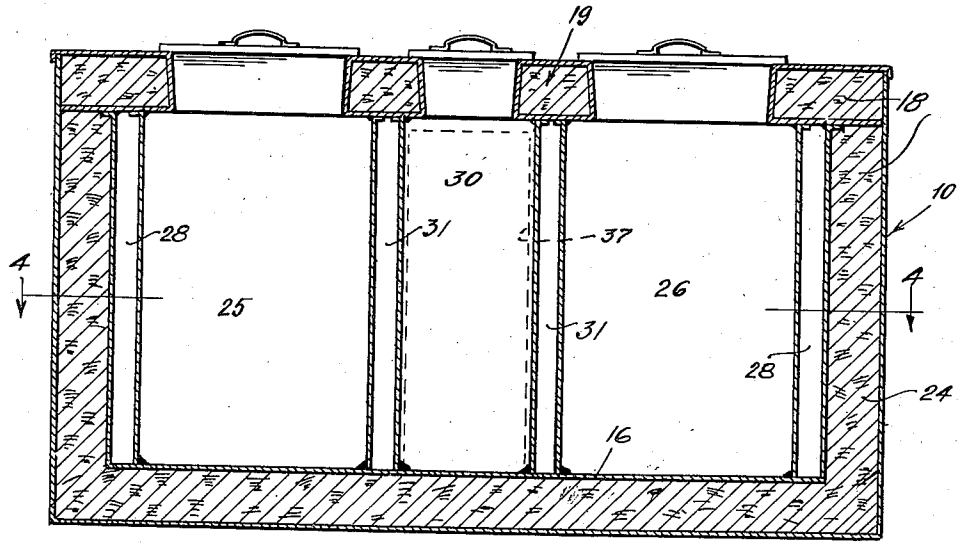
Dec. 29, 1936. A. E. RINKER 2,066,124

REFRIGERATOR CABINET

Filed Oct. 9, 1935 2 Sheets-Sheet 1

Fig. 2.



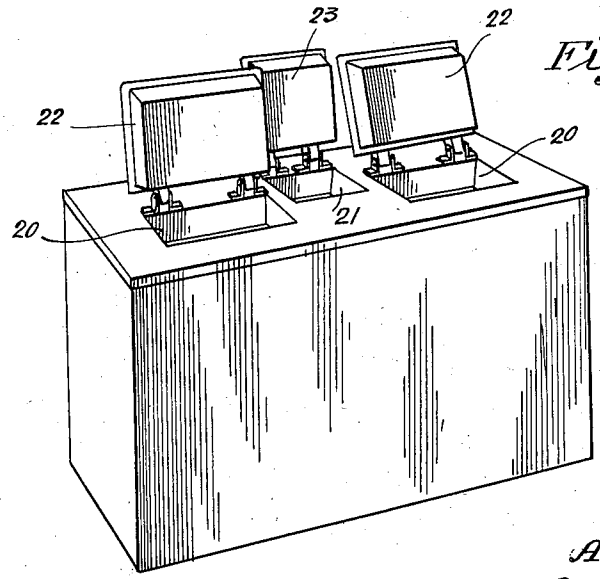




Fig. 1.

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Filed Oct. 9, 1935 2 Sheets-Sheet 2

Fig. 3.

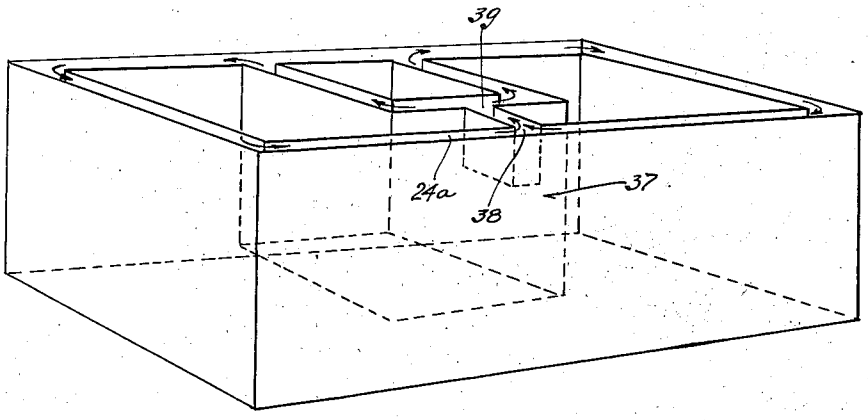



Fig. 4.

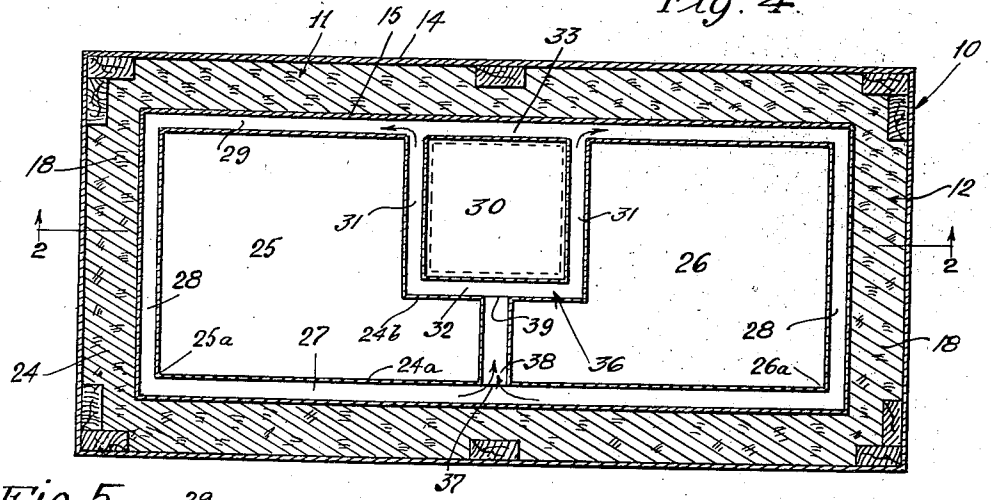
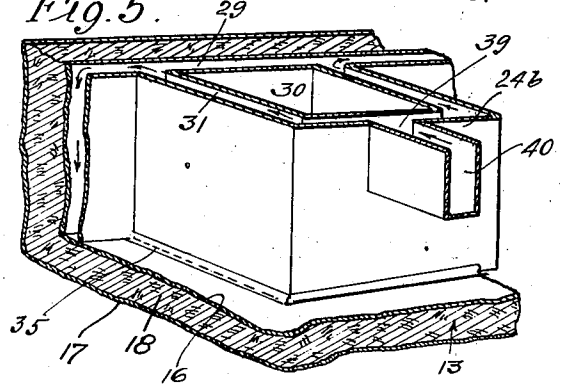



Fig. 5.




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# UNITED STATES PATENT OFFICE

2,066,124

## REFRIGERATOR CABINET

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Application October 9, 1935, Serial No. 44,207

11 Claims. (Cl. 62—101)

This invention deals generally with refrigerators of the brine circulation type wherein the flow of brine from the cooling compartment or refrigerating element around the compartment to be refrigerated, is maintained by virtue of temperature differentials in the brine liquid. The present type of refrigerator cabinet is especially suitable for stores, restaurants and the like for keeping ice cream and other foods in a refrigerated condition, and has been particularly designed with the view of using solid carbon dioxide or "dry ice" as the primary cooling medium or refrigerant.

One of my principal objects is to provide a refrigerator that is both highly efficient as regards its ability to maintain all parts of the food compartment or compartments at substantially the same low temperature, and yet operate highly economically in the respect that a minimum cooling load is imposed on the cooling element to maintain such uniform low temperatures. The invention also has for its purpose to provide a refrigerator having these characteristics, that is extremely simple in construction and capable of manufacture at unusually low cost. It may be stated, in connection with the use of dry ice as the primary refrigerant, that by virtue of its ability to maintain highly efficient cooling, the present refrigerator requires a minimum consumption of the dry ice for its operation and consequently is economical from a standpoint of maintenance or operation, as well as initial cost.

The invention may be characterized briefly as comprising a suitable insulated brine tank containing a cooling compartment, and one or more, though preferably two, food compartments that are spaced from the wall of the tank to provide elongated and comparatively narrow passages through which a circulation of brine is maintained. The relative positions of the cooling and food compartments, together with the brine circulation passages, are such that the lowest temperature brine at the outside of the cooling compartment, circulates through the passages between the insulated sides of the tank and the food compartment, around the latter and back into the passages next to the cooling compartment. As will later appear, the arrangement and spacing of the compartments within the tank provide food compartments of maximum size, consistent with the tank dimensions, and yet enable at least the lower portions of the food compartments furthest from the cooling compartment, to be kept at substantially the same low temperatures as prevail in the immediate vicinity of the cooling zone.

As previously mentioned, in the present refrigerator the circulation of brine is maintained by virtue of temperature differentials in the brine itself, or more specifically, by reason of higher and lower temperatures of the brine within the upper and lower portions, respectively, of the brine passages. Another purpose of the invention is to provide, in conjunction with the brine circulating system, an improved and efficient means for maintaining a thermosiphonic circulation of the brine through the passages at sufficient rate of flow to compensate for heat losses through the wall of the tank, and thereby insure the maintenance of desired uniform low temperatures within the food compartments.

The invention has various additional objects and features, but all these, as well as structural details, will be explained to best advantage and more fully understood from the following detailed description of the invention in one of its typical and preferred forms. Throughout the description reference is had to the accompanying drawings, in which:

Fig. 1 is a perspective showing the outside of the refrigerator cabinet with the doors to the cooling and food compartments open;

Fig. 2 is an enlarged vertical longitudinal section on line 2—2 of Fig. 4, showing the doors in elevation and in closed position;

Fig. 3 is a diagrammatic perspective illustrating the positions and spacing of the several compartments within the tank, and also the directions of brine circulation;

Fig. 4 is a horizontal section on line 4—4 of Fig. 2; and

Fig. 5 is a fragmentary perspective illustrating the trough in the brine circuit leading to the passages surrounding the cooling compartment.

The brine tank, generally indicated at 10, may be of any suitable dimensions and shape, although in order to provide for maximum capacity of the later described food compartments, the tank preferably is made rectangular in horizontal cross section, as shown in Fig. 4. The side walls 11 and 12, and also the bottom wall 13 of the tank, are of insulated construction comprising spaced sheet metal 14, 15 and 16, 17, between which is placed suitable heat insulated material 18 such as cork. The top wall 19 of the brine tank is of similar construction, and is provided with openings 20 and 21 for the food and dry ice compartments, respectively, and into

which the hinged insulated doors 22 and 23 close.

The brine tank 10 contains a vertical wall shell 24 made of suitable heat conductive metal and shaped to form compartments 25 and 26 which contain the ice cream or other food to be refrigerated, the side walls of shell 24 extending parallel with the walls of the brine tank, and spaced therefrom to provide elongated brine circulation passages 27, 28 and 29 extending in depth preferably the full height of the food compartment shell. The brine passages are purposely made narrow in order that the brine will circulate through them at a sufficient rate to maintain at all times the desired uniform low temperature entirely around the cooling compartments, and so that the temperatures at the corner 25a and 26a of these compartments will be substantially as low as the temperatures existing at points closer to the cooling compartment 30. The latter is formed by a shell 31 of rectangular horizontal cross section spaced at 31 and 32 from the inner walls of shell 24, and at 33 from the wall of the tank 10, to provide brine circulation passages similar in dimensions to the previously described passages around the outside of the food compartments. Both shells 24 and 31 rest on the sheet metal 16 of the brine tank floor, and are secured thereto by soldering on their lower edges, as indicated at 35 in Fig. 5, or by other suitable means providing a fluid-tight joint.

Although in certain broad aspects of the invention, any suitable refrigerating or cooling unit may be placed in space 36, shown to be occupied by shell 31, I preferably use dry ice, indicated by the dotted lines 37, as the primary refrigerant because of the demands for and salability of the ice itself, and because of the ability of the refrigerator to keep the ice over long periods without great loss.

Brine circulation from passages 31, 32 and 33 surrounding the cooling compartment, through passages 29, 28 and 27 surrounding the food compartments, occurs by thermosiphonic action resulting from temperature differentials in the brine and the tendency of the warmer brine within the upper portions of the circulation passages, to flow toward the cooling compartment. At a suitable point in the brine circulation system, I provide a barrier extending upwardly a substantial distance from the bottom of the passages and restricting the circulation of the brine to the space within the upper portion of the passage above the barrier. The barrier thus serves the dual purpose of preventing unnecessary circulation of the colder brine within the lower portions of the passages, and increasing the rate of brine circulation, because of greater temperature differential, in permitting only the warmer brine within the upper portions of the passages to circulate back to the cooling compartment.

According to my preferred construction, I provide the barrier at a point in the brine circulation system where separate portions of the relatively warm brine, after having circulated around the food compartments, come together to flow back around the cooling compartment. As best illustrated in Figs. 3 to 5, the barrier, generally indicated at 37, is formed by cutting in walls 24a and 24b of shell 24, notches 37 and 39 extending downwardly a substantial distance from the top edges of the shell, and connecting these notched portions with a horizontally extending channel 40. As will be readily apparent, the shell wall 24a below the opening 38 closes the lower portion of passage 37 below trough 40 to the circulation of brine into passage 32. The colder brine is thus confined against recirculation, but the warmer brine in the passage above the bottom of the trough 40, is allowed to circulate inwardly through the trough in the direction indicated by the arrows, and into the space surrounding the cooling compartment.

During operation, the brine circulates through the various passages in the troughs indicated by the arrows in Figs. 3 to 5. The coolest brine in the passages surrounding the cooling compartment 30 flows in separate portions entirely around the food compartments 25 and 26, by way of passages 29, 28, 27, the combined streams finally returning together through channel 40 into passage 32. The warmed brine carrying heat absorbed from the walls of the food compartments, is again cooled upon contacting the walls of the cooled chamber and is recirculated in the manner described.

It will be understood that the drawings are to be regarded merely as illustrative of a typical and preferred form of the invention, and that various changes and modifications may be made without departure from its true spirit and scope.

I claim:

1. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, a shell enclosing a food compartment within the tank and spaced from the sides thereof to provide an elongated and comparatively narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said shell, and means forming in said passage a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

2. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, a shell enclosing a food compartment within the tank and spaced from the sides of the tank and the wall of the cooling compartment to provide an elongated and comparatively narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said shell, and means forming in said passage a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

3. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, a shell enclosing a food compartment within the tank and spaced from the sides thereof to provide an elongated and comparatively narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said shell, and means forming in said passage adjacent the cooling compartment, a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

4. A refrigerator of the character described comprising a tank, walls forming within said tank a cooling compartment containing dry ice, a shell enclosing a food compartment within the tank and spaced from the sides thereof to provide an elongated and comparatively narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling

compartment around said shell, and means forming in said passage a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

5. A refrigerator of the character described comprising a horizontally rectangular heat insulated tank, wells forming a cooling compartment within said tank, a shell enclosing a food compartment within the tank and having three sides extending parallel with the sides of said tank and spaced therefrom to provide an elongated narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said shell, and means forming in said passage a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

6. A refrigerator of the character described comprising a horizontally rectangular heat insulated tank, wells forming a cooling compartment within said tank, a shell enclosing a food compartment within the tank and having three sides extending parallel with the sides of said tank and spaced therefrom, and a fourth side spaced from the wall of the cooling compartment, to provide an elongated narrow passage through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said shell, and means forming in said passage a barrier extending upwardly a substantial distance from the bottom of the passage and confining the brine circulation at the barrier to the space thereabove.

7. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, walls enclosing a pair of food compartments within the tank and spaced from the sides thereof to provide elongated and comparatively narrow brine passages through which brine circulates, by virtue of its temperature differential, from said cooling compartment around said food compartments, and means forming in the path of brine circulation a barrier extending upwardly a substantial distance from the bottom of said passages and confining the brine circulation at the barrier to the space thereabove.

8. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, walls enclosing a pair of food compartments within the tank and spaced from the sides thereof to provide elongated and comparatively narrow brine passages through which separate portions of the brine circulate, by virtue of the brine temperature differential, in opposite directions from said cooling compartment around said food compartments, and means forming in the path of brine circulation a barrier extending upwardly a substantial distance from the bottom of said passages and confining the brine circulation at the barrier to the space thereabove.

9. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, walls enclosing a pair of food compartments within the tank and spaced from the sides thereof and from said cooling compartment to provide elongated and narrow brine passages through which brine circulates, by virtue of its temperature differential from around the cooling compartment, around said food compartment and back into the passages between the cooling and food compartments, and means forming in the path of brine circulation a barrier extending upwardly a substantial distance from the bottom of said passages and confining the brine circulation at the barrier to the space thereabove.

10. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank, walls enclosing a pair of food compartments within the tank and spaced from the sides thereof and from said cooling compartment to provide elongated and narrow brine passages through which separate portions of the brine circulate, by virtue of the brine temperature differential, from around the cooling compartment, around said food compartments and combine to flow back into the passages between the cooling and food compartments, and means forming in the path of flow of the combined portions of the brine, a barrier extending upwardly a substantial distance from the bottom of said passages and confining the brine circulation at the barrier to the space thereabove.

11. A refrigerator of the character described comprising a tank, walls forming a cooling compartment within said tank and containing dry ice, walls enclosing a pair of food compartments within the tank and spaced from the sides thereof and from said cooling compartment to provide elongated and narrow brine passages through which separate portions of the brine circulate, by virtue of the brine temperature differential, from around the cooling compartment, around said food compartments and combine to flow back into the passages between the cooling and food compartments, and means forming in the path of flow of the combined portions of the brine, a barrier extending upwardly a substantial distance from the bottom of said passages and confining the brine circulation at the barrier to the space thereabove, said barrier including a trough through which the brine flows into the space at one side of said cooling compartment.

ARTHUR E. RINKER.