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REFRIGERATOR CABINET AND MEANS FOR MAINTAINING A LAYER OF COLD AIR THEREIN

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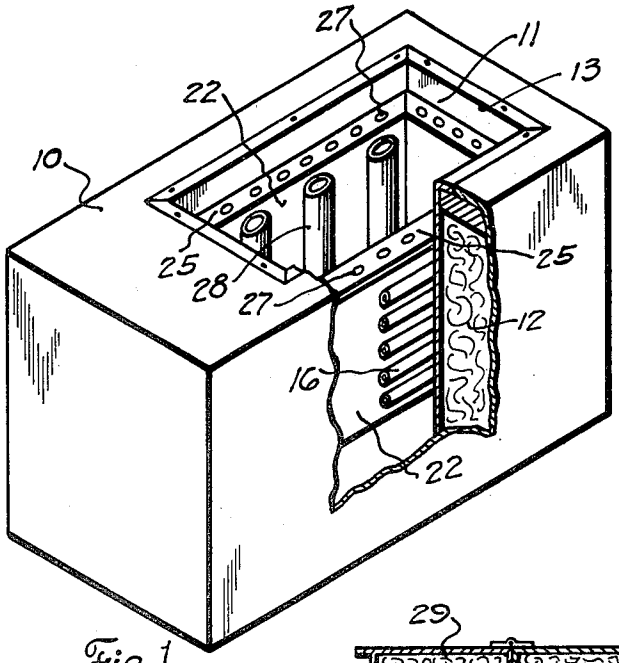


Fig. 1

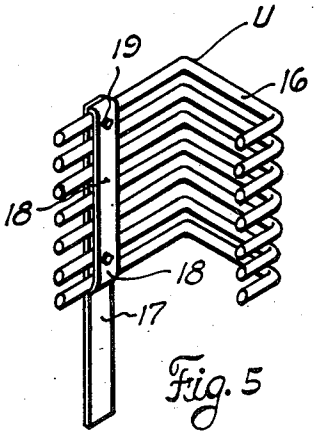


Fig. 5

Fig. 4

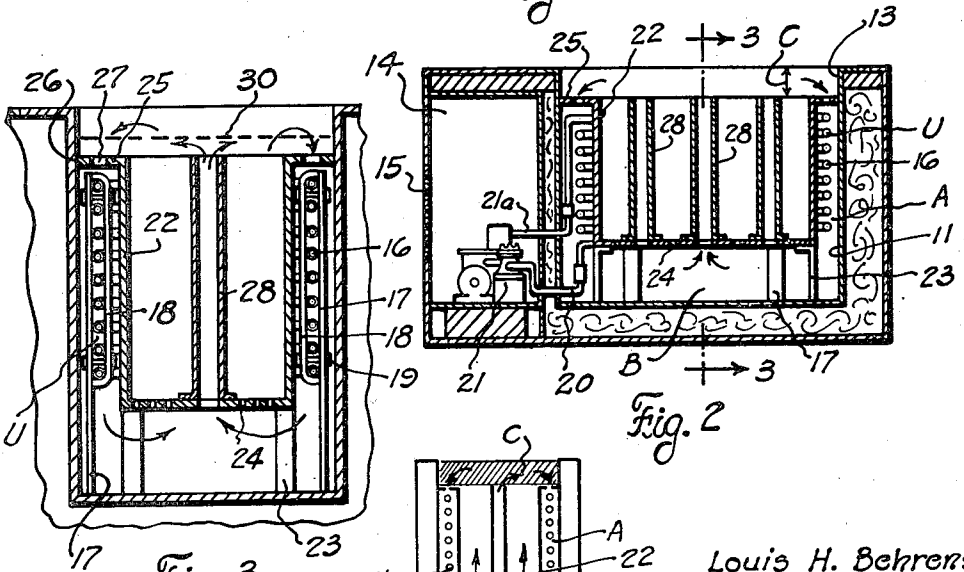


Fig. 3

Fig. 2

Fig. 6

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REFRIGERATOR CABINET AND MEANS FOR MAINTAINING A LAYER OF COLD AIR THEREIN

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16 Claims. (Cl. 62—89)

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This invention relates to new and useful improvements in refrigerating cabinets.

One object of the invention is to provide an improved refrigerating cabinet which is particularly adapted for use in retail stores or other establishments when frozen food products which must be maintained under refrigeration are offered.

An important object of the invention is to provide an improved refrigerating cabinet having a cooling compartment in which any desired temperature may be maintained, said compartment having its upper end open to atmosphere whereby the interior thereof is readily accessible to facilitate the insertion and removal of articles.

Another object of the invention is to provide an improved refrigerating cabinet wherein an article-receiving receptacle is mounted within the cabinet and spaced from the inner walls of said cabinet to provide a circulation area around said receptacle, the upper end of said receptacle being spaced below the top of said cabinet in a horizontal plane, whereby a space is formed above the receptacle and within the cabinet for a cool air stratum or layer which forms a seal against the admission of room or outside air into said cabinet and which also provides a source of cool air supply for circulation through the area around the receptacle.

Still another object of the invention is to provide a refrigerating cabinet, or the character described, wherein a stratum or layer of cool air is maintained above the product-receiving receptacle and wherein a circulation area which communicates with said stratum or layer is provided around the sides and bottom of said receptacle, together with vertically extending conduits or passages establishing communication between the space below said receptacle and the space immediately thereabove, whereby a complete unrestricted circulation around and through the receptacle may be had to assure the maintenance of a substantially constant temperature at all levels within said receptacle; the arrangement also minimizing frosting up of the cooling coil located in the circulation area.

A still further object of the invention is to provide an improved cabinet, of the character described, wherein the cooling coil unit as well as the product-receiving receptacle are removably supported within the cabinet which facilitates cleaning and maintenance of said cabinet and also simplifies the construction and reduces manufacturing costs.

The construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawing,

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wherein an example of the invention is shown, and wherein:

Figure 1 is an isometric view, partially broken away, of a cabinet, constructed in accordance with the invention,

Figure 2 is a longitudinal, sectional view of said cabinet,

Figure 3 is a transverse, vertical, sectional view, taken on the line 3—3 of Figure 2,

Figure 4 is a longitudinal, sectional view of the cover which may be used to close the cabinet,

Figure 5 is a partial isometric view of the cooling coil unit, and,

Figure 6 is a diagrammatic view, illustrating the direction of circulation of air through said cabinet.

In the drawings the numeral 10 designates a box-like cabinet or casing which is generally rectangular in shape. The major portion of the interior of the cabinet forms a well or compartment 11 and the walls surrounding this well are suitably insulated through the use of insulation material 12 as is the usual practice. The upper end of the well 11 is completely open as indicated at 13 and it is preferable that the well be offset toward one end of the casing (Figure 1). An uninsulated chamber 14 which has its vertical end wall closed by a grill 15 is formed within the casing at one end thereof.

The well 11 is rectangular in cross-section and a cooling coil unit U is arranged to be supported within the well. The continuous cooling coil 16 of the unit is shaped to generally conform to the rectangular cross-section of the well 11, whereby said coil of said unit is disposed contiguous or adjacent to the vertical walls of said well. The particular construction of the unit U is clearly shown in Figure 5 with the coil 16 supported by vertical legs 17. The upper ends of the legs 17 extend on the outside of the coil while clamping bars 18 engage the inner side of the coil, each clamping bar extending parallel and being fastened to the upper portion of its complementary leg 17 by suitable bolts 19. With this arrangement the coil is firmly clamped between the upper portion of each leg and its associate clamping bar, whereby the rectangular shaped coil may be supported by the legs. In mounting the coil unit U within the well or compartment 11, said unit is merely inserted therein and the legs 17 rest on the bottom thereof to support said unit; thus, the coil unit is readily removable and yet is firmly supported within the cabinet.

One end of the coil 16 of the unit is connected to the outlet side 20 of a compressor and motor unit 21 which latter unit is mounted within the end chamber 14 of the cabinet. The inlet end of the coil is suitably coupled to the return line 21a of the compressor and motor unit and it is apparent that operation of the latter will result in cir-

culating the usual refrigerant through the coil to cool the interior of the cabinet. It is noted that when the coil unit is in position within the well 11, the top of said unit is spaced some distance below the upper end of the cabinet 10.

For receiving the articles or material to be cooled, an inner receptacle 22 is adapted to be mounted within the well or compartment of the cabinet. This receptacle is preferably constructed of sheet metal or similar material and is generally rectangular in shape and smaller in size than the well, whereby a space A is provided between the vertical walls of the receptacle and the vertical walls of said well, with a space B being provided between the bottom of said receptacle and bottom of the well. The receptacle 22 fits within the coil unit U and is preferably spaced from the cooling coil and is supported in position within the well by vertical legs 23 which are secured to the bottom of said receptacle and which extend downwardly therefrom. The bottom of the receptacle is formed with perforations 24, or if desired, this bottom may be an open grill or screen.

The receptacle 22 is centered within the well 11 by means of a peripheral flange 25 which is preferably formed integral with the upper end of said receptacle and which extends outwardly in a horizontal plane. The marginal edge 26 of the flange is adapted to engage the vertical side walls of the well 11 and obviously, when the receptacle is in position the flange 25 will overlie the space A between the vertical walls of the receptacle and the vertical walls of the well or compartment. The length of the supporting legs 23 and the vertical heighth of the receptacle 22 is such that when said receptacle is within the well, the upper end of the receptacle and the upper surface of the horizontal peripheral flange 25 is spaced below the top of the cabinet, such space being indicated at C. The peripheral flange 25 is perforated throughout substantially its entire area, the perforations 27 extending completely through said flange and establishing a communication between the space C and the space A within said cabinet. A plurality of vertically disposed pipes or conduits 28 are mounted within the receptacle 22 and are located at spaced distances throughout its length, it being preferable that these pipes or conduits be at the longitudinal center of said receptacle. As is clearly shown in Figure 2 the pipes or conduits 28 are of substantially the same height as the receptacle 22 and since said pipes are open at both ends they establish a direct communication between the space B below the receptacle and the area or space C immediately above said receptacle and within the cabinet 10.

In the operation of the cabinet the motor and compressor unit will circulate the refrigerant through the continuous coil 16 of the unit U whereby said coil is cooled to cool the air within the cabinet. Since air will tend to stratify in accordance with its temperature with the cooler air falling downwardly and the warmer air rising, it will be apparent that the air surrounding the coil 16 will move to the lower end of the well 11 and downwardly into the space B (Figure 6). This downward movement of the colder air will cause or set up a circulation which will draw air from the space or area C immediately above the receptacle through the perforations 27 and into the space A where it will contact and be cooled by the coil 16. The air in the space B will be forced upwardly as colder air continues to move downwardly through the space A and the air from

space B will rise upwardly not only through the perforated or grilled bottom 24 but also through the vertical pipes or conduits 28. This air will pass into the space or area C and although it is warmer than the air in the bottom of the well 11, it is cooler than the air which is in the room or area surrounding the outside of the cabinet; because of this, the air which has moved upwardly into the space C from beneath the receptacle will tend to remain in the space C and will be drawn back through the perforations 27 and into a second contact with the cooling coil to be recooled.

This arrangement will eliminate the entrance of the warm room or outside air into the unit because the layer of cooler air C which will not escape from the cabinet because of its temperature will be drawn into and recirculated through the cabinet. Thus, the same air is constantly circulated through the cabinet from the space C, downwardly through space A and into B; as it becomes warmer than the air moving downwardly through space A, this cool air rises into the area C from which it is again drawn back into space A. The cool layer of air C which overlies the receptacle 22 forms a stratum or layer of air which although not as cold as the air in the bottom of the well 11, is cooler than the room air and this cool stratum or layer will prevent the admission of room or outside air into the cabinet. Thus, it becomes possible to leave the upper end of the well or compartment 11 entirely open to atmosphere and no cover or closure is required to efficiently maintain a desired temperature within the device. As the air within the cabinet is cooled to the desired temperature, the compressor and motor unit will automatically shut off in the usual manner as controlled by a thermostat and the temperature within the cabinet will remain constant. It has been found that actually there is very little difference in the temperature of the air in the space B and that in the space C at this time and the interior of the cabinet becomes a pocket of cooled air which remains so long as no heat is introduced into said cabinet. This cold pocket of air, being cooler than the air in the room or surrounding area, will prevent the admission of any warmer air and a static condition within the cabinet is obtained.

As a package or article to be cooled is placed within the receptacle 22 a heat transfer will, of course, occur and the temperature of the air within the receptacle will tend to rise. When it has risen to a sufficient point as determined by the thermostat setting, the compressor and motor unit 21 will again be operated and the circulation of air through the unit will be set up. As pointed out, this circulation will be downwardly from the stratum or layer C through the perforations 27 and downwardly through the space A over the continuous coil cooling 16. The colder air moving downwardly into the space B will force the less colder air in this space upwardly through the conduits or pipes 28 and grilled bottom 24 and into the space C from where it is drawn into the space A through the perforations to complete the cycle.

The important feature of the present invention is the particular disposition of the upper end of the receptacle which is spaced below the top of the cabinet whereby a stratum or layer of cool air is constantly present above the receptacle and also above the coil. This particular arrangement provides for a layer of cool air which is always available to be drawn through the perforations 27 and into the space A and also makes possible

a sealing of the upper end of the cabinet by such cool layer or stratum to prevent the admission of the warmer room air. If the upper end of the receptacle were in horizontal alignment with the upper end of the cabinet, the function of the present invention could not be accomplished because in such case the air rising upwardly through the pipes or conduits **28** would merely "spill over" the top of the cabinet and into the room and would thereby become admixed with this warmer room air. Under such circumstances the unit would constantly draw in the warmer room temperature and a static condition could never be reached; furthermore, there could be no sealing of the open upper end of the well since there would be no space for a sealing stratum or layer of cool air.

The cabinet is particularly adapted for use in retail stores or establishments which are offering frozen products but, of course, may be used for any purpose. When used in retail stores it is desirable to provide a hinged cover or closure **29** which may be placed over the open upper end of the well **11** during those times that the cabinet is not in actual use by the public. The cover or closure is suitably insulated and has a thickness which is less than the space C, whereby when the cover is in position over the opening **13**, the bottom of said cover is spaced above the top of the receptacle as indicated by the dotted lines **30** in Figures 2 and 3. This spacing provides for a layer or stratum of cool air above the receptacle which is sufficient to carry out the purposes of the present invention, even though this stratum or layer is not as thick as the stratum or layer C which is present when the cover **29** is not in place. However, it is specifically pointed out that the cover is not necessary and is merely provided as a matter of convenience in preventing extraneous matter from entering the interior of the cabinet.

From the above it will be seen that a simple and efficient cooling cabinet suitable for many uses is had. The open well and receptacle makes the interior thereof readily accessible and the advantages in dispensing frozen food products is apparent. Because the design of the cabinet is such that the same air is constantly recirculated therethrough it is apparent that said cabinet may operate with a greater efficiency and at less cost. This recirculation of the same air also prevents the frosting up of the coils and unless extreme loads are placed on the cabinet no defrosting problem is had. The receptacle **22** as well as the coil unit U are readily removable whereby the cabinet may be easily cleaned at any time. Any desired temperature may be held within the cabinet and also the temperature of the air within the entire well and receptacle is substantially the same; in other words, the temperature at the upper end of the cabinet is substantially the same as the temperature in the bottom of said cabinet and there is no wide variation in temperatures at these points such as occur in the usual type of refrigerating cabinet.

What I claim and desire to secure by Letters Patent is:

1. A refrigerating cabinet including, a casing having a refrgerating compartment therein, a product-receiving receptacle having its upper end open mounted within the compartment and of a smaller size than said compartment whereby a space is provided around the side walls and bottom of said receptacle for air circulation, the upper portion of the receptacle being spaced below the top of the cabinet to form an air space

immediately above the receptacle and within the casing, means for establishing communication through the receptacle between the area below the receptacle and the space thereabove, and a cooling coil unit mounted within the compartment between the inner walls of said compartment and the receptacle.

2. A refrigerating cabinet including, a casing having a refrigerating compartment therein, a product-receiving receptacle having its upper end substantially open to allow an unrestricted air flow from the receptacle mounted within the compartment, means for establishing a circulation of air around and upwardly through the receptacle, and means for cooling the air within the compartment and receptacle, the receptacle having its upper end spaced below the top of the casing, whereby a cold air stratum or zone is formed within the compartment above said receptacle.

3. A refrigerating cabinet including, a casing having a refrigerating compartment therein, said compartment having an open upper end, a product-receiving receptacle having its upper end substantially open to permit free circulation of air upwardly therethrough, said receptacle being mounted within said compartment, means for establishing a circulation of air between the sides and bottom of the receptacle and compartment and also upwardly through the interior of said receptacle, means for cooling said circulating air, and means for forming a cold air zone or stratum above the receptacle and in the extreme upper portion of the compartment, said zone acting to seal said compartment against the admission of outside air into the open upper end of the compartment and also providing a supply of air for recirculation through the compartment and receptacle.

4. A refrigerating cabinet as set forth in claim 3, wherein the cold air zone or stratum is formed by locating the upper end of the receptacle in a horizontal plane below the top of the casing, and means for establishing circulation between said air zone and the area between the sides of the receptacle and the compartment.

5. A refrigerating cabinet including, a casing having a refrigerating compartment with its upper end open to atmosphere, a product-receiving receptacle mounted within said compartment and being of a smaller size than said compartment whereby the walls and bottom of said receptacle are spaced from the inner walls and bottom of said compartment to permit air to circulate therebetween, the upper end of said receptacle being located in plane below the top of the cabinet to form a zone or stratum immediately above said receptacle and within the compartment, a peripheral flange on the receptacle extending outwardly in a horizontal direction from the upper end of the receptacle, said flange overlying the space between the side walls of the receptacle and compartment and having openings therein for establishing communication between the zone above the receptacle and the space between said receptacle and compartment, means for establishing circulation between the area below the receptacle and the zone thereabove, and means for cooling the air within the compartment and receptacle.

6. A refrigerating cabinet as set forth in claim 5, wherein the product-receiving receptacle is mounted on supports secured to the bottom thereof, whereby the receptacle is readily removable from the compartment.

7. A refrigerating cabinet as set forth in claim 5, wherein the means for cooling the air within the compartment and receptacle is a cooling coil unit which is disposed within the space between the receptacle and inner walls of the compartment and which is removably supported in position within said compartment.

8. A refrigerating cabinet including, a casing having a refrigerating compartment with its upper end open to atmosphere, a product-receiving receptacle mounted within said compartment and being of a smaller size than said compartment whereby the walls and bottom of said receptacle are spaced from the inner walls and bottom of said compartment to permit air to circulate therebetween, the upper end of said receptacle being located in a plane below the top of the cabinet to form a zone or stratum immediately above said receptacle and within the compartment, a peripheral flange on the receptacle extending outwardly in a horizontal direction from the upper end of the receptacle, said flange overlying the space between the side walls of the receptacle and compartment and having openings therein for establishing communication between the zone above the receptacle and the space between said receptacle and compartment, means for establishing circulation between the area below the receptacle and the zone thereabove, a cooling coil unit removably supported within the compartment and located within the space between the vertical walls of the receptacle and compartment, the casing having a chamber at one end thereof adjacent the compartment, and a refrigerating unit within said chamber and connected with the cooling coil unit for circulating a refrigerant through the coils of said unit.

9. A refrigerating cabinet including, a casing having a refrigerating compartment with its upper end open to atmosphere, a product-receiving receptacle mounted within said compartment and being of a smaller size than said compartment whereby the walls and bottom of said receptacle are spaced from the inner walls and bottom of said compartment to permit air to circulate therebetween, the upper end of said receptacle being located in a plane below the top of the cabinet to form a zone or stratum immediately above said receptacle and within the compartment, a peripheral flange on the receptacle extending outwardly in a horizontal direction from the upper end of the receptacle, said flange overlying the space between the side walls of the receptacle and compartment and having openings therein for establishing communication between the zone above the receptacle and the space between said receptacle and compartment, said receptacle having openings in its bottom and also having vertically disposed conduits therein for establishing communication between the area below the receptacle and the zone thereabove, and means for cooling the air within the compartment and receptacle.

10. A refrigerating cabinet as set forth in claim 9, wherein the means for cooling the air is a cooling coil which is disposed in the space between the vertical walls of the receptacle and the compartment.

11. A refrigerating cabinet as set forth in claim 9, wherein the receptacle and also the cooling means are removably supported within the compartment.

12. A refrigerating cabinet including, a casing having a refrigerating compartment therein, a product receiving receptacle having substantially its entire top removed whereby the interior of the receptacle is readily accessible, air circulation passages around the sides and bottom of the receptacle, the upper portion of the receptacle being spaced below the top of the casing to form an air space immediately above the receptacle and within the casing, means for establishing communication between the circulation passage below the receptacle and the space above said receptacle, and means within the casing for cooling the air circulating through the air circulation passages around the receptacle.

13. A refrigerating cabinet including, a casing having a refrigerating compartment therein, a product receiving receptacle having substantially its entire upper end open whereby the interior thereof is readily accessible, the bottom of said receptacle having means for allowing free circulation of air upwardly into the receptacle, air circulation passages around the sides and bottom of said receptacle, the upper portion of the receptacle being spaced below the top of the casing to form an air space immediately above the receptacle and within said casing, and means within the casing for cooling the air circulating through the passages around the casing, whereby said cooled air may enter the interior of the receptacle through the means in the bottom thereof.

14. A refrigerating cabinet as set forth in claim 13, together with air passages extending upwardly from the space below the receptacle to the space thereabove, whereby when products are within the receptacle a free flow of air from below to above the receptacle may occur.

15. A refrigerating cabinet including, a casing having a refrigerating compartment therein, a product receiving receptacle within the casing and having its top substantially open to facilitate access to the interior thereof, said receptacle being of a smaller size than the casing whereby air circulation passages are formed around the sides and bottom of the receptacle and also whereby a cold air space or stratum is formed immediately above the receptacle, means for establishing communication between the area below the receptacle and the air space thereabove whereby a circulation of air upwardly through said receptacle may occur, and means for cooling the air flowing through the circulation passages.

16. A refrigerating cabinet as set forth in claim 15, wherein the cooling means is disposed within the circulation passages between the side walls of the receptacle and the side walls of the compartment whereby circulation of air is downwardly from the air space above the receptacle, then through the passages and finally upwardly through the receptacle to said air space.

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