May 3, 1932. D. F. KEITH 1,857,086

MEANS FOR PREVENTING CONDENSATION IN REFRIGERATOR WALLS

Filed Nov. 20, 1928 3 Sheets-Sheet 1

Fig. 1.

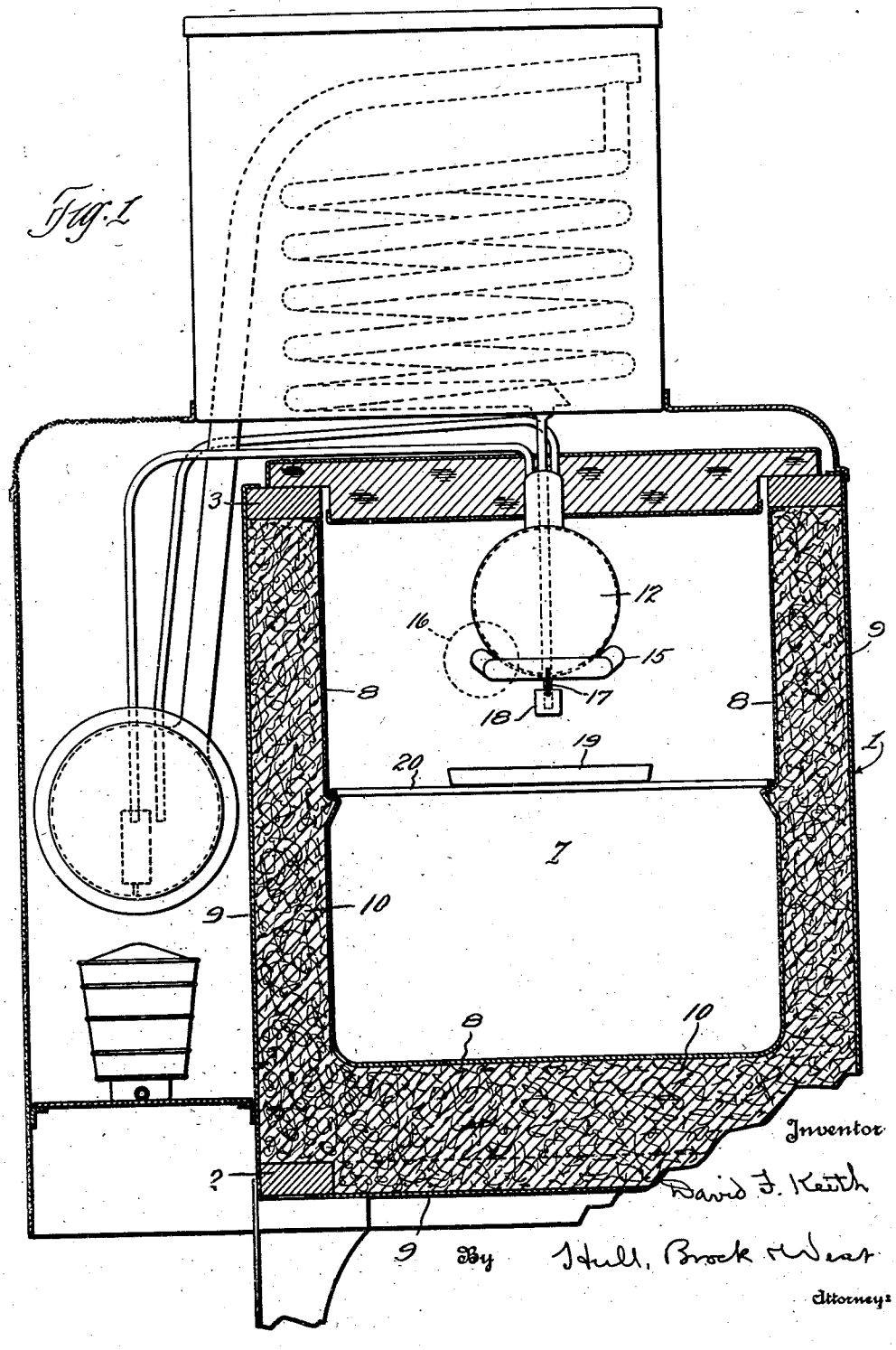

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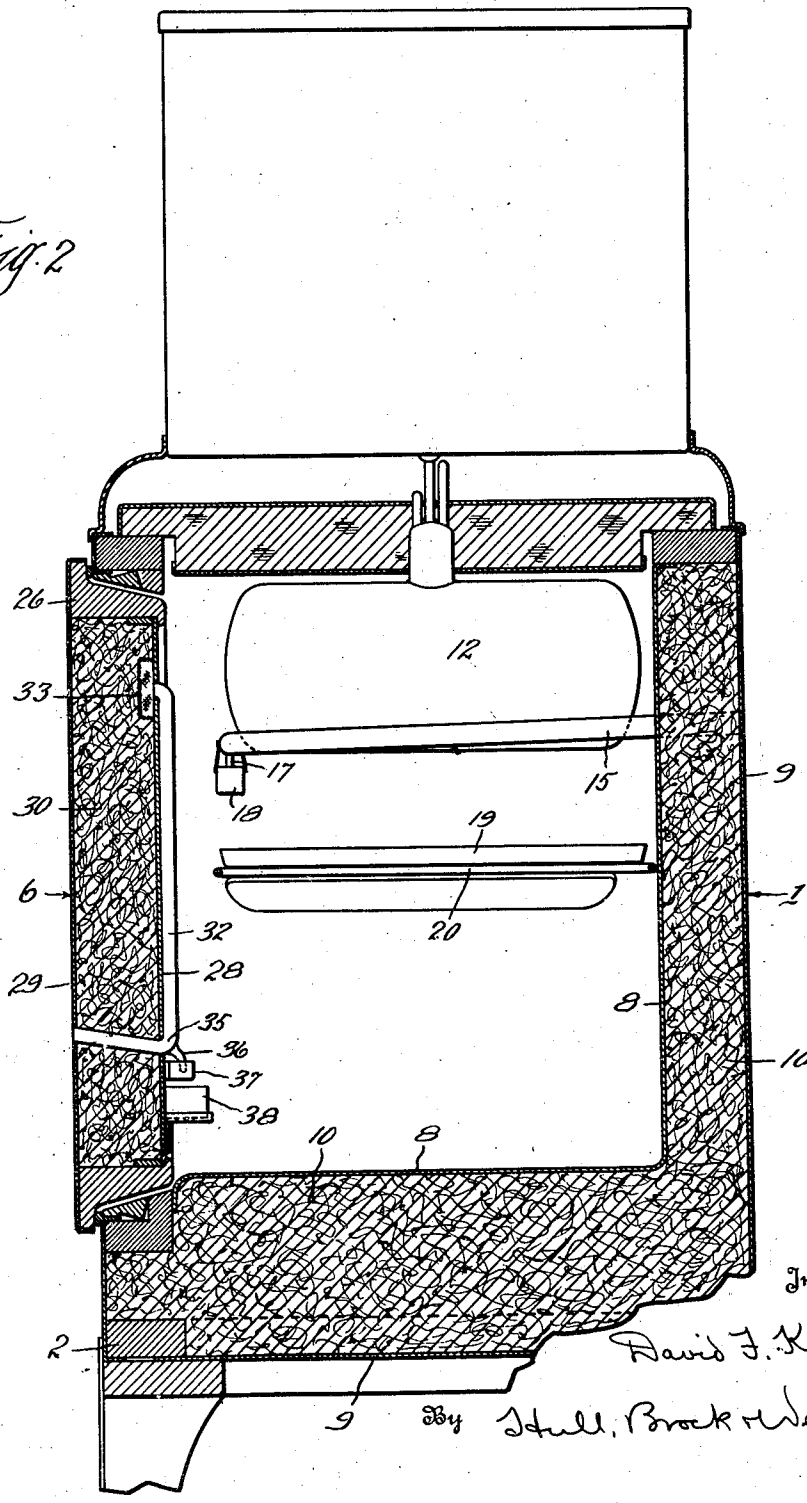
Fig. 2



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MEANS FOR PREVENTING CONDENSATION IN REFRIGERATOR WALLS

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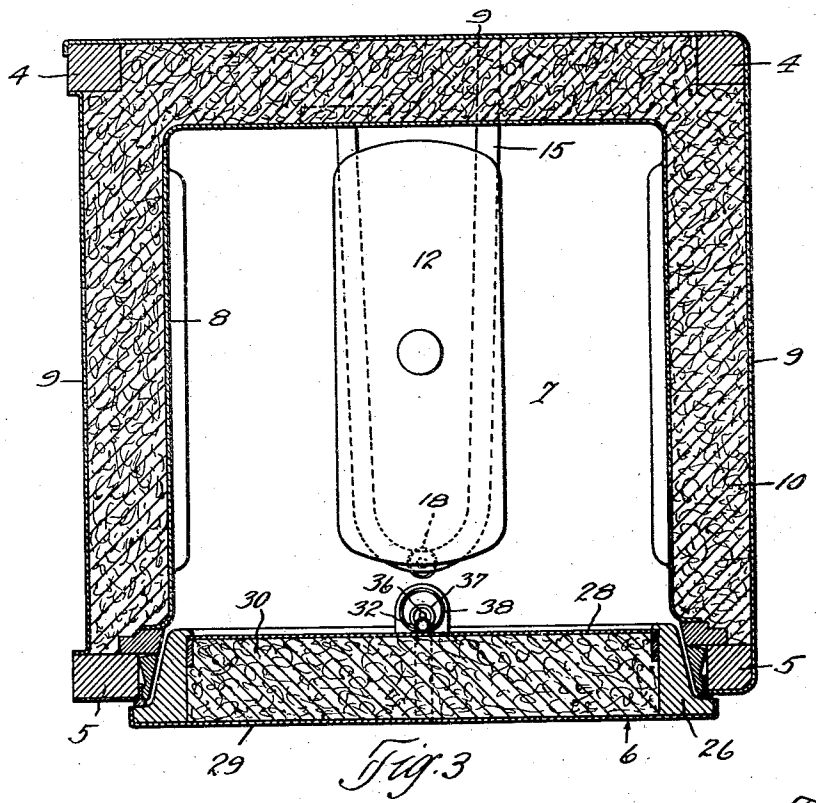
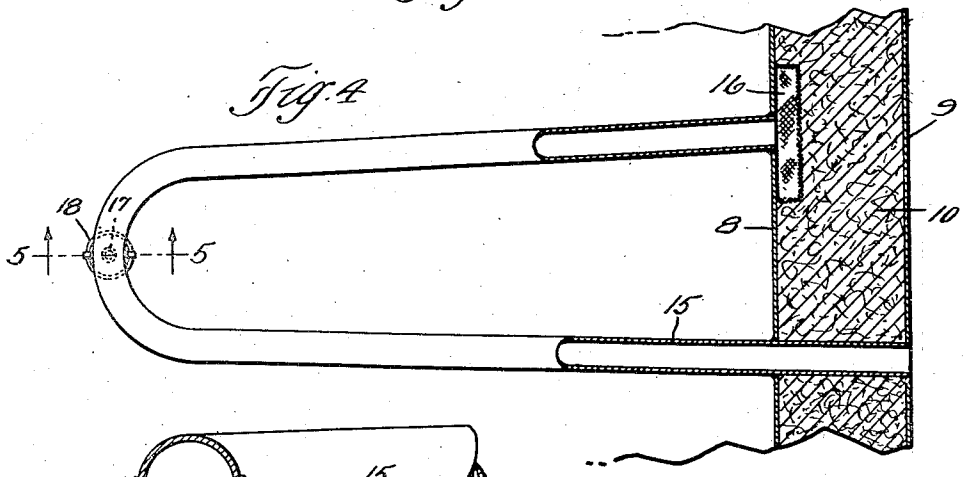


Fig. 3

Fig. 4



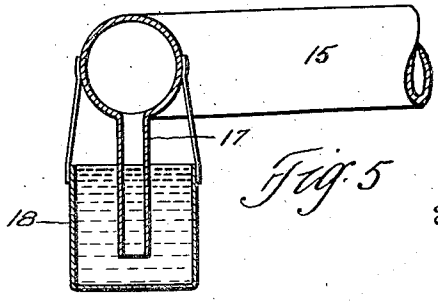


Fig. 5

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UNITED STATES PATENT OFFICE

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MEANS FOR PREVENTING CONDENSATION IN REFRIGERATOR WALLS

Application filed November 20, 1928. Serial No. 320,630.

This invention relates to means for preventing the condensation of moisture in the interior of the insulated walls of refrigeration cabinets and it is applicable to all classes of refrigerators wherein the cold chamber is enclosed by double walls consisting of spaced-apart inner and outer sheets or panels of suitable material between which there is a filling of insulation such as ground cork, balsam wood, or the like.

For the purpose of this description, the inner and outer sheets or panels of a double wall construction will be referred to as the inner and outer walls, and either may consist of a continuous shell, as will hereinafter appear.

In practically all types of refrigerators, there is a pronounced fluctuation of the temperature within the cabinet. In iced refrigerators, the temperature of the so-called cold chamber is considerably higher when the ice is nearly or entirely melted than when a fresh supply of ice is placed within the ice compartment; in refrigeration apparatus of the intermittent absorption type, the so-called cold chamber is of a higher temperature during the heating and condensing period than it is during the period of evaporation and absorption; and in other types of mechanical refrigerators, the temperature of the cold chamber is higher during the defrosting operation than at other times, and furthermore it fluctuates considerably due to the intermittent operation of the apparatus.

In the construction of double wall refrigerator cabinets, it is practically impossible to make the space between the inner and outer walls air tight, and as a consequence of this, when the temperature within the cold chamber rises, the air within the space between the inner and outer walls expands and some of its escapes through the minute cracks and openings; and when the temperature of the cold chamber subsequently becomes lower, the air within the walls contracts and draws in atmospheric air. Obviously, this breathing action of the insulated walls may be caused also by changes in barometer pressure, changes in outside temperature, etc. Since the atmospheric air is practically always more or less humid, the moisture which it contains is condensed when it comes within the chilling influence of the inner wall that separates the insulation space from the cold chamber and the insulation within said space absorbs the moisture until finally it becomes so saturated that it has little insulting value. In fact, when it becomes wet it is a conductor of heat between the inner and outer wall panels.

Attempts have been made to overcome this difficulty by hermetically sealing the insulating material. Cork, for example, has been thoroughly coated with a composition of asphalt, as by dipping or painting the cork with the compound. Other kinds of insulation have been wrapped in waxed paper. Both of these methods of moisture proofing the insulation are costly and require a great deal of care in order to make certain that every opening is sealed, for the smallest opening in the protective coating will defeat the purpose thereof. By providing means for preventing the condensation of moisture in the interior of the insulated walls of refrigerators, much cheaper insulating materials may be used with highly satisfactory results.

The primary purpose of my invention is to provide a refrigerator cabinet enclosing the so-called "cold chamber" and constructed of double or spaced-apart inner and outer walls, the space between said walls containing suitable insulating material, and to incorporate in such cabinet a passageway leading from the exterior to the interior of said space and passing in intimate heat exchanging relation to a cooling medium, such as the cold chamber, so that when the pressure differential between the outer air and the insulation space is in favor of the outer air, the atmospheric air drawn in by reason thereof through said passageway is lowered in temperature below the temperature of said space so that any moisture in the air that would otherwise be condensed upon reaching the space is actually removed from the air by condensation in the passageway.

Other objects of the invention are to provide means of the aforesaid character that is simple, relatively inexpensive, highly effi-

cient, that requires no attention, and will not get out of order.

The invention is especially suited for refrigeration apparatus of the intermittent absorption type because of the fact that at regular intervals in the operation of the apparatus, the temperature of the cold chamber or refrigeration compartment is raised above normal operating temperature for a brief period while the relatively hot refrigerant condensate is collecting in the evaporator. Each time this occurs, the warmth of the evaporator is communicated, to a limited degree at least, to the walls of the cold chamber or refrigeration compartment and this causes the air within the insulation space of the walls to expand and, as the cabinets have heretofore been constructed, a part of it to be expelled through the small cracks or holes that are practically unavoidable, and then during the subsequent cooling period, when the refrigerant in the evaporator is vaporizing and being distilled over into the generator absorber the temperature of the cold chamber or refrigeration compartment falls as does also the temperature of the air within the insulated walls causing said air to contract and draw in atmospheric air. This breathing action occurs with every change of temperature of the cold chamber.

Because of its peculiar adaptability to the class of apparatus just described, I have illustrated my invention in connection therewith in the accompanying drawings wherein Fig. 1 is a sectional front elevation of refrigeration apparatus incorporating my present improvements, all parts excepting the cabinet being shown in elevation; Fig. 2 on a somewhat larger scale, is a vertical section through the cabinet from front to rear; Fig. 3 is a sectional plan, the plane of section being immediately below the top of the cabinet; Fig. 4 is a horizontal section through the breather tube and the adjacent portion of the cabinet wall, the same being on a scale considerably enlarged over that of the previous views, and Fig. 5 is a sectional detail on the line 5—5 of Fig. 4.

The cabinet of the refrigerator is designated 1 and it is made up of a framework comprising a base 2, top 3, rear corner posts 4 and front corner posts 5. An insulated door 6 swings between the last mentioned corner posts and closes the cold chamber or refrigeration compartment 7 that is formed by the interior of what is, in effect, a one-piece sheet metal shell that constitutes the inner wall of the cabinet and is designated 8. While this one-piece shell is in accordance with the better practice, the wall 8 might be made up of a number of separate panels, so far as my present invention is concerned. Applied to the corner posts 4 and 5 are sheets or panels of suitable material, such as metal, and they constitute the outer wall that is designated 9. The space between the inner and outer walls contains insulating material 10 and while, at present, I prefer to use balsam wood as insulation, cork or other suitable material may be substituted therefor.

Within the cold chamber or refrigeration compartment 7, desirably within the upper portion thereof, is located the cooling unit or evaporator 12 of the refrigeration apparatus. The apparatus herein disclosed is, in all essential respects, the same as that which constitutes the subject matter of my co-pending application Serial No. 242,574, filed December 27, 1927, and for a detailed description of the construction and operation of the apparatus reference may be had to the said case. It is sufficient for the present purpose to explain that during what is known as the heating period of each cycle of operation, relatively hot refrigerant condensate collects within the cooling unit or evaporator 12 and warms the same which results in a noticeable rise in temperature of the air in the chamber or compartment 7 and, through the conductivity of the wall 8, in a warming up of the air within the space between said wall and the outer wall 9.

Following the heating period is what is known as the cooling period when the liquid refrigerant in the cooling vessel or evaporator 12 evaporates and abstracts heat from the air within the chamber or compartment 7, lowering the temperature thereof which has a like effect upon the air in the space between the inner and outer walls 8 and 9. So far as the present invention is concerned, the cooling agent may be ice, as in ordinary iced refrigerators or ice boxes; or it may be the cooling unit of any type of mechanical refrigeration apparatus. In all cases there is more or less variation in the temperature of the cold chamber or refrigeration compartment.

In the present embodiment of my invention, I employ a U-shaped breather tube 15 that is disposed immediately below the cooling unit or evaporator 12 and which has one of its ends extended through the rear sections of the inner and outer walls 8 and 9, and its other end projected through the wall 8 so as to open into the space between said walls. A cup-shaped screen 16 surrounds the last mentioned end of the breather tube and prevents the same from being closed or obstructed by the insulating material 10. The tube is inclined downwardly and forwardly so that its lowest part is adjacent the front of the chamber or compartment 7, said lowest part constituting a sump, and a drip spout 17 is connected to the sump and dips into a receptacle 18 which provides a liquid seal for the spout. The receptacle 18 overflows into a pan 19 that is shown as supported by a shelf 20 sustained by and between the side walls of the compartment 7,

said pan serving also to catch any condensate which may drip from the cooling unit.

It will be readily understood from the foregoing description that when the breathing action occurs within the space between the inner and outer walls 8 and 9, air is alternately expelled and inhaled through the breather tube 15, and such moisture in the air that is drawn in through said tube as would otherwise be condensed in the space of the wall is condensed when subjected to the cooling influence of the unit or evaporator 12 and drains to the lowest point of the breather tube from which it escapes through the drip spout 17 into the receptacle 18, said receptacle, in turn, overflowing into the pan 19, as above explained. Thus it will be seen that no moisture can condense from the air that finds its way to the space between the walls 8 and 9 of the cabinet because the air has previously been subjected to a temperature lower than that which exists in said space, and consequently the insulating material 10 never becomes moist, but remains dry and retains its maximum insulating value indefinitely.

The insulated door 6 closes the open front of the cabinet 1 and the same is made up of a frame 26 to the inner and outer sides of which are applied, respectively, the inner wall or panel 28 and the outer wall or panel 29. The space between said walls is filled with insulating material 30, which, as in the case of the insulated walls of the cabinet, may be balsam wood.

To protect the insulation of the door from moisture I employ a breather tube 32 whose body portion is located on the inner side of the wall 28 where it will be inside the cold chamber when the door is shut, and the upper end of the tube is extended through an aperture in said wall and opens into the insulation space, a screen 33 serving to space the insulation material from the open end of the tube. The opposite end of the tube is shown as extended through apertures in the inner and outer walls 28 and 29 so as to be open to the atmosphere; and it is, of course, understood that the apertures in the walls through which the ends of the tube pass are sealed against the ingress and egress of air. The outwardly extended lower end of the breather tube 32 is preferably inclined upwardly so as to provide a low part or sump 35 to which will gravitate any moisture condensed from the atmospheric air as the latter passes upwardly through the tube in intimate heat exchanging relation to the cold chamber of the refrigerator. The sump 35 is drained through a spout 36 into a receptacle 37 which is so related to the spout as to provide a liquid seal therefor, and the receptacle overflows into a receiver 38 that is shown as removably supported by the door so that it may be conveniently emptied as occasion requires.

The manner in which this breather tube functions will be obvious from the above description of the operation of the breather tube 15.

A characteristic of the breathing action of insulated refrigerator walls that is favorable to the present invention is that the exhalation occurs during the time the temperature of the cold chamber is rising and the inhalation takes place after the temperature of the cold chamber has fallen enough to lower the temperature in the insulation space of the walls. Consequently, when the air is being drawn in through the breather tube the temperature of the walls of said tube will be sufficiently below that of the insulation space to insure condensation of all moisture in the atmospheric air that would otherwise be condensed in said space.

Having thus described my invention, what I claim is:—

1. A refrigerator comprising a cabinet having spaced-apart inner and outer walls, the space between said walls containing insulating material, the cabinet incorporating a passageway leading from the exterior to the interior of said space, and means for cooling a portion of said passageway to a temperature lower than the lowest temperature existing in said space, said passageway being arranged to drain any moisture condensed therein away from said space.

2. A refrigerator comprising a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, the cabinet incorporating a passageway leading from its exterior to said space and passing in intimate heat exchanging relation to the cold chamber, the same being so arranged as to drain any moisture condensed therein away from said space.

3. A refrigerator comprising a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, the cabinet incorporating a passageway leading from its exterior to said space and passing in intimate heat exchanging relation to the cold chamber, the same involving a sump wherein any moisture that is condensed in the passageway will collect.

4. A refrigerator comprising a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, the cabinet incorporating a passageway leading from its exterior to said space and passing in intimate heat exchanging relation to the cold chamber, the same involving a sump wherein any moisture that is condensed in the passageway will collect, and means permitting the egress of condensate from the sump and preventing the ingress of air thereto from the cold chamber.

5. A refrigerator comprising a cabinet

having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, a conduit opening at one end exteriorly of the cabinet and at its opposite end into said space and having a part intermediate its ends in intimate heat exchanging relation to the cold chamber, the conduit being inclined to drain any moisture condensed therein away from said space.

6. A refrigerator comprising a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, a breather tube opening at one end exteriorly of the cabinet and at its opposite end into said space and having a part located within said cold chamber, the tube being inclined to drain any moisture that is condensed within it away from said space.

7. A refrigerator comprising a cabinet having a spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, a breather tube opening at one end exteriorly of the cabinet and at its opposite end into said space and having a part located within said cold chamber, said part incorporating a sump to which any moisture that is condensed within the tube drains, said sump being provided with an outlet.

8. A refrigerator comprising a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, the space between said walls containing insulating material, a breather tube opening at one end exteriorly of the cabinet and at its opposite end into said space and having a part located within said cold chamber, said part incorporating a sump to which any moisture that is condensed within the tube drains, said sump being provided with an outlet, and a liquid seal for said outlet.

9. In a refrigerator, a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, insulating material in the space between said walls, a cooling unit within said chamber, a breather consisting of two tubular branches that are communicatively connected together adjacent their inner ends and are disposed in intimate heat exchanging relation to the cooling unit, the outer end of one of said branches extending through the inner and outer walls of the cabinet so as to open into the atmosphere while the corresponding end of the other tube enters the space between said walls, the breather having a sump for the accumulation of condensate, and a drain for said sump.

10. In a refrigerator, a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, insulating material in the space between said walls, a cooling unit within the cold chamber, a U-shaped breather tube disposed below said cooling unit and having one of its ends extended through the inner and outer walls of the cabinet so as to open into the atmosphere and its opposite end extended through the inner wall of the cabinet so as to open into the space containing the insulating material, the tube being inclined downwardly and inwardly and having draining means at its low point.

11. In a refrigerator, a cabinet having spaced-apart inner and outer walls and enclosing a cold chamber, insulating material in the space between said walls, a cooling unit within the cold chamber, a U-shaped breather tube disposed below said cooling unit and having one of its ends extending through the inner and outer walls of the cabinet so as to open into the atmosphere and its opposite cabinet so as to open into the space containing end extended through the inner wall of the the insulating material, the tube being inclined downwardly and inwardly and having a drain opening at its low point, and a receptacle supported in receiving relation to said drain opening and providing a liquid seal therefor.

12. In a refrigerator, a cabinet enclosing the cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls, the space between said walls containing insulating material, the door incorporating a passageway leading from its exterior to said space and passing in heat exchanging relation to the cold chamber, the same being so arranged as to drain any moisture condensed therein away from said space.

13. In a refrigerator, a cabinet enclosing the cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls, the space between said walls containing insulating material, the door incorporating a passageway leading from its exterior to said space and passing in intimate heat exchanging relation to the cold chamber, the passageway involving a sump wherein any moisture that is condensed in the passageway will collect, and means for draining the sump.

14. In a refrigerator, a cabinet enclosing the cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls, the space between said walls containing insulating material, the door incorporating a passageway leading from its exterior to said space and passing in intimate heat exchanging relation to the cold chamber, the said passageway involving a sump wherein any moisture that is condensed in the passageway will collect, and a liquid seal through which said sump is drained.

15. In a refrigerator, a cabinet enclosing the cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls,

insulating material in the space between said walls, a breather tube having its body portion disposed inwardly of the inner wall and having one of its ends extending through both inner and outer walls so as to be open to the atmosphere, the other end of said tube opening into the space between the walls, the tube being so arranged as to drain any moisture condensed therein away from said space.

16. In a refrigerator, a cabinet enclosing a cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls, insulating material in the space between said walls, a breather tube having its body portion disposed inwardly of the inner wall and having one of its ends extended through the inner and outer walls so as to be open to the atmosphere, the opposite end of the tube opening into the space between said walls, the tube being so formed as to provide a sump, a drain spout for said sump which discharges on the inner side of the door, and a vessel into which said spout drains.

17. In a refrigerator, a cabinet enclosing a cold chamber and having a door opening, a door for closing said opening and comprising spaced-apart inner and outer walls, insulating material in the space between said walls, a breather tube having its body portion disposed inwardly of the inner wall and having one of its ends extended through the inner and outer walls so as to be open to the atmosphere, the opposite end of the tube opening into the space between said walls, the tube being so formed as to provide a sump, a drain spout for said sump which discharges on the inner side of the door, a receptacle so disposed with respect to said spout as to provide a liquid seal therefor, and a receiver removably supported by the door into which said receptacle overflows.

In testimony whereof, I hereunto affix my signature.

DAVID F. KEITH.