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J. R. FEHR
REFRIGERATING APPARATUS HAVING MEANS
FOR PREVENTING CONDENSATION
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2,632,313

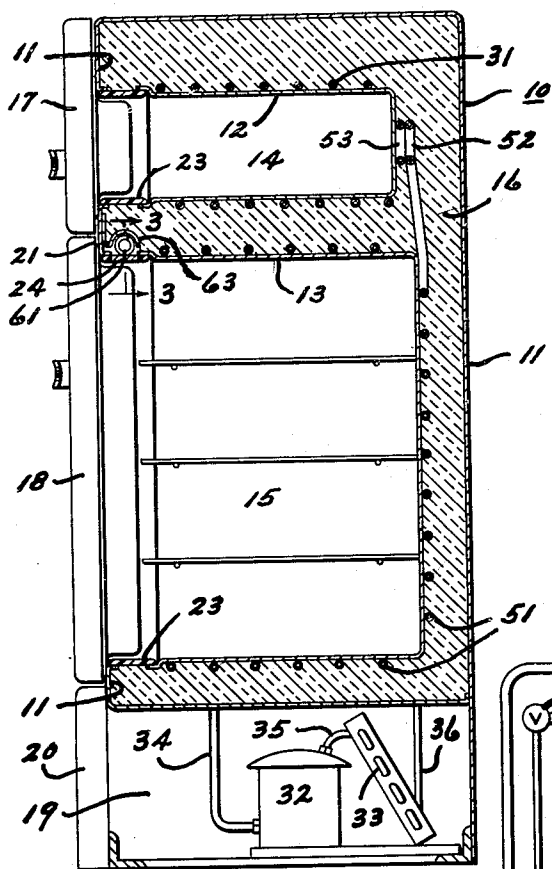


FIG. 2

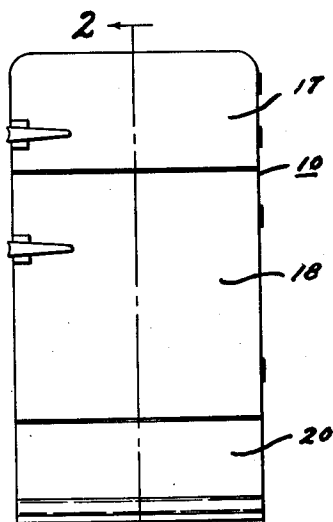


FIG. 1

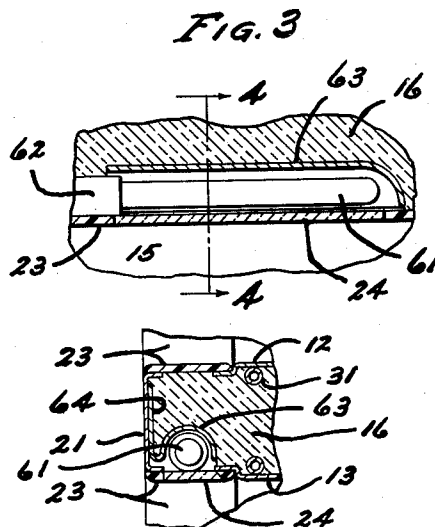


FIG. 3

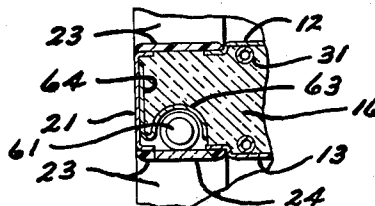


FIG. 4

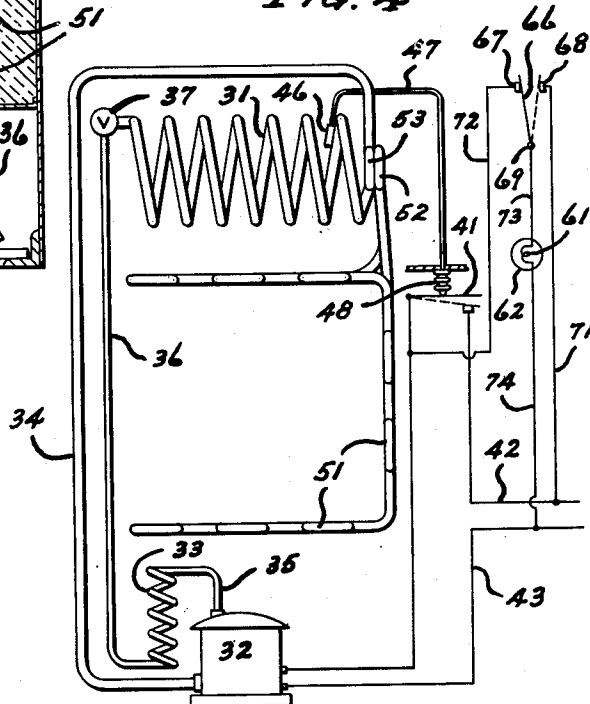


FIG. 5

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REFRIGERATING APPARATUS HAVING
MEANS FOR PREVENTING CONDENSATIONJohn R. Fehr, Dayton, Ohio, assignor to General
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This invention relates to refrigeration and particularly to refrigerated cabinets having refrigerating apparatus installed therein.

Complicated and expensive insulated molding members have been employed in refrigerator cabinet structures to break the metal-to-metal contact between the liner of a compartment within the cabinet and the metal exterior walls thereof adjacent to the compartment access opening normally closed by a door. In spite of the complicated and expensive molding members and elaborate sealing or insulating means heretofore employed about the access opening of refrigerator cabinets entirely satisfactory results have not always been obtained. The low temperature maintained within a refrigerated food storage compartment of a refrigerator cabinet leaks past, or is transmitted beyond the seal on the door which closes an access opening, thus causing condensation and accumulation of moisture on these exposed surfaces of the cabinet. Under certain conditions this moisture may accumulate in sufficient quantity to flow from the surfaces upon which it accumulates onto the floor, but may also cause discoloration and deterioration of the cabinet exterior finish.

An object of my invention is to provide improved means for preventing condensation or accumulation of moisture on the exterior wall surface of a refrigerator cabinet and particularly along a door which closes an access opening leading to the interior of a compartment in the cabinet.

Another object of my invention is to provide means whereby heat generated by an element employed to illuminate the interior of a food storage compartment of a refrigerator cabinet is utilized to warm that portion of the exterior wall surface of the cabinet adjacent the door opening therein, and particularly the mullion or that portion of the exterior wall surface which lies between the doors of adjacent refrigerated compartments.

A further object of my invention is to render the combined illuminating and heating means effective automatically by movement of one of the compartment doors and/or by operation of an element of the refrigerating system associated with the cabinet.

Further advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawing:

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Fig. 1 is a view of a refrigerating apparatus showing the front of a refrigerator cabinet having the present invention embodied therein;

Fig. 2 is an enlarged vertical sectional view of the refrigerating apparatus shown in Fig. 1 taken on the line 2-2 thereof;

Fig. 3 is an enlarged fragmentary sectional view taken on the line 3-3 of Fig. 2, showing illuminating means for one of the compartments of the refrigerator cabinet;

Fig. 4 is an enlarged fragmentary sectional view taken on the line 4-4 of Fig. 3, showing another view of the illuminating means; and

Fig. 5 is a diagrammatic view showing a refrigerating system of the type installed in the refrigerator cabinet of Fig. 2, together with the electrical control circuit associated therewith.

Referring to the drawings illustrating my invention, I have shown in Fig. 1 thereof a refrigerating apparatus including a household refrigerator cabinet having a closed refrigerating system associated therewith. The refrigerator cabinet, generally represented by the reference character 10, includes a plurality of exterior metal walls or panels 11 and a plurality of metal liners 12 and 13 (see Fig. 2) forming walls of an upper food storage compartment 14 and a lower food storage compartment 15 respectively. Insulating material 16 is interposed between the walls 11 and liners 12 and 13 to effectively insulate the compartments 14 and 15 from one another and from the exterior of the cabinet. Each of the compartments 14 and 15 is provided with an access opening in the front wall of cabinet 10. A door 17 normally closes compartment 14, while a door 18 normally closes compartment 15. The exterior metal walls or panels 11 extend downwardly beyond the insulated bottom wall of compartment 15 to provide a machine compartment 19 in the lowermost part of cabinet 10, which compartment is normally closed by door 20. That portion of the exterior cabinet wall 11 at the front of cabinet 10 and located in front of the insulated wall 16 between the liners 12 and 13 forms a mullion 21 extending horizontally across the cabinet between compartments 14 and 15. The mullion 21 cooperates with other front wall surfaces 11 of cabinet 10 to form a bearing surface for gaskets carried by the doors 17 and 18 in order to seal the access openings of the food storage compartments.

Each access opening of compartments 14 and 15 is provided with an insulated throat or breaker strip structure adapted to prevent conduction of heat from the metal exterior walls 11

of cabinet 10 to the metal compartment liners 12 and 13. This throat structure comprises a hard strip or strips of molded insulating or molded plastic material 23 around the sides of the access openings of compartments 14 and 15. Each strip 23 has its one edge secured, in any suitable and well-known manner, to the exterior walls 11 of cabinet 10 and has its other edge secured in any conventional or well-known manner to the edges of liners 12 and 13. The breaker strip 23 across the upper part of compartment 15 is provided with a glass window or with an integrally molded transparent portion 24 (see Figs. 3 and 4) for a purpose to be presently described.

The upper compartment 14 is for the storage or freezing of frozen foods, and is normally maintained at freezing temperatures of from 0° to 10° F. In order to cool compartment 14 to this temperature an evaporator 31 in the form of a conduit coil having its convolutions wrapped around the liner 12 is secured in intimate thermal contact with the exterior wall surface thereof. Evaporator 31 is a part of a closed refrigerating system comprising a refrigerant translating device including a motor-compressor unit 32 and a condenser 33. This refrigerant translating device is mounted in the machine compartment 19 of cabinet 10, as shown. Operation of the unit 32 withdraws evaporated refrigerant from evaporator 31, to cause cooling of the interior of compartment 14 to the temperature range indicated, through conduit 34 (see Fig. 5) whereupon the compressor of unit 32 compresses the refrigerant vapor and discharges same through conduit 35 into condenser 33. The compressed refrigerant is cooled and liquefied in condenser 33, in any suitable or well-known manner, from whence the liquified refrigerant is conducted through conduit 36 to the evaporator coil 31 under the control of a suitable expansion valve or restrictor 37.

Starting and stopping operation of the refrigerant circulating or motor-compressor unit 32 is accomplished by a control switch 41 interposed in electric power line 42 of lines 42 and 43 leading to the motor. Switch 41 has a closed thermostatic system, charged with a suitable volatile fluid, associated therewith and comprising bulb 46, conduit 47 and an expansible member such as a bellows 48 employed to transmit movement to switch 41. Bulb 46 is secured to evaporator 31 to thus render the thermostatic system responsive to temperature changes of the evaporator for causing starting and stopping of the compressor of unit 32.

The lower compartment 15 is ordinarily maintained, for example, between 40° and 50° F., for the storage of food products left over from the table, or foods not requiring freezing temperatures for their preservation. In order to cool the interior of compartment 15 to the temperature indicated, a closed secondary refrigerant circuit is employed in the present disclosure. This closed secondary circuit comprises a refrigerant evaporating portion or coil 51, having a plurality of conduit convolutions secured in intimate thermal contact with the outer surfaces of liner 15, and a refrigerant condensing portion or coil 52 secured in intimate thermal contact with the coil portion 53 of freezing evaporator 31. This secondary circuit and its function is now well known to those skilled in the art and is fully described in the reissue patent to J. L. Gibson, No. 21,040, dated April 4, 1939. Instead of employing the closed secondary circuit as here-

in disclosed, the compartments 14 and 15 may be cooled to their different respective temperatures by two primary evaporators connected in series or in parallel with the refrigerant translating device 32 in a manner also well known to those skilled in the art.

Due to the low temperatures maintained in compartments 14 and 15 and particularly the below-freezing temperature at which the upper food compartment 14 is maintained, a cold zone exists in the vicinity of the door mullion 21. Such a cold zone is a characteristic of the type of refrigerator disclosed wherein two refrigerated compartments are disposed closely adjacent one another. The cold zone tends to chill the outer wall surface of mullion 21 below the dew point of the atmosphere about the refrigerator cabinet thereby causing condensation of moisture on the exterior surface of mullion 21. This moisture accumulates on the mullion 21 at a point intermediate the gasket seal on the lower side of upper door 17 and the gasket seal on the upper side of the lower door 18.

It is therefore the purpose of the present invention to prevent such condensation of moisture on the mullion 21 by heating the same to a temperature above the dew point of the exterior atmosphere so that condensation will not take place thereon, or so that if moisture does condense under extreme conditions it will soon be evaporated upon the application of the heat. A modern refrigerator is generally equipped with a door-controlled electric lamp, usually located on the rear wall of the food compartment, for illuminating the interior of the refrigerator when the access door is opened. I take advantage of the heat emitted by this lamp to supply heat to the mullion 21 and this is accomplished by changing the location of the lamp to a position close to or inside the mullion and so mounting it that substantially all of the available heat is transmitted to the mullion. In my preferred construction I employ an elongated incandescent electric lamp 61 mounted in an electric terminal socket 62 located behind the wall of mullion 21 adjacent to a transparent portion or window 24 in the breaker strip 23 of the access opening leading to compartment 15. A metal reflector member 63 has an extension 64 welded to or otherwise suitably secured in intimate thermal contact with the inner metal wall surface of mullion 21. The arcuate shaped portion of reflector 63 surrounds a part of the lamp bulb 61 and is adapted to reflect light from the bulb through the window 24 into the food compartment 15 to illuminate the interior thereof. Lamp 61 may be energized by a conventional door-operated switch which lights the lamp when the door is opened and deenergizes the lamp when the door is closed again. In some cases the heat thus emitted by the lamp may be sufficient to maintain the mullion 21 dry. However, when the door is opened infrequently or when the humidity conditions of the surrounding atmosphere are unfavorable, this may not be sufficient, and I therefore provide a supplemental or alternative switch control means for closing the circuit to the lamp while the refrigerator door is closed to supply additional heat to the mullion. Such supplemental switch means may be operated manually or automatically by any suitable means, as for example, by the periodic opening and closing of the circuit to the electric motor 32. In the form of the invention shown in the drawings, I employ a switch having a plurality

of contacts in place of the conventional off-on switch operated by opening and closing of door 18. Such a switch comprises a movable arm 66, contact 67, contact 68 and a contact 69 to which the arm 66 is pivotally mounted (see Fig. 5). It is to be understood that any suitable or desirable linkage or like mechanism can be provided between the arm 66 and door 18 to cause movement of the arm 66 when the door 18 is opened or closed. Contact 68 of this door operated switch is connected by wire 71 direct to power line 42, while contact 67 is connected by wire 72 to power line 42 at a point intermediate the refrigerating system control switch 41 and motor 32. Contact 69 is connected by wire 73 to one terminal of the lamp socket 62, the other terminal of which is connected by wire 74 with power line 43. The electric circuit described causes the lamp 61 to be energized, through switch arm 66 and contact 68, whenever the cabinet door 18 is opened irrespective of whether or not the motor-compressor unit 32 is operating. Lamp 61 will also be energized whenever the circuit to the motor of unit 32 is completed, the lamp circuit in this case being from power line 42 through switch 41, wire 72, contact 67, switch arm 66, contact 69, wire 73, lamp 61 and wire 74 to power line 43. Thus the lamp 61 will be intermittently energized, to transfer heat generated thereby to the outer wall portion of mullion 21, irrespective of whether or not the door 18 of compartment 15 is opened or closed. The intermittent energizing of lamp 61 causes heat generated thereby to be absorbed by the metal reflector member 63 and due to the contact of reflector 63 with the outer metal wall portion of mullion 21, as hereinbefore described, the outer surface of the mullion is heated above the dew point of the atmosphere exteriorly of cabinet 10 to thereby prevent condensation of moisture thereon. In Fig. 5 of the drawing, the movable arm 66 of the door-operated switch is shown in its full line positions and in engagement with contact 67. The temperature responsive switch 41 of the refrigerating system is shown with its switch arm in full line or open circuit position. In this position of the switches no current can pass from the power lines 42 and 43 to lamp 61 nor to the motor of unit 32. If now door 18 to food compartment 15 is opened the movable arm 66 of the door-operated switch will be actuated to the dotted line position shown in Fig. 5 into engagement with contact 68. When arm 66 engages contact 68 current flows from power line 42 by way of wire 71, contact 68, switch arm 66, wire 73, lamp bulb 61, and wire 74 to line 43 to energize the lamp. So long as door 18 remains open, the lamp 61 is energized and heat generated thereby is transferred or conducted to the door mullion 21 by or through the reflector member 63 and extension 64. Movement of door 18 to closed position again actuates the door-operated switch arm 66 into its full-line position in engagement with contact 67 to render the lamp 61 ineffective.

When the temperature of evaporator 31 increases, due to refrigeration demands placed thereon, the volatile fluid in the thermostatic system expands and causes extension of the bellows 48 to thereby actuate the arm of switch 41 into engagement with its contact as shown in dotted lines in Fig. 5. Engagement of the arm of switch 41 with its contact completes the electric circuit from power line 42 to power line 43 through the motor of unit 32 to cause opera-

tion of the motor and consequently the compressor of the refrigerant translating device to effect a lower temperature of evaporator 31. At this same time the lamp 61 is energized or rendered effective by current flowing from power line 42, through switch 41, wire 72, contact 67, arm 66 of the door-actuated switch, contact 69, wire 73, lamp bulb 61, and wire 74 to power line 43. Thus the lamp 61 is energized each time the motor of the refrigerating system operates and should door 18 be opened while the motor is operating, movable arm 66 of the door-actuated switch will simply move to the dotted line position shown to complete the alternate electric circuit to the lamp 61 as before described. Thus the lamp will remain energized so long as the motor is running or the door 18 is open.

From the foregoing it will be apparent that I have made an improvement invention by utilizing the lamp employed to illuminate the interior of a food storage compartment of a refrigerator cabinet to perform the double purpose herein described. My improved apparatus eliminates the necessity of providing an extra heater and the attendant wiring circuit for warming the door mullion, in addition to a food compartment lamp. In my novel arrangement the food storage compartment will be illuminated each time the door affording access thereto is opened while at the same time I insure that the door mullion is sufficiently warmed to prevent condensation of moisture thereon even though the food compartment door may not be opened for long periods of time.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A refrigerating apparatus comprising in combination, walls forming a cabinet having a food storage compartment therein, said compartment being provided with an access opening, a movable door having a part thereof normally engaging a wall of said cabinet about said access opening for closing same, a refrigerating system comprising means for cooling said compartment and a refrigerant translating device including a refrigerant circulating unit, means for illuminating the interior of said compartment, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said cabinet adjacent said compartment access opening for transferring heat generated thereby to said cabinet outer wall portion, and said illuminating means being normally ineffective and rendered effective automatically by operation of said refrigerant circulating unit.

2. A refrigerating apparatus comprising in combination, walls forming a cabinet having a food storage compartment therein, said compartment being provided with an access opening, a movable door having a part thereof normally engaging a wall of said cabinet about said access opening for closing same, a refrigerating system comprising means for cooling said compartment and a refrigerant translating device including a refrigerant circulating unit, means for illuminating the interior of said compartment, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said cabinet adjacent said compartment access opening for transferring heat generated thereby to said cabinet outer wall portion, and said illu-

minating means being normally ineffective and rendered effective automatically by movement of said door and/or by operation of said refrigerant circulating unit.

3. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with a first food storage compartment and a second food storage compartment insulated from one another and each having an access opening with a mullion therebetween, a movable door for each of said compartment access openings, each of said doors having a part thereof normally engaging said mullion and other portions of an outer wall of said cabinet about said access openings for closing same, a refrigerating system comprising means for cooling said compartments and a refrigerant translating device including a refrigerant circulating unit, means for illuminating the interior of one of said compartments, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said mullion for transferring heat generated thereby to said mullion outer wall portion, and said illuminating means being normally ineffective and rendered effective automatically by operation of said refrigerant circulating unit.

4. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with a first food storage compartment and a second food storage compartment insulated from one another and each having an access opening with a mullion therebetween, a movable door for each of said compartment access openings, each of said doors having a part thereof normally engaging said mullion and other portions of an outer wall of said cabinet about said access openings for closing same, a refrigerating system comprising means for cooling said compartments and a refrigerant translating device including a refrigerant circulating unit, means for illuminating the interior of one of said compartments, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said mullion for transferring heat generated thereby to said mullion outer wall portion, and said illuminating means being normally ineffective and rendered effective automatically by movement of the door of said one compartment and/or by operation of said refrigerant circulating unit.

5. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with an upper food storage compartment and a lower food storage compartment insulated from one another and each having an access opening with a mullion therebetween, a movable door for each of said compartment access openings, each of said doors having a part thereof normally engaging said mullion and other portions of an outer wall of said cabinet about said access openings for closing same, a refrigerating system comprising means for cooling said compartments and a refrigerant translating device including a refrigerant circulating unit, an insulating breaker strip extending around the access opening of said lower compartment and disposed between the liner thereof and the cabinet outer wall, that part of said breaker strip along the upper wall of said lower compartment including a transparent portion, an incandescent electric lamp located within the insulated wall between said compartments and adapted to direct rays emitted therefrom through said transparent portion of said breaker strip into said lower compartment for illuminating the

interior thereof, said lamp being disposed in heat exchange relationship with an outer wall portion of said mullion for transferring heat generated thereby to said mullion outer wall portion, and said lamp being normally ineffective and rendered effective automatically by movement of said door of said lower compartment and/or by operation of said refrigerant circulating unit.

6. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with an upper food storage compartment and a lower food storage compartment insulated from one another and each having an access opening with a mullion therebetween, a movable door for each of said compartment access openings, each of said doors having a part thereof normally engaging said mullion and other portions of an outer wall of said cabinet about said access openings for closing same, a refrigerating system comprising means for cooling said compartments and a refrigerant translating device including a refrigerant circulating unit, an insulating breaker strip extending around the access opening of said lower compartment and disposed between the liner thereof and the cabinet outer wall, that part of said breaker strip along the upper wall of said lower compartment including a transparent portion, an incandescent electric lamp located within the insulated wall between said compartments above said transparent portion of said breaker strip, a metallic member around a portion of said lamp for directing rays emitted therefrom through said transparent portion of said breaker strip into said lower compartment to illuminate the interior thereof and for absorbing heat generated by said lamp, said metallic member having a part thereof in intimate thermal contact with an outer wall portion of said mullion for transferring heat absorbed thereby from said lamp to said mullion outer wall portion, and said lamp being normally ineffective and rendered effective automatically by movement of the door of said lower compartment and/or by operation of said refrigerant circulating unit.

7. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with a first food storage compartment and a second food storage compartment adjacent thereto and insulated from one another, each of said compartments having an access opening with a mullion therebetween, a movable door for each of said compartments and normally closing the access opening thereof, a refrigerating system associated with said cabinet, said system comprising means for cooling one of said compartments below 32° F., means for cooling the other of said compartments above 32° F. and a refrigerant translating device including a refrigerant circulating unit connected in closed circuit relation with at least one of said cooling means, means for illuminating the interior of one of said compartments, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said mullion for transferring heat generated thereby to said mullion outer wall portion, and said illuminating means being normally ineffective and rendered effective automatically by operation of said refrigerant circulating unit.

8. A refrigerating apparatus comprising in combination, a plurality of walls forming a cabinet provided with a first food storage compartment and a second food storage compartment adjacent thereto and insulated from one another, each of said compartments having an access

opening with a mullion therebetween, a movable door for each of said compartments and normally closing the access opening thereof, a refrigerating system associated with said cabinet, said system comprising means for cooling one of said compartments below 32° F., means for cooling the other of said compartments above 32° F. and a refrigerant translating device including a refrigerant circulating unit connected in closed circuit relation with at least one of said cooling means, means for illuminating the interior of one of said compartments, said illuminating means being disposed in heat exchange relationship with an outer wall portion of said mullion for transferring heat generated thereby to said mullion outer wall portion, and said illuminat-

ing means being normally ineffective and rendered effective automatically by movement of the door of one of said compartments and/or by operation of said refrigerant circulating unit.

JOHN R. FEHR.

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