May 10, 1955 W. G. MOCEY 2,707,871

REFRIGERATION APPARATUS

Filed Oct. 31, 1952

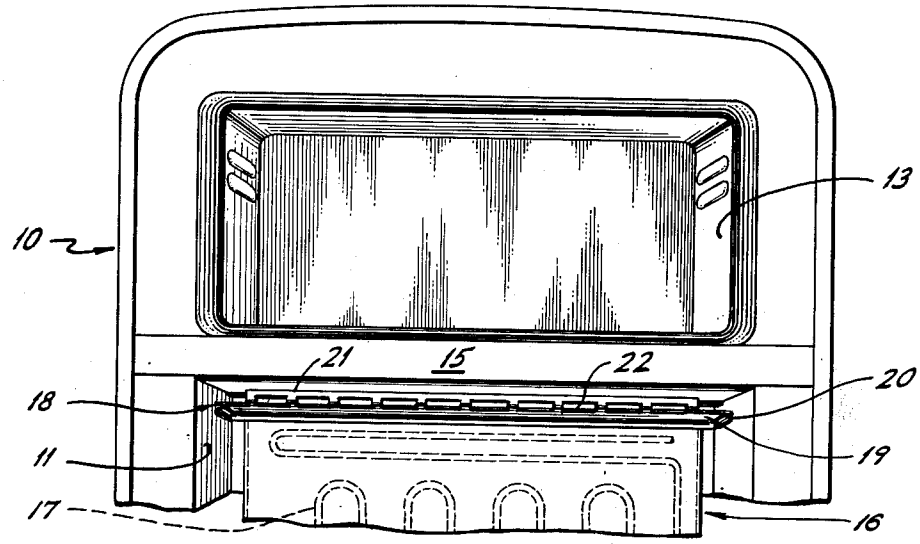


FIG. 2.

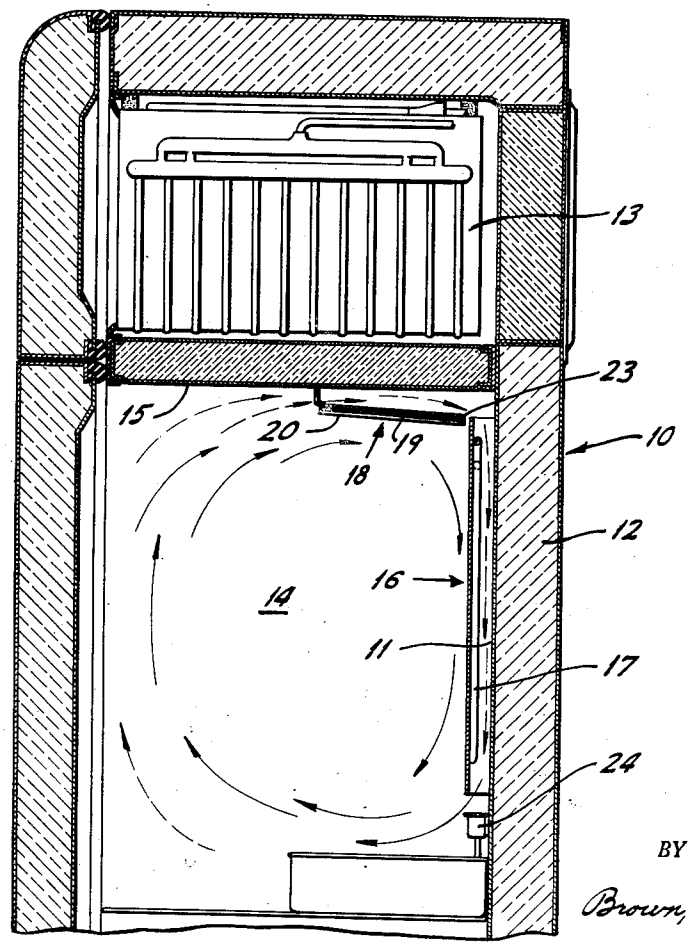


FIG. 1.

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AGENTS

United States Patent Office

2,707,871

Patented May 10, 1955

2,707,871

REFRIGERATION APPARATUS

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Application October 31, 1952, Serial No. 317,984

2 Claims. (Cl. 62—99)

This invention relates to refrigeration apparatus of the kind having a storage compartment cooled by a vertically disposed plate type evaporator, and the invention has as its primary object the prevention of moisture accumulation upon certain portions of the wall structure which defines the compartment.

It is now recognized that a desirable way of constructing a refrigerator comprises dividing the space defined by the inner liner of the cabinet into upper and lower compartments by means of a generally horizontal partition which serves as the bottom of the upper compartment and the top of the lower compartment, and isolates the two compartments in such manner as to prevent contact of air within one compartment (usually the lower) with the low temperature evaporator which cools the upper compartment. In order to refrigerate the lower compartment it is known to provide a vertically extending plate-like evaporator disposed in closely spaced adjacency with respect to a rear wall of that compartment. One such refrigerator is disclosed and claimed in the copending application of Malcolm G. Shoemaker, bearing Serial No. 296,995, filed July 3, 1952, and assigned to the assignee of the present invention.

While constructions of this general character are well known and are advantageous, they have been found in practice to be subject to a disadvantage in that moisture tends to condense and accumulate upon portions of the top wall of the lower compartment. This condensation is generally localized, being limited to the rear portions of the top wall, that is, portions which overlie or are closely adjacent to the upper part of the plate-like evaporator aforesaid. The reason for this accumulation will be understood when it is recognized that in a compartment refrigerated by such a vertically extending evaporator these surface portions tend to be maintained at a temperature somewhat lower than the temperature of other surfaces disposed within the compartment and, also, there is relatively little circulation of air in this region.

Respecting the relative lack of circulation in this area, it is to be understood that a compartment of this type is cooled by a convectional, circulatory flow of air which takes place downwardly past the low temperature forward surface of the evaporator and upwardly through opposed zones of the compartment spaced from the evaporator. There is a tendency for the warmer, upwardly moving air to return to the cooled plate by curving downwardly in a streamline path such that the rear portion of the underside of the partition is not swept with warm air.

To overcome this difficulty, and to achieve the general objective indicated above, the invention contemplates provision within the compartment of an air deflector or baffle which is spaced somewhat from the top wall of the compartment, preferably underlies the region of condensation only, and has its rear edge so disposed, as respects the upper edge of the plate-like evaporator, as to cause said baffle to define—in cooperation with the top wall of the compartment—a passage through which a portion of the circulating air moving backwardly toward the evaporator flows across the stated region of the top wall and downwardly behind the evaporator. It is of importance that the baffle not be refrigerated, and that it be maintained out of conductive association with the evaporator.

While the primary flow of air in such a refrigerator is downwardly across the front surface of the evaporator, there is also a tendency for air, as it is cooled, to be drawn downwardly through the space between said evaporator and the adjacent portions of the rear wall of the compartment. A baffle constructed and arranged in the manner aforesaid utilizes the mentioned tendency and draws air across the rear portions of the top wall, thereby preventing condensation of moisture upon such portions.

The manner in which the foregoing and other objectives of my invention may best be achieved, will be more clearly understood from a consideration of the following detailed description, considered in conjunction with the accompanying drawing, in which:

Figure 1 is a fragmentary, side sectional view illustrating a two-compartment refrigerator embodying apparatus in accordance with the invention; and

Figure 2 is a perspective illustration of the upper, forward portion of the refrigerator.

Now making more detailed reference to the drawing, it will be seen that the invention is therein illustrated as embodied in a household or domestic refrigerator comprising an outer shell **10** and an inner shell or liner member **11** spaced and insulated from the outer shell **10** by any suitable insulation shown at **12**. A pair of doors seat against the forward face of the cabinet, sealing the same and providing access thereto. It will be understood that the refrigerator also includes circulating means for example, a compressor-condenser unit of any desired type, but illustration of this portion of the apparatus is not necessary herein since the present invention is not concerned therewith.

As indicated above, and as clearly appears in the drawing, the refrigerator is of the type in which the space within the inner liner **11** is sub-divided into an upper relatively low temperature freezing compartment which, in the embodiment shown, is defined by an evaporator **13**, and a lower main food storage compartment **14**, division being effected by means of an insulated partition designated by the reference character **15**. The partition spans the width and depth of the space defined by the inner liner **11** and is so constructed, and disposed within the cabinet, as thermally to isolate the two compartments, preventing contact of the air within the main lower compartment with the low temperature evaporator **13**.

In order to refrigerate the lower compartment it is provided with a plate type evaporator **16** which extends vertically within said lower compartment, being spaced somewhat from the rear wall of the latter. Since thermosyphonic movement of air is relied upon to refrigerate the compartment **14**, and since the quantity of air which can move, convectionally, downwardly through the restricted space behind the evaporator is insufficient to provide adequate refrigeration within the compartment, the evaporator must be of such a character as to cause its front surface to be maintained at a relatively low temperature in order that substantial circulation across said front surface will occur. To this end, evaporator **16** comprises a metal plate of high thermal conductivity having bonded to its rear surface suitable refrigerant tubing **17** which latter, together with upper evaporator **13**, is connected in refrigerant flow relationship with the condensing unit (not shown). The normal circulatory flow of air which cools the compartment **14** is clearly shown by solid-line arrows applied to Figure 1.

In particular accordance with the present invention, an

air deflector, or baffle structure 18 is provided within the compartment 14, this structure comprising a relatively thin metallic sheet 19 spaced beneath the rear part of the top wall of the compartment, that is, so located as to underlie the aforesaid zone of condensation. The sheet 19 spans the width of the cabinet and is carried by the side walls of the compartment in any convenient manner, as through the agency of track-like supports shown at 20. In order to space the forward edge of the sheet 19 somewhat below the top of the compartment, and to improve the appearance of the baffle structure, the sheet carries at its forward edge an upwardly turned flange portion 21 which is provided with a plurality of air inflow apertures shown at 22. The baffle preferably has slight downward inclination toward the rear of the compartment, and its back edge 23 lies closely adjacent to the upper edge of the plate-like evaporator 16. Inclination of the baffle serves a dual purpose, decreasing the frictional resistance presented to the air flowing through the passage above the baffle and delivering to the face of the evaporator 16 any drops of moisture which may, under unusual circumstances, collect upon the upper surface of the baffle. Moisture thus passed to the surface of evaporator 16 is delivered to any suitable drain, as for example the drain structure indicated at 24 in Figure 1.

It is to be noted that the baffle does not extend forwardly within the cabinet beyond a distance just sufficient to underlie the area of condensation. This factor is of importance, since extension of the baffle to the front of the compartment 14 would result in an undue increase in the resistance to air flow through the space above the baffle, and consequent reduction in the effectiveness of the structure. Further, air circulating within the refrigerator follows a path of streamline contour, and in order that a sufficient quantity of the circulating air may be delivered to the space above the baffle, in the manner indicated by broken-line arrows applied to Figure 1, its forward or inlet edge is preferably disposed rearwardly of the midpoint of the depth of the cabinet. A baffle of this kind has been found completely to eliminate the aforesaid condensation difficulty, and to have a noticeable effect in maintaining desired temperatures throughout the compartment 14. In this latter connection the baffle tends to reduce the thermal gradient throughout the height of the compartment.

Considering the operation of apparatus constructed in accordance with my invention in somewhat greater detail, it will be seen that there are two operational advantages which, together, result in virtually complete elimination of condensation.

Firstly, the baffle provides positive circulation of air across the critical surface areas of the partition 15, thereby insuring a supply of relatively dry air. There is a change in density, due to heat transfer to the evaporator 16, of air confined between the rear surface of the evaporator and the back wall of the compartment. In changing density the air moves to a lower level, thereby creating a reduced pressure area in the region of the top of the evaporator, and as will now be understood this pressure reduction is utilized to create the aforesaid positive circulation. Secondly, the baffle structure 18 is instrumental in raising the temperature in the region concerned above the dew point temperature of the moisture-laden air within the refrigerator. The air passing above the baffle is of course at a more elevated temperature than air in contact with the evaporator, or present in the lower part of the refrigerator, and it is also to be borne in mind that the relatively low thermal mass of the unrefrigerated baffle causes the baffle itself to warm rapidly, under the influence of the circulatory flow of air which it induces. This warming of the baffle further assists in maintaining the temperature, in the region above the baffle, at a value in excess of the dew point. If refrigerant were to be circulated in heat exchange relation with the baffle structure, it will be evident that reduction in the temperature above the baffle would occur, and condensation would result. The term "baffle," as used in the appended claims, should be understood with this in mind.

In summary, and as will now be well understood, there is provided, by this invention, refrigeration apparatus of the plate-cooled type having in novel combination therewith baffle structure so constructed and arranged as to result in virtually complete elimination of a condensation problem formerly encountered in refrigerators of this kind. It is to be noted that the construction, disposition, and the extent of the baffle structure all contribute to achievement of this result.

I claim:

1. In refrigeration apparatus, a storage compartment including top, bottom and side walls, a plate type evaporator having cooling means bonded thereto, said evaporator extending generally vertically within the compartment in closely spaced adjacency to one of the side walls thereof, the front surface of said evaporator being maintained at a relatively low temperature during normal operation of the apparatus whereby the compartment is cooled primarily by a convectional current of air circulating downwardly past the front surface of said evaporator and upwardly through an opposed region of the compartment spaced from said evaporator, there further being a tendency for air to flow downwardly through the space between said evaporator and the adjacent wall of the compartment, and means for utilizing the last-mentioned flow of air to prevent condensation of moisture upon the top wall of the compartment in a restricted region extending somewhat forwardly from the plane of said evaporator, said means comprising an air deflecting baffle spaced from said top wall and underlying the said region only, the rear edge of said baffle being so disposed, as respects the upper edge of said evaporator, as to cause said baffle to define, in cooperation with the top wall of the compartment, a passage through which a portion of the circulating air flows across the stated region of said top wall and downwardly behind said evaporator.

2. In refrigeration apparatus, a storage compartment including top, bottom, side and rear walls, cooling means within the compartment comprising a plate-like member of high heat conductivity extending generally vertically within the compartment in spaced adjacency to the rear wall thereof and having an upper edge closely underlying said top wall, said plate-like member having in high heat exchange relation therewith a refrigerant flow passage to maintain said member at a relatively low temperature, the construction and arrangement being such that during normal operation of the apparatus the compartment is cooled primarly by a convectional circulatory flow of air downwardly past the front surface of said member and upwardly through a portion of the compartment spaced from said member, and means for promoting flow of air across a restricted region of the rear part of said top wall generally overlying said member, said means comprising an air deflector spaced from said top wall and extending beneath the said region, said deflector having a rear edge portion disposed in closely spaced adjacency with respect to the upper edge of said member.

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