SINGLE EVAPORATOR, SINGLE FAN REFRIGERATOR INCLUDING CONTROL MEANS

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ABSTRACT OF THE DISCLOSURE

A refrigerator comprising a fresh food storage compartment and means for supplying below freezing air to the compartment including a refrigeration system and a mixing chamber for mixing the refrigerated air from the system with compartment air and introducing the mixture into the compartment. Control means responsive to the temperature of the mixed air includes a thermal mass for preventing short cycle "off" periods of operation of the refrigeration system.

The present invention relates to household refrigerators and is more particularly concerned with a combination refrigerator including a fresh food compartment cooled by a stream of below freezing air and improved temperature control means therefor.

Copending application Ser. No. 455,277 (now Patent 3,520,761) filed May 12, 1963 in the name of Robert E. Gelbard and assigned to the same assignee as the present invention discloses and claims a two-temperature refrigerating including a freezer compartment and a fresh food compartment both of which compartments are maintained at their proper operating temperatures by means including a single evaporator contained within an evaporator chamber separate from the two compartments and a single fan which withdraws air from each of the compartments, passes it in heat exchange relationship with the evaporator and supplies the refrigerated or below freezing air from the evaporator in separate air streams to the two compartments. The refrigerated air supplied to the fresh food compartment is discharged through a nozzle into a mixing hood or chamber so designed that a proportioned amount of fresh food cabinet air is drawn into the mixing chamber by the aspirating effect induced by the flow of air from the nozzle and becomes mixed therewith within the chamber before passing out of the chamber into the fresh food compartment. The operations of the fan and a refrigerating condensing unit for supplying condensed refrigerant to the evaporator are controlled by means of a thermostat including a sensing element subjected to the temperature of the mixed air within the mixing chamber. The mixing chamber is further so constructed and arranged that when the refrigerant condensing means and fan are de-energized at a predetermined low temperature of the mixed air, the sensing element will sense the temperature of the air within the fresh food compartment and will re-energize the condensing means and fan at a predetermined maximum fresh food compartment air temperature.

In the operation of the refrigerator disclosed in the aforementioned Gelbard application it has been found that the exact relative positions of the nozzle and temperature sensing means are critical to consistent operation of the control system and that variations in their relative positions significantly affect compartment temperatures. It is an object of the present invention to provide a control assembly designed to provide a more consistent and uniform operation of a refrigerator of the above type.

Another object of the invention is to provide a unitary control assembly in which all of the essential control components are arranged in their proper operating positions.

Further objects and advantages of the invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims appended to and forming part of this specification.

In accordance with the illustrated embodiment of the present invention, there is provided an improved air flow and control means for a refrigerator of the type described in the Gelbard application characterized by a construction in which one wall of the fresh food compartment liner has a relatively large opening therein and the duct for supplying below freezing air to the fresh food compartment terminates in a cavity formed outside the compartment liner by a dish-shaped member having its edges in contact with the outer surface of the liner surrounding the liner wall opening. A unitary control component including a substantially rectangular plastic panel covering the wall opening is removably secured to the wall and a rigid solid plastic nozzle holder is fixedly secured to the rear surface of the panel adjacent one edge of the opening and in substantial alignment with and spaced from the duct outlet. The holder supports and positions a cellular plastic nozzle having an outlet end slidably received within and positioned by the nozzle holder and an inlet end adapted to extend into the duct outlet. The panel further includes a louvered inlet passage in one end thereof adjacent the nozzle holder while the opposite end of the panel slopes outwardly from the liner to form an air outlet passage communicating with the compartment. Spaced first and second flanges extending from the rear surface of the panel toward the dish-shaped member and on opposite sides of the nozzle holder form with the dish-shaped member a mixing chamber. The flow of refrigerated air from the nozzle induces a flow of air from the compartment into the chamber through the panel inlet passage and mixed refrigerated and compartment air is discharged through the outlet passage into the compartment. Control means for controlling the supply of refrigerated air is also mounted on the rear surface of the panel and includes a temperature sensing means mounted on the sloping end of the panel so that it is responsive to the temperature of the mixed air flowing through the outlet passage.

For a better understanding of the invention reference may be had to the accompanying drawings in which:

FIGURE 1 is a front view of a refrigerator embodying the present invention;
FIGURE 2 is an enlarged vertical sectional view of a portion of the air supply and control components of the refrigerator taken along line 2—2 of FIGURE 1;
FIGURE 3 is a rear view, partly in section of the components shown in FIGURE 2;
FIGURE 4 is a sectional view along lines 4—4 of FIGURE 3; and
FIGURE 5 is a perspective view of one element of the control component.

With reference to the drawings, there is shown a refrigerator comprising insulated walls defining an upper fresh food compartment 1 intended to operate at a temperature above freezing and a lower freezer compartment 2 adapted to operate at a below freezing temperature. The two compartments are separated by an insulated partition 3. The access openings to the two compartments are closed by means of insulated doors (not shown). A machinery compartment 6 in the lower portion of the cabinet contains the refrigerant condensing component of a refrigeration system including a compressor and condenser for supplying condensed refrigerant to an evaporator contained in an evaporator chamber 7 positioned in the rear por-
A control thermostat generally indicated by the numeral 43 is also supported on the panel 24 or more specifically on the rear side thereof with a fan 8 by the flange 32. The thermostat is also provided with an accessible control wheel knob 44 for adjusting the operating temperature of the thermostat. The control capillary or temperature sensing component of the thermostat has its end portion 45 and the flange 46 closely welded on a metal leg 46 secured to the rear surface of the panel 24 within the path of the portion of the air flowing through the outlet passage 27 to the fresh food compartment 1. This metal leg 46 functions as a thermal mass which prevents short "off" cycles and hence possible overheating of the compressor due to a rapid increase in the temperature of the cabinet air immediately following a compressor "on" cycle due, respectively, to door openings. A deflector flange 49 provided within the mixing chamber is provided for directing a specific portion of the mixed air flowing from that chamber into contact with the cabinet air by the numeral 41 and into the fresh food compartment 1. Air from the compartment 1 is withdrawn through passage 12 and into the housing 7.

In accordance with the present invention, there is provided improved means comprising a unitary control component for controlling both the air flow to the fresh food compartment and the operation of the refrigerated air supply means. To this end, the duct 11 is positioned within the insulated space between the rear wall 16 of the liner and the adjacent wall 18 of the outer cabinet shell and, as shown particularly in FIGURE 3, discharges at its upper or outlet end 17 into a flared or substantially dish-shaped component or member 19, the peripheral edges 20 of which are in contact with the rear surface of the liner wall 16. Air entering through the passages 26 becomes mixed with the below freezing air from the duct 11 and the resultant mixed air is discharged through an air outlet passage 27 at the upper end of the panel 24 formed by an outwardly sloping upper portion 28 of the panel and the adjacent edge portion 29 of the liner 16 above the opening 21.

The panel 24 also includes rearwardly extending flanges 32 and 33 disposed on opposite sides of the duct opening 17 for directing the flow of air through the outlet 27. The flanges 32 and 33 in cooperation with the adjacent portions of the member 19 and the panel 24 form a mixing chamber in which the below freezing air introduced through a nozzle generally indicated by the numeral 35 is mixed with the air from the fresh food compartment drawn through the openings 26 by aspirator action. To this end, the outlet end 36 of the nozzle structure is so positioned that the below freezing air is directed into the mixing chamber at a point intermediate its inlet and outlet ends.

Preferably, the nozzle is of the split type including, as shown in FIGURES 3 and 4 of the drawing, spaced outlets 37 and 38. The nozzle is formed of a foam plastic insulating material and each of the outlets 37 and 38 is provided with a damper for controlling the amount of the air flow through the nozzle structure. The dampers 39 are connected to a control wheel 40 partially extending through a slot 41 in the panel 24 so as to be accessible from within the fresh food compartment whereby the dampers 39 can be manually adjusted to regulate the amount of air flowing through the nozzle structure.
air supply means are cooled by the below freezing air flowing through the duct 11, and since the exterior surfaces of the nozzle holder 52 are contacted by relatively moist air from the fresh food compartment 1, frost may tend to collect in certain areas and particularly in the groove 69 between the two stripped portions of the nozzle 35. In order to prevent the accumulation of frost in this area which may interfere with the operation of the control wheel 40, means are provided for maintaining such portions of the nozzle above freezing temperatures. This means comprises a sheet metal member shown more particularly in FIGURE 5. This member generally indicated by the numeral 61 comprises a trough shaped portion 62 adapted to rest within the groove 60 and to contact the surface portions thereof and spaced heat absorbing flanges 63 positioned on the front or the fresh compartment air side of the nozzle holder 52 in the path of the fresh food air flowing through the passages 26. The fresh food air warms flanges 63 and this heat is conducted to the heat exchange portion 62 positioned in the groove 60 below the control wheel 40 thereby maintaining these areas at above freezing temperatures. The portion 62 is preferably shaped so that any moisture collecting thereon will flow forwardly into the compartment 1 and downwardly along the rear liner wall 16.

While there has been shown and described a specific embodiment of the present invention it will be understood that it is not limited thereto and it is intended by the appended claims to cover all such changes and modifications which fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A refrigerator comprising:
   a liner defining an above-freezing storage compartment, said liner including a wall having a substantially rectangular opening therein,
   a substantially dish-shaped plastic member disposed on the outer surface of said liner wall with the periphery thereof in contact with the portions of said wall adjacent said opening,
   refrigerated air supply means for supplying below freezing air to the compartment comprising a refrigeration system including an evaporator operating at below freezing temperatures and a fan for circulating air from said compartment over said evaporator,
   a duct for conducting air from said evaporator to said compartment, said duct extending parallel to the said wall and having an outlet into said dish-shaped member adjacent said opening,
   a unitary control component including a substantially rectangular plastic panel covering said wall opening and removably secured to said wall,
   a rigid solid plastic nozzle holder fixedly secured to the rear surface of said panel in substantial alignment with and spaced from said duct outlet,
   a cellular plastic split nozzle having a pair of spaced outlets slidably received within and positioned by said nozzle holder and including an inlet adapted to extend into said duct outlet,

said panel including a louvered area in one end thereof forming an inlet passage opposite said nozzle holder, the opposite end of said panel sloping outwardly away from said liner to form an air outlet passage communicating with said compartment, said panel including spaced first and second flanges extending from the rear surface thereof towards said dish-shaped member and on opposite sides of said nozzle holder to form with said dish-shaped member a mixing chamber in which the flow of refrigerated air from said nozzle induces a flow of compartment air from said compartment into said chamber through said panel inlet passage for mixing with said refrigerated air before being discharged through said outlet passage into said compartment,
control means mounted on the rear surface of said panel for controlling the cycling operation of said refrigeration system and said fan, said control means including a temperature sensing means mounted on said sloping opposite end of said panel and responsive to the temperature of the mixed air flowing through said outlet passage, and a thermal mass in contact with said sensing means for preventing short cycle "off" periods in the operation of said refrigeration system.

2. The refrigerator of claim 1 comprising:
   air flow control means including a damper in each of said nozzle outlets and a damper control means positioned between said outlets and extending through a slot in said panel, and means for maintaining said holder and the exterior portions of said nozzle at above freezing temperatures comprising a sheet metal member including a first portion in contact with said nozzle within the space between said outlets and a second portion spaced from said nozzle and exposed to the above-freezing compartment air flowing through said panel inlet passages.

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