March 7, 1967 J. S. BOOTH 3,307,373

TRANSPARENT REFRIGERATOR DOOR CONTROL

Filed Oct. 22, 1965 2 Sheets-Sheet 1

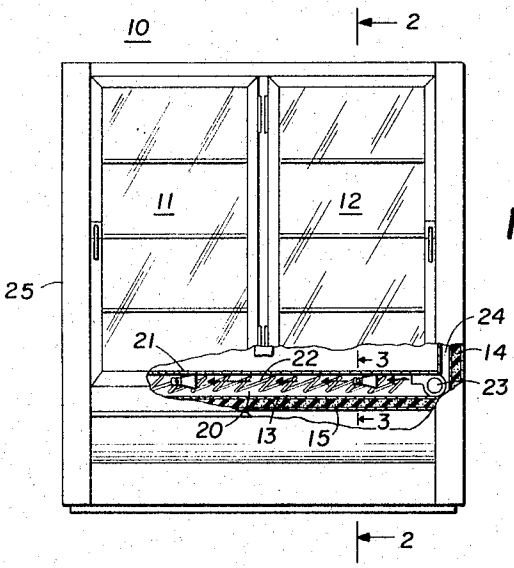


FIG. 1

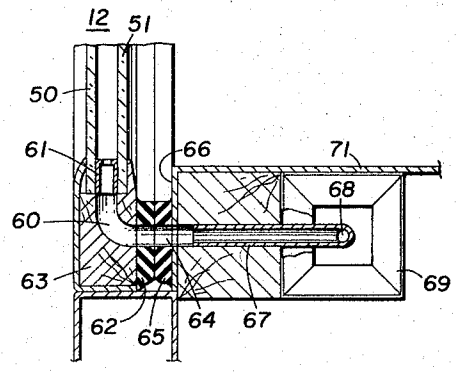


FIG. 3

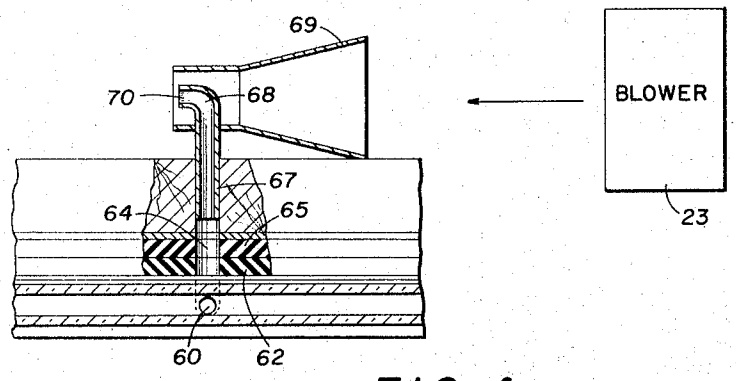


FIG. 4

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TRANSPARENT REFRIGERATOR DOOR CONTROL

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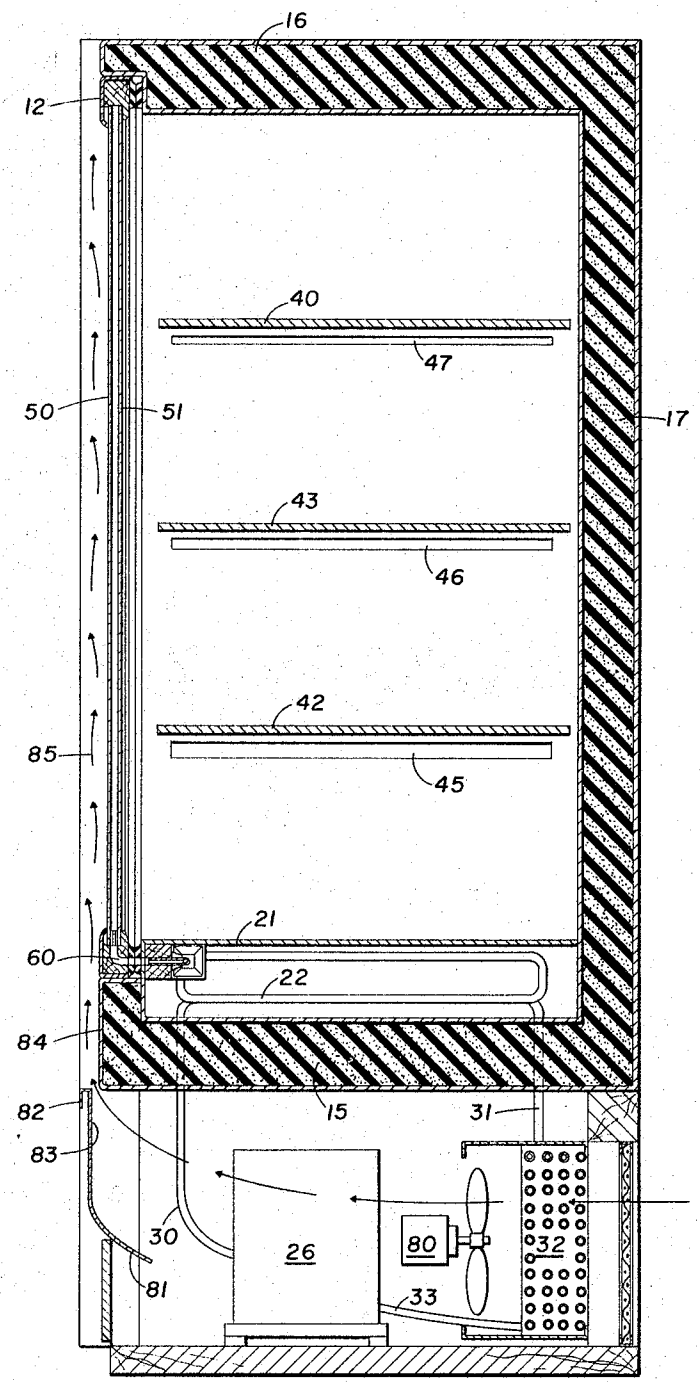


FIG. 2

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TRANSPARENT REFRIGERATOR DOOR CONTROL

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5 Claims. (Cl. 62—248)

This invention relates to the control of transparent multipane doors employed in display refrigeration systems, and more particularly to control of the flow of air in the region of the surfaces of dual pane glass doors.

The present invention is an improvement over applicant's invention disclosed and claimed in U.S. Patent No. 3,025,681. Sealed dual glass paneled doors are employed in refrigerators and in walk-in coolers employed for display and sale of food products that must be maintained cool. Glass paneled doors are employed because they permit the contents to be inspected without opening the doors, thus avoiding loss of cool air.

While the invention described in U.S. Patent No. 3,025,-681 provides for moisture control, the present invention accomplishes the same result in a different manner and with structure which is considerably less expensive. The present invention represents a direct and immediate way of eliminating moisture between double-glassed doors, as well as on the inside and outside of the doors, so that the glass remains clear and merchandise inside may be readily seen. In accordance with the present invention, a refrigerator compartment having forced air circulating therein, with doors having a plurality of spaced transparent panels, is provided with a duct structure which opens at one end within the compartment and at the other end in the space between the transparent panels. The duct structure is severable upon opening the door. Means are provided for developing a pressure lower than ambient pressure and for applying such low pressure to the end of the duct opposite the panels to assure that movement of air through the duct, when the door is closed, will be from between the panels to the compartment.

In a further aspect of the invention, flow of air over the condenser and compressor of the refrigerator is directed upward over the outer face of the transparent panels to eliminate condensation thereon.

In a more specific aspect of the invention, air circulating in the refrigerator compartment is directed through a restricted flow zone to develop, by Venturi action, a reduced pressure at the opening in the compartment of the duct leading from the space between the door panels.

For a more complete understanding of the present invention and for further objects and advantages thereof, reference may now be had to the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a front view of a typical refrigerator embodying the present invention with parts partially broken away;

FIGURE 2 is a sectional view of the unit of FIGURE 1, taken along lines 2—2 of FIGURE 1;

FIGURE 3 is an enlarged sectional view, taken along lines 3—3 of FIGURE 1; and

FIGURE 4 is a top view, partially in section, of the elements of FIGURE 3.

In FIGURE 1, a refrigerator **10** has glass panel doors **11** and **12** which open into a shelved storage compartment having a floor **13**. The side wall space **14** and a like space on the opposite side of the box are filled with insulating material to minimize heat loss. Similarly, the

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space **15** below floor **13** is insulated as is a similar top section **16** and a back section **17**, sections **16** and **17** being shown only in FIGURE 2. Thus, the entire box may readily be insulated except for that portion represented by the door areas. An evaporator coil **22** is located in the space **20** below the bottom of shelf **21**. A blower **23** is positioned as to force air over the coil **22**. The air travels downward to the fan **23** by way of a duct **24**. The air traveling over the coil then passes upward along the side **25** of the box through a similar duct and into the storage compartment in the box through slots in the walls of the left-hand duct.

As best shown in FIGURE 2, a compressor **26** is mounted below the insulated section **15**. A line **30** leads from the evaporator coil **22** to compressor **26**. A return line **31** leads from the coil **22** to a condenser unit **32**. The condenser unit **32** is connected, by way of line **33**, to the compressor **26**.

In FIGURE 2, it will be noted that shelves **42**, **43**, and **44** are located successively above the bottom shelf **21**. Slots **45**, **46**, and **47** in the left-hand wall of the box **10** provide for flow of air leaving the coil **22** into the storage compartment of the box. Similar slots lead from the compartment to duct **24**.

A problem generally encountered in the operation of such units is to keep the glass panels, such as panels **50** and **51**, free of dust and clear from moisture. The door **12** must be repeatedly opened when in use by a store operator or by the trade. The present invention is directed toward maintaining the confronting walls of the glass panes **50** and **51** free from moisture and from dust. Another aspect of the present invention involves maintaining the outer face of the pane **50** free from moisture.

In order to maintain the inside or confronting faces of panes **50** and **51** free from moisture, applicant has provided for the generation of a low pressure or a partial vacuum in the inter-pane space while the door **12** is closed. More particularly, the door **12** supports the panels **50** and **51** in a completely sealed relationship. That is, the entire peripheries of both panels **50** and **51** are sealed in the door frame. However, a duct or passage **60**, best seen in FIGURE 3, extends downward through the spacer **61** between the panes **50** and **51**. The duct **60** then extends through a gasket **62** which is mounted on the inner face of the door frame **63**. A duct **64** then extends through a gasket **65** which is mounted on the face **66** of the portal in which the door **12** is mounted. A tube **67** extends into the duct **64** and, from the frame, to a point beneath the floor **21** of the refrigerator. The tube **67** is formed with a right-angle bend **68** located at the center of an air scoop **69**. As indicated in FIGURE 1, the funnel or scoop **69** has its large end facing the fan **23** so that it diverts part of the air flow from fan **23** into the funnel. A low pressure zone is thus created at point **70** by Venturi action. When this is the case, flow of air from within the refrigerator into the space between the glass panes **50** and **51** is inhibited. Furthermore, whenever the door is closed, a low pressure is immediately applied to the duct **60** so that any air flow will be away from the inter-pane space. By this means, the confronting faces of the panels **50** and **51** can be maintained free and clear from moisture and from dust particles which would be carried with moisture thereto and be deposited on the glass upon evaporation.

It will thus be seen that the air flow in the region of the coils coupled to the compressor **26** is employed for creating a low pressure to control the zone between the

glass panels. At the same time, flow of air across the condenser 32 and across the compressor 26, as produced by the fan 80, is employed to keep the outer face of panel 50 free from condensation. More particularly, the air from fan 80 passes over the compressor 26 and is diverted upward by a scoop 81. The scoop 81 extends the width of the doors and has an upper channel-shaped edge 82, the inner wall 83 of which is spaced outward and beyond the front wall of the frame member 84 which is about flush with the bottom of the door 12. By this means, air propelled across the condenser 32 by fan 80 is directed upward, as along path 85, to sweep the outer surfaces of the doors and thereby to maintain them free from condensation.

While the foregoing description has been confined to a refrigerator unit of the type shown in FIGURE 1, it will be appreciated that the same type of operation may be embodied in walk-in type cooling compartments, where glass paneled access doors are provided in at least one wall of the compartment. The same structure as shown in FIGURES 2–4 may be employed for control of the pressure between such panels. At the same time, a flow of air may be directed upward from the bottom of the doors to wipe the outer surface of the doors free from moisture. Thus, the invention involves a refrigeration unit having a door opening into the storage compartment and having spaced transparent panels. The door is provided with a duct structure opening at one end within the storage compartment and at the other end in the space between the panels. The duct structure is severable upon opening the door. Means are provided for developing a pressure lower than the ambient pressure in the interior of the refrigerator from the air circulation within the storage compartment and for applying low pressure to the end of the air duct to cause any movement through the duct structure, when the door is closed, to be toward the interior of the box and away from the space between the panels.

Thus, in accordance with the invention, a refrigerator having a compressor and condenser in a lower compartment and an evaporator in a superimposed cooling compartment preferably is provided with a door having a frame in which at least two transparent panes are peripherally sealed in air-tight relation. A restricted channel leads through the frame from the space between the panes. A door jamb structure is provided in which the door is hinged and adapted to be locked. The jamb structure has a restricted channel leading therethrough which is in registration with the channel through the frame when the door is locked. A tube has one end extending into the channel in the jamb structure and has Venturi structure at the other end.

A circulating fan in the refrigerator directs air through the Venturi structure to create a low pressure at the end of the tube to induce air flow away from the inter-pane space when the door is locked, thereby to maintain the inter-pane space free from condensation.

Further, a cooling fan is provided for directing an air stream over the condenser and the compressor. An air scoop, located in the path of flow of air from the cooling fan, has an elongated slot-like outlet extending the width of the door immediately below and in front of the plane of the door adjacent to the bottom course of the jamb. By this means, a blanket of air is directed upward across the door to maintain the outer surface thereof free from condensation.

Having described the invention in connection with certain specific embodiments thereof, it is to be understood that further modifications may now suggest themselves to those skilled in the art and it is intended to cover such modifications as fall within the scope of the appended claims.

What is claimed is:

1. In a refrigerator having forced air circulation therein and a door having a plurality of spaced transparent panels, which door is provided with sealing structure which is air-tight upon closure thereof, the combination which comprises

(a) duct structure opening at one end within said refrigerator and at the other end in the space between said panels with said duct structure being severable upon opening of said door, and

(b) means for developing pressure lower than the ambient pressure in said interior from said air circulation and for applying said low pressure to said other end to cause any air movement through said duct structure when said door is closed to be toward said interior.

2. In a refrigerator having forced air circulation therein and a door fitted in a door jamb and having transparent spaced apart door panes, the combination which comprises:

(a) a door frame in which said panes are mounted marginally sealed to said panes and having a duct extending from between said panes to an opening on the inner face of said frame,

(b) a gasket means extending around said door between said inner face and said jamb with a port therethrough aligned with said duct,

(c) a fan for circulating air within said refrigerator, and

(d) duct means extending through said jamb in registration with said port and having structure for generating reduced air pressure from said circulating air to draw air from between said panes.

3. In a refrigerator:

(a) a door having a frame in which at least two transparent panes are peripherally sealed in air-tight relation and having a restricted channel leading through said frame from the space between said panes,

(b) a door jamb structure in which said door is hinged and adapted to be locked, said structure having a restricted channel leading therethrough which is in registration with the channel through said frame when said door is locked,

(c) a tube having one end extending into the channel in said jamb structure and having Venturi structure at the other end, and

(d) a circulating fan in said refrigerator for directing air through the Venturi structure to create a low pressure at said other end of said tube to induce air flow away from said space when said door is locked.

4. The combination set forth in claim 3 in which said Venturi structure includes a truncated cone deflector having an open base facing said fan and said other end of said tube is directed toward the apex of said cone deflector.

5. In a refrigerator having a compressor and condenser in a lower compartment and an evaporator in a superimposed cooling compartment, the combination which comprises:

(a) a door having a frame in which at least two transparent panes are peripherally sealed in air-tight relation and having a restricted channel leading through said frame from the space between said panes,

(b) a door jamb structure in which said door is hinged and adapted to be locked, said structure having a restricted channel leading therethrough which is in registration with the channel through said frame when said door is locked,

(c) a tube having one end extending into the channel in said jamb structure and having Venturi structure at the other end,

(d) a circulating fan in said refrigerator for directing air through the Venturi structure to create a low pressure at said other end of said tube to induce air flow away from said space when said door is locked and maintain the inter-pane space free from condensation,

(e) a cooling fan for directing an air stream over said condenser and said compressor, and

(f) an air scoop in the path of flow of air from said cooling fan having an elongated slot-like outlet extending the width of said door immediately below and in front of the plane of said door adjacent to the bottom course of said jamb for directing a blanket of air upward across said door to maintain the outer surface thereof free from condensation.

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