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S. BECKWITH ETAL
REFRIGERATED ENCLOSURE

3,128,609

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FIG. 1

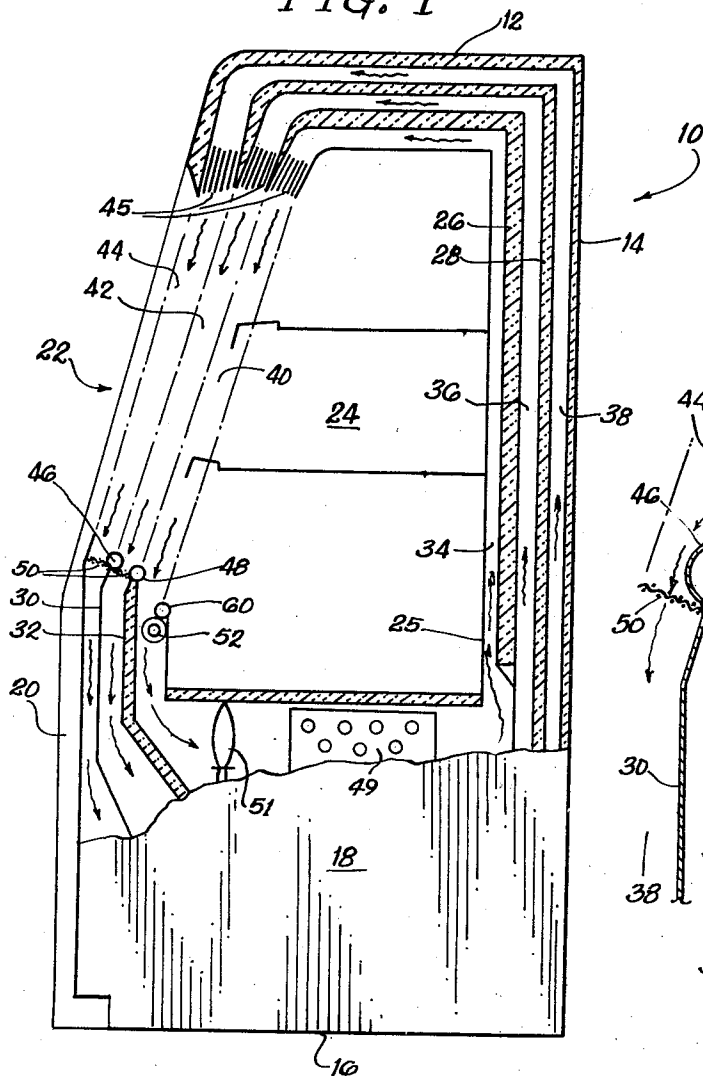


FIG. 2

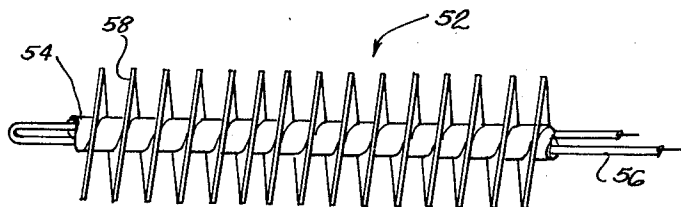
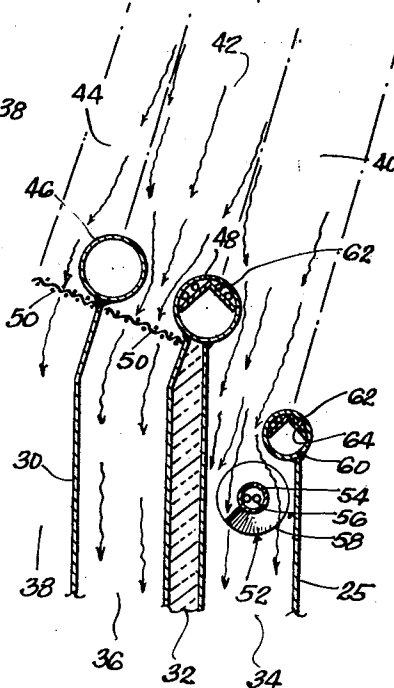


FIG. 3

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1

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REFRIGERATED ENCLOSURE

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7 Claims. (Cl. 62-256)

This invention relates to improvements in a refrigerated enclosure of the type having an open side for access to the enclosed space. The invention in particular relates to devices of the type which are capable of maintaining a refrigerated state within the enclosed space while still providing an opening for access to the contents.

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 an 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 at least the inner cold air panel and, at times, 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 in 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 constructions of the type described in the aforementioned disclosures, and also in systems of the type set forth in applicant's copending applications Serial No. 88,879, filed February 13, 1961, now Pat. No. 3,082,612, and Serial No. 106,805, filed May 1, 1961, now Pat. No. 3,094,851, accumulation of frost on various parts of the mechanisms results in the necessity for periodic defrosting operations. The accumulation of frost has been particularly apparent around the inlet openings for the circulating air panels. These inlet openings may be provided with screening means to prevent entry of insects or other foreign matter into the air passages, and the screens are especially prone to the collection of frost. This situation tends to disturb the air panel movements due to the clogging of the screens. Furthermore, undue formation of frost contributes to the need for more frequent defrosting intervals.

It is an object of this invention to provide improve-

2

ments in refrigerated enclosures, these improvements being particularly directed to providing means for decreasing frost accumulation.

It is a more particular object of this invention to provide means located adjacent the air panel inlet portions of a refrigerated enclosure which inhibit frost formation in these portions and which may also act as substitutes for screening means employed.

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:

FIG. 1 is a schematic elevation, partly in section, of a refrigerated enclosure characterized by the features of this invention;

FIGURE 2 is an enlarged fragmentary view in section illustrating the improvements in the air panel inlet portions of a refrigerated enclosure;

FIGURE 3 is a fragmentary elevational view of a combined heating and screening means which provide the improvements of this invention.

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.

The problem of undue frost accumulation is particularly troublesome with regard to the innermost refrigerated stream or streams. In accordance with this invention, heating means are located near the inlet portions of the enclosure in the path of the refrigerated stream or streams. These heating means, which are of relatively low heating capacity, serve to raise the temperature of the stream a small amount in the inlet area and this effectively inhibits frost formation. Thus, if the innermost stream flowing across the access opening is at -20° F., the heating means employed at the inlet portions may be adapted to raise the temperature to -15° F. It will be understood that the degree of differential in temperature is not particularly critical, since a difference of even one or two degrees has been found effective to some extent. Of course, if the temperature of the stream is raised a relatively large amount, then an unduly large increase in burden on the refrigerating coils will result and, therefore, the temperature differential has this practical limitation.

In the preferred form of this invention, modifications are provided in screening means for the inlet openings of the enclosure passages. Specifically, the screening means for the cold air inlet opening are provided with heating elements and the temperature of the screening means is maintained above the temperature of the refrigerated air panel entering at this point. In a preferred form for the screening means, an elongated hollow rod is provided with heat radiating fins. This rod extends along the entire inlet opening and includes electrical resistor means in its interior.

In a more limited form of the invention, divider means of a unique design are located adjacent the inlet opening for the air passages. Heating means are also provided in these dividers whereby the dividers cooperate to raise the temperature of the refrigerated stream. The heating

3

elements in the dividers are preferably disposed so that the oncoming air panel will receive a maximum amount of the heat generated.

The accompanying drawings illustrate the refrigerated enclosure 10 provided with the improvements which form the subject matter of this invention. The enclosure generally consists of a top wall 12, a back wall 14, a bottom wall 16, side walls 18 and a front wall 20. An opening 22 is defined in the front wall, and this opening permits access to the enclosed refrigerated space 24. An inner wall 25 defines the extent of the refrigerated space.

The top and back walls of the enclosure are provided with partitions 26 and 28, while similar partitions 30 and 32 are provided in the front wall. Continuations of these partitions extend into the bottom area where refrigeration coils and circulating means 49 and 51, respectively are provided as disclosed in the prior applications.

The partitions and walls form passages 34, 36 and 38 which confine air panels 40, 42 and 44, respectively. As illustrated, these air panels pass across the access opening 22 between the confines which define the air passages.

At least the innermost panel 40 is adapted to be refrigerated, although refrigeration means can be provided for the other panels. The concepts of this invention contemplate the use of two or more panels, and the invention is not necessarily limited to the three panels shown. Circulating means are provided for the innermost panel, and preferably circulating means are provided for all of the panels, although in some cases the outermost panel may be allowed to circulate without mechanical aid. Honeycomb sections 45 preferably form the outlet nozzles for the passages as described in the above mentioned applications.

In considering the specific means employed for inhibiting frost formation, it is first to be noted that the most troublesome area is that area traversed by the innermost refrigerated panel. However, it will be appreciated that the concepts of this invention are applicable to all inlet areas where undue accumulation of frost presents problems.

The inlet area structure illustrated includes divider means 46 and 48 located at the top edge of partitions 30 and 32. These dividers extend across the inlets for the passages and screens 50 are located behind the dividers to prevent entry of insects and other foreign material into the air passages.

In the passage 34, which confines the air panel 40, there is located near the inlet thereof a heating means 52. The heating means shown comprises a tubular body portion 54 having an internally disposed electrical resistance element 56. The radial fins 58 serve to effectively distribute the heat generated.

It will be apparent that an air panel 40 which contacts the heating element 52 will be heated as it circulates. Heating of this air panel, even a few degrees Fahrenheit, has been found to be effective to prevent the formation and accumulation of frost in this area.

The tubular member 54 of the heating means is preferably secured to the side walls 18, with an inlet being provided for the resistor 56. Due to the location of the heating means across the inlet of the passage, this member serves as a screening means. Thus, the fins and tubular body of the heating means serve to block the passage and thereby inhibit the entrance of foreign material into the passage.

In order to further inhibit the formation and accumulation of frost, the divider 48 and the divider 60 located on the other side of the inlet for the passage 34 can be heated. To accomplish heating of the dividers, resistor wires 62 are located within the hollow body of the dividers. An angular member 64 serves to support the wires against the top side of the tubular body so that the heated side of the dividers will be exposed to the oncoming air panel. The heating accomplished by the low capacity heating elements cooperates with the heating

4

provided by the means 52 and, therefore, the refrigerated panel 40 will not deposit frost in this inlet area.

A further concept of this invention resides in the construction of the dividers 46, 48 and 60 to present a broad curvilinear contour in the portion facing the oncoming cold air streams whereby frost formation on the surface is markedly decreased by comparison with the amount of frost formed when the contour is such as to present a sharp edge. In the preferred modification illustrated the dividers 46, 48 and 60 are in the form of elongate cylindrical members.

In the preferred practice of this invention the heating means in the dividers are adapted to operate constantly at low voltage for low heat output. With the heating element 56, it is preferred to make use of a switch means whereby the element operates at low voltage such as 55 or 110 volts during the time cycle for refrigeration to produce the small amount of heat which operates to keep the fins free of frost but which operates at high voltage of 220 volts during the defrost cycle to produce a large amount of heat for removal of frost from elements in the cold air passage in advance of the defrost heaters.

The provision of a heating means of the type represented by the means 52 has been found to increase the efficiency of operation of refrigerated enclosures of the type referred to. Only a small amount of power is necessary to provide the low capacity heating. However, the prevention of undue frost formation provides for a more efficient and consistent flow of the air panels. A decrease in the frost built up prevents disruption of the air flow and also contributes to a decrease in the frequency of defrosting operations. Furthermore, the complementary effect of the heating means disposed in the dividers has been found to increase the operating efficiency in many cases.

It will be understood that various modification may be made in the above described apparatus which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

We claim:

1. In a refrigerated enclosure of the type which defines an access opening in one wall communicating the 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 inlet extending in side-by-side relationship across an opposite edge 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 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 of said panels, the improvement comprising screening means extending substantially completely across said inlet to impede entrance of foreign material into said passages, the screening means covering at least the innermost one of said cold air inlets being provided with heating means whereby the temperature of this screening means is adapted to be made higher than the temperature of the air panel entering the cold air inlet, said last mentioned screening means contacting substantially all of the cold air passing through its associated inlet.

2. In a refrigerated enclosure defining an access opening in one wall communicating the otherwise enclosed space with the outside atmosphere, means for circulating a plurality of air panels across said opening and through said enclosure, and means for refrigerating at least the innermost one of said panels, the improvement comprising screening means extending substantially completely across inlets for said panels to impede entrance of foreign material into said enclosure, the screening means in the path of said refrigerated panel being provided

5

with heating means whereby the temperature of the screening means is adapted to be made higher than the temperature of the refrigerated air panel, said last mentioned screen means contacting substantially all of the refrigerated air passing through its associated inlet.

3. In a refrigerated enclosure of the type which defines an access opening in one wall communicating the 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 extending in side-by-side relationship across an opposite edge 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 in the from 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 of said panels, the improvement comprising screening means extending across said inlets to impede entrance of foreign material into said passages, the screening means covering at least the innermost one of said cold air inlets being provided with heating means whereby the temperature of this screening means is adapted to be made higher than the temperature of the air panel entering the cold air inlet, divider means extending along said cold air inlets, and heating means in said divider means adapted to raise the temperature of the air entering said inlets above the temperature of the innermost panel.

4. A refrigerated enclosure of the type claimed in claim 3 wherein said divider means comprise at least one tubular member extending the length of said cold air inlet, and heating elements disposed in said tubular member on the side thereof which is exposed to the oncoming air panel.

5. In a refrigerated enclosure of the type which defines an access opening in one wall communicating the 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 extending in side-by-side relationship across an opposite edge 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 in the form of panels across said access opening and refrigeration means

6

disposed in at least some of said passages and adapted to refrigerate at least the innermost of said panels, the improvement comprising screening means extending across said inlets to impede entrance of foreign material into said passages, said screening means covering the innermost one of said cold air inlets comprising an elongated hollow rod having radial fins along its length and an electrical resistor element in its interior, whereby the temperature of this last mentioned screen means is adapted to be made higher than the temperature of the air panel entering the cold air inlet.

6. In a refrigerated enclosure defining an access opening in one wall communicating the otherwise enclosed space with the outside atmosphere, means for circulating a plurality of air panels across said opening and through said enclosure, and means for refrigerating at least the innermost one of said panels, the improvement comprising screening means extending across inlets for said panels to impede entrance of foreign material into said enclosure, said screening means in the path of said refrigerated panel comprising an elongated hollow rod having radial fins along its length and an electrical resistor in its interior whereby the temperature of the screening means is adapted to be made higher than the temperature of the refrigerated air panel.

7. In a refrigerated enclosure defining an access opening one wall communicating the otherwise enclosed space with the outside atmosphere, means for circulating a plurality of air panels across said opening and through said enclosure, and means for refrigerating at least the innermost one of said panels, the improvement comprising screening means extending across inlets for said panels to impede entrance of foreign material into said enclosure, the screening means in the path of said refrigerated panel being provided with heating means whereby the temperature of the screening means is adapted to be made higher than the temperature of the refrigerated air panel, divider means extending along the inlet for said refrigerated panel, and heating means in said divider means adapted to raise the temperature of the refrigerated panel.

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