May 30, 1967 T. G. SCHEITLIN ET AL 3,321,933

REFRIGERATION APPARATUS

Filed Aug. 25, 1965

3 Sheets-Sheet 1

Fig. 1.

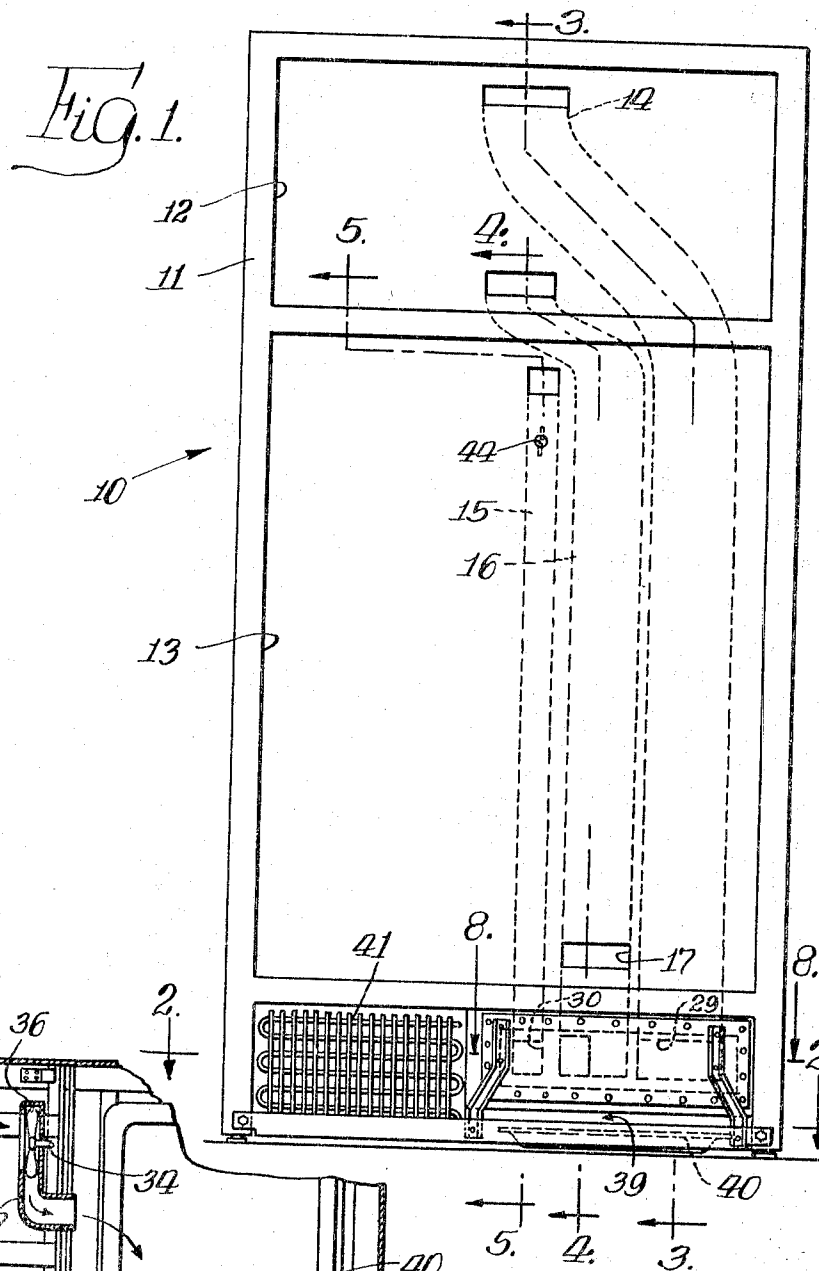
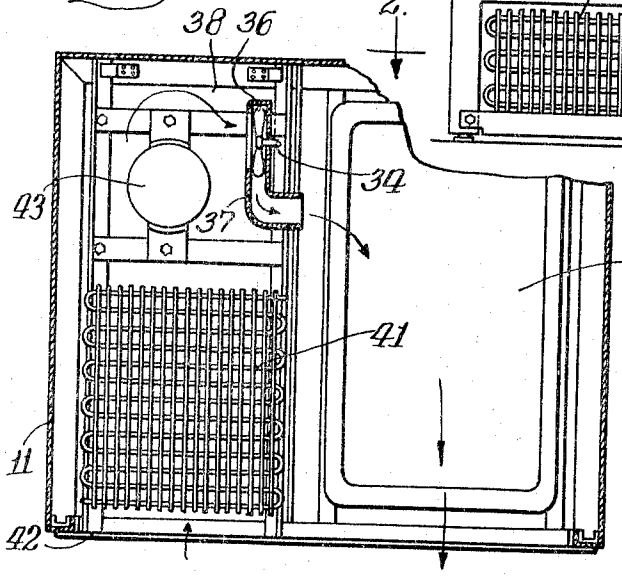



Fig. 2.




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Fig. 3.

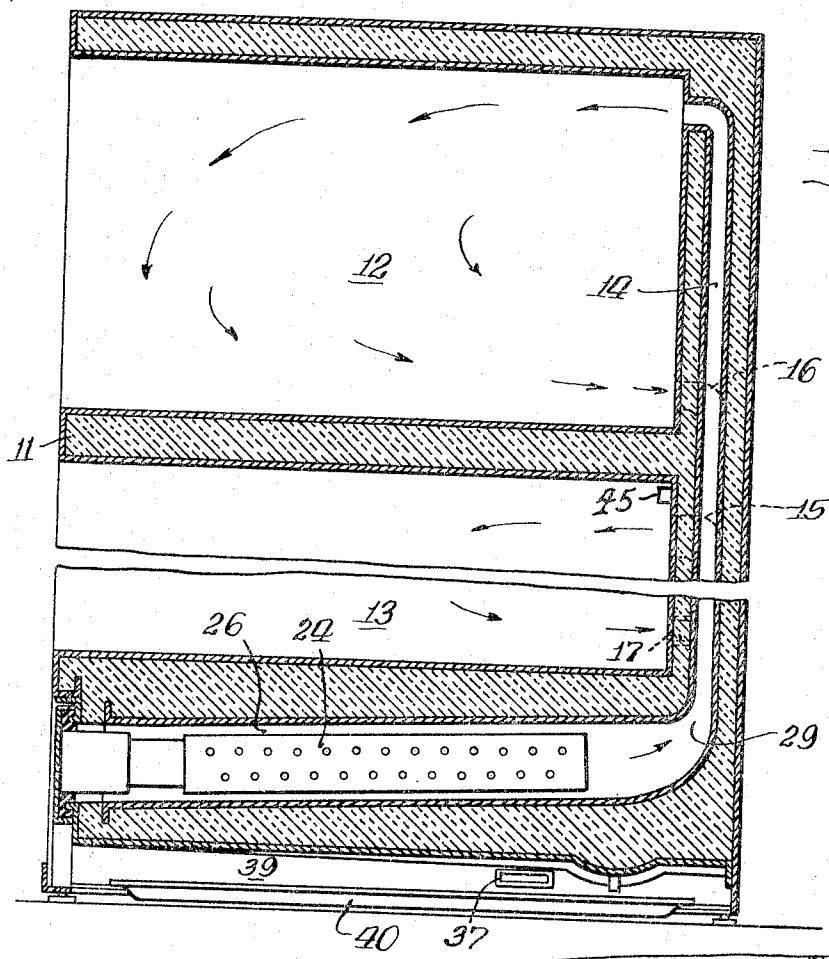
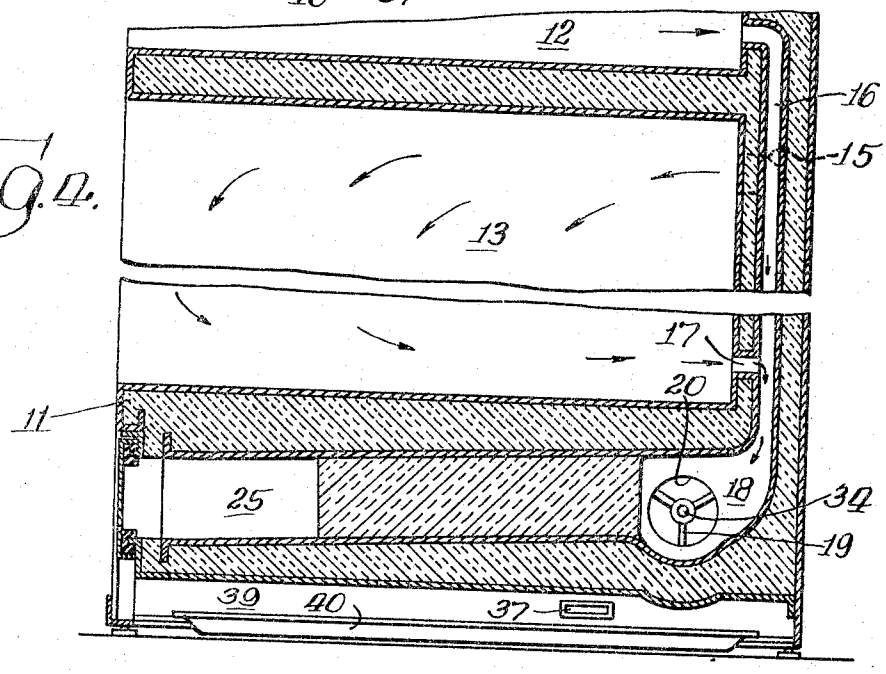



Fig. 4.



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Fig. 5.

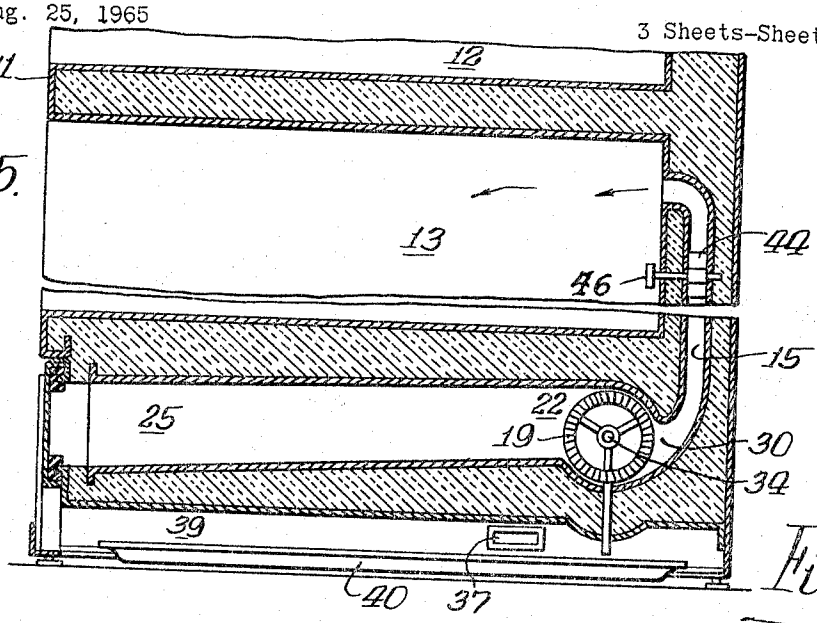



Fig. 6.

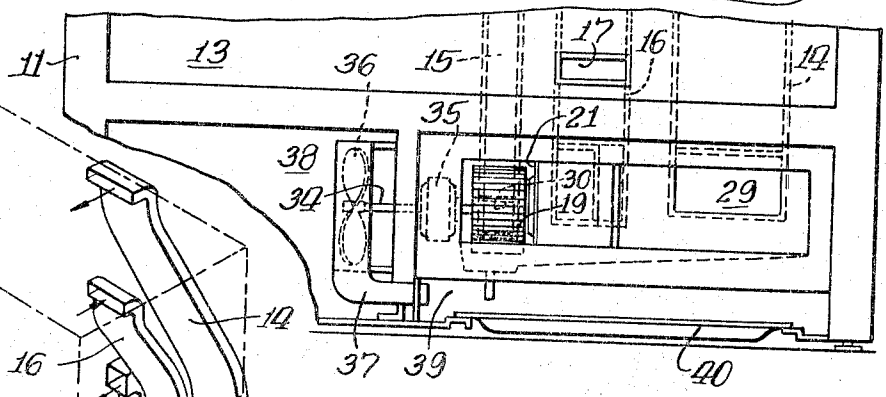



Fig. 7.

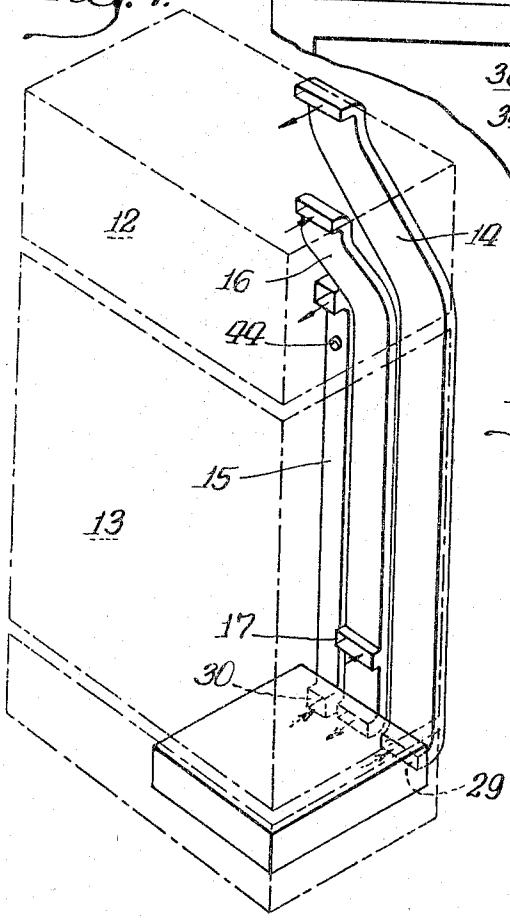
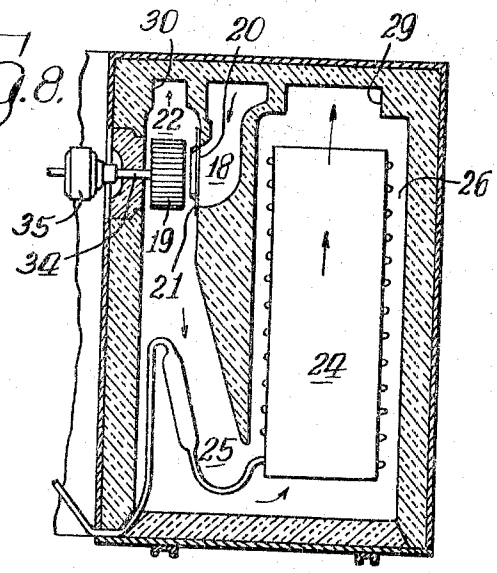



Fig. 8.



United States Patent Office 3,321,933 Patented May 30, 1967



3,321,933

# REFRIGERATION APPARATUS

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4 Claims. (Cl. 62—419)

This invention relates to refrigeration apparatus and in particular to refrigeration apparatus having a forced air circulation system for providing frost-free refrigeration.

In one conventional form of refrigeration apparatus, a cabinet is provided defining a freezer chamber and an above-freezing refrigeration chamber. To refrigerate such chambers without forming frost therein, refrigerated air is ciculated through the chambers by means of a blower or fan which first passes the air in heat exchange relationship with a cooling means such as an evaporator disposed exteriorly of the chambers before delivering the air to the chambers. Thus, the air is at its lowest temperature prior to the delivery thereof into the cabinet chambers whereby any frost which forms externally of the chambers for facilitated disposal.

A problem arises, however, in such a system in that to maintain the refrigerator chamber at an above-freezing temperature only a small volume of the refrigerated air is circulated to the refrigerator chamber. Because only a small volume of refrigerated air flows through the refrigerator chamber, the temperature within this chamber is not always uniform throughout. This non-uniform temperature condition is highly undesirable relative to storage of food products and the like in the refrigerator chamber and, further, makes it difficult to select the proper location for a conventional thermal sensistive control element for controlling the refrigeration producing apparatus.

The present invention comprehends an improved refrigeration apparatus which substantially eliminates the above discussed disadvantages of the known forced air type refrigeration apparatus. The improved functioning of the present structure is obtained herein by providing therein a substantially increased flow of refrigerated air in the above-freezing refrigerator chamber.

Thus, a principal feature of the present invention is the provision of a new and improved refrigeration apparatus arranged to effectively increase the flow of refrigerated air in the above-freezing refrigeration chamber of a forced air type refrigerator-freezer apparatus.

Another feature of the invention is the provision of such a refrigeration apparatus wherein air circulation therein is provided in a new and improved manner to effect increased air flow to the refrigerator chamber.

A further feature of the invention is the provision of such a refrigeration apparatus wherein air is recirculated in a novel manner to provide a substantially uniform temperature throughout the refrigerator chamber.

Still another feature of the invention is the provision of such a refrigeration apparatus having means for selectively controlling the ratio of air deliveries to the freezer and refrigerator chambers of the apparatus.

A yet further feature of the invention is the provision of such refrigeration apparatus comprising means defining a first chamber to be refrigerated, means defining a second chamber to be refrigerated, means defining a third chamber, refrigerating means, means for conducting air from the third chamber in thermal transfer association with the refrigerating means and thence to the first chamber, means for conducting air from the first chamber to the third chamber, means for conducting air from the second chamber to the third chamber for forming therein a mixture of the air from the second chamber and the air from the first chamber, and means for conducting the air



mixture from the third chamber to the second chamber free of any heat transfer association with the refrigerating means whereby the second chamber is refrigerated solely by refrigerated air conducted from the first chamber to form the mixture.

Still another feature of the invention is the provision of such refrigeration apparatus wherein new and improved means are provided in the third chamber for substantially uniformly mixing the air delivered thereto from said first and second chambers.

Other features and advantages will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIGURE 1 is a front elevation of a refrigeration apparatus embodying the invention with the doors removed;

FIGURE 2 is a horizontal section thereof taken substantially along the line 2—2 of FIGURE 1 with a portion broken away for facilitated illustration thereof;

FIGURE 3 is a fragmentary vertical section thereof taken substantially along the line 3—3 of FIGURE 1 with a portion broken away for facilitated illustration thereof;

FIGURE 4 is a fragmentary vertical section thereof taken substantially along the line 4—4 of FIGURE 1 with a portion broken away for facilitated illustration thereof;

FIGURE 5 is a fragmentary vertical section thereof taken substantially along the line 5—5 of FIGURE 1 with a portion broken away for facilitated illustration thereof;

FIGURE 6 is a fragmentary front elevation of the lower part of the apparatus with certain elements removed;

FIGURE 7 is a diagrammatic isometric view illustrating the arrangement of the ducts relative to the freezer and refrigerator chambers of the evaporator space; and

FIGURE 8 is a fragmentary horizontal section thereof taken substantially along the line 8—8 of FIGURE 1.

In the exemplary embodiment of the invention as disclosed in the drawing, a refrigeration apparatus generally designated 10 is shown to comprise an insulated cabinet 11 defining a freezer chamber 12 and a subjacent above-freezing refrigerating chamber 13. The respective chambers 12 and 13 are refrigerated in apparatus 10 by the circulation of low temperature air therethrough so as to provide a substantially frost-free refrigeration thereof. The invention comprehends an improved circulation of the refrigerating air so as to effectively refrigerate articles placed in the chambers 12 and 13.

More specifically, the refrigerated air is circulated to the respective chambers 12 and 13 by a delivery duct 14 leading to the freezer chamber 12, a delivery duct 15 leading to the refrigerator chamber 13, a return duct 16 leading from the freezer chamber 12 and a return duct 17 leading fom the refrigerator chamber 13 and joining with the return duct 16 for delivering the air from chambers 12 and 13 to a plenum chamber 18 at the lower end of duct 16.

As best seen in FIGURE 8 plenum chamber 18 is connected to a second plenum chamber 22 through opening 20 in panel 21. Disposed within plenum chamber 22 is a fan 19 for effectively mixing the air delivered from chambers 12 and 13 and for conducting a portion of the mixed air to the above-freezing chamber 13 through duct 15, and the remainder of the mixed air to the evaporator through passage 25.

A refrigeration means such as a conventional evaporator structure 24 is disposed within chamber 26 adjacent passage 25 and plenum chambers 18 and 22. At its rear end chamber 26 opens at 29 into duct 14. Thus, a portion of the air directed by fan 19 through panel opening 20 is conducted from the second plenum chamber 22 through

passage 25, thence in heat transfer association with the evaporator 24, thence into duct 14 and into the freezer chamber 12 in the upper portion of cabinet 11. At the same time, another portion of the air delivered to second plenum chamber 22 is conducted through an outlet 30 at the rear of plenum chamber 22 into duct 15 for delivery to refrigerator chamber 13 free of any heat transfer association with evaporator 24 during such circulation from the return plenum 18 back to the refrigerator chamber 13.

Thus the refrigeration air system includes a first portion which circulates air in heat transfer association with the evaporator to chill the air to its lowest temperature which may be a sub-zero temperature for delivery to the freezer chamber 12 where maximum refrigeration is effected. This air which may pick up moisture in the freezer chamber 12 is then mixed with the air being returned from the refrigerator chamber 13 so as to provide in the resultant mixture a portion of the moisture picked up from the freezer chamber. At the same time the mixing of the return freezer air with the return refrigerator air lowers the temperature of the return refrigerator air to be suitable for recirculation to the refrigerator chamber 13 to effect the desired refrigeration of articles therein at the normal refrigerator temperatures which may be above-freezing temperatures as in the conventional refrigerator.

Referring to FIGURE 6 in illustrating the invention, the blower 19 is shown to be mounted on a motor shaft 34 driven by an electric motor 35 which carries on the opposite end of shaft 34 a fan 36 having a suitable shroud 37 for conducting air from a compressor space 38 to an exhaust space 39 overlying a drip pan 40 below the plenum chamber 22 and evaporator 24. A conventional condenser 41 is disposed forwardly of the compressor space 38 as illustrated in FIGURE 2 whereby cooling air is circulated through the front grille 42 at the base of the refrigerator cabinet 11 past the condenser coil 41, past the compressor 43 and from fan 36 over the drip pan 40 to exhaust through the grille 42. Thus conventional means (not shown) may be employed for causing frost deposit on the evaporator to be delivered as melt into the pan 40 from which it is evaporated and delivered into the ambient atmosphere by the above discussed air circulation over the pan.

Control of the temperature in the freezer chamber 12 and above-freezing refrigerator chamber 13 is effected herein by means of a damper 44, shown in FIGURE 5, and a conventional thermostat 45, shown in FIGURE 3. As the volume of refrigerated air to chamber 13 is relatively large, the distribution of the refrigerated air in the refrigerator chamber 13 is substantially uniform throughout that chamber. Thus, the thermostat 45 may be disposed in any convenient location within the chamber while yet being responsive to the effective temperature of the entire chamber. Thus, as shown in FIGURE 3, the thermostat may be installed at the rear of the chamber. The thermostat functions in the conventional manner to cycle the compressor 43 whereby the evaporator 24 is cyclically refrigerated for refrigerating the circulated air flowed in heat transfer association therewith.

As indicated above, the temperature control further includes the damper 44 which, as shown in FIGURE 5, is disposed in delivery duct 15 leading to refrigerator chamber 13. In the illustrated embodiment, damper 44 is selectively positioned by a manual control 46 to selectively regulate the ratio of air delivered to the respective chambers 12 and 13 by selectively throttling the air delivery to the chamber 13 from the air moving means 19. Resultingly, the damper 44 controls the amount of time during which compressor 43 is caused to operate during each refrigeration cycle by controlling the amount of time required to lower the temperature in chamber 13 to the desired low above-freezing refrigeration temperature. Correspondingly, the temperature in the freezer chamber 12 will be decreased as a function of the length of time the compressor is operated and, thus, damper 44 cooperates with thermostat 45 for adjusting the relative temperatures of the two chambers. More specifically, an adjustment of damper 44 to increase the throttling of the air delivery to chamber 13 has the effect of increasing the temperature differential between the two chambers by causing the freezer chamber 12 temperature to be lower at the time the preselected temperature controlled by thermostat 45 is reached in refrigerator chamber 13. Reversely, where the damper 44 is adjusted to permit greater air flow to the chamber 13, the preselected low temperature sensed by thermostat 45 therein will be reached more quickly and, thus, the temperature in the freezer chamber 12 will not be as greatly decreased.



While we have shown and described one embodiment of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. Refrigeration apparatus comprising: means defining a first chamber to be refrigerated to a first temperature; means defining a second chamber to be refrigerated to a second temperature lower than said first temperature; means exteriorly of said chambers for refrigerating air; and means for circulating air to said chambers for refrigerating the same to said temperatures including

(a) air translating means,

(b) first duct means for delivering air to said translating means,

(c) second duct means for delivering air from said air translating means into heat exchange relationship with said refrigerating means and to said second chamber,

(d) third duct means for delivering air from said air translating means to said first chamber,

(e) fourth duct means for delivering air from said second chamber to said first duct means, and

(f) fifth duct means for delivering air from said first chamber to said first duct means to be entrained in and mixed with the air from said second chamber prior to contact of the translating means by the air from said second chamber,

whereby refrigeration of said first chamber is effected substantially solely by flow therethrough of a relatively large volume mixture of refrigerated air received from said second chamber and recirculated air received from said first chamber which is passed to said first chamber prior to heat transfer association with said air refrigerating means.

2. The refrigeration apparatus of claim 1 wherein said air translating means is disposed below said second chamber and said first duct means conducts the air downwardly from said fourth and fifth duct means.

3. The refrigeration apparatus of claim 1 wherein said second duct means includes a portion leading from the air translating means in a first direction, and said third duct means including a portion leading from the air translating means in a second direction directly opposite said first direction.

4. The refrigeration apparatus of claim 1 wherein each of said first, second and third duct means open horizontally to said air translating means.


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