

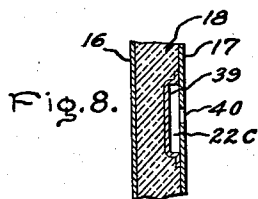
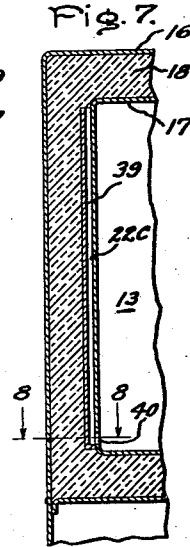
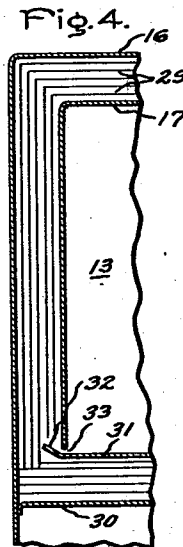
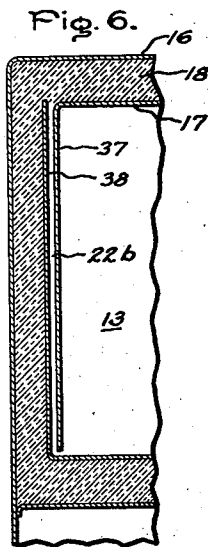
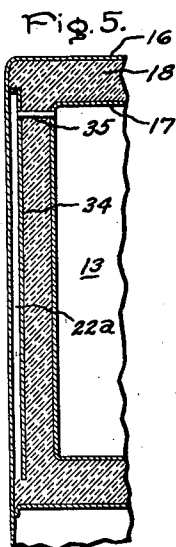
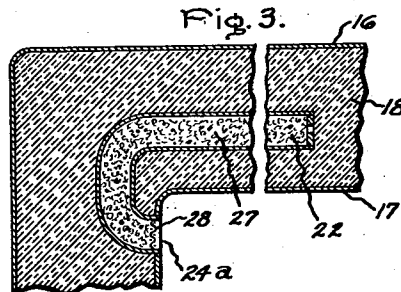
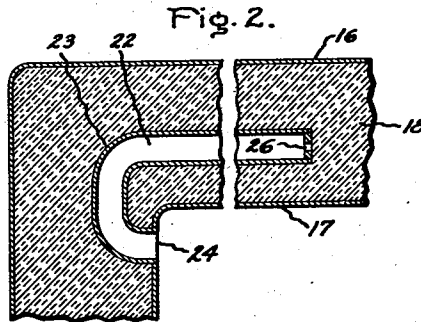
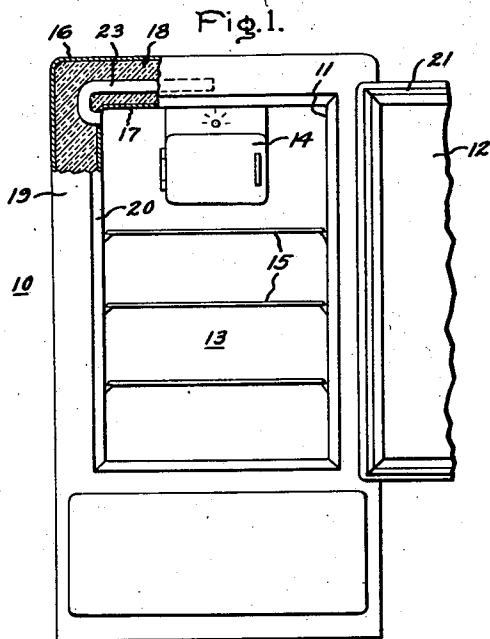
March 23, 1943.

R. H. NORRIS

2,314,657

REFRIGERATOR

Filed Jan. 26, 1940



Inventor:
Rollin H. Norris,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

2,314,657

REFRIGERATOR

Rollin H. Norris, Schenectady, N. Y., assignor to
General Electric Company, a corporation of
New York

Application January 26, 1940, Serial No. 315,796

10 Claims. (Cl. 220—9)

My invention relates to refrigerators and more particularly to wall constructions for refrigerators.

Under certain conditions condensation and collection of moisture in the insulation placed in refrigerator walls occurs and causes deterioration of the thermal conductivity of the insulation and reduces the efficiency of the refrigerator. Such condensation results from the tendency of moisture to travel to the coldest surfaces and from the phenomenon known as "breathing." The temperature of any air in the space between liners or shells defining the refrigerator walls varies with temperature changes inside of and outside of the refrigerator. Any change in temperature is accompanied by a change in pressure within the space because of the substantially constant volume of the space. Thus, temperature changes result in periodic expansion and contraction, or "breathing," through any openings into this space, however small. Pressure variations caused by slamming the refrigerator door also establish "breathing." Moisture entrained with the breathed air will condense whenever the temperature of the relatively cold refrigerator lining is below the dew point of the air. While under many conditions of operation, the evaporator or cooling unit in the refrigerator will extract moisture from the air and accumulate the same in the form of frost on the evaporator, under some conditions, as in very damp climates, moisture cannot be accumulated on the evaporator as fast as it can be breathed into the insulation, especially when the refrigerator door is opened frequently.

Accordingly, it is an object of my invention to provide a new and improved refrigerator wall construction in which the condensation and collection of vapor in the heat insulation of refrigerators is minimized.

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

For a better understanding of my invention reference may be had to the accompanying drawing in which Fig. 1 is a view of a domestic type refrigerator cabinet illustrating the application of one form of my invention; Fig. 2 is an enlarged view of a portion of the refrigerator cabinet shown in Fig. 1 illustrating the application of my invention; Fig. 3 is a modification of the arrangement disclosed in Fig. 2; Figs. 4 to 7, in-

clusive, are other embodiments of my invention; and Fig. 8 is a cross sectional view taken along the line 8—8 of Fig. 7.

Referring to the drawing, I have shown a refrigerator cabinet 10 of the domestic type, access thereto being had through a door opening 11, the door opening 11 having a door 12 associated therewith. In order to cool the air within the refrigerated space or food compartment 13 I have provided a suitable cooling unit or evaporator 14 in the upper part of the food compartment 13 and a plurality of shelves 15 are provided to support articles within the food storage compartment 13. The refrigerator 10 comprises an outer case or liner 16 and an inner liner 17 with suitable heat insulating material 18 therebetween, the liners being formed of relatively impervious material, such as sheet steel for example. The outer liner 16 is provided with a flange 19 around the edge of the front face of the cabinet 10. The space between the edge of the inner liner 17 and the flange 19 is closed by a breaker strip 20 of non-hygroscopic heat insulating material, for example resinous materials such as sold under the trade names "Bakelite," "Textolite," etc. It has been recognized that the outside of a refrigerator cabinet should be as completely impervious to the diffusion of water vapor as possible. Any non-impervious joints which exist are therefore placed on the inner surface of the cabinet. To this end I have provided a suitable gasket 21 on the door 12 engaging the face or flange 19 of the outer case 16 on the outside of the joints between the breaker strip 20 and the lining 17 and flange 19. In accordance with my invention I have provided means for minimizing the entrance of moisture into the insulation 18 through these joints and any other openings in the liners and from gradually accumulating in the insulation 18.

According to one aspect of my invention, as shown in Figs. 1 and 2, I have provided a passage or chamber 22 between the walls or linings 16 and 17, of the cabinet 10 communicating with the insulating material 18 adjacent one end of the chamber 22 and the interior or food storage compartment 13 of the refrigerator 10 adjacent the other end thereof, the chamber or passage being long enough to minimize the amount of wet air reaching the insulating material 18.

Chamber 22 comprises a conduit 23 formed of relatively impervious material placed near the upper lefthand corner of the refrigerator 10. The conduit 23 is suitably secured at one end thereof in an opening 24 in the inner liner 17.

The hole or aperture 26 at the other end of conduit 23 should be of such a size that the flow of air therethrough will be restricted whereby any moisture in the air which enters the chamber 22 will have an opportunity to diffuse out again through the opening 24 before the dew point of the air in the insulation can attain the temperature of the inner liner. It is preferable that the chamber 22 be of such a length that any condensation will take place within the chamber and so positioned that any moisture which condenses therein will not drain into the insulation. The chamber 22 has been illustrated in a bent form placed in the upper lefthand corner of the cabinet 10 for convenience of illustration. However, it is generally desirable to place the opening 24 to the chamber 22 at the coldest point of the inner liner 17 which is usually opposite the lower portion of the cooling unit 14 in the back wall of the lining 17.

In Fig. 3 I have illustrated a modification of my invention in which a moisture absorbing material 27 such as silica gel or calcium chloride, for example, is placed in the chamber 22. A screen 28 or other means for retaining the material 27 within the chamber 22 while permitting air to flow into and out of the chamber 22 is placed across the opening 24a of the chamber 22.

In Fig. 4 I have illustrated an arrangement in which insulating material 29 in the form of metallic foil or fibers which are not wettable by water is provided. With this arrangement moisture which condenses in the space between the liners 16 and 17 will not be absorbed but it will tend to drain downward and, if liquid is permitted to accumulate in the bottom of the space between the liners 16 and 17, there is provided an undesirable heat path by evaporation from the bottom wall 30 of the outer liner 16 and condensation on the bottom wall 31 of the inner liner 17. A shelf or trough 32 suitably secured to the bottom wall 31 or integral therewith, if desired, is provided to catch water running down the sides of the foils 29 and liner 17 and deflect the same through an opening 33 into the refrigerated space 13.

In Fig. 5 I have shown a modification of my invention which eliminates the accumulation of condensate in the space between the liners 16 and 17. I have provided a plate-like member 34 between the liners 16 and 17 cooperating with the outer liner 16 to define a chamber or passage 22a which is free of insulating material. The space or chamber 22a is closed at the upper end and open at the lower end, as shown in Fig. 5, and communicates with the refrigerated space 13 by means of a conduit 35 communicating between the upper portion of the chamber 22a and the refrigerated space 13. The member 34 is preferably substantially of the same area as the adjacent side wall of the refrigerated space 13 in order to provide large enough space on the warmer side of the wall of the cabinet 10 so that any moist air which is breathed into the chamber 22a will not reach the cold portions of the insulation 18 until after the moisture has had time to diffuse back into the refrigerated space.

In Fig. 6 I have illustrated an arrangement which is a modification of the arrangement shown in Figs. 1 to 3, inclusive. In this instance one of the vertical walls of the liner 17 is formed by overlapping portions 37 and 38 of the liner 17 suitably maintained in spaced-apart relationship to provide a vertical chamber or passage 22b adjacent the inner liner 17 open to the insulat-

ing material 18 at the upper end thereof and the refrigerated space 13 at the lower end thereof. With this arrangement the entire wall 37 of the inner liner 17, and to some extent the wall 38, acts as a condensing surface which is cold enough to render it probable that all breathed air which eventually reaches the insulating material 18 will have a dew point so low that further condensation will not occur within the insulating material 18 for time intervals long enough to be harmful. In some instances, as where collection of condensate is not apt to be serious, it may be permissible to use an arrangement similar to that shown in Fig. 6 but omitting the overlapping portion 38 of the inner liner 17 in order to provide a chamber free of insulating material adjacent the inner liner, the portion 37 serving as a portion of the wall thereof, and communicating with the refrigerated space 13 through an opening at the lower end of the chamber, a trough being provided to collect any condensate and return it to the refrigerated space in the manner shown in connection with the arrangement of Fig. 4.

Figs. 7 and 8 illustrate a modification of the arrangement disclosed in Fig. 6. A chamber 22c is provided by suitably securing a flanged impervious member 39 to the outside face of the inner liner 17, the passage 22c being open to the insulating material 18 at the top thereof and communicating with the refrigerated space 13 through the opening 40 adjacent the lower end thereof.

Other arrangements will occur to those skilled in the art. Combinations of the arrangements disclosed may also be employed. For example, the embodiment disclosed in Fig. 5 may under some conditions be advantageously combined with the structure disclosed in Fig. 6 or Fig. 7. While I have shown a particular embodiment of my invention I do not desire my invention to be limited to the particular construction shown and described and I intend in the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means for minimizing the amount of moisture carried into the insulating material by air forced from said storage compartment into the space between said shells during periods of breathing, said means comprising a chamber disposed between said shells and which is free of insulation, said chamber including walls formed of a substantially impervious material and communicating only with the interior of said storage compartment and said space between said shells, respectively, at separated points, the distance between said points being sufficiently great that moisture in the air entering said chamber diffuses out through the point of communication with said storage compartment before air passing through said chamber attains the dew point, and means effective to maintain moisture condensing in said chamber out of said insulating material.

2. In a refrigerator wall construction of the

type comprising inner and outer spaced apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means for minimizing the amount of moisture carried into said insulating material by air forced from said storage compartment into the space between said shells during periods of breathing, said means comprising a chamber free of insulation and including walls formed of a substantially impervious material and communicating only with the interior of said storage compartment and said space between said shells, respectively, at separated points, the distance between said points being sufficiently great that moisture in the air entering said chamber diffuses out through said point of communication with said storage compartment before the air passing through said chamber to the insulating material attains the dew point, said chamber being so positioned that vapor condensing therein will not drain into said insulating material.

3. In a refrigerator wall construction of the type comprising inner and outer spaced apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, a door for closing said opening, said inner shell defining a storage compartment, means for minimizing the amount of moisture carried into said insulating material by air forced from said storage compartment into the space between said shells during periods of breathing, said means comprising a chamber disposed between said outer shell and said storage compartment which is free of insulation, said chamber including walls formed of a substantially impervious material and communicating only with the interior of said storage compartment and said space between said shells, respectively, at separated points, the distance between said points being sufficiently great that moisture in the air entering said chamber diffuses out through said point of communication with said storage compartment before the air passing through said chamber attains the dew point, said chamber being so positioned that condensate forming therein will drain into the interior of said storage compartment.

4. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means for minimizing the amount of moisture carried into said insulating material by air forced from said storage compartment into the space between said shells during periods of breathing, said means comprising a chamber disposed between said outer shell and said storage compartment which is free of insulation, a portion of said inner shell constituting a portion of the wall defining said chamber, the remaining walls being formed of a substantially impervious material, said chamber communicating only with the interior of said storage compartment and said space between said shells, respectively, at separated points, the distance between said

points being sufficiently great that moisture in the air entering said chamber will diffuse out through the point of communication with said storage compartment before the air passing through said chamber attains the dew point, and means effective to maintain moisture condensing in said chamber out of said insulating material.

5. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means for minimizing the amount of moisture carried into said insulating material by air forced from said compartment into the space between said shells during periods of breathing, said means comprising a chamber disposed between said outer shell and said storage compartment which is free of insulation, said means including walls formed of a substantially impervious material, an aperture in said inner shell communicating between the storage compartment and one portion of said chamber, said chamber having an aperture communicating between said shells and another portion thereof, said apertures providing the only communication with said chamber and being spaced apart an appreciable distance such that moisture in the air entering said chamber may diffuse out through the last mentioned aperture before the air passing through said chamber attains the dew point, and means effective to maintain moisture condensing in said chamber out of said insulating material, said last-mentioned aperture being of such a size as to restrict the flow of air therethrough.

6. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means forming a chamber between said outer shell and said storage compartment which is free of insulation, means for minimizing the amount of moisture carried into the insulating material by air forced from said storage compartment into the space between said cells during periods of breathing, said means comprising a chamber including walls formed of a substantially impervious material and communicating only with the interior of said storage compartment and said space between said shells, respectively, at separated points, the distance between said points being sufficiently great that moisture in the air entering said chamber diffuses out through said point of communication with said storage compartment before the air passing through said chamber attains the dew point, means effective to maintain moisture condensing in said chamber out of said insulating material, and moisture-absorbing material disposed in said chamber.

7. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having spaced edges, heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and de-

fining a door opening, and a door for closing said opening, said inner shell defining a food storage compartment, a conduit of substantially impervious material disposed in the space between said outer shell and said food storage compartment, an aperture in said inner shell, said conduit having an opening at each end thereof one of which is aligned with said aperture, absorbing material in said conduit and means in said aperture for retaining said absorbing material in said conduit while permitting the passage of air therethrough.

8. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means forming a chamber between said outer shell and said storage compartment which is free of insulation, a substantial portion of said chamber being disposed in heat exchange relationship with said outer shell, said chamber communicating at separated points only with the interior of said refrigerator and said space whereby the air breathed into said insulating material is maintained above the dew point.

9. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and

having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means forming a chamber between said outer shell and said storage compartment which is free of insulation, said means including a plate-like member disposed in spaced-apart relationship with said outer shell and defining a passage between said member and said outer shell free of insulating material, said passage communicating with said space and also with the interior of said storage compartment.

10. In a refrigerator wall construction of the type comprising inner and outer spaced-apart shells of substantially impervious material and having heat insulating material disposed between said shells, a breaker strip connecting together said edges of said shells and defining a door opening, and a door for closing said opening, said inner shell defining a storage compartment, means forming a chamber between said outer shell and said storage compartment which is free of insulation, said chamber comprising spaced-apart overlapping portions of said inner shell and providing a vertical passage open to said insulating material at the upper end and to the interior of said storage compartment at the lower end.

ROLLIN H. NORRIS.