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REFRIGERATED CASE AUXILIARY DUCT STRUCTURE

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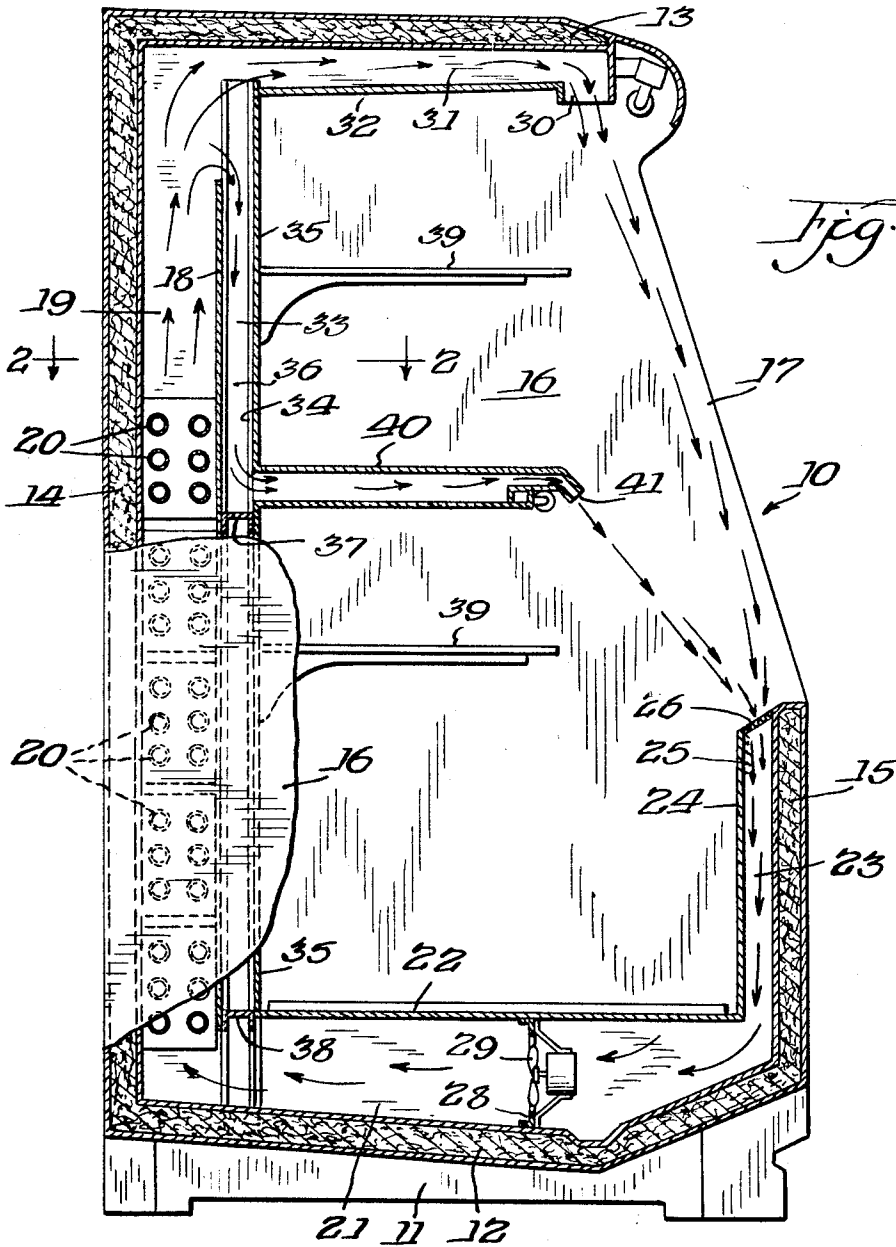


Fig. 1

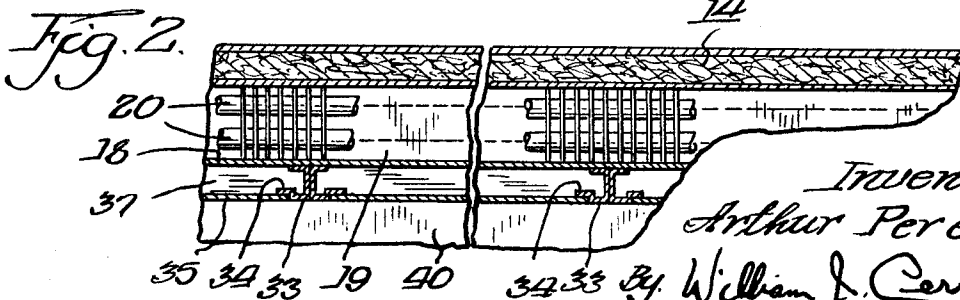


Fig. 2

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REFRIGERATED CASE AUXILIARY DUCT STRUCTURE

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ABSTRACT OF THE DISCLOSURE

The construction employs a refrigerating air duct containing cooling means and which communicates with an air discharge at one side of an access opening to the interior of the case, the air flowing in a screen over the opening to a return inlet through which it is recycled to the cooling means. A portion of the air flowing over the cooling means is drawn off at a point above the level of the cooling means to flow through a hollow shelf within the case, from the forward edge of which it is directed toward the return inlet. The hollow shelf is connected to the cooling means by a duct portion having a common wall with the cooling means duct.

BACKGROUND

Field of the invention

The present invention relates to refrigerated cases and particularly to such cases of the type having an open front over which a screen of refrigerating air is moved to prevent entry of ambient air, a portion of the screening air flowing through the interior of the case to cool the contents and ultimately return it to the remainder of the screen for recirculation over suitable cooling means mounted in vertical air duct means extending between the air return inlet and the air discharge. Auxiliary duct structure is provided by the invention to direct a portion of the air cooled by the cooling means through the case and toward the air return. The auxiliary duct structure includes a duct element, which may constitute a shelf, extending within the case and having an outlet opening toward the air return inlet, and a connecting duct portion opening to the cooling means duct above the cooling means, and also opening to the duct element in the case so as to conduct cooled air from the cooling means duct to the duct element for discharge through the duct element outlet. The duct element is disposed at a level below the top of the cooling means in the cooling means duct, the connecting duct thus providing for a doubling back of the air flowing thereinto from the cooling means duct.

Description of prior art

Cases of the general type described have long been known and it has been found that the increased temperature and moisture content of the air screen as it approaches the return inlet causes problems of maintaining the desired temperature in the lower portion of the case and in deposition of frost. Attempts have been made to solve this difficulty by providing a hollow shelf or like duct element within the case opening from a rear duct through which cooling air is moved to the air discharge of the air screen, with the shelf having an outlet directed toward the air return. This diverts a portion of the air through the air screen to bolster or reinforce it both physically as a shield and thermally as a refrigerating medium. Such arrangements have proved fairly satisfactory for "normal temperature" refrigerated cases, designed for contents which are properly refrigerated at temperatures above the freezing point, or not much below. They have not been as satisfactory with "low temperature" or

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"freezer" cases, designed for products which require temperatures well below 0° F. to be maintained in proper condition. It is a simple matter to provide refrigerating means having the cooling capacity required to maintain the desired low temperature, but a dimensional problem is encountered because of the greater space needed for cooling means of the greater capacity.

In normal temperature cases, the refrigerating means is readily disposed in the lower portion of the cases, as in a rear wall duct, below the level of the hollow shelf. Thus air flows through the shelf only after having passed over the entire cooling means so as to have been cooled to the minimum temperature. In low temperature cases, however, the cooling means if disposed in a vertical duct extend to a level above that of the hollow shelf, so that the air diverted through the shelf has not been subjected to the full refrigerating effect of the cooling means. The efficiency of the diverted air in aiding the refrigerating effect of the air screen at the lower level is thus greatly reduced.

SUMMARY

The solution proposed by the prior art, as exemplified by Dickson et al. Patents 3,063,253 and 3,063,254, issued Nov. 13, 1962, has been to dispose a portion of the cooling means at the bottom of the case, below the space in which the products or contents are displayed, and the remainder within a duct in the rear wall of the case. This avoids having the cooling means in the rear wall duct extend to a level above that of the hollow shelf, but in order to obtain maximum cooling of the air passing through the shelf, such prior arrangements sacrifice space within the case, so that the quantity of products or the contents which may be refrigerated and displayed is reduced. This follows from the disposition of a portion of the cooling means below the display space, which reduces the vertical dimension of the display space, the upper limit of which is fixed by the height to which an average person may conveniently reach.

The present invention solves the problem of passing air through a hollow shelf or similar duct element within the case only after it has passed completely through the cooling means, without requiring any sacrifice in the volume of the display space, in a simple and inexpensive, yet completely effective, manner. The invention permits all of the cooling means, such as the usual refrigerant evaporating coils, to be disposed in a vertical duct portion in the rear wall of the case. The bottom of the display space therefore may be at the lowest level commensurate with the reach of an average person, so that the interior height of the case, or in other words, the vertical dimension of the display space, may be the practical maximum. A connecting duct is provided extending between the inner or rear end of the hollow shelf or similar duct element and the vertical duct portion in the rear wall, at a point above or downstream of the cooling means, so that the air conducted to and through the hollow shelf is at the minimum temperature obtainable by the cooling means. The remainder of the air flowing through the cooling means passes to and through the discharge to provide the air screen. The invention, it may be noted, is not limited to use in low temperature refrigerated cases.

It is an object of the invention to provide, in a refrigerated case having a screen of refrigerating air flowing over an access opening therein, an auxiliary duct structure for a secondary stream of refrigerated air to reinforce or bolster the air screen which permits the use of large capacity air cooling means without reducing the display space of the case.

Another object is the provision of a refrigerated case having duct means by which air moved upwardly past cooling means is drawn downwardly from a zone above

the cooling means to a level below the top of the cooling means and discharged interiorly of the case.

Other and further objects, advantages, and features will be apparent to those skilled in the art from the following detailed description, taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is a view mostly in vertical section illustrating diagrammatically a refrigerated case incorporating the present invention; and

FIGURE 2 is a fragmentary horizontal sectional view taken substantially as indicated by the line 2—2 in FIG. 1.

Referring first to FIG. 1, there is shown a refrigerated case generally designated 10, comprising a base 11 supporting a thermally insulated case body including a bottom wall 12, a top wall 13, a rear wall 14 extending vertically between the top and bottom walls, a front wall 15 of less height than the rear wall 14, and a pair of end walls 16. An opening 17 affording access to the interior of the case is defined between the end walls 16, the upper edge of the front wall 15, and the forward edge of the top wall 13. Mounted between the rear wall 14 and panel means 18 of suitable sheet material spaced inwardly thereof and defining therewith a vertical duct portion 19 for the passage of refrigerating air is a series of finned evaporator coils 20 through which refrigerant from any suitable source is passed to effect cooling of the coils and of air flowing thereover, in well-known manner. The coils may extend to any suitable height in the duct portion 19 required to provide the desired cooling capacity. Of course, other cooling means than refrigerant evaporating coils might be employed. At its lower end, the duct portion 19 communicates with a horizontal duct portion 21 defined between the bottom wall 12 and a panel 22 which defines the bottom of the display space of the case 10. The duct portion 21 at its forward end connects with a vertical duct portion 23 defined between the inner face of the front wall 15 and a panel 24 spaced inwardly therefrom. The duct portion 23 terminates adjacent the top of the front wall 15, providing an air return inlet 25 which may be covered by any suitable screen 26. A fan panel 28 extends longitudinally across the horizontal bottom duct 21 and is provided with a number of apertures in each of which is disposed a motor-driven fan 29, the fans drawing air downwardly through the return inlet 25 and front vertical duct portion 23 and moving it through the horizontal duct portion 21 to pass upwardly through the rear vertical duct portion 19 and over the coils 20. A downwardly directed air discharge 30 is defined below the top wall 13 adjacent the forward edge thereof by a downturned portion of a duct 31 defined between the wall 13 and a substantially horizontal panel 32 extending rearwardly from the air discharge opening 30, defining the top of the display space in the case. The duct portion 31 at its rear end communicates with the upper portion of the rear vertical duct portion 19, receiving air therefrom which is moved through the discharge opening 30 to flow downwardly to the air return 25 of the front vertical duct portion 23 for recirculation by the fans 29 over the coils 20. The air flowing from the discharge 30 to the inlet 25 forms a curtain or screen to shield the air within the case, to a very great degree, from contact with the warmer and moister ambient air, as indicated by the arrows. It will be understood that a portion of this air flows and circulates through the display space in the case to cool the air therein and maintain the contents thereof at the desired temperature. This portion of the air discharged from the duct portion 31 eventually is also drawn into the air return inlet 25 and recycled.

The panel 18 is supported in upright position by one or more posts 33 which, as best shown in FIG. 2, may be of general T-section, each with a foot portion engaging against the forward surface of the panel 18, and

having a head portion with rearward offsets 34 at the ends thereof. Preferably end posts, not shown, are provided adjacent the inner faces of the end walls 16. The posts 33 are supported on the bottom wall 12, and may extend to and help support the top wall 13, but may also terminate short of the top wall as shown. The panel 18 is secured to the posts in any appropriate manner. Spaced forwardly from the panel 18 are a plurality of panels 35 each extending between two of the vertical posts described, arranged substantially flush with the head portions of the posts 33 and with vertical marginal portions in lapped relation to the offsets 34 and secured thereto by any suitable means. The panels 35 define with the panel 18 a vertical duct 36, which while divided into sections by the posts, may nevertheless be considered as a single duct for purpose of description. The panels 35 extend from the rear edge of the bottom panel 22 to the rear edge of the top panel 32. The duct 36 terminates at a level below the top of the evaporating coils or other cooling means 20, the space between the panel 18 and panels 35 being closed at such level by any suitable means, such as the close-off channel members 37 bridging the space between panels 18 and 35, and extending from each post to the next adjacent one. Similar close-off channels 38 may be employed to close the spaces between the posts and the panels 18 and 35, at the level of the bottom panel 22. The panel 18, as shown, terminates at a level appreciably below the top of the panels 35.

A plurality of bracket-supported shelves 39 are provided in the display space, two of such shelves being shown in the present instance, one in the upper portion of the display space and the other somewhat above the level of the top of the front wall 15 of the case. The shelf brackets are suitably secured on the posts, and if desired, may be vertically adjustable thereon as by providing suitable slots in the post for engagement by projections on the bracket in a well-known manner. If the heads of the posts are so slotted, suitable means are provided to cross off the slots in the portions of the posts above the channel 37.

Another shelf, generally designated 40, is provided in the display space, extending forwardly from the panels 35 and supported on the posts by any suitable means. The shelf 40 is of hollow construction, located below the level of the coils or other air-cooling means 20 and not below the level of the close-off channels 37. The hollow shelf opens at its rear edge to the duct 36. The shelf 40 may be formed of a pair of substantially horizontal vertically spaced upper and lower panels which at the forward edge of the shelf define an outlet 41 inclined downwardly and forwardly toward the return inlet 25 of the front vertical duct portion 23. Air moved upwardly through the rear vertical duct portion 19 after passing the coils or other cooling means 20, flows through the duct 31 and air discharged 30 as described, but a portion of the air also flows over the top of the panel 18 and downwardly in the channel 36, which connects the duct portion 19 with the hollow shelf 40, and the through the outlet 41 toward the air return inlet 25. A portion of this air also flows through the display space below the shelf 40, to assist in maintaining the desired refrigerating temperature in the lower portion of the case. It will be evident that the shelf 40 serves as a duct portion or element for the circulation of refrigerating air, and that if desired such a duct element in the display space might be employed without serving as a shelf.

The air issuing from the outlet 41 of the shelf flows toward the air return inlet 25, as indicated by the arrows, and in its downward flow entrains the air at the lower portion of the air screen, which in this area would otherwise move at considerably lower velocity and be at an appreciably higher temperature, than at the air discharge 30. The temperature of the air in the lower portion of the air screen is thus lowered, so that its shielding effect against entry of warmer air and moisture into the case

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is bolstered, and its maintenance of the desired low temperature at the lower portion of the case is assisted. In addition, a portion of the auxiliary air stream flows and circulates through the lower portion of the display space to add to the refrigerating effect of the air from the air screen. This circulating air portion eventually is drawn into the return inlet 25 and recirculated and recycled with the other air. Besides supplementing the refrigerating effect of the air from the air screen, the auxiliary air stream issuing from the shelf 40 increases the velocity of the air screen at the lower portion thereof, minimizing diffusion and intermingling thereof with the ambient air. This avoids unnecessary increase in the temperature of the cooling air, and minimizes absorption of moisture from outside air which would result in increased deposition of frost. The refrigeration efficiency of the case is thus improved, because the air returning for recycling is maintained at a lower temperature than otherwise, and the frequency of interruption of the refrigerating operation in order to effect defrosting of the ducts and coils is held at a low level by the avoidance of excessive frosting. It may also be noted that because the air in the front vertical duct portion 23 is at a lower temperature than otherwise, the contents of the case adjacent the panel 24 are more readily maintained at the desired temperature, since there is reduced heat transfer from the panel.

The employment of the panel 18 as a common wall between the cooling air duct 19 and the connecting duct 36 assures maintenance of the air flowing through the duct 36 at the desired lower temperature level, so that upon discharge from the shelf outlet 41 it can augment and assist the air screen to the greatest possible extent.

While the invention is of greatest value in low temperature cases, it may be used effectively in normal temperature cases as well. When incorporated in normal temperature cases, it allows greater design freedom because it affords a greater range of locations for the cooling means. It is also advantageous in that identical case constructions may be employed for both normal and low temperature cases, thus providing manufacturing economies.

It is to be understood that the embodiment of the invention disclosed herein is exemplary of the inventive concept, and that the invention is not limited to such embodiment, since modifications and variations thereof may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. In a refrigerated case having wall structure pro-

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viding an unobstructed opening for access to the case interior, duct means for circulation of refrigerating air across said access opening including a vertical duct portion, and air discharge communicating with the upper end of said vertical duct portion, an air return spaced from said air discharge by the access opening and communicating with a lower portion of the vertical duct portion, means for moving air through the vertical duct portion for circulation through said discharge and return, and means in the vertical duct portion for cooling air moving therethrough, the improvement comprising a duct element communicating with the vertical duct portion above the air cooling means and having an air opening with said duct element extending in the case below the level of the top portion of said air cooling means and with said air openings located below said top portion of said air cooling means and adapted to direct air toward said air return.

2. The improvement defined in claim 1 in which said duct element comprises a horizontal duct portion with the air opening in said horizontal duct portion.

3. The improvement defined in claim 2 in which said horizontal duct portion comprises a hollow shelf structure with said air opening located toward the outer edge and the lower portion of the hollow shelf structure.

4. The improvement defined in claim 1 in which said duct element includes an elongated outlet portion extending in the direction of the air return.

5. The improvement defined in claim 1 in which the duct element is partially formed by a common wall with the vertical duct portion.

6. The improvement defined in claim 5 in which the common wall is a panel between the vertical duct portion and the duct element and which terminates at the top to form the air discharge.

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