Oct. 15, 1957 H. L. SOUTHWORTH 2,809,402

DOOR STRUCTURE FOR REFRIGERATORS

Filed Jan. 5, 1953

Fig. 1

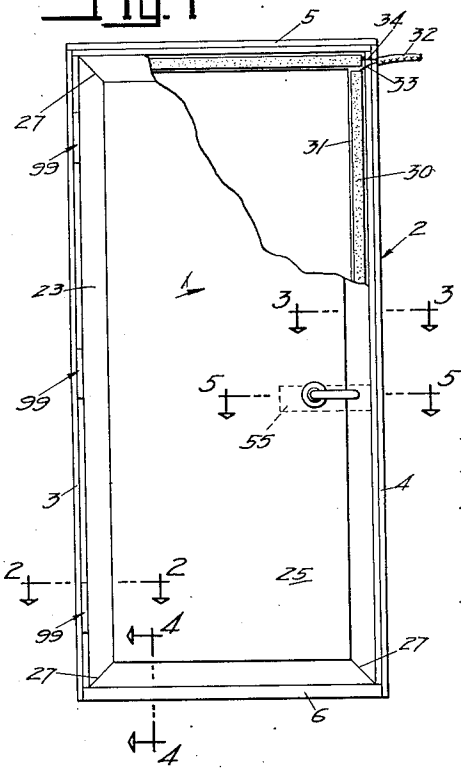


Fig. 3

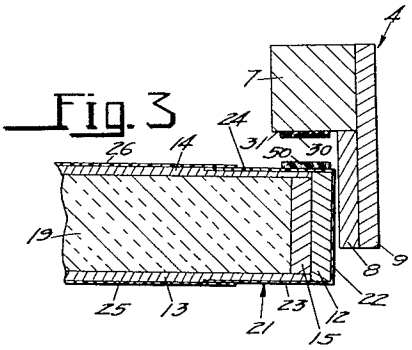


Fig. 4

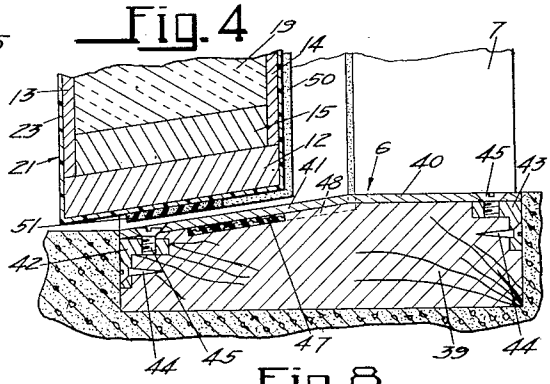


Fig. 2

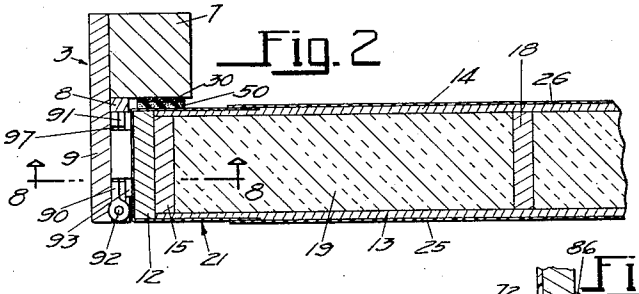


Fig. 8

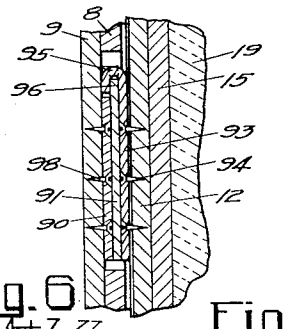


Fig. 6

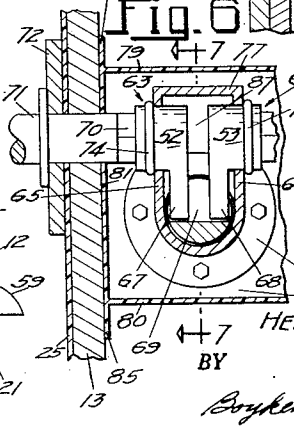


Fig. 7

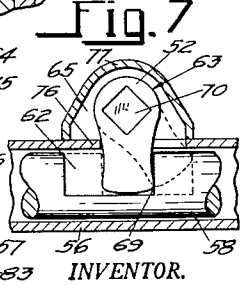
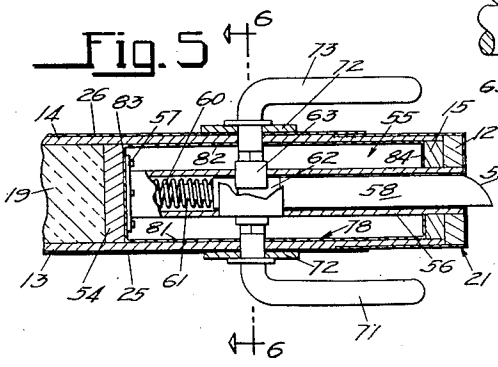


Fig. 5



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DOOR STRUCTURE FOR REFRIGERATORS

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5 Claims. (Cl. 20—35)

This invention relates to doors and more particularly to a door and frame structure suitable for cold storage refrigerators of the type in which the temperature may reach as low as —30° F.

In refrigerator door installations, difficulty is frequently experienced in preventing warpage of the door. Such warpage is caused to a great extent by the flow of vapor to and from the interior of the door and results in undesirable heat leakages in many instances.

It has been customary in the past to guard against warpage by the addition of structural members in the manufacturing process. This results in the weight of the door being increased thus making the opening and closing of the same a more strenuous operation and increasing the likelihood of injury to the door and frame when the door is slammed shut.

In addition, when the temperature inside the refrigerator is very low, the door and frame tend to stick together due to freezing of any moisture or water vapor on the door or door frame. This creates a resistance to opening a closed door which, when added to the effort required to move the door, sometimes necessitates the use of extraordinary mechanical means to pry the door open.

The main object of the present invention is to provide a novel door and frame construction which not only eliminates warpage of the door, but also results in the door being made considerably lighter than heretofore possible.

Another object of the invention is the provision of a door and frame construction in which freezing of the door to the frame is effectively prevented.

Still another object of the invention is the provision of a novel latch mechanism for locking the door shut and which mechanism is actuatable from inside the refrigerator so that there is no possibility of a person being locked within the refrigerated space.

Yet another object of the invention is the provision of a novel means for hingedly securing the door to the frame so as to permit exact registration of the door and corresponding frame opening during manufacture and also when the door is installed in the frame.

Another object of the invention is the provision of a novel latch actuating means including a pair of handles operable from opposite sides of the door and constructed to prevent undesirable transmission of heat from one handle to the other.

Other objects and advantages will be apparent from the following specification and from the drawings.

Fig. 1 is a front elevational view of a door and surrounding frame showing my new construction. A portion of the door is broken away to show the frame structure.

Fig. 2 is an enlarged horizontal cross-sectional view through the door as taken along lines 2—2 of Fig. 1 and illustrating the general construction of the same and showing the hinge structure.

Fig. 3 is a greatly enlarged horizontal cross-sectional view through the door jamb on the latch side of the door and showing the door slightly open relative to said jamb.

Fig. 4 is a greatly enlarged fragmentary cross-sectional view through the sill of the door frame as taken along lines 4—4 of Fig. 1 and showing the door partly open relative to said sill and illustrating the manner of installing the sill in a concrete floor.

Fig. 5 is an enlarged horizontal cross sectional view through the latch mechanism as taken along lines 5—5 of Fig. 1.

Fig. 6 is a greatly enlarged vertical cross-sectional view through the latch bolt as taken along lines 6—6 of Fig. 5.

Fig. 7 is a longitudinal sectional view through a portion of the latch bolt as taken along lines 7—7 of Fig. 6.

Fig. 8 is a vertical cross-sectional view through the jamb and door adjacent the hinge structure showing the latter in section.

In detail, the invention comprises a refrigerator door generally designated 1 and a door frame 2. The frame comprises a pair of vertical, opposed jambs 3, 4, a head piece 5 and a sill 6.

The frame 2 includes a door stop 7 (Fig. 3) extending along the length of the jambs 3, 4 and the head piece 5. This door stop is preferably about 2½" x 2½" in cross-section for a 3' x 6'-6" standard door and will, of course, vary with the size of the door desired.

The jambs 3, 4 are preferably constructed from two lengths 8, 9 of ⅝" plywood secured together and to the door stop as best seen in Fig. 3 with the outer length 9 overlapping the stop 7 and the inner length 8 abutting said stop.

The door 1 is formed with an inner hollow body defined by plywood walls as best seen in Figs. 2, 3. The inner door body is preferably formed with an outer strip 12 of ⅝" plywood which peripherally encircles the door and a pair of opposed relatively thin plywood sheets 13, 14 butted against the inner margins of strip 12.

To provide additional reinforcement around the margins of the doors an inner strip 15 of ⅝" plywood, slightly narrower than strip 12 is secured to the latter and also to the sheets 13, 14 as seen in Figs. 2, 3, 4 thus providing a strong corner joint. At spaced points along the width and length of door 1 are stiffeners 18, preferably of ⅝" plywood, which extend between and are secured to the outer sheets 13, 14.

By the above described structure, it will be apparent that an inexpensive, rigid hollow body is formed which may be filled with any desired insulation 19 such as the type known to the trade as "Fiberglas."

Inasmuch as the door is constructed of wood, the same would be subject to warpage after a period of use due to the passage of vapor into and out of the interior of the door by the passage of vapor through the non-tight seams of the plywood layers.

To obviate such leakage, I provide a sheath of vapor-tight material around the door.

This sheath preferably comprises a channel member 21 of tough plastic having a bottom 22 and a pair of opposed legs 23, 24 (Fig. 3). This channel 21 is adherently secured to the top, bottom and opposite lateral side edges of the door 1 by any suitable cement with the bottom 22 engaging the outer plywood strip 12 and with the legs 23, 24 engaging the outer marginal surfaces of the plywood sheets 13, 14. In this connection, it is preferable that the plywood sheets 13, 14 be relieved as best seen in Fig. 3 to receive legs 23, 24 of channel 21 so that the outer surfaces of said legs are coplanar with the outer surfaces of said sheets.

To complete the vapor tight sheath surrounding the inner door body I provide sheets **25**, **26**, of plastic similar to channel **21** and which sheets cover the outwardly directed faces of plywood sheets **13**, **14** respectively. These sheets **25**, **26** are preferably large enough to lap over a portion of legs **23**, **24** of channel **21** so that a vapor tight joint may be effected by means of a suitable cement.

The material of channel **21** and sheets **25**, **26** is preferably a fiberglass reinforced polyester resin of about 1/16" thickness. This material is extremely tough due to the fiberglass reinforcement and has the important characteristic of being substantially unaffected by extremes of temperature and other changes in atmospheric conditions. Such material is known to the trade by various trade-names such as "Plexolite."

The plastic sheets **25**, **26** may be conveniently installed with an integral backing of plywood similar to sheets **13**, **14** if desired. In any event, such backing or sheets **25**, **26** need not exceed about 1/4" in thickness for a 3' x 6'–6" door such as described herein.

The legs **23**, **24** of channel **21** may be notched at the points where the same is bent to form the corners of the door and the side edges of such notches butted together as indicated at **27** (Fig. 1) and cemented in any suitable manner to effect a vapor tight joint.

To prevent freezing of the door to the frame, I provide a ribbon **30** (Fig. 1) of conductive rubber secured to the door engaging face **31** of door stop **7**. This ribbon **30** is resilient and bendable in like manner as a strip of rubber, but is impregnated with fibers of material adapted to conduct electricity so that said ribbon, in effect, becomes a heating element. Thus, in addition to acting as a gasket, ribbon **30** also functions to heat the door and frame at their points of engagement. Preferably, the ribbon **30** is made in one length although several standard lengths may be joined together if desired. Electricity is conducted to said ribbon **30** by a cable **32** including a pair of wires **33**, **34** which may be respectively connected to opposite ends of the ribbon **30** (Fig. 1). The jamb members **8**, **9** may be apertured as desired for passing said wires **33**, **34**.

The ribbon **30** of conductive material per se is old and no claim is made to the same herein except in combination with the door and frame. In the trade, the material forming the ribbon is sometimes referred to by the trade-name "Uskon."

The sill **6** of the door frame preferably comprises an elongated relatively heavy block of redwood **39** extending between the jambs **3**, **4** and, if the adjoining floor is of concrete, as is usually the case, the block **39** may be embedded in said concrete as best seen in Fig. 4. In such a case, the depth of the block **39** is preferably such that a metal plate **40** may be secured to the top of block **39** so that the upper surface of plate **40** is flush with the surface of the floor.

Preferably, the floor level within the refrigerator is slightly higher than the floor level outside the refrigerator so that plate **40** must be bent to provide a downwardly and outwardly sloping portion **41** against which the refrigerator door is adapted to seal. Inasmuch as trucks and other vehicles are usually moved into and out of the refrigerator, during the normal use of the latter, the plate **40** is preferably made replaceable so that a new plate may be installed after the old one is worn.

To this end the redwood block **39** is provided along its longitudinal side edges with angles **42**, **43** which may be secured to block **39** by wood screws **44**. Angles **42**, **43** are disposed with one leg horizontal as best seen in Fig. 4 and said legs may be tapped to receive screws **45** which are passed through countersunk holes in plate **40**.

The sill block **39** is provided with an upwardly opening groove adjacent slanting portion **41** of plate **40** and which groove is adapted to receive therein the lower horizontal run **47** of ribbon **30** (Fig. 4). Additional grooves as required in block **39** may be provided to permit ribbon **30** to be run laterally as at **48** from the plane of door stop **7** to the horizontal run **47**.

From the above described structure, it will be apparent that the heating element or ribbon **30** will serve to heat the metal plate **40** which, being heat transmissible will, in turn, serve to locally heat the surface of engagement between plate **40** and the gasket on door **1**.

The door gasket **50** may be in any convenient form but preferably is of a width about equal to the width of the heating element ribbon **30**. This gasket **50** may be adherently secured to the inner leg **24** of channel **21** along the vertically extending margins of the door and along the head piece.

At the lower edge of the door, the gasket is directed along the outer side of the bottom **22** of channel **21** and extends in a horizontal run **51** along said bottom. It will be understood in this connection that the bottom edge of the door is biased as best seen in Fig. 4 so that the same is complementary to slanted portion **41** of sill plate **40**.

It will thus be apparent that the gasket **50** is heated along its entire length by the heating element **30** which, when conducting electricity, effectively prevents freezing of the door to the frame.

Inasmuch as the locking mechanism for the door must be arranged so that no vapor can pass therethrough into the interior of the door, I have provided a novel locking mechanism for this purpose having certain additional advantages which will subsequently be pointed out.

Referring to Figs. 1, 5 and 7 the locking mechanism, generally designated **55**, comprises a latch bolt housing **56** which may conveniently be formed from a length of pipe. One end of housing **56** is passed through a suitable aperture formed in plywood strips **12**, **15** and is secured at its opposite end by means of an integral flange **57** to a vertical plywood stiffening strip **54** similar to the stiffeners **18** hereinbefore described.

Reciprocably mounted in housing **56** is an elongated latch bolt **58** which is provided at its outer end with a biased portion **59** adapted to engage a conventional strike plate (not shown) on the frame in the usual manner. The latch bolt **58** is urged to projected position at all times by a compression spring **60** extending between the inner end of housing **56** and the inner end of latch bolt **58** (Fig. 5). The latch bolt **56** is preferably provided with a reduced inwardly extending portion **61** to serve as a retainer for spring **60**.

Intermediate its ends, latch bolt **58** is provided with an upwardly opening recess **62** which is adapted to receive therein the lower ends of a pair of transversely spaced cams **63**, **64** (Figs. 6, 7). Cams **63**, **64** are provided at their upper ends with cylindrical portions **52**, **53** respectively which are rotatably supported in upwardly extending ears **65**, **66** integral with housing **56**. As best seen in Fig. 7, the lower ends **67**, **68** respectively of cams **63**, **64** are adapted to engage the inner end **69** (Fig. 7) of recess **62** when said cams are rotated counterclockwise (Fig. 7) and urge said latch bolt inwardly for retracting the latch bolt to permit opening the door.

Cylindrical portion **52** of cam **63** is centrally provided with a horizontally extending square hole for receiving the complementary formed square end **70** of handle **71** (Figs. 6, 7). Handle **71** is passed through a suitable opening in the outer face of door **1** and is rotatably supported in a bearing plate **72** secured by any suitable means such as wood screws to the plywood sheet **13**. In an identical manner, handle **73** is carried by the inner plywood sheet **14** on the inner face of the door (Fig. 5) for operating cam **64**. Spring retainer rings **74**, **75** may be received in complementarily formed annular grooves in cylindrical portions **52**, **53** for preventing shifting of cams **63**, **64** axially of handles **71**, **73**.

From the above described structure, it will be apparent that downward swinging of either handle will urge the latch bolt **58** to retracted position. Upon slamming the door,

the latch bolt will be retracted in the usual manner against the urging of spring **60**.

The ears **65**, **66** which rotatably support the cams **63**, **64** are provided with a hood portion **77** which may be integrally welded to said ears and also to the upper side of pipe housing **56** so as to seal the inside of the door against vapor which might pass through the housing **56** alongside latch bolt **58**.

To limit the outward movement of latch bolt **58** to its projected position, the upper side of the pipe housing **56** may be extended inwardly as at **76** (Fig. 7) to prevent clockwise rotation of cam **63** beyond the full line position of Fig. 7.

Completely surrounding the latch mechanism hereinbefore described is a casing generally designated **78** having top and bottom walls **79**, **80**, lateral sidewalls **81**, **82** and inner and outer end walls **83**, **84**. This casing **78** is completely vapor tight being formed from sheets of fiberglass reinforced plastic with the walls adherently secured together by cement. Outwardly extending flanges **85**, **86** may be provided integral with said casing to assist in cementing the casing to the inner sides of plywood sheets **13**, **14**. Said casing may be suitably apertured for passing handles **71**, **73** and latch bolt housing **56**, but inasmuch as the casing is adherently secured to the plywood door sides no escape of vapor between the casing and the plywood is possible. In addition, it will be understood that should vapor enter the interior of casing **78**, either through the latch bolt or handle openings, entrance of such vapor to the hollow interior of the door is nevertheless effectively prevented by the vapor tight casing **78**.

It should be noted at this point that one door handle may be operated independently of the other and if a locking means (not shown) is provided on the outside of the door to prevent unauthorized entrance to the refrigerated space, the inner handle may nevertheless be operated to open the door if someone is inadvertently locked inside. This satisfies the safety requirements of existing state statutes.

The latch mechanism hereinbefore described has the additional advantage of not providing a metallic connection between the inner handle **73** and outer handle **71**. Thus the space **87** between cams **65**, **66** eliminates heat loss through the conduction of heat from handle **71** to handle **73** and prevents the former from becoming uncomfortably cold.

The present invention also contemplates the provision of a novel hinge structure by which the door is more readily fitted to the frame than heretofore possible and by which hinge structure entrance of vapor to the interior of the door is effectively prevented.

Referring to Figs. 2 and 8, the inner plywood strip **8** of jamb **3** is cut away to receive the frame leaf **90** and also the door leaf **91** (Fig. 8). Leaves **90**, **91** are pivotally secured together in the usual manner as by hinge pin **92** (Fig. 2).

Door leaf **91** is not secured to the door in the usual manner, but a hooked plate **93** somewhat similar to a hinge leaf is secured to the outer strip **12** of the door by screws **94**. Along the upper edge of plate **93** the same is formed with an outwardly projecting extension **95** which terminates in a downturned hook portion **96**. As best seen in Fig. 8 the extension **95** extends over the upper edge of door leaf **91** and, as seen in Fig. 2, the upper portion of frame leaf **90** is provided with an upwardly opening notch **97** for receiving the hook portion **96**.

By this structure, when the door is installed, the door leaf **90** may first be secured to the frame as by screws **98** in the usual manner and then the door leaf **91** may be swung outwardly from the frame and away from door leaf **90**. When the door leaf **91** is thus in its "open" position the door may be hooked onto said door leaf by hook **96**. Only one hinge structure has been described, but it will be understood that all hinges, generally designated **99** (Fig. 1) are the same.

By the use of this hinge structure, there are no holes required to be made in the door at the time the same is installed at the site, consequently there is no possibility of the vapor tight seal being punctured by the workmen installing the door. It, therefore, follows that when the door is constructed at the factory, the necessary precautions and tests may follow to insure vapor tightness with the assurance that such tightness will not be subsequently impaired.

By the present invention, the weight of the refrigerator door may be reduced three or four times over conventional without reducing the insulating qualities of the same and at the same time insuring against warpage of the door with its attendant heat loss.

The detailed description herein given of the invention is not to be taken as restrictive of the same as it is obvious that various minor changes in design may be made without departing from the invention as defined in the following claims.

I claim:

1. A refrigerator door comprising a hollow inner body having a pair of opposed faces, top and bottom edges and opposite lateral side edges, a vapor tight sheath of relatively tough sheet material secured to said body and enclosing the same for preventing movement of vapor to and from the space within said inner body for preventing warpage of said door, said sheath comprising channel members secured along said top and bottom edges and said side edges with the legs of said channel members extending inwardly of said faces and in engagement with the latter and sheets of said material covering said faces respectively and in lapping relation along their margins with the adjacent legs of said channels, said sheets and the legs of said channels being adherently secured together to form vapor tight joints.

2. A refrigerator door comprising a hollow inner body having a pair of opposed faces, top and bottom edges and opposite lateral side edges, a vapor tight sheath of relatively tough sheet material secured to said body and enclosing the same for preventing movement of vapor to and from the space within said inner body for preventing warpage of said door, said body being internally provided with a latch mechanism including a latch bolt extending outwardly of one of said lateral side edges, a casing of vapor tight material surrounding said mechanism for preventing movement of vapor to and from said space through said latch mechanism.

3. A refrigerator door comprising a hollow inner body having a pair of opposed faces, top and bottom edges and opposite lateral side edges, a vapor tight sheath of relatively tough sheet material secured to said body and enclosing the same for preventing movement of vapor to and from the space within said inner body for preventing warpage of said door, said body being internally provided with a latch mechanism including a latch bolt extending outwardly of one of said lateral side edges, a casing of vapor tight material surrounding said mechanism for preventing movement of vapor to and from said space through said latch mechanism, the other of said lateral side edges being provided with laterally outwardly projecting members formed at their outer ends with downwardly turned flanges, said members being secured to said other side edges in vapor tight relationship whereby said door is adapted to be supported by said members on the corresponding leaves of a pair of hinges without the use of removable fasteners.

4. A refrigerator door comprising a hollow inner body having a pair of opposed faces, top and bottom edges and opposite lateral side edges, a vapor tight sheath of relatively tough sheet material secured to said body and enclosing the same for preventing movement of vapor to and from the space within said inner body for preventing warpage of said door, a latch mechanism within said space including a latch bolt extending outwardly of one of said lateral side edges, a housing for reciprocably

receiving said bolt and a pair of handles extending outwardly of the opposite faces of said door respectively for actuating said bolt, separate means carried by said handles respectively for actuating said bolt by either one of said handles independently of the other, said last mentioned means being spaced apart to prevent conduction of heat from one handle to the other.

5. A refrigerator door comprising a hollow inner body having a pair of opposed faces, top and bottom edges and opposite lateral side edges, a vapor tight sheath of relatively tough sheet material secured to said body and enclosing the same for preventing movement of vapor to and from the space within said inner body for preventing warpage of said door, a latch mechanism within said space including a latch bolt normally projecting outwardly of one of said lateral side edges, a housing for reciprocably receiving said bolt and a pair of handles extending outwardly of the opposite faces of said door respectively for actuating said bolt, bearing members

carried by said housing and rotatably supporting said handles at their inner ends adjacent said bolt, bolt engaging members carried by said inner ends and spaced from each other for independently retracting said bolt depending upon which handle is operated.

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