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FROST COLLECTING MEANS FOR REFRIGERATED STRUCTURES

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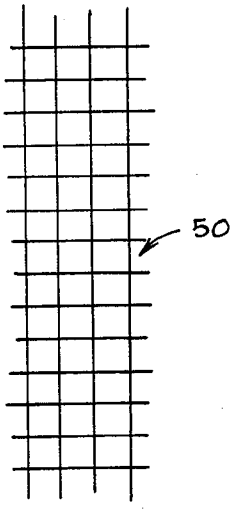


FIG. 2

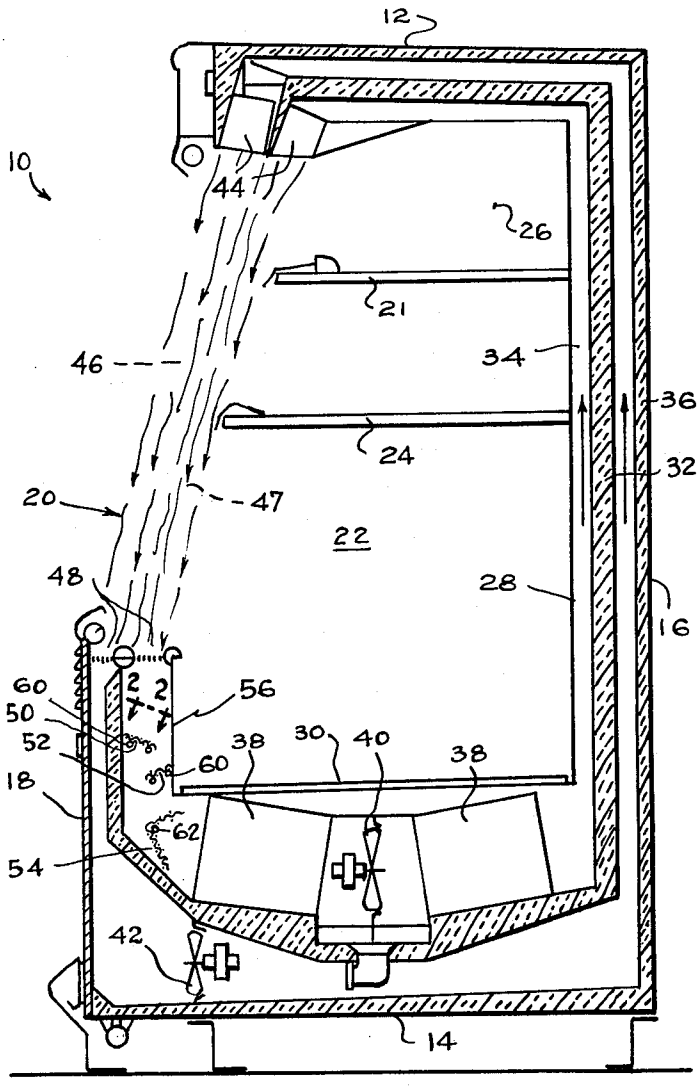


FIG. 1

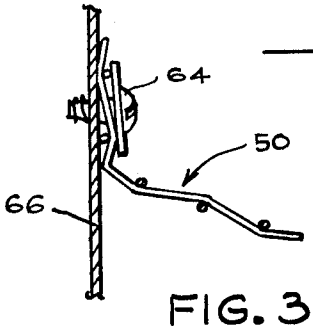


FIG. 3

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FROST COLLECTING MEANS FOR REFRIGERATED STRUCTURES

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The means of this invention are designed for use in structures which provide for the circulation of refrigerated air. In particular, the means of this invention provide for the collecting of frost which is known to be formed on various areas of a refrigerated structure during operation thereof. The purpose of the frost collecting means is to prevent, or at least substantially minimize, the collection of frost in areas of the apparatus which only operate efficiently in the absence of frost.

It will become apparent when considering the following description that the means of this invention are particularly suitable for use in combination with refrigerated cabinets of the type employing circulating air streams. It will be understood, however, that the novel means referred to herein can be utilized in other constructions where similar problems arise.

In an application of Hagen et al., Serial No. 54,077, filed September 6, 1960, and in the issued Simons Patent No. 2,862,369, there are described refrigerated display cabinets which are provided with access openings exposed to the atmosphere while still being capable of maintaining the contents in a refrigerated state. Loss of refrigeration from the enclosed space through the access opening is reduced in a highly effective manner in these constructions by the use of a gaseous, preferably air, curtain which is continuously advanced across the open side from one edge of the opening to the opposite edge. The air curtain in these constructions is adapted to be formed of adjacent panels of air, with the innermost panel comprising a refrigerated cold air panel, and with one or more outer panels having temperatures approaching the ambient temperature. It has been found that it is desirable to recirculate the inner cold air panel and to provide means for circulating the adjacent guard panels, to conserve the refrigeration and to maintain the enclosed space in a satisfactory refrigerated state.

In these constructions there are described assemblies which include nozzles extending across the bottom edge of the access opening to direct the air panels upwardly across the opening towards inlets which extend across the top side of the access opening. As an alternative, the nozzles are located across the upper edge for projecting the air panels downwardly toward inlets arranged across the bottom edge. It is also contemplated that the air nozzles be located across one of the lateral edges of the opening for directing the corresponding air panels across the opening toward inlets on the opposite edge. Because of the more desirable effect of gravity on the higher density cold air, it has been found preferable to provide the air curtain with a downward movement from nozzles across the top to inlets across the bottom. The following description will refer to this preferred construction, although it will be understood that the concepts to be described are also applicable to other directions of flow.

In the use of cabinets of the type described, it is, of course, desirable to provide maximum efficiency insofar as the amount of power consumed is concerned. In refrigeration systems of this type, the consumption of power is partly due to the need for refrigeration of the moving air streams which pass over the access opening for the cabinet. In addition, power is consumed during defrosting cycles and due to the driving of fans for circulation of the streams. As far as the refrigeration of the streams is concerned, a major factor contributing to the amount of power consumption is the loss of refrigeration (or intake of heat) through the access opening.

The present invention is specifically concerned with improved means designed to provide for preferential collection of frost in the apparatus. It has been recognized that the build-up of frost in certain areas of a refrigerated cabinet will greatly decrease the operating efficiency thereof. For example, where frost is allowed to collect in areas where restriction of the openings for the passage of air would result, greater power is necessary for circulation of the air streams. In addition, undue accumulation of frost on the evaporator coils of refrigeration means greatly reduces the operating efficiency of such means.

It is one object of this invention to provide improved means designed for the collection of frost in structures which employ circulating refrigerated air streams.

It is a further object of this invention to provide frost collecting means of the type described which serve to greatly minimize the tendency toward the collection of frost in areas of the refrigeration structure which would decrease the operating efficiency of the structure.

It is an additional object of this invention to provide refrigeration means of the type described which can be manufactured and assembled into existing refrigeration structures with a minimum of expense and assembly difficulties.

These and other objects of this invention will appear hereinafter, and for purposes of illustration but not of limitation, specific embodiments of this invention are shown in the accompanying drawings in which:

FIGURE 1 is a vertical sectional view of a refrigerated cabinet structure characterized by the improved frost collecting means of this invention;

FIGURE 2 is a detail view of the frost collecting means as they appear when looking along the line 2—2 of FIGURE 1; and,

FIGURE 3 is an enlarged detail view of the frost collecting means and also illustrates an alternative means for supporting the frost collecting means within the cabinet structure.

As indicated, the improvements of this invention are directed to refrigerated enclosures of the type which define an access opening in one wall which is provided for communication with the otherwise enclosed space. The enclosures are provided with a plurality of nozzles arranged in side-by-side relationship across one edge of an access opening and corresponding inlets are located across an opposite edge of the access opening. The inner nozzles and inlets are provided for the passage of refrigerated air streams across the access opening, while the outer nozzles and inlets circulate progressively warmer air panels. As indicated, the refrigerated streams are circulated through passages having refrigeration coils or the like situated therein, and one or more of the outer streams may also be refrigerated.

In the aforementioned copending application, means are described which enable operation of the refrigerating functions of an enclosure with a minimum of interruption for defrosting purposes. The instant invention also provides means which assist in providing maximum efficiency in the apparatus insofar as defrosting cycles are concerned. Specifically, the instant invention provides structures in the passages of the refrigerated enclosures which collect frost and which thereby prevent or substantially reduce the collection of frost in critical areas of the enclosure. The frost collecting means are preferably positioned whereby the moisture tending to condense will not

collect on the surfaces of the refrigeration coils or in areas where the flow of air would be impeded.

The improved means of this invention comprise means formed of screening materials or of materials which can be shaped to define screen-like configurations. The screens are located in the passage of the cabinet through which the refrigerated air stream moves. These screens act as surfaces for the condensation of the moisture carried by the refrigerated stream whereby they will collect frost in preference to the refrigeration coils. To achieve this result, the screens are located beyond the inlet of the passage and forwardly of the refrigeration means. Accordingly, frost forming elements in the refrigerated air stream can be substantially completely removed before the air stream contacts the refrigeration coils.

In accordance with preferred techniques of the invention, a plurality of screens are located in the refrigerated air passage, and these screens are positioned in the passage in a manner whereby maximum contact with the air stream can be achieved without substantial disruption of the air flow.

FIGURE 1 of the accompanying drawing illustrates a refrigerated cabinet construction **10** which includes the frost collecting means of this invention. The cabinet includes a top wall **12**, a bottom wall **14**, a back wall **16** and a front wall **18**. The front wall **18** defines an access opening **20** which provides access to the enclosed refrigerated space **22**. The display shelves **24** are supported within the space through their attachment with the side walls **26** and the inner wall **28**. The inner wall **28** and the bottom interior wall **30** define a chest portion in the cabinet which can also be employed for the display of goods.

A partition **32** is formed in the construction, and this partition defines an inner passage **34** with the inner wall **28** and an outer passage **36** with the back wall **16**. In the construction shown, the inner passage **32** carries a refrigerated stream while the outer passage carries a warmer guard panel. Refrigeration coils **38** are located in the lower portion of the passage **32** and fans **40** and **42** provide for the circulation of the inner and outer streams.

Communicating with the passages **34** and **36** are nozzles **44**. These nozzles provide outlets for the passages whereby a pair of panels **46** and **47** can issue therefrom. These panels are intended to move in more or less laminar fashion across the access opening for the construction. The panels are directed toward inlets **48** whereby complete circulation of the air streams can be accomplished. Suitable screens can be located over the inlets to prevent the entry of insects or other foreign matter.

In a refrigerated cabinet of the type illustrated, the circulating refrigerated air stream will necessarily carry and pick up moisture which will tend to be condensed during movement of the circulating air stream. The condensation in the form of frost is detrimental to the operation of the construction since the frost tends to collect on the refrigeration coils whereby the efficiency of these coils will be diminished. Frequent defrosting operations must be undertaken in order to avoid difficulties with regard to refrigeration of the products in the construction.

The instant invention, in its preferred embodiment, provides for the inclusion of screens **50**, **52** and **54**. These screens are located in the passage **34**, and they are positioned between the inlet and the refrigeration coils. As the air entering the inlet contacts these screens, frost will collect thereon and, therefore, the air passing to the refrigeration coils will have a greatly reduced capability for the deposition of frost. The natural result of this condition in the refrigerated air stream is to eliminate need for frequent defrosting operations. Accordingly, the over-all efficiency of the construction can be greatly improved with the provision of the screen means referred to herein.

As shown in FIGURE 1, each of the screen means is disposed whereby it will be situated at an angle with respect to the direction of movement of the refrigerated air stream. The angle is such that the air stream will flow over the surface of the screen means while still being directed in substantially the same direction. Accordingly, there will not be any great disruption in the free circulation of the air.

The upper screen means **50** is attached to the inner surface of the partition **32** and the outer edge of the screen means extends angularly downwardly with respect to the upper edge. The screen means **52** is similarly disposed; however, this screen means is attached to the inner surface of the front interior wall **56**. It will be noted that the air stream will flow over and through the screen means and then contact with the screen means **52**. These screens must be spaced apart by a sufficient distance to prevent a bridge of frost from being formed therebetween. A distance of about 1½ inches between these members has been found satisfactory.

The third screen **54** is formed in an angular configuration with both legs being directly toward the refrigeration coil **38** whereby the air stream can easily flow through and over this third screen means. The angular disposition of the several screens provides for maximum contact with all portions of the refrigerated air. This contact is highly desirable since the screens can then eliminate substantially all of the frost forming substances in the air.

In order to support the screen means in the construction, there can be provided transverse rods **60** which carry the screen means on the upper surface. A similar transverse rod **62** can be utilized for the screen means **54** to provide a support in the apex of the angular configuration formed by this screen.

FIGURE 2 illustrates the screen **50** looking along the line **2—2** of FIGURE 1. The screen can be economically obtained in the form of hardware cloth, this cloth having the desired size for a purpose of the nature discussed. For the purposes of this invention, ½ inch mesh hardware cloth has been found particularly suitable. This size is cited only as an example since other suitable materials and sizes are also obviously available.

The screen means are located in their illustrated positions in a manner such that they extend across the entire width of the cabinet. Accordingly, all portions of the refrigerated air issuing from the nozzles will be contacted by one of the screen surfaces.

FIGURE 3 illustrates an alternative means for mounting the screen means within the apparatus. In this case, a screw **64** is adapted to be attached to the wall **66** forming a part of the partition **32**. This attaching arrangement is more or less permanent; however, it is also desirable to provide for quick removal of the screen means. It will be appreciated that due to their location, the screen means will pick up a substantial amount of moisture, and this moisture can be removed by pulling the screen means out of the cabinet.

The screens described are also considered advantageous since they can be situated in the cabinet in a manner such that they will be removed and replaced in a simple operation. Thus, if replacement screens are available, the collected frost can be eliminated from the system without the necessity for a defrosting operation.

In considering the following claims, it will be appreciated that the references to screen means are also intended to apply to arrangements which do not employ screens in the strict sense but which employ elements arranged in a manner such that a screening effect is substantially provided. Such arrangements may include the provision of wires, pins or strips which are attached to one or both walls of a cabinet passage and which are spaced apart so as to provide the desired screening results. Thus, such arrangements serve to remove part of the frost in a refrigerated stream, and the following claims contemplate these arrangements.

It will be apparent that various changes and modifications can be made in the above described structures which

provide the characteristics of the instant invention without departing from the spirit thereof particularly as defined in the following claims.

That which is claimed is:

1. In a refrigerated cabinet of the type which defines an access opening in one wall communicating an otherwise enclosed space with the ambient atmosphere, and which is provided with at least one inner cold air inlet and at least one outer warmer air inlet, at least one inner cold air nozzle and at least one outer warmer air nozzle, said inlets and nozzles extending in side-by-side relationship across opposite edges of said access opening, passages communicating each of the corresponding inlets and nozzles, circulating means in at least some of the passages for forcing air through the passages and out of said nozzles for movement in the form of panels across said access opening, and refrigeration means disposed in at least some of said passages and adapted to refrigerate at least the innermost stream of air to maintain a temperature in the innermost stream below 32° F., the improvement comprising screen means located in the passage through which the refrigerated air stream moves, said screen means being positioned between the inlets for said passage and the refrigeration means therein whereby the moisture in the air contacting said screen means can be collected thereon in the form of frost to provide for removal of substantial portions of the moisture from the air before contact of the air with the evaporator coils of said refrigeration means.

2. A cabinet in accordance with claim 1 wherein a plurality of said screen means are located in said passage between the inlet thereof and said refrigeration means.

3. A cabinet in accordance with claim 1 wherein said screen means extend along the entire length of said passage and have a width less than the width of said passage to provide a free path for portions of said air stream.

4. A cabinet in accordance with claim 1 wherein said screen means are angularly disposed in said passage with an upper edge of said screen aligned parallel with the top edges of said inlet, and wherein a lower edge of said screen means is located below said upper edge.

5. In a refrigerated cabinet of the type which defines an access opening in one wall communicating an otherwise enclosed space with the ambient atmosphere, and which is provided with at least one inner cold air inlet and at least one outer warmer air inlet, at least one inner cold air nozzle and at least one outer warmer air nozzle, said inlets and nozzles extending in side-by-side relationship across opposite edges of said access opening, passages communicating each of the corresponding inlets and nozzles, circulating means in at least some of the passages for forcing air through the passages and out of said nozzles for movement in the form of panels across said access opening, and refrigeration means disposed in at least some of said passages and adapted to refrigerate at least the innermost stream of air to maintain a temperature in the innermost stream below 32° F., the improvement comprising hardware cloth forming a screen means and located in the passage through which the refrigerated air stream moves, said screen means being positioned between the inlets for said passage and the refrigeration means therein whereby the moisture in the air contacting said screen means can be collected thereon in the form of frost to provide for removal of substantial portions of the moisture from the air before contact of the air with the evaporator coils of said refrigeration means.

6. A cabinet in accordance with claim 5 wherein a plurality of said screen means are located in said passage between the inlet thereof and said refrigeration means, and wherein said screen means extend along the entire length of said passage and have a width less than the width of said passage to provide a free path for portions of said air stream.

7. A cabinet in accordance with claim 6 wherein said screen means are angularly disposed in said passage with an upper edge of said screen aligned parallel with the top edges of said inlet, and wherein a lower edge of said screen means is located below said upper edge.

8. In a refrigerated cabinet of the type which defines an access opening in one wall communicating an otherwise enclosed space with the ambient atmosphere, and which is provided with at least one inner cold air inlet and at least one outer warmer air inlet, at least one inner cold air nozzle and at least one outer warmer air nozzle, said inlets and nozzles extending in side-by-side relationship across opposite edges of said access opening, passages communicating each of the corresponding inlets and nozzles, circulating means in at least some of the passages for forcing air through the passages and out of said nozzles for movement in the form of panels across said access opening, and refrigeration means disposed in at least some of said passages and adapted to refrigerate at least the innermost stream of air to maintain a temperature in the innermost stream below 32° F., the improvement comprising a plurality of screen means located in the passage through which said refrigerated air moves, said screen means being formed of hardware cloth and being spaced from the inlet for said passage and being located at intervals in said passage for contact with refrigerated air prior to movement of said air to said refrigeration means, said screen means operating to collect the moisture in the air passing in contact therewith whereby said screen means collect frost from said air before contact of the air with the evaporator coils of said refrigeration means.

9. A cabinet in accordance with claim 8 wherein said screen means are angularly disposed in said passage with an upper edge of said screen aligned parallel with the top edges of said inlet, and wherein a lower edge of said screen means is located below said upper edge.

10. A cabinet in accordance with claim 9 including an upper screen means positioned adjacent one wall defining said passage, a second screen means disposed beneath said upper screen means and positioned adjacent the opposite wall defining said passage, and a third screen means located below said other screen means adjacent the forward end of said refrigeration means.

11. A cabinet in accordance with claim 10 wherein said third screen means comprises an angularly disposed upper portion and a lower portion extending angularly in the opposite direction from said upper portion.

12. In a construction of the type adapted for the handling of air streams wherein at least one air stream is powered for circulation in said construction and wherein at least one air stream is subjected to refrigeration for maintaining the temperature of said one air stream below 32° F., the improvement comprising screen means located in a passage through which said refrigerated air moves, said screen means being located up-stream of the refrigeration means for said air stream whereby moisture in the air stream contacting said screen means can be collected on said screen means in the form of frost to provide for removal of substantial portions of the moisture from the air before contact of the air with the evaporator coils of said refrigeration means.

13. In a refrigerated cabinet of the type which defines an access opening in one wall communicating an otherwise enclosed space with the ambient atmosphere, and which is provided with at least one inner cold air inlet and at least one outer warmer air inlet, at least one inner cold air nozzle and at least one outer warmer air nozzle, said inlets and nozzles extending in side-by-side relationship across opposite edges of said access opening, passages communicating each of the corresponding inlets and nozzles, circulating means in at least some of the passages for forcing air through the passages and out of said nozzles for movement in the form of panels across said access opening, and refrigeration means disposed in at

least some of said passages and adapted to refrigerate at least the innermost stream of air to maintain a temperature in the innermost stream below 32° F., the improvement comprising screen means located in the passage through which refrigerated air stream moves, said screen means being positioned between the inlets for said passage and the refrigeration means therein whereby the moisture in the air contacting said screen means can be collected thereon in the form of frost to provide for removal of substantial portions of the moisture from the air before contact of the air with the evaporator coils of said refrigeration means, said screen means removably located in said passage and being accessible through said inlet whereby the screen means can be removed to eliminate frost collected thereon from the cabinet environment.

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