Sept. 22, 1964 S. BECKWITH 3,149,476

REFRIGERATED DISPLAY CABINET

Filed May 31, 1962

FIG. 1

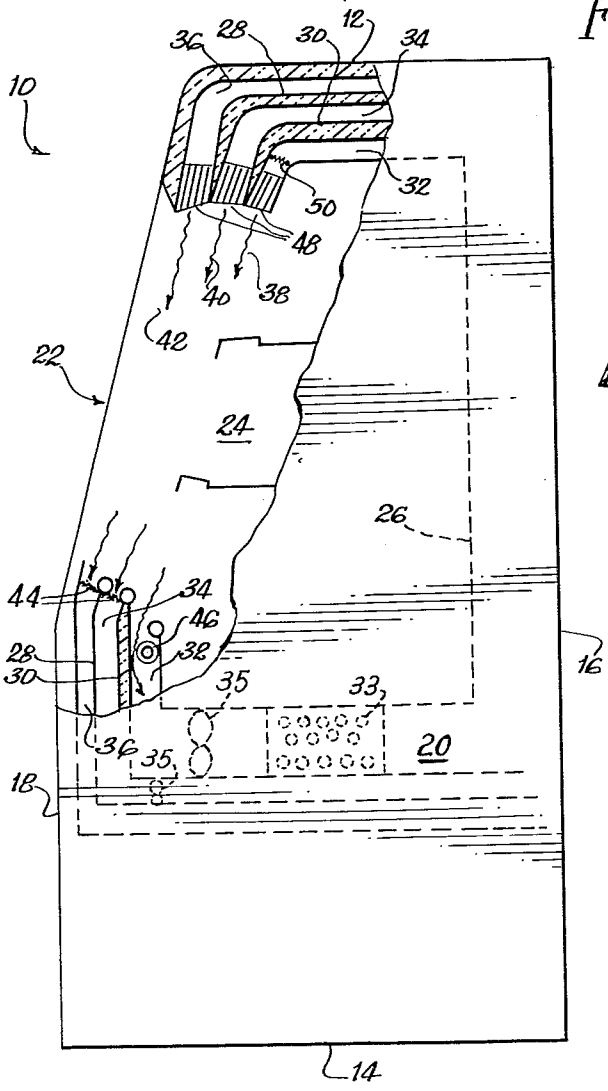


FIG. 2

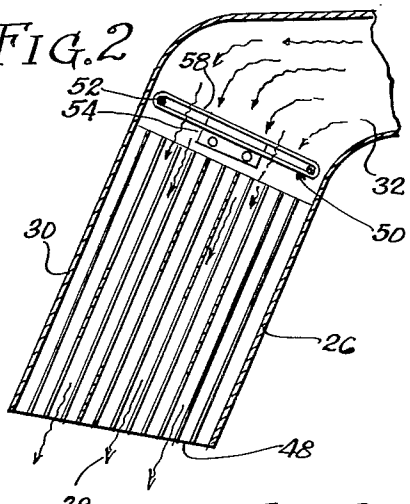
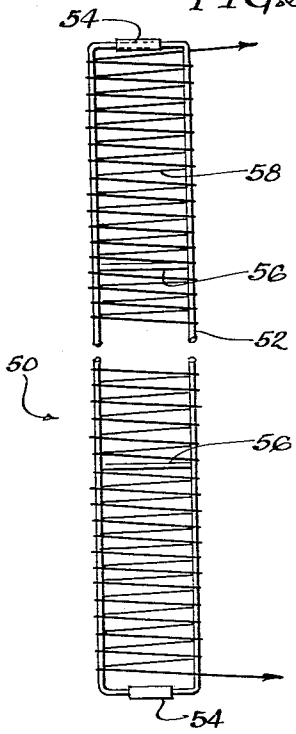


FIG. 3



INVENTOR.
Sterling Beckwith

BY
Toms, McDougall & Hersh
Attys

United States Patent Office 3,149,476 Patented Sept. 22, 1964

3,149,476

REFRIGERATED DISPLAY CABINET

Sterling Beckwith, Libertyville Township, Lake County, Ill., assignor, by mesne assignments, to Dual Jet Refrigeration Company, a corporation of Illinois

Filed May 31, 1962, Ser. No. 198,962
7 Claims. (Cl. 62—256)

This invention relates to improvements in a refrigerated cabinet or enclosure of the type having an open side permitting access to an enclosed refrigerated space. The invention particularly 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.

It has been applicant's experience that there is a tendency for frost formation in the area of the outlet nozzles, particularly in the passage or passages confining the innermost refrigerated streams. This situation has led to disruption in the normal flow of the air panels thereby increasing the difficulties in obtaining uniformity in the temperature control. Furthermore, the tendency for accumulation of frost in these nozzles necessitates an increase in the frequency of defrosting operations and, therefore, the over-all efficiency of the cabinet operation is reduced.

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, reference is made to the use of honeycomb sections for the nozzles used to direct the air panels across the access opening. These honeycomb sections are characterized by a plurality of small openings and, when employed in lengths from about 1 to about 6 inches, they

are particularly effective in providing uniformity in the laminar air panels.

The problem of frost accumulation noted above is particularly troublesome, however, when such honeycomb nozzles are employed. The small openings in the honeycomb sections can become substantially reduced in cross-section if frost accumulates, and this disrupts the uniformity of the operation. In addition, the larger surface area presented by these sections accelerates frost accumulation and necessitates more frequent defrosting operations.

It is an object of this invention to provide improvements in refrigerated cabinets which are particularly directed to decreasing frost formation and accumulation in the outlet areas for air panels employed in the cabinets.

It is a more particular object of this invention to provide a heating means adapted to be located adjacent nozzle outlets for refrigerated cabinets, the heating means being effective to inhibit frost formation in these areas thereby increasing the efficiency of the cabinet.

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 schematic elevation, partly cut away, of a refrigerated enclosure characterized by the features of this invention;

FIGURE 2 is a fragmentary view in section of the nozzle area of a refrigerated cabinet having associated heating means; and

FIGURE 3 is a detail plan view of the heating means employed in the nozzle area.

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 formation and accumulation is particularly apparent in the innermost refrigerated stream or streams, and the accumulation appears to occur with greater regularity in the area of the outlet nozzles for these refrigerated streams. It has been found that the provision of heating means in the path of the refrigerated streams adjacent the nozzle areas serves to effectively reduce the frost formation and accumulation. The refrigerated streams contact these heating means prior to contact with the outlet nozzles. The heating means, which are of relatively low capacity, serve to raise the temperature of the stream a small amount in the nozzle area, and this inhibits the frost formation. Thus, if the innermost stream flowing through the cabinet is at −20° F., the heating means located adjacent the nozzle for this stream may be adapted to raise the temperature to −15° F. This increase in temperature is not particularly critical, since a difference of even one or two degrees has been found effective to some extent. However, if the temperature is raised a relatively large amount, then the burden on the refrigerating coils must be unduly increased and, therefore, the temperature differential has this practical limitation.

In the preferred form of this invention, the heating means comprises a frame member which extends across

the refrigerated air passage immediately preceding the nozzles. An electrical resister wire is wrapped around this frame member with the turns thereof being sufficiently spaced apart to avoid undue constriction of the air panel. As indicated, the concepts of this invention are particularly applicable where honeycomb sections are used as the nozzle means. The heating means described, when employed in combination with these sections, generate heat to a degree sufficient to raise the temperature of the innermost refrigerated panel or panels thereby inhibiting frost formation on the exposed surfaces of the honeycomb sections.

The accompanying drawings illustrate a refrigerated cabinet **10** which is provided with the improvements which form the subject matter of this invention. The enclosure comprises a top wall **12**, bottom wall **14**, back wall **16**, front wall **18** and side walls **20**. The front wall **18** defines an opening **22** for access to the refrigerated space **24**. An internal wall **26** defines the extent of the refrigerated space.

Partitions **28** and **30** and the inner and outer walls define passages **32**, **34** and **36**. These passages confine streams **38**, **40** and **42** which then form laminar air panels as they cross the access opening.

Located in the passages in the bottom area of the cabinet there are provided refrigeration coils **33** and circulating means **35** as disclosed in the prior applications. At least the innermost panel **38** is 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 are provided for all of the panels, although in some instances the outermost panel can be efficiently circulated without specific mechanical aid.

Screens **44** are provided in the path of the outer panels **40** and **42** to prevent entry of insects and other foreign material into the air passages. A similar screen may be provided over the passage **32**. However, a heating element **46**, of the type described in the copending application Serial No. 198,963, dated May 31, 1962, and entitled "Refrigerated Enclosure," can be advantageously substituted for the screening means.

Outlet nozzles **48** for the air streams are located at the top edge of the access opening. As noted, there is a tendency for frost to collect in these areas, particularly in the innermost refrigerated passage **32**. It has been discovered that the accumulation of frost can be effectively reduced if a heating means **50** is located in the air passage adjacent the nozzle **48**. This heating means is positioned to contact the stream **32** prior to passage of the stream through the nozzle. Although the heating means **50** is shown only in the passage **32**, it will be appreciated that the concepts of this invention are applicable to all of the nozzle areas where undue frost accumulation presents problems.

The heating means **50** shown comprises a rectangular frame member **52** which may be suspended across the air passage and secured to the side walls of the cabinet by means of bracket members **54**. To provide rigidity in the frame, braces **56** are employed.

An electrical resister wire **58** is formed in a plurality of turns around the frame. The wire may be of any conventional type, however, a thin wire is preferably employed, and the turns are preferably uniformly spaced apart a substantial amount when compared with the thickness of the wire. This arrangement permits uniform distribution of heat without unduly interrupting the flow of the air panels. Thin plastic coated wire wound around a steel frame with about one inch between turns has been found to be a suitable construction, although many variations in this respect will be obvious to those skilled in the art.

The use of the heating means **50** in the nozzle area is particularly effective where honeycomb sections of the type illustrated comprise the nozzles **48**. The combination of the small passages in these sections as well as the large surface area presented accentuates the frost problem. It has been found that the use of heating means of the type described provides noticeable increases in the effectiveness and efficiency of operation of the refrigerated cabinets.

One of the problems encountered has been the frosting effect resulting from the variations in temperature of the air stream due to the operation of expansion valves in the system. When the temperature of the cold air stream is on the increase, the contacted surfaces of the honeycomb, etc., will be from 1–3° F. colder than the air stream. This ordinarily will accelerate frost formation on the colder surfaces. The presence of the heating means of this invention in close proximity of the cold surfaces operates to minimize the effect of the temperature changes whereby frost formation is eliminated.

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

I claim:

1. In a refrigerated cabinet defining an access opening in one wall communicating the otherwise enclosed space with the outside atmosphere, outlets across one side of said access opening and inlets across the other side of the access opening, means for circulating a plurality of air panels from the outlets to the inlets across said opening and through separate passages about said enclosure, and means for refrigerating at least the innermost one of said panels, the improvement comprising heating means disposed in the passages confining said innermost panel, said outlet comprising honeycomb sections extending across each of said passages immediately in advance of the inlet of said heating means being located immediately in advance of the inlet end of the outlet for said panel at one edge of said access opening, and said heating means being adapted to generate heat to raise the temperature of said innermost panel thereby inhibiting frost formation.

2. 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 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 heating means in the passage confining the said innermost refrigerated panel, said nozzles comprising honeycomb sections extending across each of said passages, said heating means being disposed immediately in advance of the inlet end of the nozzles for said passages, and said heating means being adapted to generate heat to raise the temperature of said innermost panels thereby inhibiting frost formation.

3. In a refrigerated cabinet 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 a honeycomb section extending across each of said passages forming outlet nozzles for said panels at one edge of said access opening, a heating means disposed immediately in advance of the inlet end of the honeycomb section in the passage confining said innermost panel, said heating means

being adapted to generate heat to raise the temperature of said innermost panel thereby inhibiting frost formation.

4. 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 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 heating means in the passage confining the said innermost refrigerated panel, said heating means comprising a frame member suspended in and extending across said passage adjacent said nozzle, and an electrical resister wire wrapped around said frame member along the length thereof, said heating means being disposed adjacent the nozzle for said passage, and said heating means being adapted to generate heat to raise the temperature of said innermost panel thereby inhibiting frost formation.

5. A refrigerated cabinet in accordance with claim 4 wherein the turns of said wire are spaced apart a distance substantially greater than their widths to permit essentially undisturbed movement of said innermost panels through said passages.

6. In a refrigerated cabinet 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 heating means disposed in the passages confining said innermost panel, said heating means comprising a frame member suspended in and extending across said passage, and a plurality of spaced apart turns of an electrical resister wire wrapped around said frame member along the length thereof, said heating means being located adjacent the outlets for said panel at one edge of said access opening, and said heating means being adapted to generate heat to raise the temperature of said innermost panel thereby inhibiting frost formation.

7. In a refrigerated cabinet 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 a honeycomb section extending across each of said passages forming outlet nozzles for said panels at one edge of said access opening, a heating means disposed above the honeycomb section in the passage confining said innermost panel, said heating means comprising a frame member suspended in and extending across said passages, and a plurality of spaced apart turns of an electrical resister wire wrapped around said frame member along the length thereof, and said heating means being adapted to generate heat to raise the temperature of said innermost panel thereby inhibiting frost formation.

References Cited in the file of this patent

UNITED STATES PATENTS

2,952,992	Voorhies	Sept. 20, 1960
3,063,252	Lamb	Nov. 13, 1962

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,149,476 Dated September 22, 1964

Inventor(s) Sterling Beckwith

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, lines 37 and 38 (claim 1):

After "passages" delete "immediately in advance of the inlet of".

Signed and Sealed this

Fifteenth Day of *August 1978*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

DONALD W. BANNER
Commissioner of Patents and Trademarks