

June 28, 1949.

C. L. SPOONHOUR
MULTIPLE TEMPERATURE REFRIGERATING UNIT
HAVING AIR CIRCULATING MEANS

2,474,499

Filed May 24, 1945

4 Sheets-Sheet 1

Fig. 1.

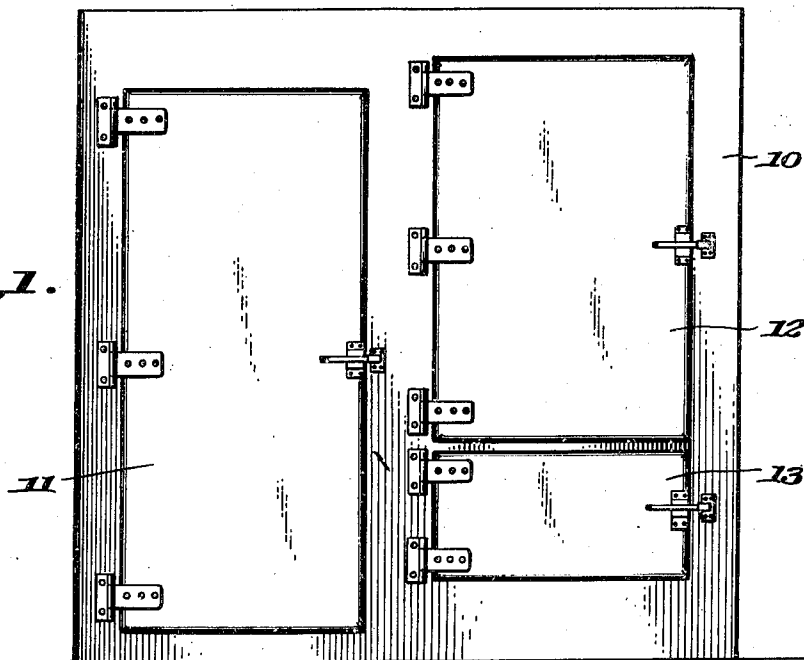


Fig. 2.

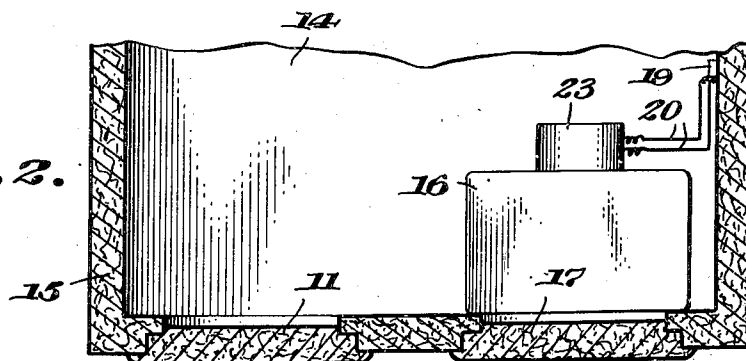
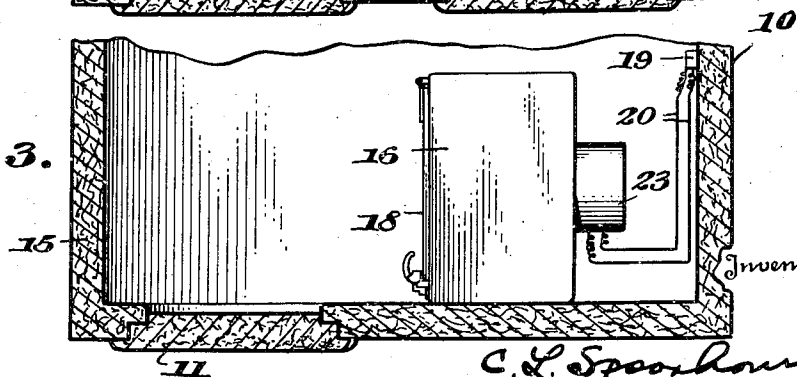


Fig. 3.



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**MULTIPLE TEMPERATURE REFRIGERATING UNIT
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4 Sheets-Sheet 2



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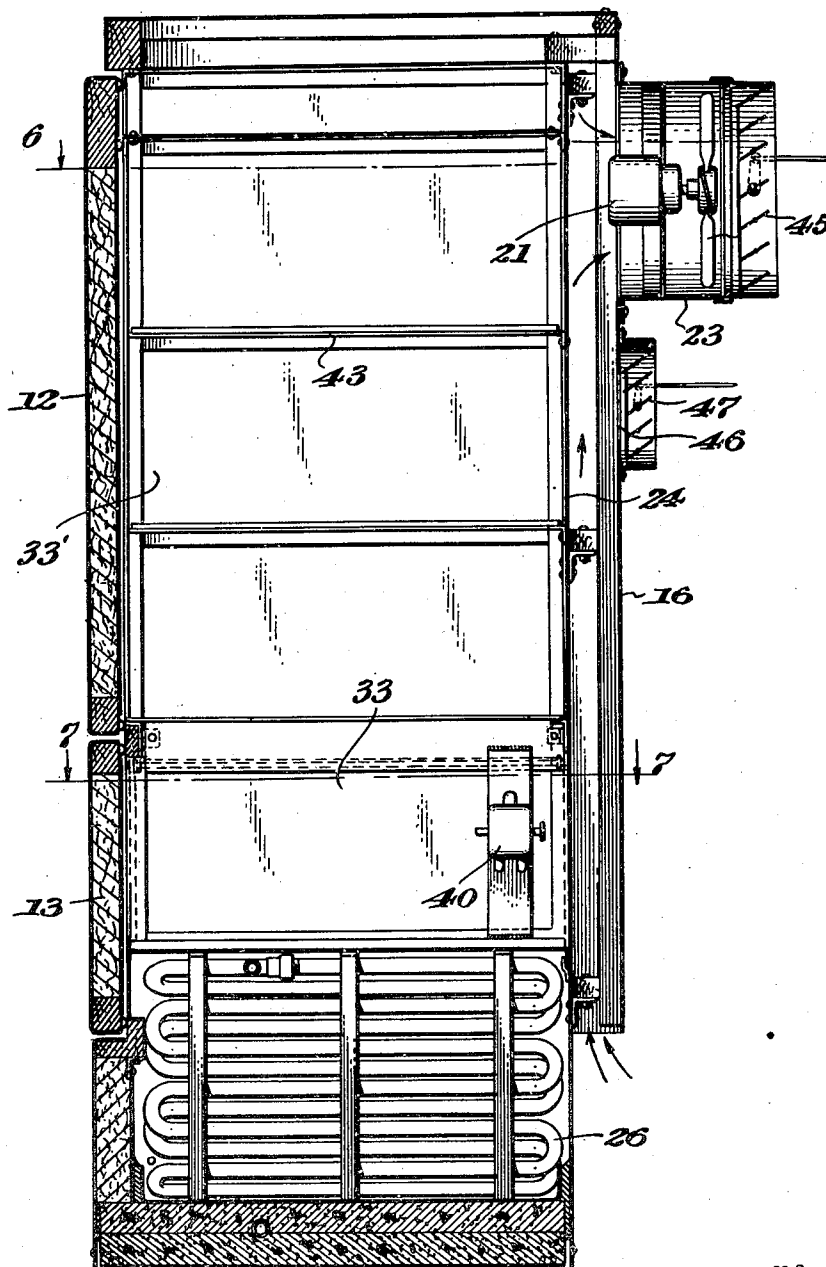
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

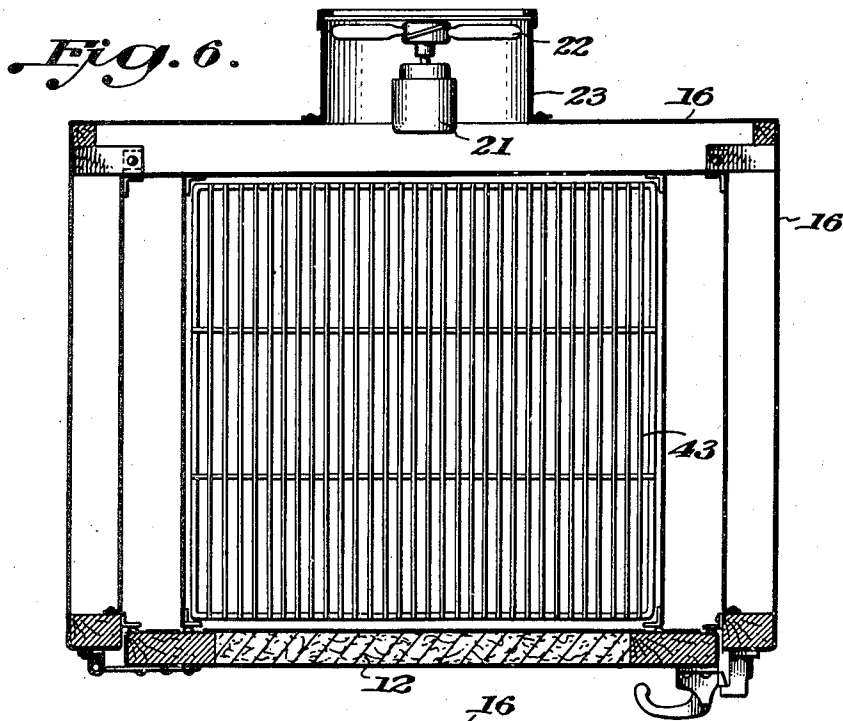
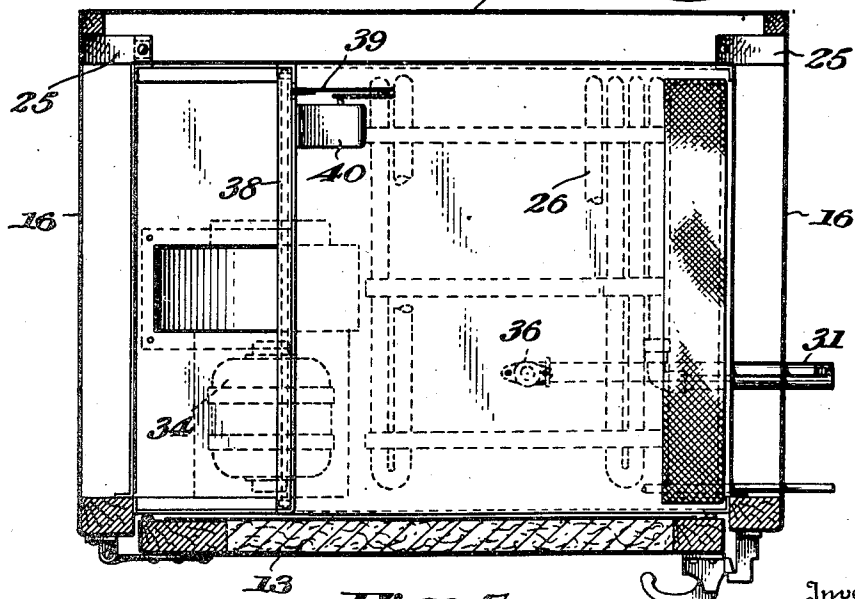


Fig. 7. C. L. Spoonhour

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MULTIPLE TEMPERATURE REFRIGERATING
UNIT HAVING AIR CIRCULATING MEANSCharles L. Spoonhour, Waynesboro, Pa., assignor
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12 Claims. (Cl. 62—102)

1

This invention relates to refrigeration, and more particularly to multiple temperature refrigeration, or refrigeration of a plurality of zones or compartments.

Among the objects of the invention is to provide a dependable, relatively simple and inexpensive refrigerator, of a plurality of temperature regions, or a refrigerator having a plurality of separate and distinct refrigerated areas or zones for the preservation of food or other products.

Another object of the invention is to provide a refrigerator structure having a plurality of refrigerated zones or compartments maintained at distinctive temperatures, as for example one compartment at a temperature slightly above the freezing temperature of water, a second at a sufficiently low temperature to maintain pre-frozen products in a thoroughly frozen condition, and if preferred one or more additional compartments at the respective temperature or temperatures desired. For example, there may be a third compartment maintained at a temperature sufficiently low to cause products placed therein to freeze quickly, as for example at a temperature of -30°F .

Another and very important object of the invention is to provide a refrigerator of the character stated, in which the several zones or compartments are refrigerated from a single evaporator or cooling unit of a refrigeration system.

A still further object of the invention is to provide a structure for modifying or controlling the amount of refrigeration to the several compartments in order to maintain them at the desired temperature and to control humidity in the spaces held at above freezing within practical limits during the refrigeration period.

Further objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

Figure 1 is a front elevation of a refrigerator illustrating one application of the invention;

Fig. 2, a horizontal section;

Fig. 3, a similar view of a slightly modified construction;

Fig. 4, a vertical section of the inner refrigerating unit on a larger scale than shown in Figs. 2 and 3;

Fig. 5, a section on the line 5—5 of Fig. 4;

Fig. 6, a horizontal section taken on the lines 6—6 of Fig. 5; and

Fig. 7, a horizontal section taken on the lines 7—7 of Fig. 5.

2

Briefly stated, the invention comprises a refrigerator cabinet containing a second cabinet with two compartments, and a refrigerating coil or cooling unit. A control is provided for selectively directing air refrigerated by the coil through one of the compartments for providing low temperature for sharp freezing therein, or for directing the refrigerated air in contact with the exterior of the wall of the other compartment for providing a below freezing temperature therein for maintaining products in frozen condition.

In order to refrigerate the interior of the compartment exteriorly of the inner cabinet, air circulating means is provided for drawing the air from the interior of the outer cabinet in contact with the wall of the inner cabinet to remove the heat from such air and maintain a temperature slightly above freezing in the outer compartment. Control means is provided for this latter circulating means so that a stable temperature is capable of being maintained, thus by control of the cooling of the refrigerating system the desired temperature can be maintained.

By controlling air circulation the temperature in the sharp freezing chamber can be readily controlled, for example, at a temperature -30°F . By selective operation of the damper the refrigerated air in contact with the wall of the low temperature chamber can be maintained at the desired temperatures, for example, -10°F . By controlling the circulating means for the air in the outer chamber the temperature of this air can be kept at slightly above freezing, for example 36°F .

The invention thus contemplates modification of the refrigeration of the several compartments dependent upon load and the material refrigerated.

Referring to the drawings, a refrigerator cabinet 10 is provided with doors 11, 12, and 13, affording access to a plurality of compartments, including a high temperature compartment 14, defined by the insulated walls 15. The compartment 14 is adapted to constitute one of the zones of the refrigerator in which zone the highest temperature is adapted to be maintained due to the fact that it is the outer of the compartments, and to the fact that the extraction of heat by the coil is through heat barriers. This high temperature compartment may be maintained at a temperature of slightly above freezing, as for example 36°F .

In the high temperature refrigerated compartment or chamber 14 is disposed a jacket 16 of a

3

second refrigerator, which may have a door opening 17 closed by the door 13 forming a common door to the cabinet 10, as shown in Fig. 2, or it may have a separate door 18 and be completely disposed in a chamber 14 of the first mentioned cabinet. The interior cabinet is refrigerated and in order to refrigerate the air within the chamber 14, a thermostat 19 is adapted to control through electrical connections 20 the motor 21 of a propeller type fan 22, by starting and stopping the motor in accordance with temperature within compartment 14, both motor and fan being disposed in a cylindrical casing or fan housing 23. In order to control humidity within compartment 14, to the outlet of the fan housing 23 is attached an air volume control damper 45 which may be set to control relative humidity in the compartment 14 within practical limits. This damper 45 may be manually adjusted or under the control of a modulating humidostat and motor to maintain the desired relative humidity or a by-pass 46 may be provided with a similar air volume control damper 47. As less volume of air is circulated, or less cooling surface is exposed to said air, its temperature is decreased to a lesser degree and, therefore, less moisture is condensed from the air, resulting in a higher relative humidity in compartment 14.

The jacket 16 may extend over the top, two sides and back of a casing 24 and is supported from said casing by means of spacing brackets 25. These spaced walls provide a space through which air is adapted to be drawn by the fan 22, so that due to the contact of the air with the wall 24 heat exchange is effected which results in abstracting heat from the air, thus reducing the temperature of the air within the chamber 14. The outside of wall 24 may be of corrugated material or provided with finned surfaces integral or attached, or the outside wall may be otherwise constructed to increase the heat absorbing surface. Also insulating material may be added to the outside or inside surface of walls 24 or 32 to decrease heat transfer from spaces 35, 36, 37 to space 33' and/or chamber 14.

The refrigerating effect may be provided by means of an evaporator coil 26 of a size and character to provide the required total refrigerating effect. The coil 26 forms part of a conventional refrigeration system, and liquid is supplied to this coil through the supply line 27, and vaporous material is withdrawn from the coil by means of the return line 28. A defrosting pan 29 covers the entire bottom of the chamber in which the coil is located, and is provided with a drain 30, and a waste pipe 31, for the removal of accumulated moisture during defrosting, or at other times. Above the coil 26 is mounted a partition plate 41, one end of which is provided with a perforated plate 42, through which air can readily pass, and a fan 34 has its casing extending through the opposite end of the plate.

Within the chamber 24 is mounted a casing 32 beneath which is a compartment 33, and within which is a compartment 33'. Between the walls 24 and 32 on all sides and top except at the front of the refrigerator are spaces which provide in effect air conduits 35, 36 and 37. Air from the fan 34 may be caused to pass directly through the chamber 33, or through the passages 35, 36 and 37, around the upper chamber formed by the walls 32. A damper or valve 38 is adapted to be actuated by means of a link 39, from an actuating member 40, which may be in the form of a manually operated control or a temperature con-

4

trol subject to the temperature within the chamber in which it is located, as by means of a thermostat.

It will be readily understood that with this valve 38 air from the fan may be caused to pass directly through the quick freezing chamber 33, or through the passages 35, 36 and 37, around the chamber 33', or if desired or required by the controls the stream of air may be divided and some of the air sent in each direction.

While only one blower has been shown, the invention may use independent blowers for supplying air to each compartment, if desired.

During the early stages of quick freezing all air from the blower may be forced through the quick freezing compartment 33 directly over the coil and back to the suction of the blower so that the air is circulated by the blower over the coil through the shortest path possible.

When quick freezing is not in progress the damper 38 may be disposed in a position to cause all of the air circulated by blower 34 to circulate around the wall of the upper compartment and eliminate direct cooling of the freezing space and give maximum refrigeration to the storage space 33'. At the same time, since the wall 24 has refrigerated air coming in contact with it beneath the shell or hood 16, it is likewise refrigerated, thus accomplishing the refrigeration of the high temperature compartment 14 through air movement by fan 22.

The hood 16 preferably is of a quickly removable character in order to permit the removal of frost on the exterior of the wall 24. The chamber 33' may be provided with a plurality of perforated shelves 43.

It will be readily understood that an important feature of the invention is the three-fold refrigerating effect produced by the refrigerating coil of the refrigeration system, and from the refrigerating coil the quick-freezing, low temperature, and high temperature chambers are refrigerated in accordance with their requirements.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawing and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In a refrigeration system a cooling unit, walls defining a quick-freezing chamber, walls defining a low temperature chamber, means for circulating refrigerated air through said quick-freezing chamber, and in contact with the walls defining the low temperature chamber for refrigerating said chambers, wall structure confining the air circulated in contact with the wall of said low temperature chamber in a manner such that said confining wall structure is refrigerated, additional wall structure defining with said confining wall structure a relatively thin chamber about said confining wall structure, and means providing a high temperature refrigerating chamber exteriorly of said relatively thin chamber, and means for circulating air through said relatively thin chamber from said high temperature chamber for refrigerating the high temperature chamber.

2. A refrigerator comprising insulating walls defining a first refrigerating chamber, walls of good thermal conductivity within the first chamber defining a second chamber, walls of good thermal conductivity within the second chamber

5

defining a third chamber, and a cooling element for cooling the air within the second chamber, such air being separated from the air within the first and third chambers by said walls of good heat conductive material, and means for controlling the amount of air circulated in contact with the walls of good thermal conductivity.

3. A refrigerator comprising walls of good thermal conductivity defining a first chamber, additional walls of good thermal conductivity defining within the first chamber a second chamber, walls defining a third chamber enclosing said first and second chambers, a refrigerating element within the first chamber, a blower for forcing air over said refrigeration element and between the walls of the first and second chambers so that the space on the remote sides of said walls may be refrigerated by contact of said air with said walls of good thermal conductivity, a damper for short circuiting the flow of air between the walls of the first and second chambers to cause the air to be returned directly to said cooling element, a detachable jacket for the walls forming the first chamber providing a limited space therearound through which air from within the third chamber around the wall forming the first chamber can have its temperature modified by contact therewith.

4. In a refrigerator, wall means defining a first chamber, wall means of good heat conducting properties defining a second chamber within said first chamber, means providing a restricted air space around the walls of the second chamber within the first chamber, and control means for causing air within the first chamber to circulate through said restricted space in contact with the walls of the second chamber so that the air within the first chamber will be refrigerated by contact with the walls of the second chamber, said restricting means comprising a hood removable for the clearing away of frost on the wall of the second chamber.

5. A refrigerator comprising walls defining a first chamber, a cooling coil in said first chamber, walls defining a second chamber within the first chamber, so that air chilled by the cooling coil in the first chamber will come in contact with the walls of the second chamber and cool the same, walls defining a third chamber about the first chamber, and means for producing air circulation within the third chamber in contact with the wall defining the first chamber.

6. The combination of a low temperature refrigerating coil, a first chamber adapted to be cooled to a low temperature by air circulating therethrough and over said refrigerating coil, a second chamber adapted to be cooled to a higher refrigerated temperature by air circulating therethrough and over said coil, means for selectively directing said air through one or the other of said two chambers, a wall of at least one of said two chambers being formed of a material of high heat conductivity so that the exterior surface of said wall is cooled by air passing thereover, and a third chamber adapted to be cooled to a still higher refrigerated temperature by air circulated between said third chamber and the exterior surface of said wall.

7. The combination of a low temperature refrigerating coil, a first chamber adapted to be cooled to a low temperature by air circulating therethrough and over said refrigerating coil, a second chamber adapted to be cooled to a higher refrigerated temperature by air circulating therethrough and over said coil, means for selectively

6

directing said air through one or the other of said two chambers, a wall of at least one of said two chambers being formed of a material of high heat conductivity so that the exterior surface of said wall is cooled by air passing thereover, a third chamber adapted to be cooled to a still higher refrigerated temperature by air circulated between said third chamber and the exterior surface of said wall, and fan means for forcing air between said third chamber and the exterior surface of said wall.

8. The combination of a low temperature refrigerating coil, fan means for circulating air to be cooled over said coil, a first chamber adapted to be cooled to a low temperature by air circulating therethrough and over said refrigerating coil, a second chamber adapted to be cooled to a higher refrigerated temperature by air refrigerated by said coil, means for selectively directing said air through one or the other of said two chambers, a wall of at least one of said two chambers being formed of a material of high heat conductivity so that the exterior surface of said wall is cooled by air passing thereover, and a third chamber adapted to be cooled to a still higher refrigerated temperature by air circulated between said third chamber and the exterior surface of said wall.

9. A refrigerator comprising insulating walls defining a first refrigerating chamber, walls within said first refrigerating chamber providing second and third refrigerating chambers, means defining narrow spaces about the inside and outside wall surfaces of the second chamber, a refrigerating element for cooling air, means for circulating the refrigerated air through the third chamber for producing low temperatures therein and for circulating the air from said last mentioned chamber through the space about the inside wall surface of the second chamber, and means for circulating air from the first chamber through the space about the outside wall surface of the second chamber whereby each of the three chambers is refrigerated from said refrigerating element.

10. Refrigeration apparatus comprising walls defining a first refrigerating chamber, walls in said chamber defining a second refrigerating chamber, a hood about the walls defining the second chamber, means for producing air circulation through the space between the hood and the outside wall surface of the wall defining the second chamber, thermostatic means within the first chamber for controlling said circulation, walls within the second chamber providing a space adjacent the inside wall surface of the wall defining the second chamber and forming a third chamber, a cooling element in one of said last mentioned chambers, means for circulating air over said cooling element, and control means for directing the flow of air circulated through the inside wall space of the second chamber and also directly back to said coil.

11. The method of providing heat exchange between a refrigeration system and a plurality of zones comprising providing walls forming a plurality of compartments defining the zones, directing air cooled by said refrigeration system through at least one of said compartments and in contact with the walls of another of said compartments, and directing air within another of said compartments in contact with the wall of said last mentioned compartment.

12. The method of providing heat exchange between a refrigeration system and a plurality of

zones comprising providing walls defining a plurality of compartments separating the zones, blowing air cooled by the refrigeration system through one of said compartments and in contact with the walls of another of said compartments for refrigerating said compartments, controlling the amount of air employed for each compartment, and directing air within another of said compartments in contact with the wall of one of said last mentioned compartments.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,913,857	Scherer	June 13, 1933
2,180,974	Atchison	Nov. 21, 1939
2,188,528	Burden	Jan. 30, 1940
2,285,946	Kalischer	June 9, 1942
2,382,084	Mathews	Aug. 14, 1945