March 19, 1929. A. L. LAMBERT 1,705,928

METHOD OF AND APPARATUS FOR PREVENTING THE CONDENSATION OF MOISTURE ON THE EXTERIOR SURFACE OF REFRIGERATOR CABINETS

Filed May 20, 1927 2 Sheets-Sheet 1

Fig. 2.

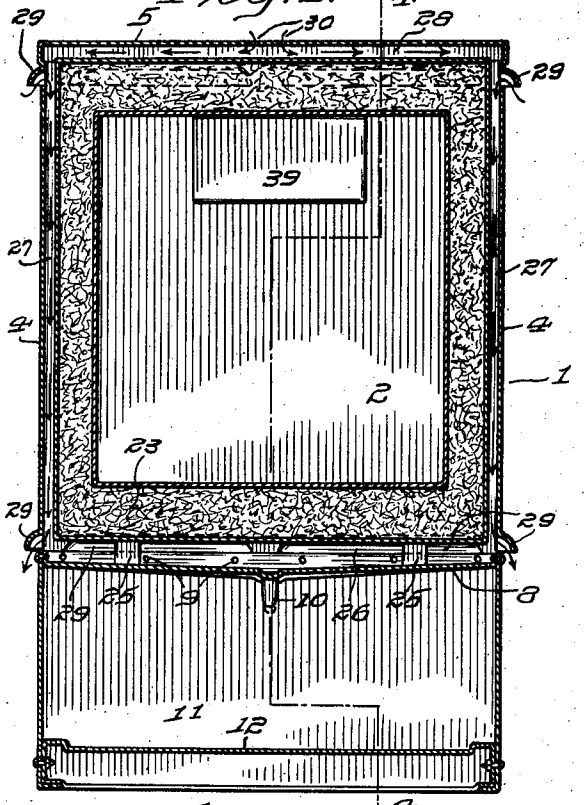
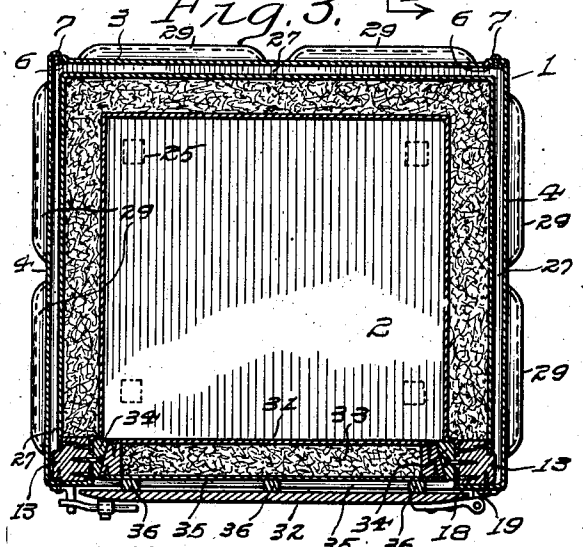


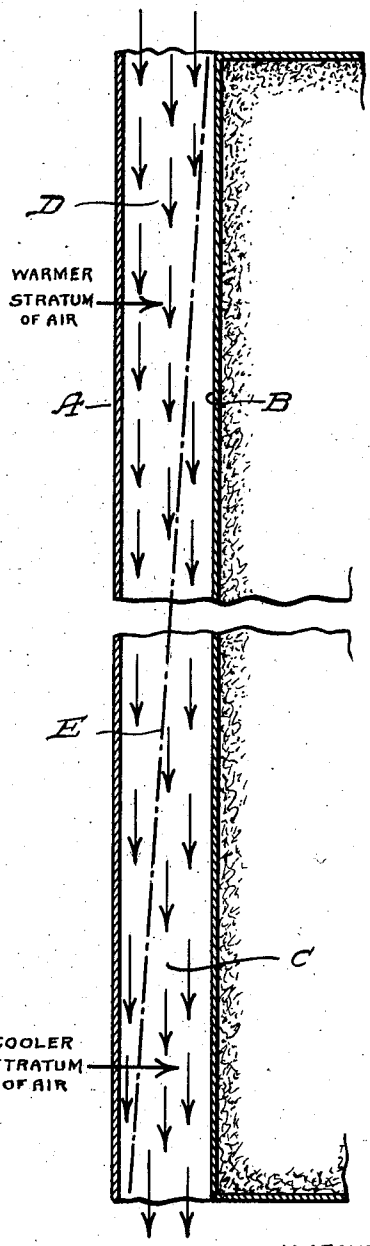
Fig. 3.



WITNESS

F. J. Hattman.

Fig. 1.



INVENTOR

Albert L. Lambert.

BY John W. Myers

ATTORNEY

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Filed May 20, 1927 2 Sheets-Sheet 2

Fig. 4.

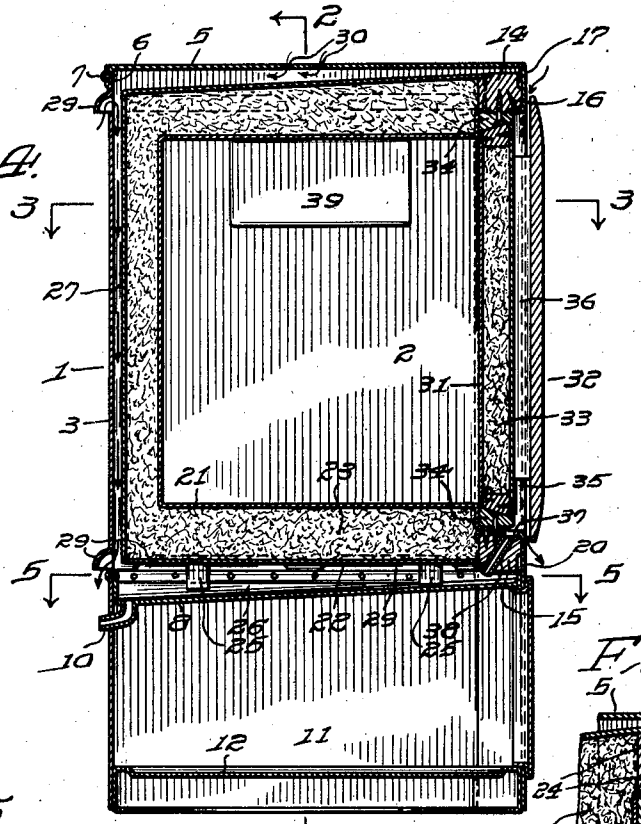


Fig. 5.

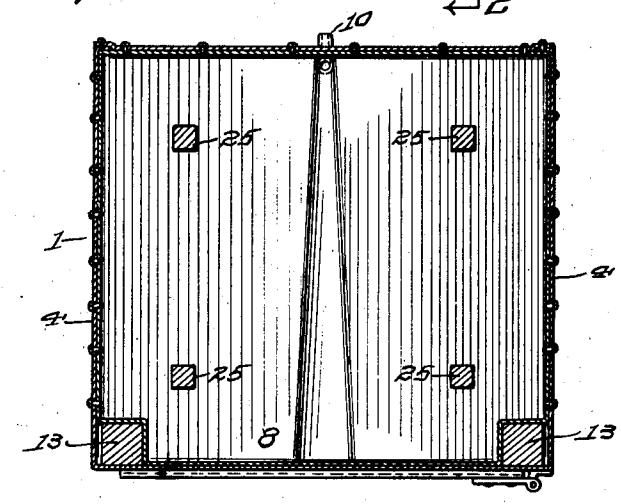
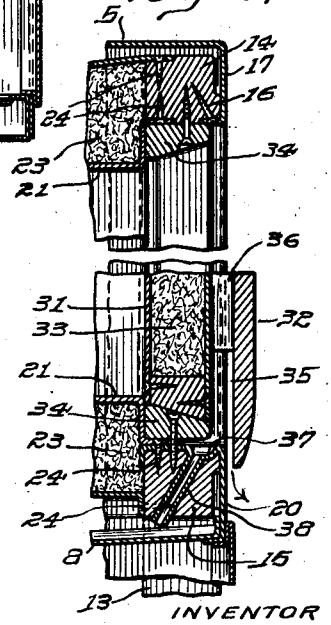


Fig. 6.



WITNESS

H. J. Hartman.

INVENTOR

Albert L. Lambert.

BY John W. Myers

ATTORNEY

Patented Mar. 19, 1929. 1,705,928

UNITED STATES PATENT OFFICE.

ALBERT L. LAMBERT, OF NARBERTH BOROUGH, PENNSYLVANIA, ASSIGNOR TO HEINTZ MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

METHOD OF AND APPARATUS FOR PREVENTING THE CONDENSATION OF MOISTURE ON THE EXTERIOR SURFACE OF REFRIGERATOR CABINETS.

Application filed May 20, 1927. Serial No. 192,861.

It is well known that as the temperature within a refrigerator is considerably below that of the surrounding atmosphere, there is a continual transfer of heat from the walls of the refrigerator to the interior thereof, with the result that the walls are reduced in temperature and maintained below that of the surrounding atmosphere. When the outer surface of the refrigerator cabinet is lowered in temperature to or below the dew-point temperature of the surrounding atmosphere the latter becomes more or less dehydrated through the condensation and deposit of moisture or "dew" on the relatively cool surface.

The condensed moisture collected on the outer surface of the cabinet is unsightly and obviously objectionable in the use of the refrigerator. As it accumulates it runs down the outer surface of the cabinet and drips upon the floor, rendering the latter continually damp and sometimes maintaining a pool there, which is, of course, unsanitary and untidy and tends to rot the floor as time goes on. Furthermore, the condensation injures the finish applied to the exterior of the cabinet and not only mars its appearance, but tends to warp or rot the wall if the outer surface is of wood or other material similarly affected by moisture, or to cause it to rust if made of metal.

The amount of such condensation per unit of area depends upon the atmospheric condition and upon the temperature of the outer surface of the cabinet due to the transfer or "leakage" of heat from the walls of the cabinet to the interior of the refrigerator, the latter factor being in turn dependent (disregarding the so-called "skin effect" and possible heat losses through radiation) upon the difference in temperature between the interior of the refrigerator and the surrounding atmosphere and upon the thermal conductivity of or rate of heat transfer through the refrigerator walls.

As to the atmospheric condition both humidity and temperature are important. The higher the humidity the relatively higher the dew-point, and the more readily the condensation forms since less heat transfer through the walls will reduce the temperature of the outer surface of the cabinet to the dew-point. A higher percentage of humidity also renders the condensation more profuse. On the other hand, a higher atmospheric temperature gives a higher saturation point, making possible a larger proportion of aqueous vapor in the air. A relatively high temperature also increases the usual temperature difference between the atmosphere and the interior of the refrigerator and thus increases the heat transfer through the refrigerator walls. For these reasons the present difficulty is especially marked when refrigerators are used under humid and warm atmospheric conditions, such as usually occur in kitchens and prevail generally in tropical and certain other climates.

In the ordinary refrigerators cooled by ice a substantial difference in temperature is developed between the refrigerating chamber and the surrounding atmosphere, but this difference is greater where mechanical units are employed for cooling since they develop and maintain lower temperatures within the refrigerators than ice does, and hence their introduction has increased the tendency toward the formation of condensation on the exterior of the cabinets and has rendered the problem more acute.

The thermal conductivity of refrigerator walls varies, of course, according to the material or materials of which they are constructed and the thickness thereof. But in every instance there is necessarily some heat transfer through the walls as perfect insulation is impossible. Furthermore, there are practical difficulties in obtaining the maximum insulating efficiency, particularly in refrigerators of the domestic type, since the element of expense limits both the character and the thickness of the insulating materials which can be used in producing a saleable article, and furthermore, since the walls cannot be too thick without either encroaching unduly on the space required for refrigerating purposes or else rendering the cabinet too bulky and cumbersome. Where the walls are constructed, as in ordinary cabinets, with their outer surfaces of wood, the objectionable condensation forms under certain of the above mentioned conditions, but where the outer surfaces are of metal as in the modern cabinets the condensation has been found to be particularly troublesome.

These various factors or conditions entering into the formation of the condensation cannot be controlled or eliminated as a prac-

tical means of effecting a solution of the problem.

An object of the present invention is to provide a method of effectively preventing the formation of such condensation on the exterior surface of a refrigerator cabinet notwithstanding the existence of the aforesaid factors or conditions and the degree in which they are present, and without interfering with the efficiency of the refrigerator, the method being equally capable of employment to prevent the condensation of moisture on the exterior surface of the door or movable wall of the refrigerator cabinet as well as on the stationary walls thereof.

A further object of the invention is to provide an apparatus for carrying out this process which operates positively and automatically and without adjustment or attention, which is simple in construction, has no moving parts, and is not likely to get out of order, and which adds but little to the cost of the usual refrigerator structure.

With these and other objects in view, the invention comprises the several steps and the relation thereof to each other which will be exemplified in the hereinafter disclosed method, and the features of construction, combinations of elements and arrangements of parts which will be exemplified in the apparatus hereinafter set forth.

Referring to the accompanying drawings in which similar reference numerals indicate similar parts throughout the several views—

Fig. 1 is a diagrammatic view illustrating the operation of my method for preventing the condensation of moisture on the exterior walls of the refrigerator cabinet;

Fig. 2 is a transverse vertical section of one embodiment of a refrigerator cabinet for carrying out the process above referred to, the section being taken on the line of 2—2 of Fig. 4;

Fig. 3 is a horizontal section thereof, the section being taken on the line of 3—3 of Fig. 4;

Fig. 4 is a vertical section from front to rear, the section being taken on the line of 4—4 of Fig. 2;

Fig. 5 is a similar view taken on the line of 5—5 of Fig. 4; and

Fig. 6 is an enlarged sectional view showing the door structure.

In carrying out the present embodiment of my method of preventing the condensation and deposit of moisture or "dew" on the exterior surface of the wall of a refrigerator cabinet, I create and maintain within, and in spaced relation to, such wall, a zone of temperature at or below the dew-point of the normal atmosphere outside of, or surrounding, the cabinet. Such zone may be formed, for instance, by the wall of an inner refrigerating compartment, which is cooled by any suitable refrigerating means and the temperature of which is usually maintained below the dew-point of the normal atmosphere outside of the cabinet. I admit air from the outside atmosphere to the inner side of the cabinet wall to form and maintain a layer of air which covers the inner surface thereof, and which is interposed between the same and the zone of relatively low temperature, and is in free communication adjacent its upper and lower ends and for substantially its full width with the outside atmosphere. I expose this layer of air at the side thereof remote from the cabinet wall to the cooling action of the zone of lower temperature and thereby effect a certain lowering of the temperature of the layer, increase its density and cause it to descend, sweep downwardly over the inner surface of the cabinet wall and pass at its lower end into the outside atmosphere, while additional volumes of air are simultaneously drawn in from the outside atmosphere at and follow the upper end of the descending layer. As the layer passes downwardly along the zone of lower temperature it is cooled thereby more and more, until it finally escapes.

I regulate the passage of the layer of air into the outside atmosphere so that it escapes before becoming lowered in temperature to the point of reducing,—by carrying off heat from the wall of the cabinet,—the temperature of the outer surface of the cabinet wall to the dew-point of the outside atmosphere. This is an important step in the process and is effected by suitably proportioning the thickness of the layer of air to the height of the zone of relatively low temperature along which it travels, and also to the heat transfer from the layer to the zone, which latter factor is dependent, when the zone is in the form of a wall of an inner refrigerating compartment, upon the thermal conductivity of such wall, and upon the difference between the normal temperature of the layer as it is admitted from the outside atmosphere, and the temperature within the inner refrigerating compartment. The height of the wall of the inner refrigerating compartment and also the thermal conductivity thereof can, of course, readily be determined. However, there may be considerable variation from time to time in the normal temperature of the layer of air (which corresponds with the temperature of the outside atmosphere), and the temperature maintained within the inner refrigerating compartment. By taking the probable maximum temperature of the former and the probable minimum temperature of the latter, and preferably allowing a suitable margin of safety, the regulation is effective for all conditions within these limits.

According to my present understanding of the theory of operation of this method, it

is believed that the portion of the layer of air coming in contact with the zone as the air is admitted from the outside atmosphere, is lowered in temperature and forms a stratum which is cooler than the stratum in contact with the inner surface of the cabinet wall. The cooler stratum descends by reason of its increased density and as it flows downwardly along and in contact with the zone is cooled thereby more and more and becomes gradually thicker and flares downwardly and outwardly, while the warmer stratum is correspondingly, gradually reduced in thickness and tapers from the upper and to the lower end of the layer.

While there may be no actual sharp line of division between the two strata, they may be considered as divided, at least theoretically, along a plane extending obliquely between the zone and the cabinet wall and inclined downwardly and outwardly toward the latter. This is diagrammatically illustrated in Fig. 1 of the drawings, in which the letter A indicates the cabinet wall, B the zone of relatively low temperature, C the cooler stratum of the layer of air, D the warmer stratum, and E the plane of division between the two strata.

The cooler stratum thus partially supports the warmer stratum and as it descends drags the latter with it so that both strata pass together at the lower end of the layer into the outside atmosphere. By suitably proportioning the thickness of the layer, as hereinabove described, the plane of division will pass from end to end of the layer without touching the cabinet wall, and the inner surface of the cabinet wall will be at all times entirely covered by the warmer stratum of the layer of air, the temperature of which stratum is substantially the same as the outside atmosphere. Under these circumstances there is little, if any, heat transfer from the cabinet wall to the layer, and therefore the lowering of the temperature of the outer surface of the cabinet wall to the dew-point of the outside atmosphere is avoided and the formation of condensation thereon is effectively prevented.

Of course, it is not desired to have the layer of air any thicker than necessary since that involves either adding to the bulk of the cabinet or encroaching on the available space therein, and might also interfere with the drawing of the warmer stratum downwardly with the cooler stratum as the latter descends. But even if the layer is reduced in thickness so that the plane of division between the strata intersects the cabinet wall and the cooler stratum comes in contact with the inner surface thereof, the method is nevertheless operative so long as the layer descends and escapes into the outside atmosphere before any portion thereof in contact with the inner surface of the cabinet wall becomes lowered in temperature by the zone to the point of reducing,—by carrying off heat from the wall,—the temperature of the outer surface of the cabinet wall to the dew-point of the outside atmosphere.

It will be apparent that this method may be employed in connection with the respective walls of a refrigerator cabinet, particularly the upright walls, and with the door or movable wall as well as with the stationary walls thereof, that it will prevent condensation on the exterior surface of the cabinet notwithstanding the existence of the beforementioned factors and conditions entering into its formation, and that the operation of the method will in no wise interfere with the efficiency of the refrigerator.

Referring to the present embodiment of the apparatus for carrying out my method, the refrigerator cabinet comprises an exterior casing 1 and an inner refrigerating compartment 2 mounted therein as hereinafter pointed out.

The casing is preferably, although not necessarily, made of heavy sheet metal, the outer surface of which is painted, lacquered, enameled or otherwise given an attractive finish. It has a back wall 3, side walls 4, and a top wall 5, the front being open. The side and top walls may be formed from one piece of metal with flanges 6 along their rear edges to which the back wall 3 is rigidly secured, as by screws or rivets 7.

A pan 8 is arranged within and extends across the casing below the refrigerating compartment 2, and is suitably fastened, as at 9, to the back wall 3 and side walls 4. A drain pipe 10 may lead from the pan and in the present instance is shown as passing outwardly through the back wall 3, the bottom of the pan being inclined toward the drain, so as to cause any water collecting in the pan to pass off therethrough.

The casing preferably extends downwardly below the pan to provide a compartment 11 beneath the same for housing the mechanical unit (not shown) employed when the refrigerator is cooled mechanically. In such instance a bottom 12 for this compartment is secured across the lower end of the casing.

A frame of wood or other suitable material is mounted within the open front of the casing and comprises sides 13 extending substantially the full height of the casing, an upper cross-bar or top 14, and a lower cross-bar 15 located above but adjacent to the pan 8. The upper cross-bar 14 of this frame is secured by screws 16 or the like to a facing 17 which depends from the top wall 5, turns inwardly beneath the cross-bar and substantially conceals the latter from view. The sides 13 are secured, as at 18, to similar facings 19 extending laterally and inwardly from the side walls 4 of the cabinet. A fac-

ing 20 covers the front surface of the lower cross-bar 15 and extends downwardly therefrom and is turned rearwardly under and supports the front of the pan 8.

The inner refrigerating compartment 2 is box-like in form, is open at its front, and is supported by, and suitably secured along its front edges to, the frame. While this compartment may be of any appropriate construction, it consists in the present instance of nested, metallic shells 21 and 22, with suitable insulating material 23 interposed therebetween, the shells being fastened, as at 24, to the sides 13 and upper and lower cross bars 14 and 15 of the frame. The bottom of the compartment is also supported upon and in spaced relation to the pan 8 by means of a plurality of interposed blocks 25 arranged so as not to interfere with the free drainage of the pan to the pipe 10. A chamber 26 is thus provided between the compartment and the pan.

The compartment 2 is otherwise spaced from the casing 1 so as to provide intervening air chambers 27 between back and sides of the compartment, and the corresponding back wall 3 and side walls 4, and an upper air chamber 28 between the top of the compartment and the top wall 5. The chambers 27 communicate at their upper ends with the chamber 28 and at their lower ends with the chamber 26.

Openings or louvres 29 are formed in the back wall 3 and the side walls 4 adjacent the upper and lower ends, respectively, of the chambers 27, whereby to admit air freely from the outside atmosphere and permit it to circulate therethrough. There may be one or a plurality of openings or louvres 29 at each end, but in either instance they extend across the corresponding wall of the casing for substantially the full width thereof and their total area is preferably approximately equal to the cross-sectional area of the adjacent chamber 27 and to the total area of the openings or louvres at the opposite end of such chamber.

To admit air from the outside atmosphere to the upper chamber 28, one or more openings 30 are formed in the top wall 5 substantially centrally thereof. In connection with this chamber 28 it is to be noted that the top of the refrigerating compartment 2 is inclined downwardly from front to rear (as shown in Fig. 4) for a purpose to be hereinafter pointed out.

Mounted on the frame at the front of the refrigerator cabinet is a door consisting of an inner wall 31 and an outer wall 32, the former being heat insulated as indicated at 33 and being adapted to close snugly against a suitable seat or gasket 34 surrounding the doorway. The outer wall 32 has a suitable finish applied to its outer surface and is supported in spaced relation to the inner wall 31 so as to provide one or more intervening air chambers 35. In the present instance the supporting means consists of a plurality of vertically disposed spacing strips 36, two of which are interposed between the walls adjacent the side edges thereof, and another of which located intermediately of these two. Two chambers 35 are thus provided and are similarly open top and bottom to admit air from the outside atmosphere and permit it to circulate therethrough.

Adjacent the lower ends of the chambers 35 and beneath the outer surface of the inner wall 31, is a trough or gutter 37 extending along and carried by the lower cross-bar 15 of the frame. This trough drains to an outlet pipe or spout 38 which passes through the cross-bar 15 and discharges into the pan 8.

A cooling element 39 is contained within the refrigerating compartment 2 and lowers the temperature therein and usually maintains the same below the dew-point of the normal outside atmosphere. This element may be in the form of the usual brine tank or other cooling unit of a mechanical cooling system, or in the form of ice.

In the operation of the apparatus, the layers or columns of air within the respective chambers 27 normally descend therein through the cooling action of the corresponding walls of the refrigerating chamber 2 and continually pass into the outside atmosphere through the lower openings or louvres 29, while additional volumes of air are simultaneously drawn into the chambers through the upper openings or louvres 29. By having the total areas of the upper and lower louvres of each chamber substantially equal to each other and to the cross-sectional area of such chamber the circulation of air is free and unobstructed, and by having the openings or louvres 29 extend transversely for substantially the full width of the wall of the casing the circulation will be substantially uniform across the full width of each chamber. On account of the communication between each of the chambers 27 and the upper air chamber 28 the descending layers of air in the former also serve to draw the layer of air downwardly from the latter and cause air from the outside atmosphere to be simultaneously admitted through the openings 30 in the top wall 5.

The thickness of the layers of air in these various air chambers is determined by the spacing between the outer casing and the inner refrigerating compartment, and is suitably proportioned, as hereinbefore set forth in connection with the process, to regulate the passage of the layers of air into the outside atmosphere so that they escape before becoming lowered in temperature by

contact with the walls of the inner refrigerating compartment to the point of reducing,—by carrying off heat from the walls of the casing,—the temperature of the outer surface of the casing to the dew-point of the outside atmosphere. The same action takes place in connection with the air chambers 35 located between the inner and outer walls of the door. As a result, the condensation of moisture or dew on the exterior surface of the casing is effectively prevented, and this applies to the door as well as to the stationary walls.

Any condensation that does form occurs on the outer surface of the walls of the inner refrigerating compartment and the outer surface of the inner wall of the door, all of which are hidden from view and are not required to take an attractive finish and hence may be suitably constructed or treated to withstand moisture,—without detracting from the appearance of the refrigerator cabinet. Moreover, such condensation collecting on the side and back walls of the refrigerating chamber runs down the same into the chamber 26 below the refrigerating compartment and is received in the pan 8, from which it is discharged through the drain-pipe 10. Moisture condensed on the top wall of the refrigerating compartment will flow rearwardly by virtue of the inclined disposition thereof, above pointed out, and hence will run down the rear wall of the compartment into the pan. The trough or gutter 37 receives the condensed moisture which drips from the outer surface of the inner wall of the door and carries the same off through the pipe 38 to the pan.

It is to be noted that none of the air chambers are in communication with the interior of the refrigerating compartment and that the admission of air thereto from the outside atmosphere and its circulation therethrough in no wise interferes with the efficiency of the refrigerator; the apparatus operates positively and automatically, and without adjustment or attention, is simple in construction, has no moving parts, and is not likely to get out of order, and involves but little addition to the cost of the usual refrigerator structure.

While in the present embodiment of the apparatus chambers surround the inner refrigerating compartment on all sides, the chamber at the top of the cabinet may be omitted, as well as one or more of the other chambers if not required in a given instance. Where a mechanical unit is not employed in cooling the refrigerator, the compartment therefor in the lower portion of the cabinet may be used for general storage purposes or omitted altogether.

Furthermore, it is to be understood that the location and arrangement of the openings or louvres may be varied, that the drain may be omitted, and that various other changes may be made in the method and apparatus herein disclosed without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States—

1. The method of preventing condensation on the exterior surface of the wall of a refrigerator cabinet, which consists in causing a layer of air from the outside atmosphere to sweep downwardly across the inner surface of the wall by exposing the layer to a zone of lower temperature within the wall, and causing the layer to pass into the outside atmosphere before becoming lowered in temperature to the point of reducing, by carrying off heat from the wall, the temperature of the outer surface of the wall to the dew-point of the outside atmosphere.

2. The method of preventing condensation on the exterior surface of the wall of a refrigerator cabinet, which consists in admitting air from the outside atmosphere to form a layer covering the inner surface of the wall and in free communication adjacent its upper and lower ends with the outside atmosphere, cooling such layer from the side thereof remote from the wall and thereby causing the layer to descend and pass into the outside atmosphere at its lower end and simultaneously draw in additional volumes of air at its upper end, and causing the layer of air to pass into the atmosphere before the portion thereof in contact with the wall becomes lowered to the dew-point temperature of the outside atmosphere.

3. The method of preventing condensation on the exterior surface of the wall of a refrigerator cabinet, which consists in creating within and in spaced relation to said wall a zone of temperature as low as the dew-point of the outside atmosphere, causing a layer of air from the outside atmosphere to be interposed between the wall and such zone, cooling the layer by contact with such zone to increase its density and thereby cause it to descend and simultaneously draw in additional volumes of air from the outside atmosphere to follow the upper end of the descending layer, and causing the descending layer to pass into the outside atmosphere at its lower end before the portion of the layer in contact with the inner surface of the wall is cooled to the dew-point of the outside atmosphere.

4. The method of preventing condensation on the exterior surface of a refrigerator cabinet, which consists in causing a layer of air to be interposed between the wall of an inner refrigerating compartment and the wall of a surrounding casing and in free communication adjacent its top and bottom with the outside atmosphere, cooling the

layer of air by contact with the wall of the refrigerating compartment and thereby causing the layer to descend and draw in additional volumes of air from the outside atmosphere to follow the upper end of the descending layer, and causing the descending layer to pass at its lower end into the outside atmosphere before becoming lowered in temperature to the point of reducing, by carrying off heat from the casing wall, the temperature of the outer surface of such wall to the dew-point of the outside atmosphere.

5. In a device of the character described, the combination of inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings leading therefrom and communicating with the outside atmosphere, and refrigerating means within the inner wall cooling the same to or below the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere normally to circulate continually downwardly through the chamber, to prevent the condensation of moisture on the exterior of the refrigerator cabinet.

6. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings leading therefrom and communicating with the outside atmosphere, and means within the inner wall cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through the chamber, the spacing between said walls being proportioned to the distance the air travels along the inner wall and to the heat transfer from the air to such inner wall.

7. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings leading therefrom and communicating with the outside atmosphere, and means within the inner wall cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere normally to circulate downwardly through the chamber, the areas of said openings being substantially equal to each other and to the cross-sectional area of the chamber.

8. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings leading therefrom and communicating with the outside atmosphere, and means within the inner wall cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere normally to circulate downwardly through the chamber, said openings extending across the chamber for substantially the full width thereof.

9. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings leading therefrom and communicating with the outside atmosphere, means within the inner wall for cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through the chamber, and means for collecting moisture condensed on the outer surface of the inner wall.

10. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of an inner refrigerating compartment, a casing surrounding the same and providing an intervening air chamber out of communication with said compartment, said casing being formed with openings leading from the chamber adjacent the upper and lower ends thereof and communicating with the outside atmosphere, and refrigerating means within said compartment cooling the wall thereof to the dew-point of the outside atmosphere and thereby causing air from the outside atmosphere normally to circulate downwardly through the air chamber.

11. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of an inner refrigerating compartment, a casing surrounding the same and providing an intervening air chamber out of communication with said compartment, said casing being formed with openings leading from the chamber adjacent the upper and lower ends thereof and communicating with the outside atmosphere, means within said compartment for cooling the wall thereof to the dew-point of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through the air chamber, and means for collecting moisture condensed on the outer surface of the wall of the compartment.

12. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of an inner refrigerating

compartment, a casing surrounding the same and providing intervening air chambers, and a door comprising inner and outer walls spaced apart with an intervening air chamber, each of said chambers being out of communication with the refrigerating compartment and being formed with vertically spaced openings communicating with the outside atmosphere and permitting air therefrom to circulate through such chamber, and the openings of each chamber extending across the same for substantially the full width thereof and having areas substantially equal to each other and to the cross sectional area of such chamber.

13. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of an inner refrigerating compartment, a casing surrounding the same and providing an intervening air chamber, a door comprising inner and outer walls spaced apart with an intervening air chamber, each of said chambers being out of communication with the refrigerating compartment and being formed with vertically spaced openings communicating with the outside atmosphere, and means within the refrigerating compartment for cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through the respective chambers.

14. In a device of the character described, for preventing the condensation of moisture on the exterior of a refrigerator cabinet, the combination of an inner refrigerating compartment, a casing surrounding the same and providing an intervening air chamber, a door comprising inner and outer walls spaced apart with an intervening air chamber, each of said chambers being out of communication with the refrigerating compartment and being formed with vertically spaced openings communicating with the outside atmosphere, means within the refrigerating compartment for cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through the respective chambers, and common means for collecting moisture condensing on the outer surface of the wall of the compartment and on the outer surface of the inner wall of the door.

15. In a device of the character described, for preventing condensation on the exterior of a refrigerator cabinet, the combination of a door comprising inner and outer walls spaced apart with an intervening air chamber, the chamber having vertically spaced openings communicating with the outside atmosphere, means within the inner wall for cooling the same to the dew-point temperature of the outside atmosphere and thereby causing air from the outside atmosphere to circulate downwardly through said chamber, and means for collecting moisture condensed on the outer surface of the inner wall.

In testimony whereof, I have signed my name to this specification.

ALBERT L. LAMBERT.