower shelf.

11. The refrigerated merchandiser of claim 10, wherein the first air curtain is defined as a long throw air curtain configured to travel through the product display area from the canopy to the base a distance substantially the height of the product display area, and wherein the second air curtain is defined as a short throw air curtain configured to travel through the product display area from at least one of the canopy and the upper shelf toward the base a distance less than the full height of the product display area.

12. The refrigerated merchandiser of claim 10, wherein the case further defines a rear discharge flue in communication with the upper shelf to distribute a first airflow to the air discharge duct, and a rear return flue in communication with the lower shelf to receive a second airflow from the air return duct.

13. The refrigerated merchandiser of claim 12, wherein the case includes a plurality of rear discharge flues and a plurality of rear return flues alternatingly positioned across a horizontal length of the case such that one rear discharge flue is positioned adjacent at least one rear return flue.

14. The refrigerated merchandiser of claim 10, wherein the lower shelf defines at least two air return ducts configured to receive at least a portion of the second air curtain from the upper shelf, the lower shelf further defining one air discharge duct configured to discharge a third air curtain generally downward toward the base.

15. The refrigerated merchandiser of claim 14, wherein the air discharge duct is located substantially below the air return ducts.

16. The refrigerated merchandiser of claim 10, wherein the upper shelf defines at least two air return ducts configured to receive at least a portion of the second air curtain from the canopy.

17. The refrigerated merchandiser of claim 10, further comprising an evaporator coupled to the case and configured to refrigerate an airflow within the case, and wherein the case defines a primary passageway having a first portion configured to direct the airflow toward the canopy, and a second portion configured to direct the airflow toward the upper shelf.

18. A method of conditioning a product display area of a refrigerated merchandiser, the method comprising:

providing a case including a base disposed below the product display area and a canopy disposed substantially above the product display area;

providing a shelf supported by the case within the product display area;

discharging a first air curtain generally downward from the shelf into the product display area toward the base;

discharging a second air curtain generally downward into the product display area from above the shelf; and

receiving at least a portion of the second air curtain via an air return duct of the shelf.

19. The method of claim 18, further comprising discharging a third air curtain from the canopy toward the base.

20. The method of claim 18, further comprising discharging the first air curtain and the second air curtain toward the base a distance less than the full height of the product display area.

21. The method of claim 18, further comprising distributing a first portion of an airflow through the case toward the canopy; and

distributing a second portion of the airflow through the case toward the shelf.