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AIR DISTRIBUTION STRUCTURE FOR REFRIGERATED CASE

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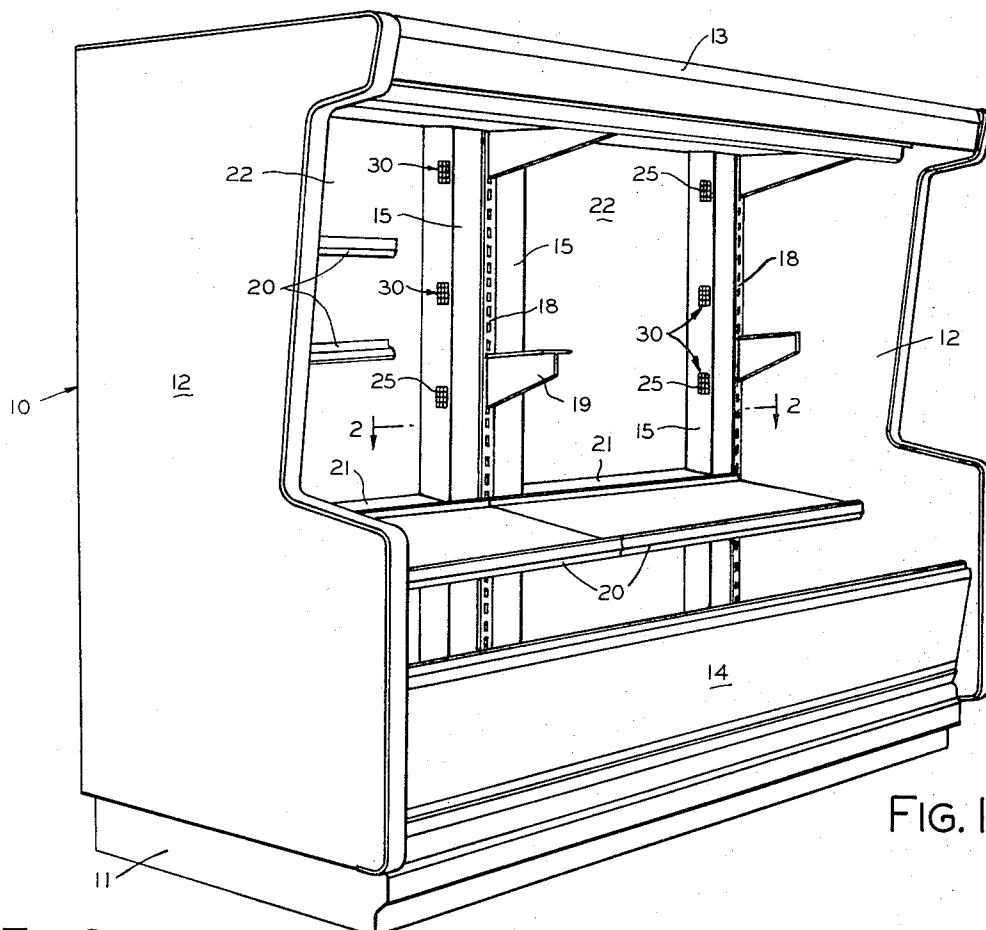


FIG. 1

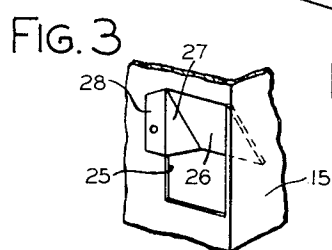


FIG. 3

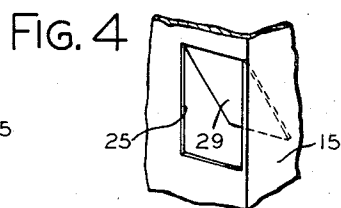


FIG. 4

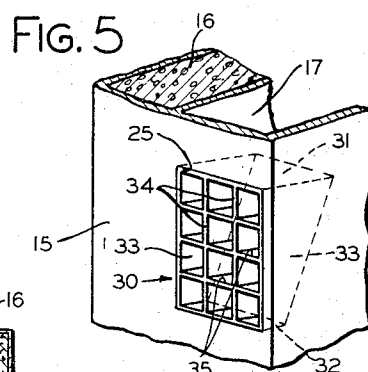


FIG. 5

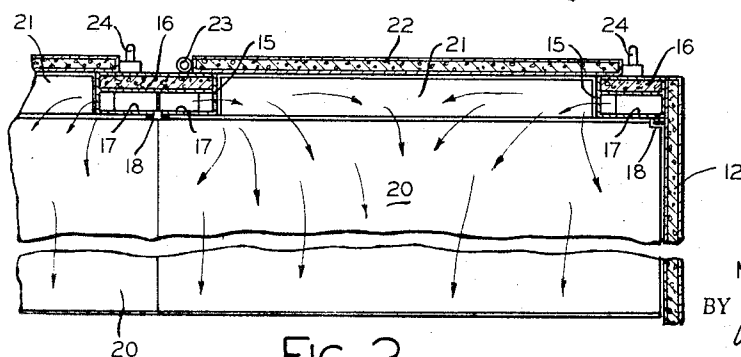


FIG. 2

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AIR DISTRIBUTION STRUCTURE FOR REFRIGERATED CASE

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The present invention relates to an air duct structure and arrangement for a case refrigerated by circulation of cooling air, such as a display case for food products, and more particularly to such a structure and arrangement which provides proper circulation of refrigerating air at all levels in the case without need for changes in the essential case construction.

In commercial refrigeration cases, such as those commonly employed in food stores and the like, air is cooled by heat exchange with evaporating coils or other suitable means, and circulated through the case. Passages or conduits for the refrigerating air may conveniently be, and commonly are, provided by hollow walls, which may have suitable apertures either at the top thereof or at any desired level or levels to permit all or a portion of the air to flow over or past the products contained in the case. Thus, if air is moved vertically through the hollow rear wall of such a case, it may be directed forwardly therefrom at any desired level, and returned through a hollow front wall after having accomplished its refrigerating function. The full length of the wall may readily be utilized for the ejection of air, so that the air is spread over the entire plan area of the case at the desired level or levels, when the wall is substantially uninterrupted. When the continuity of such a wall is interrupted or divided by relatively large openings allowing access to the interior to the case, a problem arises in effecting the same distribution of the refrigerating air. In such case, the portion of the length of the wall available for conducting the air is greatly reduced, the wall being divided into horizontally spaced vertical passages or conduits. Accordingly, refrigerating air flowing out of such a divided or apertured wall is restricted to a number of laterally separated individual streams having at best only limited lateral distribution, so that the spaces or areas between such streams are not properly refrigerated. Thus, products on shelves or other supporting surfaces extending across the openings are rendered subject to spoilage. While a transverse duct might be provided above or below each opening from which the air might be directed forwardly, such an arrangement is cumbersome, expensive, and at best only partially effective, since it can provide flow of air only at the one level. Similarly, other expedients, as for example employing hollow shelves to extend across the openings and provide for forward discharge of air therefrom, are also unsatisfactory. Cooling of products on such shelves is limited to conduction from the shelf, without any appreciable flow of cooling air over the products. Furthermore, it becomes impracticable to provide for adjustment of the shelves vertically in the case.

The present invention provides a simple means and arrangement for obtaining the desired distribution of refrigerating air at any desired number of levels, without necessitating redesign of the case or major alterations in its construction. Vertical adjustability of shelves in such a case is retained without difficulty, while providing for the desired refrigerating flow of air over the products on the shelves or other supporting surfaces regardless of the different levels at which they may be disposed.

It is an object of the invention to provide in a refrigerated display case an air duct structure providing for refrigerating air flow from rear to front throughout the

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full length thereof, while allowing provision of unblocked rear access openings therein.

Another object is the provision of an air duct structure in a refrigerated case having an article-supporting surface therein and access openings in a wall thereof which provides for flow of air from the wall toward the opposite wall over substantially the entire supporting surface without requiring obstruction of the access openings.

It is also an object of the invention to provide for flow laterally outward, from laterally spaced vertical conduits for refrigerating air in a refrigerated display case, of a portion of the air for circulation and distribution of refrigerating air throughout the area of the case.

Another object is the provision of an air duct structure in a refrigerated case for distribution of refrigerating air in a generally horizontal direction from vertical air conduits by deflector means diverting and directing some of the air outwardly from the conduits at any desired level or levels.

A further object is the provision of deflector means for diverting and directing a portion of a stream of air flowing in one direction into a direction at an angle to the one direction while maintaining throughout the cross-section of the diverted portion generally uniform pressure and velocity.

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

FIGURE 1 is a perspective view of a commercial refrigerated case embodying the invention, with certain parts broken away to show the construction more clearly;

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

FIGURE 3 is an enlarged perspective view of one form of deflector according to the invention;

FIGURE 4 is a view similar to FIG. 2, but showing another form of the deflector; and

FIGURE 5 is a further enlarged view similar to FIGS. 2 and 3, and showing a preferred form of deflector.

Referring to the drawings, there is shown in FIG. 1 one type of refrigerated case, generally designated 10, which embodies the present invention. The case 10 is of a common type of construction, comprising a base 11, end walls 12, a top 13, and a front wall 14, as well as a rear structure. The front wall is of only limited height, so that the front of the case is formed with a large access opening defined by the end walls 12, the top 13 and the upper edge of the front wall 14. This opening allows attractive display of food and other products, and easy selection and removal thereof by purchasers. To minimize refrigeration loss, a sheet or curtain of cool air is blown across the opening, in this case, as is common, from the forward edge of the top 13 to the upper edge of the wall 14. For this purpose, the top 13, the front wall 14, and the bottom portion of the case are of hollow construction to provide passages for flow of the air. Suitable edge openings for the discharge and reception of the air are provided in the case top and the front wall 14, this wall communicating with a chamber in the hollow bottom of case 10. The chamber may contain refrigerating means such as evaporating coils, and communicates through the rear structure with the top 13 of the case. Fans or other suitable air-moving means pass air over the refrigerating means to be cooled to a desired temperature, and upwardly through passageways or conduits provided by the rear structure of the case to the top 13, from which it is discharged in the aforesaid curtain across the front opening to the front wall 14, and back to the refrigerating means, the air being continuously recirculated through this cycle. The refrigerating and/or air-moving means, or auxiliary means, may be located in the top 13 of the case,

or in any other desired location. As already indicated, this construction is well known in the art, and therefore is not illustrated or described in detail herein.

It is obvious, of course, that more is required for maintenance of proper refrigerating conditions within the case 10 than the air curtain flowing across the front opening. When the rear wall of the case is of substantially continuous or unbroken construction, it may be of hollow formation to provide for passage of air from the bottom of the case to the top, and at the same time be provided with openings at desired levels delivering air to the interior of the case along the entire length thereof, so that refrigerating air is appropriately distributed and circulated through the case to maintain the products therein at the desired temperature. It is often desired, however, to have openings in the rear of the case to provide access for replenishing stock therein from the rear, so as not to interfere with customer access to the products from the front of the case. To provide for such rear access openings, and still provide the desired flow of air to the top of the case, hollow columns or posts 15, which serve as conduits or passageways for the air, any may also constitute vertical frame members of the case 10, are provided at the rear of the case, spaced laterally or longitudinally therealong to define the sides of the openings. The posts 15 are shown as formed of sheet metal or the like in any suitable manner to provide a duplex or partitioned construction, so as to be divided into front and rear spaces or portions, the rear portion being filled with any suitable heat-insulating material 16, and the forward portion constituting an air duct 17. In the illustrated case, two access openings are provided, framed at the sides by two pairs of posts 15. The two centrally adjacent posts may be formed as a single air structure of substantially double the width of a single post, with a common rear portion containing the insulation 16, but with two separated air ducts 17, as shown in FIG. 2. As already indicated, the several ducts 17 provide for passage of air from the bottom of the case 10 to the top 13 for discharge of an air curtain towards the front wall 14 for recycling and recirculation as explained.

On the forward faces of the posts 15 are provided vertically extending bars or rails 18 suitably slotted for supporting in vertically adjusted relation thereon a plurality of brackets 19 for the support of display shelves 20. The brackets are formed to have hooking engagement, in a known manner, with the slotted rails, so that they may be disposed at various levels along the height of the posts 15, and support the shelves at desired levels. The shelves 20 are provided with rear extensions 21 which substantially fill the spaces between the posts 15 defining the sides of each door opening. The shelf extensions 21 may be shelf portions secured to standard shelf constructions, as in the illustrated arrangement, or may be formed as integral parts of the shelves. The door openings are closed by any suitable doors 22, shown in this instance as swinging doors each hinged as at 23 on one of the posts 15 and having latching engagement as at 24 on another of the posts. The doors are preferably constructed to provide thermal insulation.

To provide for the desired distribution and circulation of refrigerating air within the case for maintaining the contents in properly refrigerated condition, apertures 25 are formed in the posts 15, a plurality of vertically spaced apertures 25 being provided in the face of each post which defines a side of a door opening, so that apertures open across each access opening toward the opposed face of the post 15 at the opposite side of the opening. The air flowing upwardly in the conduits provided by the several posts thus may in part flow outwardly through the apertures 25 in a generally horizontal direction toward the opposite post. As best evident from FIG. 2, the portion of the air flowing laterally outwardly from each post 15 through apertures 25 results in development of a plenum or pressurized condition at the rear of the case across the access opening,

and interference between the air flowing in opposite directions across the opening, so that the air then passes and flows forwardly over the shelves 20 respectively disposed below the apertures, and over the products supported thereby. Refrigerating air is thus supplied substantially uniformly over the entire area of the shelves, to maintain the desired temperature over the entire shelf area and thus provide the desired protection for the products in the case.

The air eventually flows downwardly over the forward edges of the shelves, and ultimately returns through the front wall 14 for recirculation by the air-moving means. The bottom portion of the case comprises a well defined at its forward portion by the front wall 14, and with its bottom surface extending over the bottom chamber with which the front wall communicates. If desired, the upper wall of the bottom chamber may serve as the bottom of the well. The well bottom provides a supporting surface similar to the shelf on which products to be refrigerated may be disposed, and preferably certain of the apertures 25 are located below the lowest usual shelf position, so that air flowing from the posts 15 through the apertures 25 will be circulated and distributed through the well and its contents, flowing forwardly to the front wall 14 and being drawn therein for recycling by the air-moving means.

It is to be understood that while the apertures 25 in the opposed faces of the post 15 of each access opening are in opposed relation, they are not necessarily directly opposed to each other, since the apertures in one of the posts may be offset or staggered vertically relative to the apertures in the opposite post. In such case, the interference between the streams of air flowing from the opposed posts 15 through the respective apertures 25 will be less than if the oppositely facing apertures were horizontally aligned, but the pressurization of the air at the rear of the case, together with such interference between the air streams as does occur, causes substantially uniform flow of the refrigerating air over the shelf or well bottom surfaces. It may be pointed out that the vertical adjustment of the shelves may be such that two product-supporting surfaces are disposed below a given level of apertures 25, so that the lower of the two surfaces does not have any of the apertures between it and the upper of these surfaces. In that event, the lower surface and the products supported thereon are nevertheless maintained in the desired refrigerated condition, because the space between the two shelves or supporting surfaces constitutes a zone of relatively low height which is surrounded by cold zones and therefore is kept cold. The spacing between such shelves would also be so close as substantially to prevent entry of any of the air from the air curtain or screen, which through contact with ambient atmosphere tends to rise in temperature in accomplishing its purpose of shielding the air within the case against contact with the outside air.

To assure the necessary supply of refrigerating air to the products in the case, deflectors are preferably provided to divert and direct air from the interior of the posts 15 through the apertures 25. The deflectors may be of any suitable form. One form of deflector is shown in FIG. 3, comprising a plate-like deflecting or scoop portion 26 extending inwardly and downwardly from the upper edge of the aperture 25, so that a portion of the air flowing upwardly in the post 15 is diverted therefrom and caused to flow generally horizontally outwardly through the aperture. A connecting portion 27 extends from one edge of the scoop portion 26 to a mounting flange 28 which is disposed along one edge of the aperture and overlies the face of the post 15, and is secured to the post by any suitable means, as a sheet metal screw, a rivet, tack weld, or the like. It will be evident that if desired the scoop portion 26 might have a flange attached directly thereto at its upper edge to overlie the portion of the post

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directly above the aperture, and be secured thereto as desired, the portion 27 then being omitted.

In FIG. 4, a deflector is shown which comprises a deflector tongue 29 extending inwardly and downwardly at an angle from the upper edge of the aperture 25, formed by the material struck from the side of the post 15 to form the aperture 25, and left integral with the post side along the upper edge of the aperture. This provides a simple and effective deflector requiring no separate assembly with and securement to the post, although necessitating the use of appropriate cutting dies in the apparatus for forming the posts.

FIG. 5 shows another form of deflector generally indicated as 30, suitably formed to provide a grid or honeycomb defining a plurality of passages for conveying air from the interior of the post outwardly through the aperture 25. The deflector 30 is shown as comprising a grid having a rectangularly related outer walls providing an outer configuration of the deflector corresponding to the shape and dimensions of the aperture 25. The upper and lower walls 31 and 32 are arranged to extend substantially horizontally, the upper wall 31 having a greater extent from the outer deflector face than the bottom wall 32. Side walls 33 extend between the top and bottom walls at opposite sides of the deflector, having a generally triangular shape, as clearly shown in FIG. 4. Vertical and horizontal partitions 34 and 35, respectively parallel to the side walls 33 and top and bottom walls 31 and 32, divide the space bounded by the outer walls into a plurality of horizontal passages extending from the plane of the rear or inner edges of the side walls 33 to the front space of the deflector. The deflector may be simply mounted on the post 15, as by frictional engagement within the aperture 25, with the front face of the deflector substantially flush with the apertured face of the post. A peripheral bead may be provided at the outer deflector face to engage against the post about the aperture edges, or a peripheral groove may be provided in the outer walls adjacent the front face to receive the edges of the aperture, providing a snap-in mount for the deflector. Again, in forming the aperture 25, material may be left about the edges and bent inwardly to provide tabs or flanges resiliently engageable with the outer walls of the deflector to hold it in the desired position. The deflector 30 is preferable over the deflectors 26 and 29 in providing a more uniform velocity and pressure distribution for the stream of air directed outwardly through the aperture 25 by the deflector. Apparently this is due to the successively further inward termination of the passages in upward progression, and the division of the deflector into a number of passages. In the present instance, twelve passages are provided, but it will be obvious that the number, as well as the cross section thereof, might be varied as desired.

It will accordingly be understood that the single embodiment of the invention illustrated herein is exemplary of the inventive concept and that the invention is not limited to such embodiment, since modifications and variations thereof, some of which have been described and suggested hereinabove, 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 merchandise display case having a plurality of hollow vertical laterally spaced posts constituting passages for refrigerating air between the top and bottom portions of the case, at least one shelf supported on said posts forwardly thereof, each pair of adjacent posts defining a doorway therebetween, a door for each doorway, and means for effecting flow of refrigerating air through the posts, the improvement comprising at least one aperture in each of at least one pair of the posts located above the level of a shelf and facing in the direction of the other post of said one pair permitting a portion only of the air flowing in each apertured post to issue outwardly therefrom in a generally horizontal stream oppositely to the stream issuing from the apertured post paired therewith to effect distribution and flow of refrigerating air over substantially the full length of said shelf and forwardly thereover while the remainder of the air continues its flow, and means for recirculating said issuing air through the posts after said over-shelf flow thereof.

2. The improvement defined in claim 1, including a deflector provided at each of at least certain of said apertures extending part way across the interior of the respective post to divert and direct said portion of air therefrom through the respective aperture.

3. The improvement defined in claim 2, in which said deflector comprises a scoop element extending inwardly from an edge of the aperture at an angle to the direction of air flow in the respective post.

4. The improvement defined in claim 2, in which said deflector comprises a plurality of generally planar elements in intersecting relation defining a plurality of passages extending between the interior and exterior of the post and opening through the aperture at a plurality of levels, the inner ends of said passages terminating successively further inward of the post in the direction of air flow, and means for securing the deflector on the post.

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