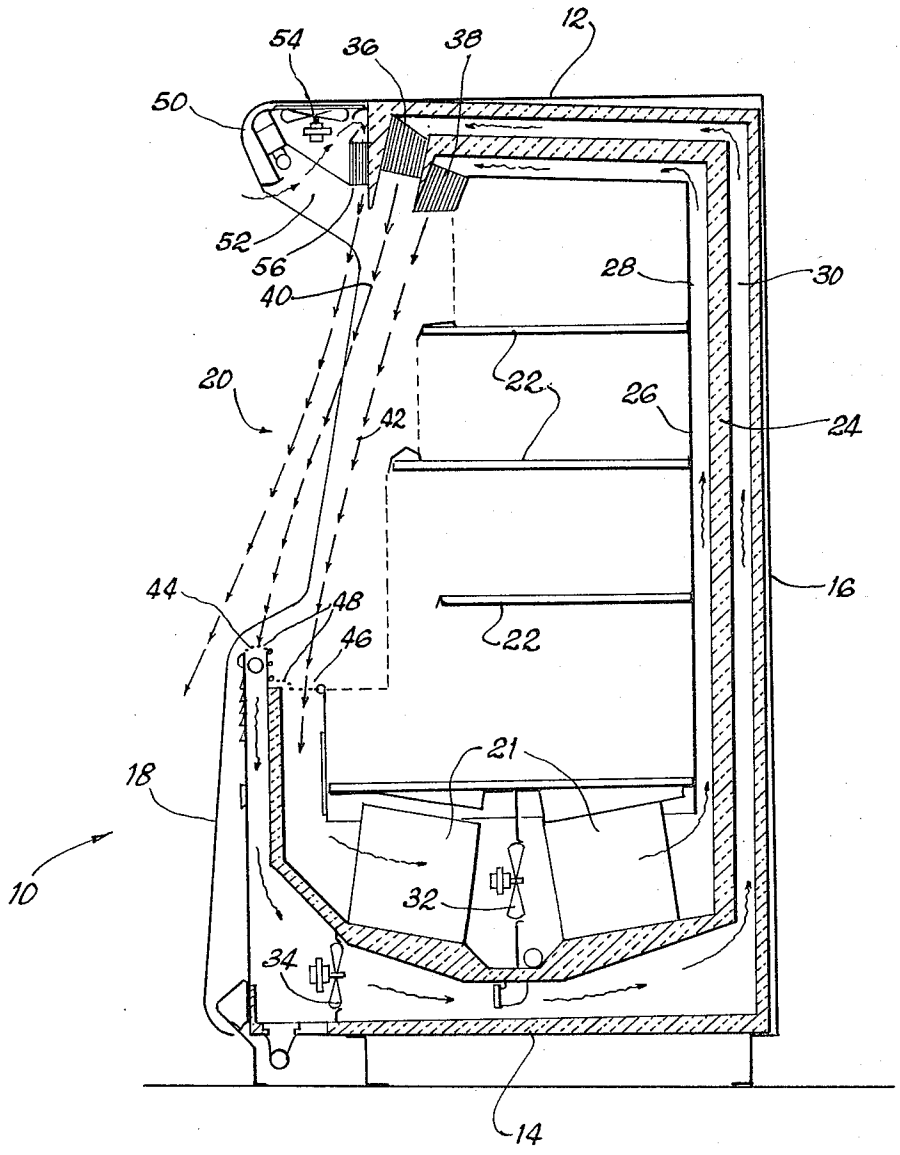
Nov. 29, 1966 S. BECKWITH 3,287,929

REFRIGERATED CABINET WITH IMPROVED NOZZLE CONSTRUCTION

Filed June 30, 1965



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United States Patent Office 3,287,929
Patented Nov. 29, 1966

3,287,929

REFRIGERATED CABINET WITH IMPROVED NOZZLE CONSTRUCTION

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Filed June 30, 1965, Ser. No. 468,373
9 Claims. (Cl. 62—256)

This invention relates to refrigerated cabinet constructions and, in particular, to cabinet constructions which include improved means for maintaining refrigeration in the construction.

The invention is specifically directed to refrigerated cabinet constructions of the type which provide at least one air curtain passing across an access opening defined by the construction. Individuals desiring to secure goods from within the cabinet can reach through the air curtain. The air curtain, on the other hand, provides a means for maintaining the desired low temperature conditions within the construction even though the ambient air surrounding the cabinet is at normal room temperatures.

Refrigerated cabinet constructions of the type referred to have been previously described in Simons Patent No. 2,862,369 and in other issued patents including Beckwith Patent Nos. 3,082,612, 3,094,851, 3,130,559 and 3,182,466. In such constructions, display cabinets 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 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 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.

The amount of frost accumulation in the construction bears directly on the operating efficiency since energy is necessary for operating constructions which remove the frost. Furthermore, efficiency is decreased where frequent defrosting cycles are required since each defrosting operation results in an increase in the energy necessary for maintaining the desired degree of refrigeration in the system.

A major factor with respect to frost accumulation concerns the amount of moisture in the air streams which circulate in the construction. The moisture in such air streams will form as frost on various surfaces within the construction, and where the moisture content of the air streams is high, the rate of frost accumulation will also be high.

It is a general object of this invention to provide a means for use in combination with a refrigerated cabinet which will reduce the amount of frost accumulation within the construction.

It is a more particular object of this invention to provide for a reduction in frost accumulation by employing means which affect the circulating air streams whereby the tendency for the air streams to pick up moisture is significantly reduced.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, a specific embodiment of the invention is shown in the accompanying drawing in which the figure comprises a vertical sectional view of a refrigerated cabinet characterized by the features of this invention.

The specific improvement of this invention is preferably utilized in refrigerated cabinet constructions which employ air curtains moving in side-by-side relationship across an opening which provides access to the interior of the constructions. The refrigerated cabinets are provided with a plurality of nozzles arranged in side-by-side relationship across one edge of the access opening, and inlets for each of the respective nozzles are located across the opposite edge of the access opening. The nozzles and inlets are provided for the passage of a refrigerated stream across the access opening while the adjacent outer nozzles and inlets circulate progressively warmer air streams. Refrigeration coils are provided in the passage which confines the inner refrigerated stream and one or more of the outer streams may also be refrigerated. Circulating means, such as blowers, are usually provided for each of the passages to power the respective streams.

In accordance with the improvement of this invention, additional means are provided for creating a stream consisting of ambient air. This stream is directed against the outermost circulating stream of the construction. The direction of the ambient air stream is such that the circulating streams in the cabinet system will be maintained in a proper path of movement. This comprises an extremely important feature of the invention since the proper movement of the circulating streams reduces the tendency of the streams to pick up moisture. Thus, the circulating streams are substantially prevented from intermixing with still, ambient air adjacent the access opening. It has been concluded that the intermixture of the circulating streams with the ambient air results in the pick up of moisture whereby the moisture content of the circulating streams is increased, and whereby frost accumulation takes place at a high rate. The system of this invention is designed to substantially reduce the intermixing and the resultant detrimental effects.

The drawing illustrates a refrigerated cabinet **10** which includes a top wall **12**, a bottom wall **14**, a back wall **16** and a front wall **18**. The front wall of the construction defines an opening **20** which provides access to the interior of the construction for the removal of articles from the shelves **22**.

A partition wall **24** is located between the interior wall **26** and the back wall **16** of the construction. Passages **28** and **30** are defined by the respective walls. A circulating fan **32** is located in the inner passage **28** and a circulating fan **34** is located in the passage **30**. Refrigeration coils **21** are situated within the passage **28** whereby the air stream in this passage will be maintained at a lower temperature than the air stream in the passage **30**.

Nozzles **36** and **38** are located across the upper edge of the opening **20**. These nozzles may comprise honey-comb constructions such as are described in the patents listed herein. Streams of air **40** and **42** issue from these nozzles and the streams are intended to pass in side-by-side relationship across the access opening **20** to the inlets **44** and **46**. Screens **48** extend across the inlets to reduce the possibility of the entry of any foreign matter into the inlets.

In a system which includes only the elements described, there is a tendency for the outermost stream **40** to spill out of the path of movement illustrated. This results in intermixing of the stream with the ambient air. Portions of the intermixed air tend to pass into the inlet **44** since the movement of the outermost stream is often characterized by a whipping action. The humidity of the streams issuing from the nozzles **36** and **38** is quite low and, accordingly, any intermixing of the circulating air streams with ambient air tends to increase the moisture content in the system. As previously noted, this increases the amount of frost accumulation thereby necessitating relatively frequent defrosting operations.

The construction shown in the drawing includes an outwardly extending canopy member **50**. This member **50** defines an opening **52** whereby ambient air is adapted to be drawn into the canopy by means of the fan **54**. A nozzle **56** is associated with the canopy whereby the air stream is adapted to be forced through the nozzle and then downwardly toward the stream **40**. The nozzle **56** is arranged whereby the ambient air stream will be directed against the outermost air stream **40**.

The arrangement described provides substantial improvements in the operation of the construction. It has been found that the presence of the additional nozzle and the ambient air stream issuing therefrom greatly reduces the amount of frost accumulation in the system. It is believed that the reduction in frost accumulation is due to the fact that the ambient air stream tends to prevent the stream **40** from intermixing with ambient air. In this connection, it will be noted that there is no substantial passage of the ambient air stream into the inlets of the construction. Thus, the ambient air stream tends to follow the path of the arrows illustrated in the drawing whereby this air stream spills outwardly of the construction.

It will be noted that in the embodiment of the invention illustrated, the air streams **40** and **42** are directed at an angle downwardly and outwardly from the nozzles **36** and **38**. The inlets **44** and **46** are positioned outwardly of the position of the corresponding nozzles whereby they will receive air streams directed at the proper angle.

The additional nozzle **56** is preferably arranged whereby the air stream issuing therefrom is directed vertically downwardly. This angular relationship of the respective air streams is preferred in order that the ambient air stream will have the best possible action with respect to the air stream **40**. It will be appreciated that equivalent angular relationships of the respective air streams can be utilized.

In considering the improvement of this invention, it will be appreciated that various arrangements of circulating air streams can be employed in combination with an ambient air stream of the type described. Thus, the instant invention contemplates the use of the ambient air stream as an addition to constructions which employ air streams movable in passages within the constructions and movable across an access opening defined by the construction.

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

That which is claimed is:

1. In a refrigerated cabinet construction of the type defining an open side and including air inlet means and air nozzles extending in side-by-side relationship across opposite edges of said open side, passages defined in said construction communicating each of the corresponding inlets and nozzles, refrigeration means located in at least the innermost one of said passages, and circulating means located in at least the innermost of said passages for driving air streams through said passages and across said open side between corresponding inlets and nozzles, said air streams crossing said open side in side-by-side contacting relationship, the improvement comprising additional driving means for an air stream, said driving means being located adjacent said nozzles, an additional nozzle having its outlet end directed toward the outermost of the air streams passing between said nozzles and inlets, said driving means being adapted to collect ambient air and to direct the ambient air through said additional nozzle for passage of an ambient air stream into engagement with said outermost air stream.

2. A construction in accordance with claim **1** including an outwardly extending enclosure at the top of the construction, said driving means and said additional nozzle being disposed within said enclosure, and an opening defined by the enclosure whereby ambient air can be drawn into the enclosure for passage through said additional nozzle.

3. A construction in accordance with claim **2** wherein said passages comprise an inner passage which includes said refrigeration means whereby said innermost stream comprises a refrigerated stream, and an outer passage without refrigeration means whereby the outermost stream comprises a warmer stream.

4. A construction in accordance with claim **3** wherein said innermost and outermost streams are directed downwardly and outwardly at an angle from said nozzles with said inlets being positioned outwardly of the position of nozzles for receiving said innermost and said outermost streams, and wherein said additional nozzle directs said ambient air stream substantially vertically downwardly.

5. In a refrigerated cabinet construction of the type defining at least one passage for the circulation of an air stream, refrigeration means for refrigerating the air stream, an access opening defined in the construction, circulating means for the air stream, and nozzle and inlet means disposed along opposite side edges of the opening whereby said stream is adapted to be directed across said opening, the improvement comprising means for collecting ambient air, said collecting means being located outwardly of said nozzle means, an additional nozzle associated with said collecting means whereby said collecting means is adapted to drive an ambient air stream out of said additional nozzle, said additional nozzle being positioned outwardly of said nozzle means whereby said ambient air stream is directed against the circulating air stream issuing from said nozzle means, said ambient air stream operating to substantially maintain the circulating air stream in its path of movement toward said inlet means, and said ambient air stream being substantially maintained outside the path of movement of said circulating air stream whereby said ambient air stream remains substantially completely outside the cabinet construction.

6. A construction in accordance with claim **5** wherein said air directing means directs the ambient air stream at an angle against the air stream moving across said opening.

7. In a refrigerated cabinet construction of the type defining at least two adjacent passages for the circulation

of air streams with the air streams being maintained at different temperatures with the innermost air stream being refrigerated and thereby maintained at the lowest temperature, said construction defining an access opening in at least one side, nozzles communicating with each of said passages for directing air from one edge of said opening across the opening, and separate inlets along an opposite edge of the opening for receiving the respective air streams issuing from said nozzles, the improvement comprising means for collecting ambient air, said collecting means being located adjacent the outermost of said nozzles, an additional nozzle associated with said collecting means whereby said collecting means is adapted to drive an ambient air stream out of said additional nozzle, said additional nozzle being positioned whereby said ambient air stream is directed against the air stream issuing from the outermost nozzle, said ambient air stream operating to substantially maintain the outermost air stream in its path of movement toward the outermost inlet, and said ambient air stream being substantially maintained outside the path of movement of said outermost stream whereby said ambient air stream substantially remains outside the construction.

8. A construction in accordance with claim 7 including an enclosure located at the top of said construction, said collecting means being maintained within said enclosure, and an opening defined by the enclosure whereby ambient air can be drawn into the enclosure and passed to said additional nozzle.

9. A construction in accordance with claim 8 wherein said innermost and outermost streams are directed downwardly and outwardly at an angle from said nozzles with said inlets being positioned outwardly of the position of the nozzles for receiving said innermost and said outermost streams, and wherein said additional nozzle directs said ambient air stream substantially vertically downwardly.

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WILLIAM J. WYE, *Primary Examiner.*