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REFRIGERATOR CABINET HAVING MEANS TO IMPROVE TEMPERATURE DISTRIBUTION

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Fig. 1.

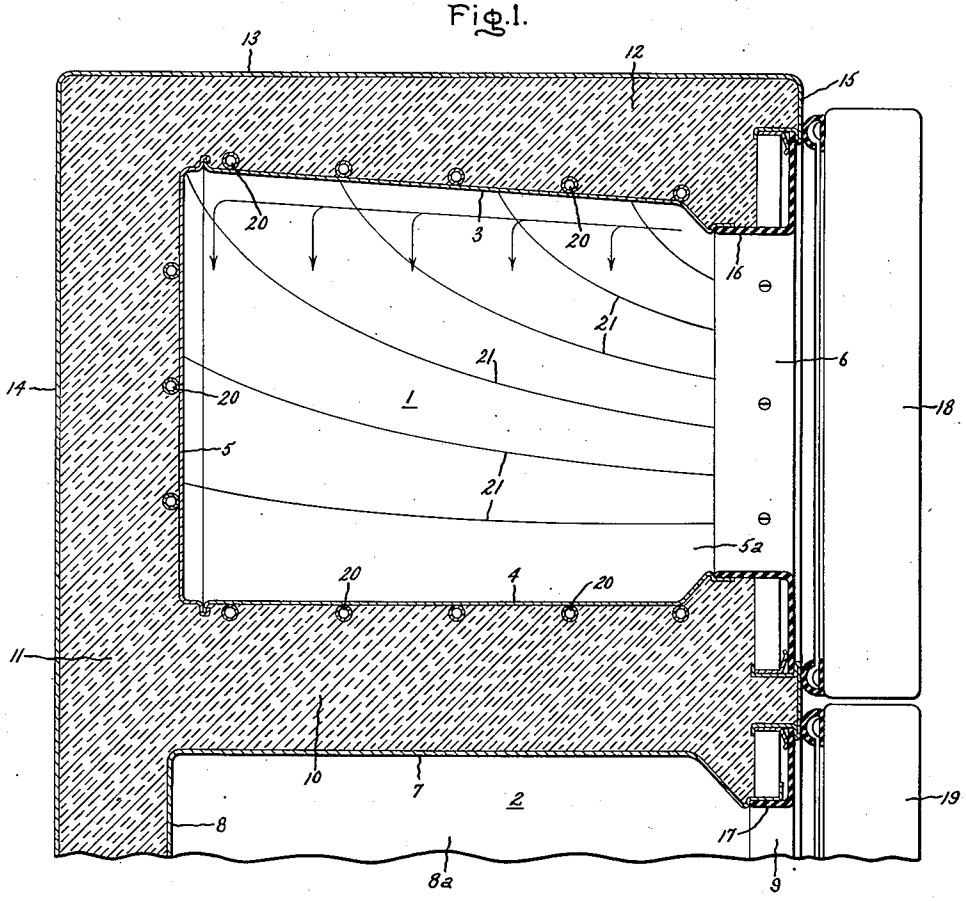
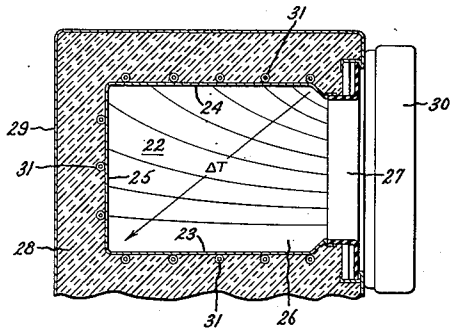



Fig. 2.




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## REFRIGERATOR CABINET HAVING MEANS TO IMPROVE TEMPERATURE DISTRIBUTION

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3 Claims. (Cl. 62—99)

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This invention relates to refrigerator cabinets, more particularly to such cabinets having a front opening normally closed by a door, and it has for its object the provision of an improved cabinet of this character which, by its wall arrangement, improves the temperature distribution of the air within the cabinet.

While this invention is applicable to refrigerator cabinets in general, it is especially useful in the low temperature, relatively small freezer cabinets employed in household refrigerators such as those formed or constructed with a relatively large higher temperature food storage compartment, as in the so-called "Two-Temperature" refrigerator.

In one type of these small freezer compartments, the evaporator cooling coils are placed along the top, bottom and end walls to extract heat from the compartment and thereby cool it. I have found that in these compartments the temperature distribution of the air is such that the warmest zone is at the top forward part of the compartment directly inside the front door opening. This is due to the fact that each time the door is opened some of the warm air from the outside the refrigerator enters and collects in a pocket at the upper forward end of the compartment. Also, air enters the compartment and collects at the forward end due to leakage at the door even when the door is closed; furthermore, heat leakage at the door while it is closed has much the same effect as a door opening.

This invention contemplates an improved cabinet construction arranged to improve substantially the temperature distribution in the cabinet, that is, which reduces materally the temperature differential between the warmest and coolest air zones in the compartment. And this invention effects this improvement by sloping the upper wall of the freezing compartment upwardly from the front door to the rear of the compartment. This upwardly sloping top wall enables the air which would tend to collect in a warm pocket at the front to rise by convection toward the back of the compartment along the top wall which cools the air as it flows. The cooled air then drops toward the bottom, and so the circulation of air in the compartment is increased. I have found that this arrangement lessens the temperature differential in the compartment to a material extent, that is, effects a more even temperature distribution throughout the compartment.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is a vertical sectional view of a portion of a two-temperature refrigerator embodying this invention; and Fig. 2 is a view similar to Fig. 1 but illustrating a conventional refrigerator cabinet.

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Referring to the drawing, this invention has been shown in one form as applied to a two-temperature refrigerator comprising an upper freezing cabinet 1 maintained at a relatively low temperature as, for example, from zero degrees to 10° F., and a lower food storage compartment 2 maintained at some suitable food storing temperature, such as 38° F. The upper compartment is formed by an inner metallic lining having a top wall 3, a horizontal bottom wall 4, a vertical rear wall 5, and a pair of vertical, substantially parallel side walls 5a (only one of which is shown), all of these walls being joined together in any suitable way so as to form a box-like storage space having an opening 6 at the front. The food storage compartment 2 likewise has an inner metallic lining formed from a horizontal top wall 7, a vertical rear wall 8, vertical and parallel side walls 8a (only one of which is shown), and a bottom wall (not shown) opposite the top wall, these walls also being joined together to form a box-like cabinet having a front opening 9.

The two compartments 1 and 2 are separated from each other by an insulating layer 10, which insulates the bottom wall 4 of compartment 1 and the top wall 7 of compartment 2. A layer 11 of insulation insulates the rear walls 5 and 8 of the two compartments, and a layer 12 of insulation insulates the top wall 3 of the upper compartment. It will be understood, of course, that the bottom wall of compartment 2 also will be provided with an insulating layer. The whole of the foregoing construction is enclosed by an outer metallic cabinet having a top wall 13, a rear wall 14, a front wall 15, and parallel side and bottom walls (not shown) to form a substantially box-like outer shell or cabinet having openings aligned with the openings 6 and 9 of the two compartments.

The metallic walls of the freezer compartment 1 at the front are separated from the front wall 15 of the outer shell by means of a breaker strip 16, while the metallic walls of compartment 2 are separated from the front wall 16 by means of a breaker strip 17, the two breaker strips 16 and 17 being formed of any suitable heat insulating material.

As shown in the case of each compartment 1, 2, the forward end portions of the top, bottom and side walls are tapered inwardly toward their respective front openings so that the throats of

the openings are somewhat smaller than the vertical cross sections of the respective compartments; this construction, however, is not necessary, since the openings may be just as large as the vertical cross sections of the respective compartments. These openings are provided with heat insulating doors 18 and 19 respectively.

The top, bottom and end walls 3, 4 and 5 of the freezer compartment 1 are cooled by evaporator coils 20 fixed to these walls at substantially uniformly spaced intervals from the front to the rear of the top and bottom walls and from the top to bottom of the rear wall, as shown.

In accordance with this invention, I have arranged the top wall 3 so as to reduce materially the temperature differential between the upper front corner and lower rear corner, and I do this by sloping the upper wall 3 from the front to the rear, as shown; in the specific example of the invention illustrated, I give the wall a 5° slope.

By reason of this arrangement the warm air which tends to collect in the upper forward part in a pocket rises by convection toward the rear of the compartment 1 along the top sloping wall 3 and as it so moves, it is cooled by the evaporator coils 20 sufficiently to cause it to drop toward the bottom of the compartment by convection action, as shown by the arrows in Fig. 1. The sloping top wall facilitates and increases the circulation of air in the compartment and materially reduces the temperature differential. I have found by actual test that by giving the top wall a slope of 5° the temperature differential between the upper forward part of the cabinet and the lower rear corner thereof is reduced by approximately 25%.

The lines 21 of Fig. 1 are isothermal lines and they indicate a 1° differential in temperature from one to the other, that is, a 1° rise in temperature from the lower to the next higher line. It will be observed in Fig. 1 that there is but a 6° rise in temperature from the lower coolest area of the compartment at the rear lower corner to the upper warmest area of the compartment at the front upper corner.

By contrast in Fig. 2 (drawn to a smaller scale than is Fig. 1), there is illustrated a conventional freezer compartment 22 of the same dimensions as the cabinet of Fig. 1 and having substantially horizontal bottom and top walls 23 and 24, a vertical rear wall 25, and a pair of side vertical walls 26 (only one shown). These walls are joined together to define the compartment 22 and to provide a front opening 27 for it. These walls are provided with an insulating layer 28 which is housed within an outer cabinet 29. The front opening is closed by a door 30, and the bottom, top, and end walls 23, 24, and 25 are cooled by evaporator coils 31 uniformly spaced along these walls, as shown. In this conventional compartment which has substantially the same volume as has the compartment 1 of Fig. 1, the temperature differential from the lower left-hand corner, which is the coolest, to the upper right corner, which is the warmest, is denoted by the isothermal lines indicating 1° temperature rise from one to the other from the lower to the upper part of the cabinet, that is, a temperature rise of 8° as contrasted with the 6° rise in Fig. 1. In other words, the 5° sloping top of Fig. 1 reduces the temperature differential by about 25%. This improvement can be accentuated by giving the top wall a greater slope than 5°.



While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A refrigerator cabinet comprising a substantially horizontal bottom wall, substantially vertical side and rear walls, and a top wall all joined together to form a refrigerator compartment having an opening at the front, a door for said opening, said top wall sloping upwardly from said opening to said rear wall, and cooling means for cooling at least said top wall from the front to the rear thereof.

2. A refrigerator cabinet comprising a substantially horizontal bottom wall, substantially vertical side and rear walls, and a top wall all joined together to form a refrigerator compartment having an opening at the front, a door for said opening, said top wall having a substantially uniform slope from the front opening to said rear wall and cooling means for cooling said top and bottom walls from the front to the rear thereof and said rear wall from the top to the bottom portion thereof.

3. A refrigerator cabinet comprising a substantially horizontal bottom wall, substantially vertical side and rear walls, and a top wall all joined together to form a refrigerator compartment having an opening at the front, a door for said opening, said top wall sloping upwardly from the said opening to said rear wall and evaporator cooling coils in contact with said top, bottom and rear walls spaced at substantially uniform intervals along the walls.

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