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REFRIGERATED SELF-SERVICE DISPLAY CASE

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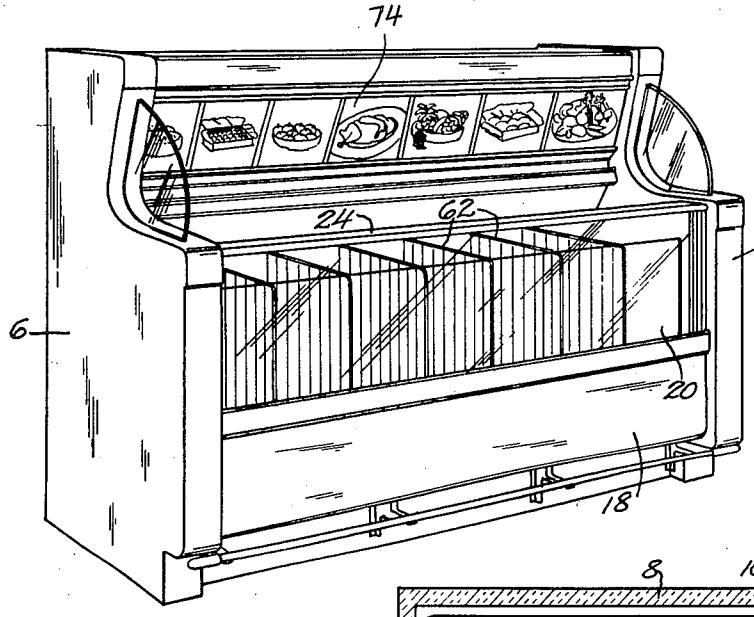


Fig. 1.

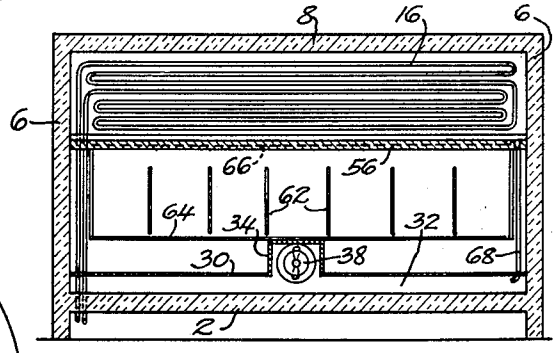


Fig. 3.

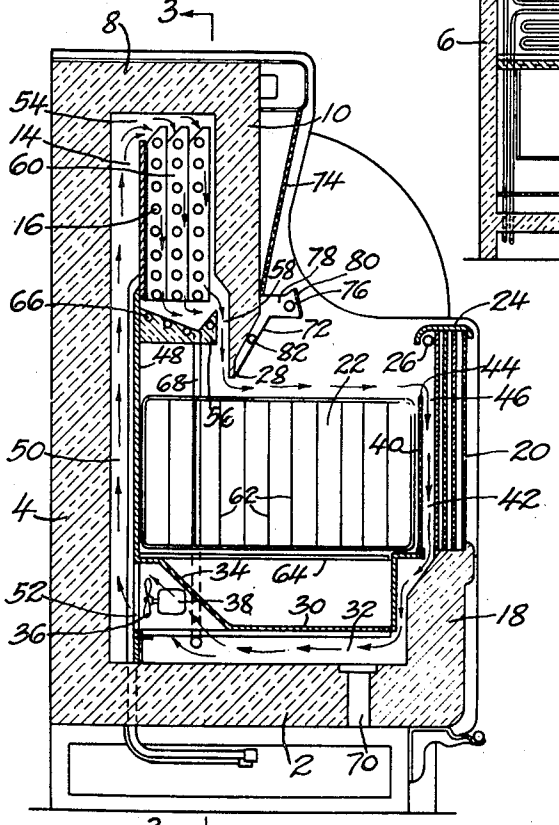


Fig. 2.

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REFRIGERATED SELF-SERVICE DISPLAY CASE

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8 Claims. (Cl. 62—89.5)

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Our invention relates to refrigerated self service display cases, and particularly to constructions of this type designed for use in the preservation and display of foods at temperatures below freezing.

The use of self service cases for frozen foods presents numerous unusual problems due to the fact that the products must be maintained continually at temperatures well below freezing, say at 0° F. to —10° F. At such temperatures moisture tends to condense on the goods very rapidly and to freeze into ice or frost accumulations which cause packages to stick together and to the surfaces of the case so that they cannot be picked up and examined or removed easily. The accumulation of frost on the surfaces of the case also tends to obstruct the removal of articles from the case and renders the construction unsightly.

Such accumulations take place most rapidly adjacent the open top of a display space where warm, moist air from the atmosphere above the case comes in contact with the refrigerated goods and with the cold air circulated through the display space. In order to reduce the condensation of moisture and the deposition of frost on the articles and surfaces of display cases maintained at such low temperatures heretofore it has been necessary to limit the height of the articles being displayed so that only about 40 or 50% of the total capacity of the display space has been used and the case is kept empty to a depth of a foot or so below the open top of the case.

Another difficulty presented in the display of frozen foods arises from the fact that it is desirable to provide a transparent window in the front of the display space through which the articles may be seen, but moisture and frost tend to accumulate on these windows resulting in such fogging of the window that it detracts from the appearance of the case and frequently obscures the articles on display.

In accordance with our invention, these objections to constructions of the prior art are overcome, and a novel type of frozen food display case is provided in which the articles may be stored in the display space to a level relatively close to the top of the case and frosting or fogging of the windows in the front of the case is prevented or substantially eliminated. These advantages are preferably attained by providing the case with means for causing air cooled by refrigerating means to flow across the upper portion of the display space and in a direction toward a transparent window whereby moist air from above the display space is carried away from the articles on display and the temperature of the surfaces contacted by the moist air is generally higher than that of the air itself so that condensation of moisture on the window does not take place.

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One of the objects of our invention is to increase the capacity of refrigerated self service display cases.

Another object of our invention is to reduce the accumulation of frost on frozen foods in a self service display case.

Another object of our invention is to reduce or eliminate fogging of display windows in the front of self service display cases.

A further object of our invention is to provide a novel arrangement of refrigerating coils and air circulating means in a refrigerated self service display case.

These and other objects and features of our invention will appear from the following description thereof in which reference is made to the figures of the accompanying drawing.

In the drawing:

Fig. 1 is a perspective of a typical form of display case embodying our invention;

Fig. 2 is a vertical sectional view through the display case illustrated in Fig. 1; and

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2.

In that form of our invention chosen for purposes of illustration in the figures of the drawing, the display case embodies an insulated base 2, an insulated rear wall 4, insulated end walls 6 and an insulated top 8 which extends forward from the rear wall 4. An insulating baffle 10 extends downward from the top 8 and cooperates with the top and rear wall 4 to form housing 14 within which refrigerating means such as the coil 16 is located.

The front of the display case is provided with an upwardly extending lower insulated wall section 18 and an upper transparent wall section 20 including multiple glass panes which serve as an insulating means while providing a front window through which articles in the display space 22 may be seen. The upper edge 24 of the front wall section 20 is provided with a cap or finishing strip which carries a fluorescent light 26 for illuminating the display space 22. The upper edge of the front wall of the case is located a short distance, say 4 or 5 inches, above the level of the lower edge 28 of the insulated baffle 10

so that the front wall rises above the top of the display space 22.

The display space is defined by a bottom member 30 which is spaced from the insulated base 2 of the case so as to provide an air channel 32. A portion of the bottom 30 is raised as shown in Figs. 2 and 3 to form a housing 34 within which a fan 36 and motor 38 are located for positively circulating air through the air channels and about the display space.

The front of the display space is defined by a transparent glass pane 40 which is spaced from the multiple glass panes 20 and cooperates therewith to form an air channel 42 which communicates at its lower end with the air channel 32 beneath the display space. The upper edge 44 of the glass pane 40 is located approximately level with or slightly below the lower edge 28 of the baffle 10 and positioned sufficiently below the upper edge 24 of the front wall to provide an air inlet 46 through which air from the top of the display space is drawn downward through the air channel 42 to the air channel 32 beneath the bottom 30 of the display space.

The rear wall of the display space is defined by a vertically extending member 48 which extends downward to the base 2 of the case and cooperates with the rear wall 4 to form a rear air channel 50 communicating at its lower end with the air channel 32 through the fan opening 52 adjacent the fan housing 34. The upper end of the member 48 is positioned below the insulated top 8 of the case and cooperates therewith to provide an air passage 54 through which air may flow into the coil housing 14 and to the top of the refrigerating coil 16. A drip pan 56 extends forward from the member 48 beneath the coil and has its front edge spaced from the lower edge of the insulating baffle 10 so as to provide an air outlet 58 through which aid passes to the top of the display space 22.

With this construction the fan serves to force air through the air channels and about the display space so as to maintain the articles on display at a temperature below freezing and preferably below —10° F. The circulation of the air is also promoted by the thermo siphon effect of the coil 16 located above the display space. Thus air from the upper portion of the display space is drawn through the inlet 46 at the top of the front air channel 42 and passes downward to the lower air channel 32 beneath the bottom 30 of the display space, the fan 36 then forces the air through the opening 52 and upward through the rear air channel 50 to the top of the coil 16, whence it flows downward over the coil and issues into the top of the display space through the air outlet 58.

In passing over the coil 16 the air is reduced in temperature to, say —10° F., and moisture carried thereby is deposited on the coil 16 and its associated fins 60. In this way the air is thoroughly dried and even though it may have a relative humidity of 100% as it leaves the coil the actual amount of moisture contained in the air is extremely limited. Therefore, as the temperature of the air rises during its passage through and across the top of the display space the relative humidity is reduced so that at —10° F. the relative humidity is only 50% and it is capable of absorbing substantial amounts of moisture from the articles on display and from the air adjacent the top of display space without becoming saturated. As a result, the air entering inlet 46 and passing downward between the window forming glass panes of the front air channel 42 is sufficiently dry to prevent the deposition of moisture or fogging of the window. In fact, the air flowing across the top of the display space travels at a relatively high speed, generally from 400 to 600 feet or more per minute, and is sufficiently dry to take up moisture which is carried by the articles or deposited thereon when they are removed by a customer for inspection and subsequently returned to the case.

In this way the articles on display and the surfaces adjacent thereto are maintained in a dry and substantially frost-free condition so that they do not stick together or become so coated with ice as to interfere with their removal from the display space. Moreover, by circulating the air across the top of the display space directly as it comes from the coil and while it is at its lowest temperature and in its driest condition, the articles may be stacked in the display space up to the top thereof and to the level of the upper edge of the front glass pane 40, leaving only sufficient space below the lower edge 28 of the baffle 10 to permit free flow of air through the outlet 58. Therefore, the entire capacity of the display space may be utilized and articles maintained at a level only a few inches below the upper edge 24 of the front of the case.

In practice, the display space is usually provided with dividers 62 for separating the articles being displayed. When only a limited number of articles are to be displayed, a rack 64 is positioned to extend across the display space above the fan housing 34. In this way the articles may be supported so as to be readily available to purchasers reaching into the top of the case and the case has the appearance when viewed through the multiple glass panes 20 of being filled to the bottom. On the other hand, when a larger volume of goods is to be preserved and displayed, the rack 64 may be removed, and the articles then may rest directly upon the bottom 30 of the display space.

In the preferred form of our invention, means such as those shown and described in the copending application of MacMaster, Serial No. 665,912, filed April 29, 1946, are provided for defrosting the coil 16. In such constructions hot gases or liquid from the condenser is circulated through the coil 16 to raise the temperature of the coil substantially above freezing so that frost and ice will melt rapidly, and the liquid and ice particles will fall into the drain pan 56. At the same time a hot fluid is circulated through the coil 66 in the drip pan to melt the ice thereon so that the resulting water may flow from the drip pan through the drain 68 into the bottom of the case. A drain 70 is provided in the bottom of the case so that the case may be washed and cleaned when necessary.

During the defrosting operation the fan 36 remains idle so that air is not circulated through the air channels or over the coil. By locating the coil well above the display space, the air adjacent the coils which is heated up during the defrosting cycle does not pass downward or mingle with the cold air in the display space. Therefore, the temperature of the articles on display remains substantially constant during the defrosting cycle. Subsequently when the expanding refrigerant is passed through the coils, the temperature of the air retained within the space adjacent the coil falls very rapidly so that on renewed operation of the fan the air issuing from the outlet 58 to the display space is suit-

ably cooled and dried to prevent any substantial rise in temperature or objectionable fogging of the window. In actual practice the increase in temperature of the air circulated immediately after defrosting is seldom more than about 2° F. and even this temperature rapidly falls to the normal operating temperature as the air is circulated.

In the preferred form of our invention illustrated the lower edge of the insulated baffle 10 is provided with an outer decorative metal strip 72 and above this strip are located illustrations of the articles on display as shown at 74, although a mirror is sometimes substituted for the illustrations. A fluorescent light 76 is mounted in brackets 78 and provided with a reflector 80. The light and reflector are spaced from the upper edge of the metal strip 72 so as to direct light downward onto the articles in the display space and to direct light upward onto the illustrations 74. A heating element 82 is located beneath the metal strip 72 and serves to raise its temperature sufficiently to prevent moisture from condensing thereon. Moreover, the heated strip and the light cooperate to promote upward flow of air from above the display space and over the strip 72 and illustrations or mirror 74 between the light and the strip. Therefore, the amount of warm moist air from above the display space which is entrained by the rapidly flowing cold air passing across the top of the display space is reduced.

The construction illustrated and described is found in practice to permit the positioning of articles within the display space to a level close to the top of the display space so that substantially the entire volume of the display space is available for use. The capacity of the case is thus materially increased over that of prior refrigerated self service cases whereas the size of the blower employed and the size and capacity of the coil need not be increased. Furthermore, the condensation of moisture as frost on the articles being displayed and on adjacent surfaces is substantially eliminated.

While we have shown and described a particular form of refrigerated self service display case embodying our invention, it will be apparent that numerous changes and modifications may be made in the form, arrangement and construction of the elements without departing from the spirit and scope of my invention. In view thereof it should be understood that the construction shown in the drawing and described above is intended to be illustrative only and is not intended to limit the scope of our invention.

We claim:

1. A refrigerated self service display case permitting unobstructive access to articles therein comprising means forming a chamber which is open at the top and thermally insulated about the front, bottom, rear and ends of the chamber, said chamber having means forming a display space therein which is open at the top for access to said space, means forming an air channel extending about the front, bottom and rear of the display space, said channel terminating in inlet and outlet openings communicating with said space at the front and rear thereof respectively and at points adjacent but below the top of said chamber, refrigerating means located in said air channel adjacent said outlet opening, means for positively circulating air in a cycle through said channel and over said refrigerating means to said outlet opening at the rear of the display space, means for directing substantially all of the air thus circulated horizontally across but below the top of the chamber to said inlet opening whereby said air, while at its lowest temperature in the cycle, is caused to establish an air curtain opposing infiltration of external air downward into contact with articles in said display space.

2. A refrigerated self service display case comprising means forming a chamber which is open at the top and thermally insulated about the bottom, front, rear and end walls thereof, channel forming means cooperating with the ends of said chamber to define a display space which is open at the top, said channel forming means being spaced from said front, bottom and rear walls of the chamber and cooperating therewith to form an air circulating channel in heat exchange relation with said display space, said channel having an inlet opening located below the top of said front wall of the chamber and extending throughout substantially the entire length of said display space and having an outlet opening located adjacent the rear wall of said chamber and near the top of the display space and extending throughout substantially the entire length of said display space, a refrigerating element located in said channel near said outlet opening, means for positively circulating air through said air channel from said inlet opening to said outlet opening, and means for directing substantially all of the air thus circulated in a horizontal direction across the top of the display space and below the top of said walls of the chamber so as to establish an air curtain maintained at substantially the lowest temperature of the air being circulated and opposing infiltration of external air downward into contact with articles in said display space.

3. A refrigerated self service display case having an insulated bottom and insulated front, end and rear walls cooperating to define a chamber which is closed about the bottom and sides and open at the top, said chamber having a display space therein which is open at the top, said front wall embodying spaced window forming panes providing an air channel therebetween which has an inlet opening located adjacent the top of said display space, means forming a second air channel communicating with the channel between the window forming panes and extending beneath the display space and upward adjacent the rear wall in heat exchanging relation with the display space, said second air channel having an outlet opening located adjacent the top of said display space on the side thereof opposite to said inlet opening, a refrigerating element located in said second air channel near said outlet opening, and means for positively forcing air through said channels from said inlet opening to said outlet opening.

4. A refrigerated self service display case comprising a chamber having a bottom, front, end and rear walls, means within said chamber defining a display space which is closed about the bottom and sides and open at the top, said front wall having spaced window forming panes therein defining an air circulating channel having an inlet opening adjacent the top of said display space, other elements forming a continuation of said air circulating channel extending about said display space in heat exchanging relation therewith and provided with an outlet opening located adjacent the top of said display space and removed from said inlet opening so as to cause air to flow

across the top of the display space from said inlet to said outlet opening, a refrigerating element located in said air circulating channel near said outlet opening and means for positively circulating air through said air circulating channel from said inlet opening to said outlet opening.

5. A refrigerated self service display case comprising an insulating bottom and insulating front, end and rear walls cooperating with said bottom to provide a chamber which is open at the top, means within said chamber defining a display space which is open at the top, said rear wall extending above said front wall and having a forwardly extending insulating top and a downwardly extending insulating baffle cooperating with said back and end walls to form a housing with an outlet opening located adjacent the top of said display space but below the level of the upper edge of said front wall, a refrigerating element located in said housing, the means defining said air space cooperating with the bottom, front and rear walls of the chamber to form an air circulating channel extending about said display space in heat exchanging relation therewith and provided with an inlet opening located adjacent and below the upper edge of said front wall, said channel communicating with said housing, and means for positively circulating air from said inlet through said channel to said housing and over said refrigerating element to said outlet opening.

6. A refrigerated self service display case comprising an insulating bottom and insulating front, end and rear walls cooperating with said bottom to form a chamber which is open at the top, means within said chamber defining a display space which is open at the top, said rear wall extending upward above said front wall, a top extending forward from said rear wall and a baffle extending downward from said top and cooperating with said back and end walls to form a housing, a refrigerating element located in said housing, the means defining said display space cooperating with the bottom, front and rear walls of the chamber to form an air circulating channel extending about said display space in heat exchanging relation therewith and having an inlet opening located adjacent to and below the upper edge of the front wall of said case, said channel communicating with said housing and having an outlet opening from said housing to the display space adjacent the top of the rear of said space and means for positively circulating air through said channel from inlet opening and over said refrigerating element to said outlet opening.

7. A refrigerated display case of the open type comprising a base, a high rear wall, end walls, a low front wall, a hood projecting from the top of said rear wall and overhanging part of the space between said front and rear walls, a refrigerating device in the top of said case adjacent to said rear wall and above the level of the top of said front wall and a downwardly extending baffle of insulating material secured to the underside of said hood and tightly fitted thereto and to said end walls, said curtain wall projecting below the level of said front wall, means forming an air channel having an inlet opening communicating with the space below the top of said front wall and extending to said hood, and means for positively forcing air through said air channel from said air inlet to said hood and over said refrigerating device back to said space.

8. A refrigerated display case of the open type, comprising a base, a high rear wall, end walls, a low front wall, a hood projecting from the top of said rear wall and overhanging part of the space between said front and rear walls, a refrigerating device in the top of said case adjacent to said rear wall and above the level of the top of said front wall and a downwardly extending baffle of insulating material secured to the underside of said hood and tightly fitted thereto and to said end walls, said baffle projecting below the level of said front wall, means forming an air channel having an inlet opening adjacent to and below the upper edge of the front wall and extending to said hood and means for positively forcing air through said air channel from said air inlet to said hood and over said refrigerating device back to said space.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,907,680	Strass	May 9, 1933
2,066,312	Bales	Jan. 5, 1937
2,332,174	Shreve	Oct. 19, 1943
2,379,885	Davis	July 10, 1945
2,382,937	Caulk	Aug. 14, 1945
2,421,314	Brinkoeter	May 27, 1947
2,446,910	Dickens	Aug. 10, 1948
2,463,614	Hardin	Mar. 8, 1949