March 20, 1962 J. S. BOOTH 3,025,681

MOISTURE CONTROLLED REFRIGERATOR OPENINGS

Filed Aug. 15, 1960

FIG. 1

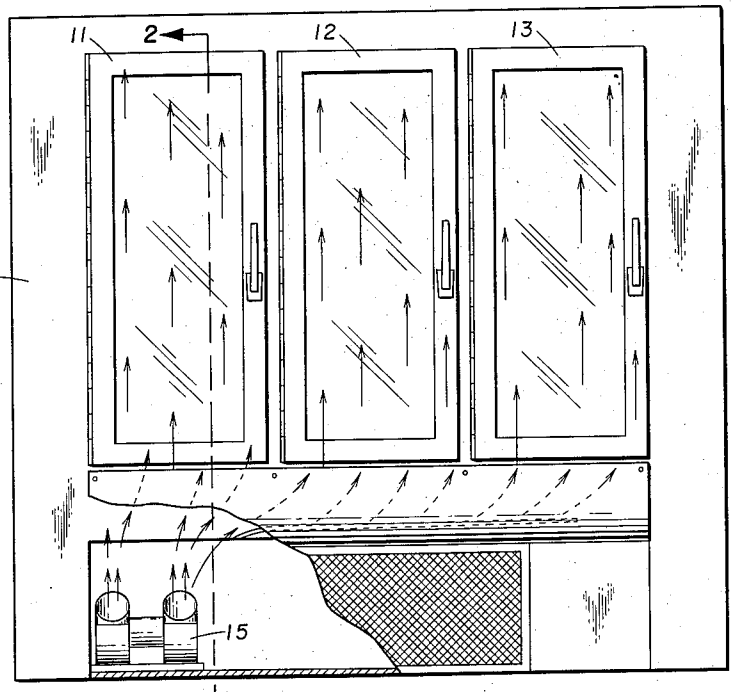
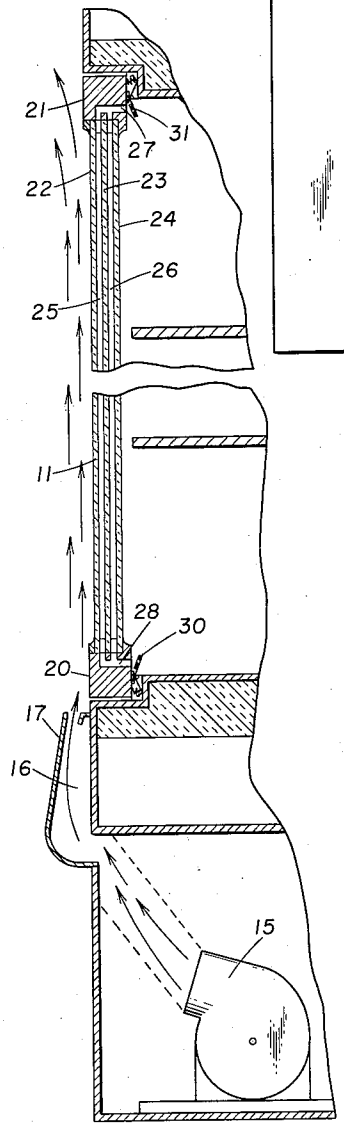


FIG. 2



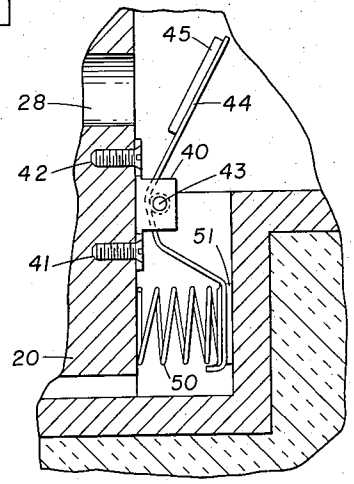


FIG. 3

JOHN S. BOOTH

INVENTOR.

BY D. Bare Richards

United States Patent Office 3,025,681 Patented Mar. 20, 1962

3,025,681

MOISTURE CONTROLLED REFRIGERATOR OPENINGS

John S. Booth, 1400 S. Haskell St., Dallas, Tex.

Filed Aug. 15, 1960, Ser. No. 49,735
5 Claims. (Cl. 62—248)

This invention relates to the art of refrigeration and more particularly to the control of condensation on openings in refrigerators where multi-pane units are employed.

In refrigeration where foods are displayed through windows or panels and where such panels are part of operative doors which are repeatedly opened for removing such foods, difficulty has been experienced in preventing the accumulation of moisture upon the window on both the inside and outside surfaces, and particularly on the inter-pane surfaces of glass forming the windows, and around the edges of the door. Where such units are employed in food dispensing operations, the accumulation of such moisture prevents a clear view of the contents therein and thus renders them less attractive to potential customers. Generally, a plurality of panes of glass are glazed in the windows and doors of such refrigerator units to minimize the heat loss.

In accordance with the prior art, it has been found that the zones between such multi-pane glazed units become sites for the accumulation of moisture which after a period of use causes the panes to become clouded through the deposition of minute dust particles carried in to the inter-pane zones by such moisture. It is difficult if not impossible to effect cleansing of the glass surfaces in the inter-pane areas, so that it is necessary to rebuild or replace a clouded door or window. It has been found that the undesirable effects may, to a degree, be controlled by providing a vent which leads from the interior of the refrigerator to each of the inter-pane spaces so that flow of air from the interior of the refrigerator will maintain the surfaces of the glass free of moisture, except for the periods immediately following the opening of a door and the flow of outside air into the inter-pane zones.

Furthermore, in prior art techniques, there has been employed the use of a fan to blow a blanket of air over the outside of such windows to maintain the outer surface free from moisture. Applicant has found it desirable to use an air blanket which serves to maintain the door gaskets and edges free from the accumulation of ice which would otherwise prevent opening thereof. However, such use tends to increase the circulation through the inter-pane zones when the door is opened.

Applicant has provided a combination of elements whereby the desirable effects of maintaining circulation from the inside of the refrigerator through the inter-pane spaces to maintain the inter-pane surfaces free from condensation may be utilized. At the same time, undesirable effects that may be encountered through the use of an air blanket with such a system are eliminated.

More particularly, in accordance with the present invention, applicant provides a refrigerator in which there is employed the combination of means for directing a blanket of air upwardly over the outside of the refrigerator to maintain the outside surfaces free from condensation. The refrigerator includes a multi-pane door which is adapted to be opened to permit acess to the refrigerator. Flow channels communicating from the inside of the refrigerator through said door frame to the inter-pane spaces permit maintenance of the same atmospheric conditions in the inter-pane spaces as in the refrigerator. Applicant further provides valve means operable upon the closure of the refrigerator door to open said flow channels and to maintain them open until the door is open, said means

being operable then to close said flow channels and prevent any flow of air through said inter-pane spaces when said door is open.

In accordance with a further aspect of the invention, applicant has found that the provision of a normally closed valve for control of air flow into the inter-pane spaces is desirable; applicant provides such a valve normally closed and adapted to be opened upon the closure of the door. In a more specific aspect, a spring biased closure member is mounted on each flow channel leading from the inner face of the door frame to the inter-pane spaces, with means adapted operably to engage the refrigerator body to open said flow channels when said door is closed.

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

FIG. 1 is a front view of a multi-door refrigerator unit of a commercial type;

FIG. 2 is a sectional view of the refrigerator of FIG. 1, taken along the lines 2—2 of FIG. 1; and

FIG. 3 is an enlarged view of the valve element.

Referring now to FIG. 1, there is illustrated an upright refrigerator unit **10** having three doors **11**, **12**, and **13**, which are located at the front of the unit. The doors are glazed to permit visual inspection of the contents. The unit is a commercial type refrigerator conveniently adapted to be used in marketing of groceries and edible foodstuffs which require maintenance at lowered temperatures in order to preserve them. The doors **11**, **12**, and **13** are positioned at a sufficient height that all contents of the refrigerator can be readily viewed. The bottom of the door preferably is at a level to permit the location of the refrigeration elements below the floor of the unit so that a unitary package may be provided.

Applicant provides for the sweeping of the front face of the doors **11**, **12**, and **13** with an upwardly directed air blanket in order to maintain the door faces and door gaskets free from the accumulation of moisture and ice which prevent inspection of the contents of the refrigerator and prevent ready opening of the doors.

The refrigeration mechanism may be of conventional type and has not been illustrated in detail since such mechanisms are well-known in the art. However, applicant has provided a blower unit indicated by unit **15**, mounted in the base of the refrigerator unit **10**, with flow channels directing air toward the front of the unit and upwardly.

More particularly and as shown more clearly in FIG. 2, the blower unit **15** directs the flow of air upward into a distributing plenum chamber **16** formed between a baffle **17** and the front surface of the refrigerator **10**. Baffle **17** extends from substantially below the bottom of the doors **11**—**13**, upward to a point immediately adjacent the bottom of the doors. As shown in FIG. 1, air from blower **15** is distributed through plenum chamber **16** along the entire length of the refrigerator **10** so that there is produced an upwardly directed blanket of air which sweeps the front of the refrigerator to maintain the panes of glass clear on the outside and to maintain the gaskets free from the accumulation of moisture and the formation of ice.

As illustrated in FIG. 2, the door **11** is formed with frame elements **20** and **21** in which three panes of glass **22**, **23**, and **24**, are glazed, being spaced apart one from another to provide inter-pane zones **25** and **26**. The upper frame element **21** is provided with a flow channel **27** which leads from the inside of the door frame to communicate with each of the inter-pane spaces of zones **25**

and 26. In a similar manner, the lower frame element 20 is provided with a passage 28 which permits communication between the inside of the refrigerator and the inter-pane spaces 25 and 26.

In operation of this system it will be recognized that when doors 11—13 are open, there will be an interchange of atmospheric air and refrigerator air so that moisture often accumulates on the glass surfaces to cloud the glass and obstruct the view therethrough. The provision of flow channels 27 and 28 into the inter-pane spaces permits openings such that when the door is closed after having been opened, any condensate on the surface of the glass panes in the inter-pane spaces will rapidly disappear through the equalization of moisture conditions in all of the contents of the box since communication is provided to the inter-pane spaces via passages 27 and 28.

Applicant has found that by providing an upwardly directed flow of air from plenum chamber 16, there is effected a substantial reduction in the loss of cooling when the door is opened, by reason of the fact that the heavier cold air which tends to spill out of the refrigerator upon the opening of the door is met by the upwardly directed blanket of air which provides sufficient force to maintain the cold air inside the refrigerator and permit but a minimum interchange of air. At the same time, the open door in such upwardly directed air stream would tend to experience an increased interchange of air from the outside with the cool air in the inter-pane spaces. Applicant has found it desirable to employ valve elements normally to close the channels 27 and 28 and to cause said channels to be opened upon closure of the door. Valve elements thus employed are activated in response to closure of the door. More particularly, as shown in FIGS. 2 and 3, valve elements 30 and 31 are provided, each being spring loaded and mounted on the door frame elements 20 and 21 respectively. When the door is closed, the valve elements are open. Closure of the door serves to overcome the force of the spring elements therein to open parts 27 and 28. When the door is open, valves 30 and 31 are closed so that there is prevented any interchange of air to the inter-pane spaces.

As shown in the enlarged view of FIG. 3, the valve structure comprises a bracket 40 which is mounted on the inner face of the lower door frame element 20 by screws 41 and 42. The bracket provides pivotal support for a shaft 43 on which there is mounted a valve element comprising a valve arm 44. Arm 44 is mounted on shaft 43 at a central point thereon and is thus cantilevered around the shaft 43. The upper extremity of the valve element 44 is provided with a resilient stop 45 which is positioned completely to close the mouth of channel 28 when the door is open. The other extremity of the valve element 44 has a helical spring 50 attached thereto which exerts force between the inside of the door frame element 20 and the end 51 of the valve element 44. Spring 50 preferably is secured as by soldering or welding to the end 51. When the door is opened, the spring expands, forcing the resilient member 45 into engagement with the face of the frame 20 to close the channel 28. Applicant has found that the use of such closure members both at the upper and the lower edges of the door to close communication channels with the inter-pane spaces is desirable. He has further found it desirable to use such closure members even though the air blanket may not be employed to sweep the front of the refrigerator unit. In the latter case, the natural exchange of air that would be present upon the opening of a door and exposing flow channels 27 and 28 to atmospheric air is completely eliminated so that the inter-pane spaces and the glazed surfaces therein may be maintained clear and unobstructed for long periods of time. Absent such valves, the surfaces gradually become clouded through deposition of dust particles therein upon repeated condensation.

However, applicant has found it to be greatly advantageous to use the combination of an air blanket sweeping the outside of the refrigerator doors and at the same time providing the isolation of the inter-pane spaces through the use of the valves when the door is opened so that all of the advantages of cleanliness and minimal maintenance may be achieved.

It will be seen that applicant has provided a new and novel combination in a refrigerator having a multi-pane glazed door, by providing a combination of frame elements having flow channels leading to the inter-pane spaces, means for maintaining an upwardly directed flow of air over the outer surface of the refrigerator. Valve means normally closed for the channel leading to said inter-pane spaces are adapted to engage the door jamb to open said flow channel only when said door is closed.

Having described certain modifications of the present invention, 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 unit having a storage compartment, the combination which comprises a multi-paned door having framing elements at the top and bottom thereof with passages extending from the inner face thereof to form communication channels extending between each space bounded by said glass panes in said door and said framing element for exchange of air between the inside of said refrigerator unit, closure means for each of said passages secured to said framing elements, and means connected to said closure means adapted to engage said refrigerator unit to open said passages when said door is closed.

2. A display door for a refrigerator case which includes in combination a door frame having an inner face and an outer face, a series of transparent panes mounted in said frame spaced apart one from another to provide air spaces therebetween, said frame having at least one passageway leading from the inner face thereof into communication with the spaces between said panes, a valve associated with said passageway adapted normally to close the same, and a valve actuating element mounted on said door frame and adapted to engage a refrigerator structure for opening said valve when said door is closed.

3. A door for a refrigerator case including a door frame, a plurality of glass panes mounted in said door frame, spaced apart one from another to provide air spaces therebetween, said frame including tubular passageways leading from the inner face thereof to the air spaces between said panes, valve means for normally maintaining said passageways closed, and valve actuating means on the inner face of said door frame adapted to engage said refrigerator case for opening said valves when said door is closed.

4. In a display-type refrigerator, the combination which comprises a door mounted on said refrigerator and hinged at one side for opening outwardly to permit access therein, said door including a frame having a series of transparent panes spaced apart from one another to provide air spaces therebetween, said frame further having tubular passageways, one at the top of said frame and one at the bottom of said frame for connecting the air spaces between said panes with the inside of said refrigerator, an air-control system for directing a blanket of air upwardly along the outer face of said door to maintain said door and the edges thereof free from condensation, and valve means mounted on said door and adapted to close said passageways when said door is opened into said blanket of air.

5. In a display-type refrigerator having at least one door opening, the combination which comprises a door having a frame and a plurality of spaced apart panes mounted therein, said door having means in said frame forming tubular passageways extending from the inner

face of said door to the spaces between said panes, means including a fan and a plenum chamber at the bottom edge of said door and adapted to direct a blanket of air upwardly over the outer surface of said door to maintain the edges thereof free from condensation, and valve means adapted to close said passageways when said door is opened into said blanket of air.

References Cited in the file of this patent

UNITED STATES PATENTS

1,610,244	Bonaccolta	Dec. 14, 1926
1,629,408	Peacock	May 17, 1927
2,660,036	Moore	Nov. 24, 1953
2,706,387	Swanson	Apr. 19, 1955