United States Patent

[11] 3,542,445

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[54] **CLOSURE MEMBER**
5 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **312/116**
[51] **Int. Cl.** **A47f 3/04**
[50] **Field of Search** 312/116, 137, 36; 62/checked; 221/150, 286; 222/131

[56] **References Cited**

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1,730,685	10/1929	Ramsey	312/297X
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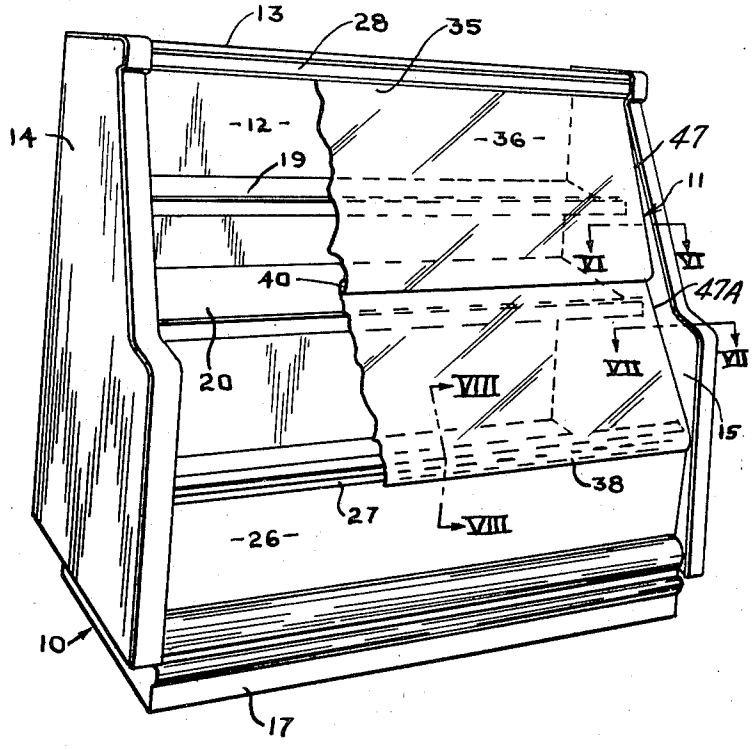
3,241,899	3/1966	Donker	312/116

Primary Examiner—Patrick D. Lawson
Attorney—Woodhams, Blanchard and Flynn

ABSTRACT: Sheet means folded upon itself along a line approximately midway between two substantially opposite edges to provide two overlapping portions, the sheet means being prestressed so that it will roll upon itself around an axis parallel with the fold line with the two said edges adjacent the outside of the roll. The prestressing of the sheet means is such that the roll is self supporting in a rolled position when it is suspended from one of said edges. The sheet means has a plurality of relatively small and relatively evenly distributed openings therethrough. The sheet means is adapted to be mounted along said opposite edges upon an open food freezer adjacent opposite edges of the access opening therein.



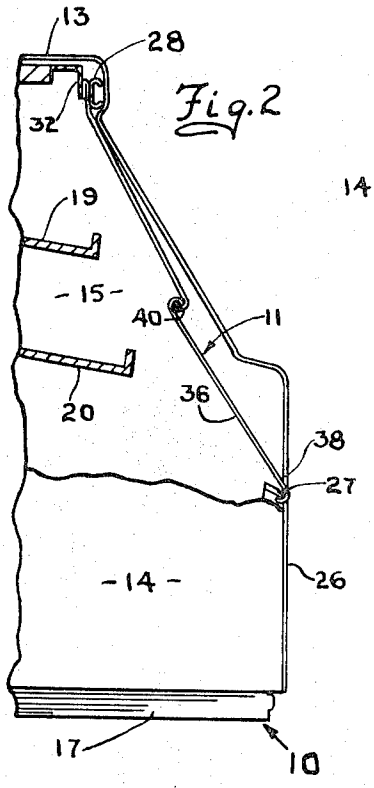


Fig. 2

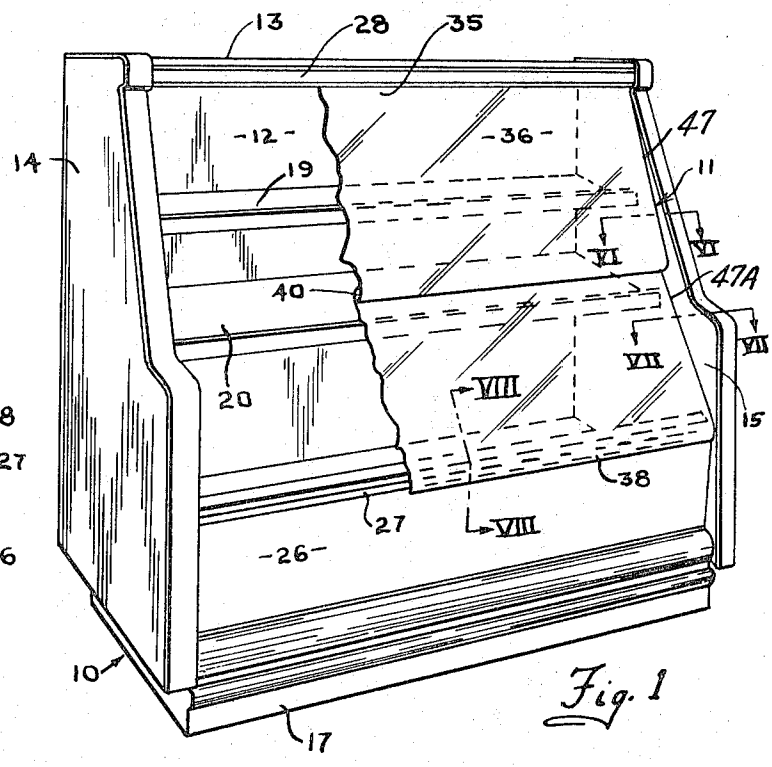


Fig. 1

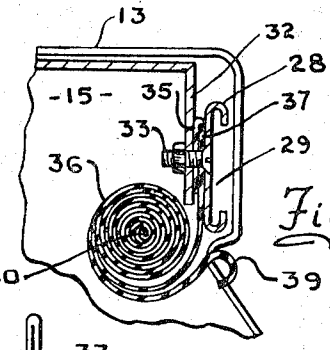


Fig. 3

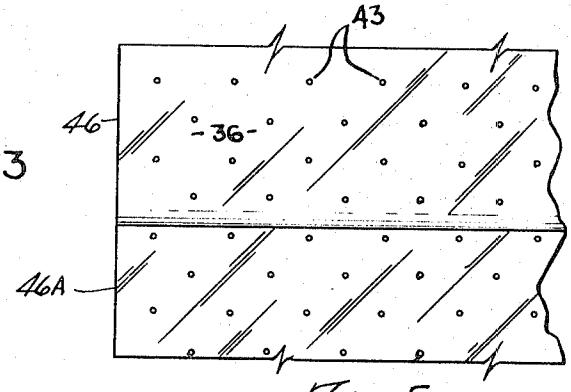


Fig 5

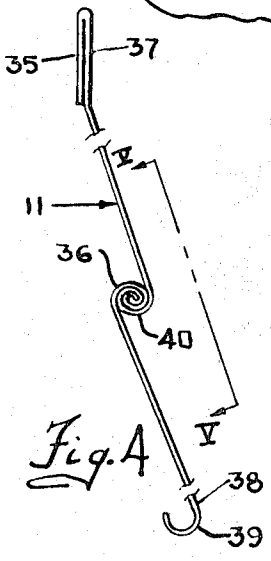


Fig. 4

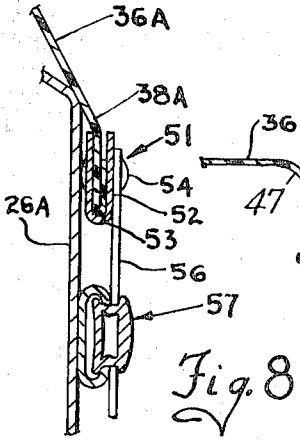


Fig. 8

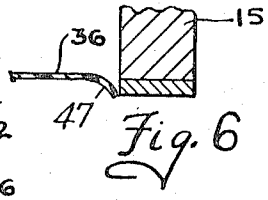


Fig. 6

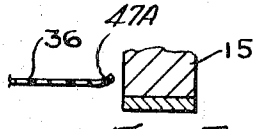


Fig. 7

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Applicant's Pat. No. 3,241,899 discloses a related curtain structure for the same purpose.

BACKGROUND OF THE INVENTION

Display-type refrigerators capable of maintaining foods in a frozen condition, but having uncovered access openings, have been used for many years. Accordingly, it is well known that many problems, previously unsolved, have developed from the use of this type of equipment, even though its value in protecting and selling produce is unquestioned. For example, and quite obviously, the uncovered access opening, particularly in a frontwardly opening freezer, permits large amounts of cool air to "spill out" of the opening and thereby create several undesirable results.

In the first place, heat losses resulting from the spilled cold air necessitate a much larger and much costly refrigerating system for the freezer than would be required to refrigerate the same amount of cubic space in a completely enclosed freezer.

The spill out of the refrigerated air, particularly in large food markets where several freezers are located in the same part of the market, creates a cold floor condition near said freezers, which is particularly noticeable in the morning. If the thermostat is located anywhere near the freezers, it will be cooled by the escaped cold air, so that the remainder of the store will be too hot both in summer and during the winter.

It will be noted that, in the foregoing discussion, most of the problems result from the fact that cold air has been permitted to spill out of the freezer during at least a 12-hour period (between 9 p.m. and 9 a.m.) when very few, if any, customers are in the market. Thus, it becomes clearly evident that some means for at least minimizing this spill out of cold air during the unoccupied hours of the market would greatly reduce the problem.

It is common knowledge in the freezer field that the defrost cycle of the freezer must be set for the most severe conditions that will normally be encountered. It is also known that excessive defrost cycles produce a deleterious effect upon the food in the freezer.

Some efforts have been made in the past to minimize the foregoing problems by draping covers of various kinds over the access opening in the display freezer, particularly during the night. However, in addition to the foregoing problems, it has been found that a moistureproof curtain placed over the access opening of a food freezer will collect substantial amounts of condensation when the dew point is reached during a defrost cycle. Such condensation will deposit itself on the food in the freezer at the end of the defrost cycle, or it will freeze solid on the curtain when the temperature is suddenly and abruptly lowered during the final stage of the defrost cycle. Accordingly, if a transparent sheet material is used, it may be clouded with condensation after a defrost cycle and not only be difficult to store but will obstruct a view of the contents of the freezer.

Applicant's U.S. Pat. No. 3,241,899 discloses a closure structure which overcomes many of the problems and meets many of the objects discussed above. However, in the course of attempting to improve upon his previous invention, applicant discovered that unexpected advantages could be achieved by folding the sheet material midway between the two edges which are secured to the refrigerator when it is in its operative position. The purpose of this change was to increase the effective stress in the material whereby a sheet of a given size could span a larger area and still return to its initial, tightly rolled position. A further purpose was to provide a greater scope of application for a sheet of a given size. For example, in applicant's previous invention, it was necessary to tailor the length of the sheet to the particular access opening so that an assortment of covers having different lengths as well as widths had to be stocked to meet all needs. However, by starting the roll from the approximate centerline of the sheet, variations of the height of the access opening in a frontwardly opening refrigerator, for example, is automatically overcome merely by increasing or reducing the amount of sheet material unrolled.

As an unexpected advantage of this procedure of stressing the sheet material away from its centerline, it developed that the side edge portions of the sheet tended to curl in one direction on one side of the centerline and curl in the opposite direction on the other side of the centerline when both sides of the sheet are at least partially unrolled. Thus, by appropriate positioning of the sheet, its curled edges can be used to minimize leakage of cold air and maximize the exit of relatively warm air from within the food freezer.

Thus, the unexpected advantage of the change in rolling and stressing was the creation of a natural accommodation to the normal flow of air as it heats and rises or is displaced from within the freezer.

Accordingly, it is a primary object of this invention to provide:

1. A curtain structure for a display freezer having an otherwise uncovered access opening, said curtain structure including a sheet folded between two opposite edges thereof and rolled tightly away from and around the fold line, one of said edges being mounted upon the display freezer so that the structure can be quickly moved into an inconspicuous, storage position near one edge of the access opening, when the contents of the freezer are on normal display, and so that it can be quickly moved into its extended, closing position to minimize, if not prevent, the spill out of cold air when the freezer is not serving its display function.
2. A curtain structure, as aforesaid, having a sheet which automatically moves into a tightly rolled, self-supporting storage position, where it will not interfere with the normal use of the freezer, which has a holding device along the other edge thereof for removably connecting said other edge to the food freezer when the curtain is in its closed position, which can be fabricated from a transparent material constructed so that it minimizes the deposit of condensation thereon during a defrost cycle of the food freezer, and which is very easy to keep clean.
3. A curtain structure, as aforesaid, which is relatively inexpensive to manufacture, which is adapted for use with either a frontward access opening or an upward access opening, which is easy to install and attractive so that it does not detract from the appearance of the display freezer with which it is used, even when said curtain is in its extended position.
4. A curtain structure which can be fabricated in one size adapted without modification to access openings having a substantial range of different dimensions in one direction crosswise of the opening, which can provide a greater amount of stress in a sheet of a given size than possible in previous structures for the same purpose, and which provide for the automatic retention of cold air and escape of warm air along the lateral edges of the sheet means where it is used with a frontwardly facing access opening.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon examining said U.S. Pat. No. 3,241,899 and/or reading the following specification and examining the accompanying drawings, in which:

FIG. 1 is a front perspective view of a display freezer having a frontwardly opening access surface and including a fragment of a curtain structure embodying the invention;

FIG. 2 is an end view of the freezer illustrated in FIG. 1, the end wall being partially broken away;

FIG. 3 is an enlarged fragment of the upper end of FIG. 2;

FIG. 4 is an enlarged broken fragment of FIG. 2;

FIG. 5 is a sectional view taken along the line V–V in FIG 4;

FIG. 6 is a sectional view taken along the line VI–VI in FIG. 1;

FIG. 7 is a sectional view taken along the line VII–VII in FIG. 1; and

FIG. 8 is a sectional view taken along the line VIII–VIII in FIG. 1;

For convenience of description, the terms "upper", "lower", "left", "right", "front" and "rear" and terms of similar import will have reference to the corresponding parts of the structure appearing in FIG. 1, which discloses the front and left sides of a front access display freezer. The terms "inner", "outer" and terms of similar import will have reference to the geometric center of the display freezer shown in FIG. 1 and to the curtain structure of the invention.

SUMMARY OF THE INVENTION

The objects and purposes of the invention, including those set forth above, have been met by providing for a display freezer having an uncovered access opening, a curtain structure having a resiliently flexible sheet which is secured along one edge thereof adjacent one edge of the access opening and which is capable of extending across and covering said access opening. The flexible sheet is prestressed so that it will roll upon itself toward its secured edge unless such rolling is positively prevented by a force, which in most circumstances must be stronger than gravity. The curtain structure also includes holding means near the edge of the sheet remote from the secured edge whereby the remote edge is releasably connected to the display freezer adjacent the opposite edge of said access opening, whereby said sheet substantially covers said access opening.

In a preferred embodiment of the invention, the sheet material is made from moistureproof, transparent plastic having a plurality of very small openings through which a small amount of air can circulate between the two sides of the sheet material to minimize the temperature differential between the surface layers of air on the opposite sides of the sheet material.

DETAILED DESCRIPTION

The food freezer **10** (FIG. 1) illustrates one form of display-type freezer or refrigerator with which the curtain or closure structure **11** of the invention may be used. Briefly, and in a substantially conventional manner, the freezer **10** has a rear wall **12** (FIG. 1), a top wall **13** and a pair of end walls **14** and **15** which are supported upon a base **17**. Shelves **19** and **20** are supported upon and between the end walls **14** and **15** so that they project outwardly from the rear wall **12** in a conventional manner and for the conventional purpose of supporting goods.

Cooled air can be moved from the refrigeration system (not shown) of the freezer **10** upwardly through the frozen food compartment in a conventional manner, as shown in said U.S. Pat. No. 3,241,899.

The freezer **10** has a front wall **26** (FIG. 1) of comparatively short vertical extent and having a frontwardly projecting flange **27** along its upper edge. A tag mold **28**, which is designed to hold price tags **29** (FIG. 3), may be secured to the downwardly extending, front flange **32** on the top wall **13** by nuts and bolts **33**.

The above-described freezer construction is substantially conventional and, therefore, except for certain details thereof which are expressly related to the curtain structure **11**, said freezer construction does not constitute a part of the invention.

The curtain structure **11** (FIGS. 1 and 4) includes a sheet **36** of resiliently flexible material, such as the plastic material known by the trade name of Mylar, which is capable of being prestressed with a substantially permanent curvature of small radius and having a relatively long memory. That is, the characteristics of the sheet material **36** must be such that, when it is curved as appearing in FIG. 3, it can remain in a tight roll fully capable of supporting its own weight, even though it is suspended by a free outer edge and even though it is repeatedly unrolled, as appearing in FIGS. 1 and 4, and is often left in the unrolled position for relatively long periods of time, such as in excess of three or four days. There are several types of plastic materials, particularly those referred to generally as the acetates, which are capable of receiving a substantially permanent curvature or set, as stated above, for serving the purpose of the invention. It will be apparent that certain metals would also be capable of such setting and performance.

The upper or outer free edge portion **35** of the sheet material **36** (FIG. 3) is folded upon itself to provide a reinforced hem or edge element **37**. In the one embodiment, the edge element **37** is placed between the front flange **32** and the tag mold **28** where it is securely held by the bolts **33** which pass through appropriate openings in the tag mold **28**, the front flange **32** and the edge element **37**. An independent stiffening element may be attached to the edge portion **35**, if desired, in place of or in addition to the hem.

The edge element **37** is preferably mounted so that the curtain structure **11** will curl into it retracted or storage position of FIG. 3 adjacent to and rearwardly of the front flange **32** on the top wall **13**. Accordingly, the retracted curtain structure **11** will be very nearly out of sight, hence inconspicuous. Yet, when it becomes desirable to move the curtain structure **11** into its extended position of FIGS. 1 and 4, the lower edge portion **38** can be easily and manually grasped and moved downwardly away from the retracted position adjacent the front flange **32**.

The plastic sheet **36** is preferably folded upon itself along the midline **40** (FIG. 4) which is preferably parallel with and about midway between the upper and lower edge portions **35** and **38**, respectively. Thus, when the curtain is in its retracted position of FIG. 3, the lower edge portion **38** is immediately and readily accessible for manual engagement and subsequent attachment to the flange **27** on the upper edge of the front wall **26**. The curtain need be unrolled only far enough to permit attachment of the lower edge portion **38** thereof the front wall flange **27**, even though the curtain may extend further.

In this particular embodiment, the lower edge portion **38** (FIGS. 5 and 6) of the sheet material **36** is permanently curved upon itself to define a portion of a cylinder **39** having a free edge **41** that forms a broad hook which can extend under and releasably engage the frontwardly projecting flange **27** on the upper edge of the front wall **26**.

In a preferred embodiment of the invention, the sheet material **36** is provided with a plurality of relatively widely spaced and relatively small openings **43** through which small amounts of air can and will move when the curtain structure **11** is in its extended position of FIG. 1. That is, when the refrigeration system is in operation, the movement of the air will produce low-pressure areas adjacent the inner surface of the sheet material **36**, according to well-known and well-understood physical laws, whereby small amounts of air will be drawn through some of the openings **43**. However, this will increase the pressure within the food compartment whereby air will be forced out of said openings in other areas of said sheet material. On the other hand, due to the tendency of the surface layer air on a sheet material to remain relatively static, again according to well-known physical laws, it is thought that the movement of air through the openings **43** will tend to be localized. It has been found that this localized circulation moves the warm air from adjacent the outer surface of the extended curtain **11** into the boundary layer zone adjacent the inner surface of the curtain and thereby maintains a minimal temperature differential between the two surfaces of the sheet material. It is believed that the same circulation will occur when the refrigeration system is not operating and air is moving upwardly along the inner surface of the sheet due to convection currents.

Accordingly, during a defrost cycle, where reasonably normal temperatures and humidities are maintained in the market in which the freezer is located, the dew point will not be reached adjacent the inner surface of the curtain **11**. Thus, condensation will not collect upon the inner surface of the curtain **11**, which contributes heavily to the problem of moisture and contaminating deposits on previous cover devices, as discussed above.

Certain impurities can be deposited upon any cover, including the sheet material **36**, as by the food handlers when said cover is in its operating position. The openings **43** serve the further purpose of ventilating the curtain structure **11**, even when it is in its retracted position of FIG. **3**, so that residual or accumulative contamination is at least minimized. Moreover, moisture can also escape from within the rolled sheet **36** if it has been deposited thereon while the curtain **11** was in use.

It must be emphasized at this point that the amount and location of the openings **43**, while not critical, are such that no appreciable amount of heat loss is developed as the result of their presence in the sheet material **36**. Moreover, it is also pointed out and emphasized that the openings **43** are provided for the express purpose of minimizing, if not eliminating, the problem of condensation occurring upon the inner side of the sheet material **36**, particularly during a defrost cycle, without increasing the heat loss appreciably. In one instance, the ratio between the diameter of the openings **43** and the space therebetween was found to be effective at one to six, where the diameter of each opening was about 1 millimeter.

Where the problem of condensation is not serious, as where fewer defrost cycles are used or required, or where the condensation can be ignored, then the use of sheet material **36** having no openings **43** therethrough may be acceptable.

As an unexpected result of folding the sheet material **36** along a midline **40**, the lateral edges **46** and **47** (FIGS. **5** and **1**, respectively) of the sheet **36** above the line **40** were found to curve outwardly, as shown in FIG. **6** with respect to the edge **47**. Thus, the warmer air rising through the food compartment by convection currents can escape from the food compartment between the edge **47** and the end wall **15**, for example. However, the lateral edges **47A** and **46B** below the midline **40** were found to curve inwardly, as shown in FIG. **7** with respect to the edge **47A**. Thus, escape of the colder air from the lower and central part of the food compartment adjacent the end wall **15**, for example, is obstructed by the edge **47A**.

OPERATION

It will be apparent from the foregoing descriptive material that the curtain structure **11** can be mounted upon a freezer **10**, for operation therewith, by securing the stiffened, upper edge element **37** thereof between the tag mold and the front flange **32** on the top wall **13**. Due to the prestressed curvature in the sheet material **36**, said curtain structure **11** will remain in its retracted and coiled position of FIG. **3** whenever it is not in use. When it becomes desirable to cover the front access opening of the freezer **10**, the lower edge **41** of the curtain structure **11** can be manually grasped and pulled downwardly with the fingers until the lower edge **41** hooks under the flange **27** on the front wall **26**, thereby holding the curtain structure **11** in its extended, operating position of FIG. **1**.

Depending upon the way in which the sheet material **36** is draped across the access opening of the freezer **10**, there will be a slight opening at the opposite ends thereof, particularly along the edges **46** and **47** above the midline **40**. However, by comparison with the size of the uncovered opening prior to the extension of the curtain structure **11**, the amount of uncovered opening along the lateral edges of the curtain is virtually negligible.

The small openings **43** in the preferred embodiment of the invention provide for a small amount of circulation between the boundary layers of air adjacent the opposite sides of the sheet material, whereby a minimal temperature differential is maintained between the opposite sides of said sheet material. Accordingly, as stated above, the dew point is rarely if ever reached on the inner surface of the sheet material, even during a defrost cycle, so that the deposit of condensation on the sheet is at least minimized, if not avoided.

When it becomes desirable to open the curtain structure, the lower edge portion thereof is manually detached from the flange **27** and permitted to follow its natural tendency to coil upon itself until it reaches its retracted position of FIG. **3**.

MODIFIED STRUCTURE

FIG. **8** illustrates a modified lower edge structure **51** for a sheet **36A** which may otherwise be identical with the sheet **36** of FIG. **1**. Specifically, the edge structure **51** includes an edge **52** of the sheet **36A** which is folded upon itself and clamped between the two sides of an elongated, stiffening element **53** having a U-shaped cross section. The element **53** is secured to the lower edge **52** by rivets **54**, one of which secures the upper end of a flexible strap **56** to said element **53**. The lower end of the strap **56** is releasably attached to the front wall **26A** by means of a snap fastener **57** having one part secured to the front wall **26** and the other part secured to the strap **56**.

The curtain structure **11**, or its modified form shown in FIG. **8**, may be used upon an upwardly opening or top access food freezer, also.

Although particular preferred embodiments of the invention have been described above for illustrative purposes, it will be understood that variations or modifications of such disclosures, which do not depart from the scope of the following claims, are fully contemplated.

I claim:

1. In a display-type, refrigerated cabinet having an access opening communicating with the atmosphere, a curtain structure for substantially covering said access opening comprising:

moistureproof and resiliently flexible sheet means having first and second, spaced and opposite edges, said sheet means being folded upon itself approximately midway between said edges to provide two overlapped portions, said sheet means being prestressed so that it will roll upon itself around an axis substantially parallel with and adjacent the fold line with said opposite edges being adjacent the periphery of the roll, said prestress being such that said structure is self supporting in a tightly rolled position when said structure is suspended from said first edge thereof, said sheet means having a plurality of spaced and relatively small openings through which air can move from one side of the sheet means to the other;

means for attaching said sheet means near the first edge thereof to said cabinet near one edge of said access opening whereby said rolled position of said structure is near said one edge of said opening, the distance between said first and second edges of said sheet means being greater than the distance between said one edge and the opposite edge of said access opening; and

first engaging means on said cabinet near the other edge of said access opening and second engaging means connected to said sheet means near the second edge and engageable with said first engaging means on said cabinet for releasably holding said second edge of said sheet means against movement toward said first edge and thereby preventing said sheet means from rolling upon itself.

2. In a display-type, refrigerated food cabinet having a substantially frontwardly facing access opening communicating with the atmosphere, a curtain structure for substantially covering said access opening comprising:

moistureproof and resiliently flexible sheet means having first and second, spaced and substantially parallel edges, said sheet means being folded upon itself along a line approximately midway between said edges to provide two overlapped portions, said sheet means being prestressed so that it will roll upon itself around an axis parallel with and adjacent said fold line, said prestress being such that said structure is self supporting in a tightly rolled position when said structure is suspended from said first edge thereof, said sheet means having a plurality of spaced and relatively small openings through which air can move in small amounts from one side of the sheet means to the other side;

means for attaching said sheet means near the first edge thereof to said cabinet along the upper edge of said access opening whereby said rolled position of said structure is near the upper edge of said opening, the distance between

said first and second edges of said sheet means being greater than the distance between the upper and lower edges of said access opening;

first engaging means on said cabinet near the lower edge of said access opening; and

second engaging means connected to said sheet means near its second edge and engageable with said first engaging means on said cabinet for releasably holding said second edge of said sheet means against movement toward said first edge and thereby preventing said sheet means from rolling upon itself.

3. A curtain structure according to claim 2, wherein said prestress in said sheet means is such that, when said sheet means extends between said upper and lower edges of said access opening, the side edges thereof on one side of the fold line curve away from the plane defined by the sheet means toward one direction and the side edges of said sheet means on the other side of the fold line curve away from said plane toward the opposite direction.

4. A curtain structure according to claim 3, wherein the edges on the upper side portion of said sheet means curve outwardly from the display cabinet and the side edges on the lower portion of the sheet means curve inwardly toward the cabinet, whereby the escape of cold air around the side edges of the lower portion of the curtain is obstructed and the escape of relatively warm air around the side edges of the upper portion is enhanced.

5. A structure according to claim 2:

wherein said sheet means is substantially rectangular and fabricated from substantially transparent plastic material; and

wherein the density of openings for any given material area of said sheet means is substantially constant.