Oct. 20, 1936. E. F. SCHWELLER 2,057,746

REFRIGERATING APPARATUS

Filed July 3, 1931 3 Sheets-Sheet 1

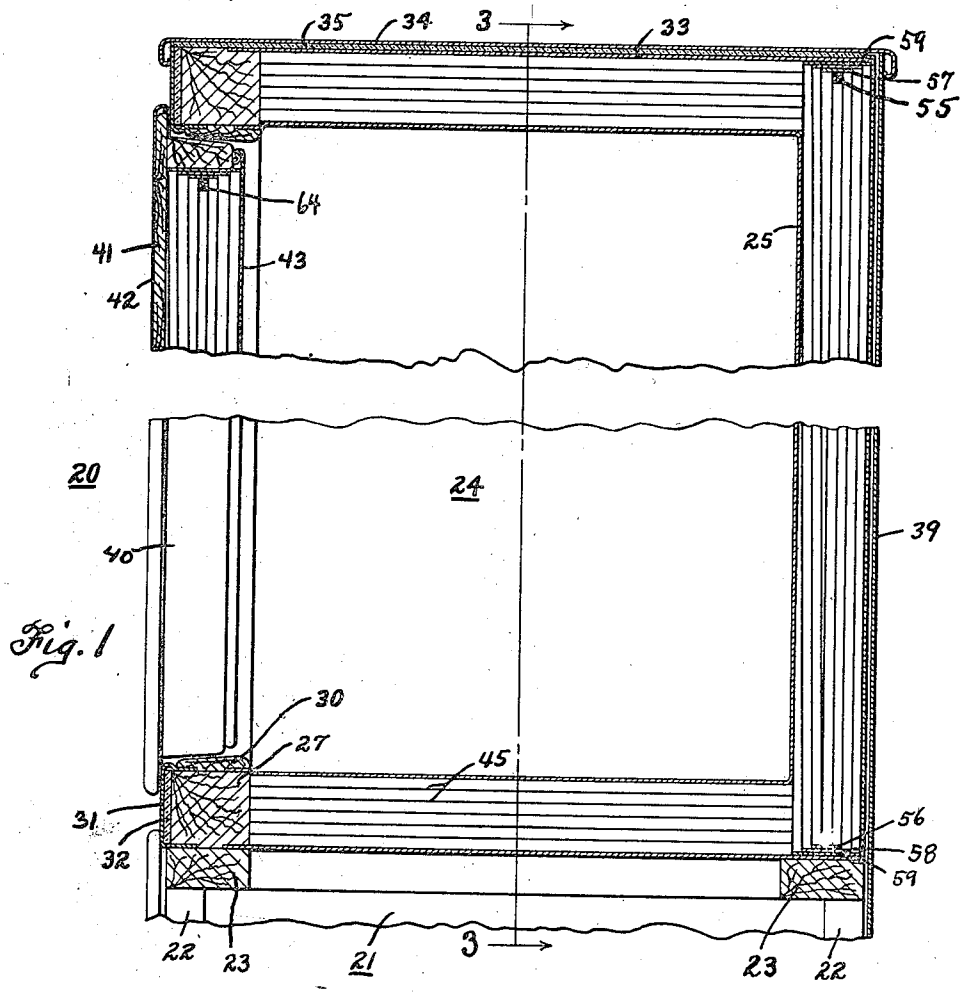

Fig. 1

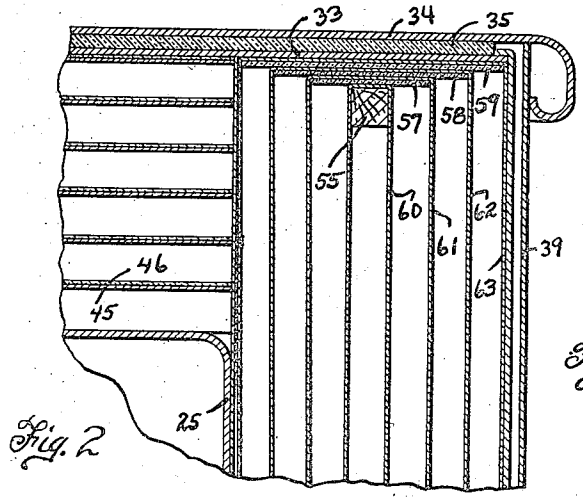

Fig. 2

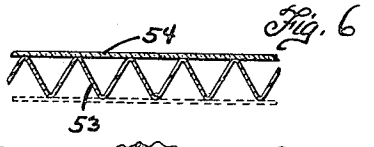

Fig. 6

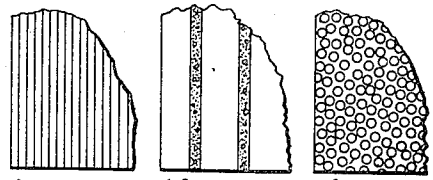

Fig. 7 Fig. 8 Fig. 9

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REFRIGERATING APPARATUS

Filed July 3, 1931 3 Sheets-Sheet 2

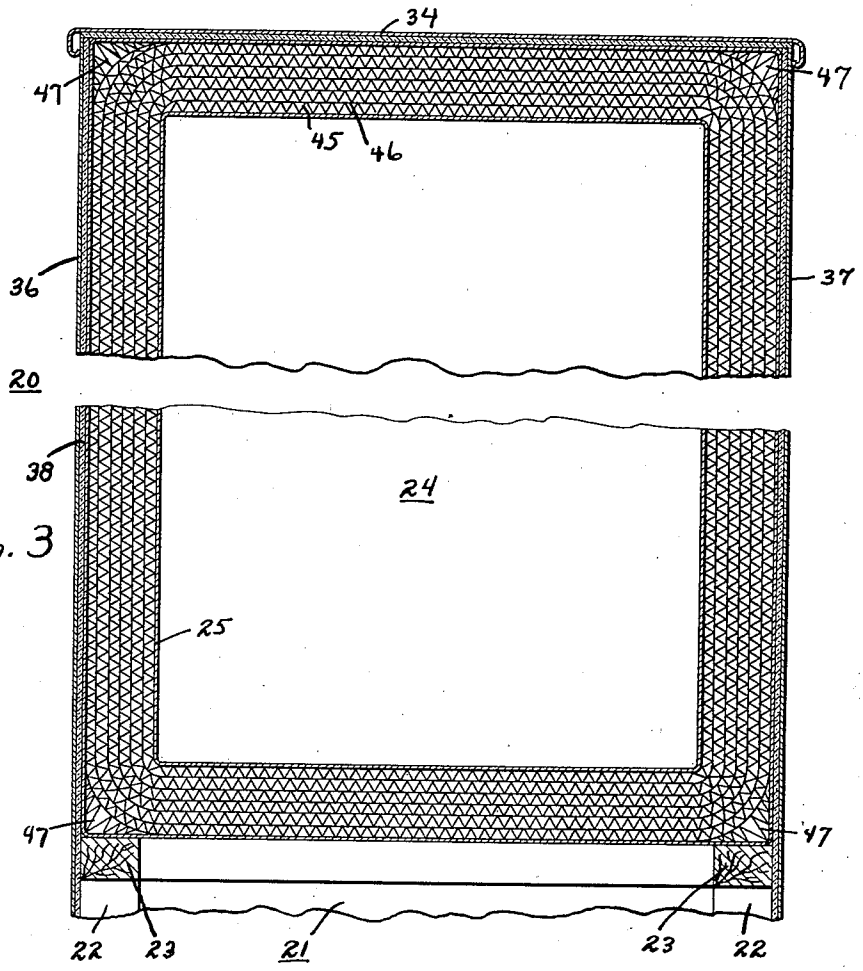

Fig. 3

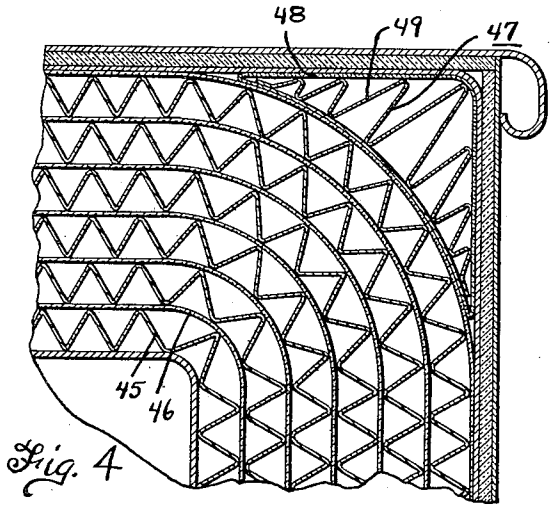

Fig. 4

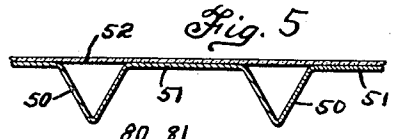

Fig. 5

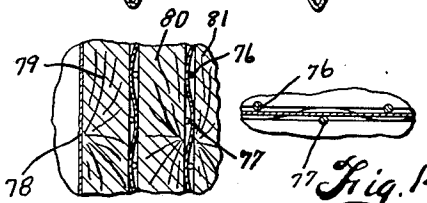

Fig. 13

Fig. 14

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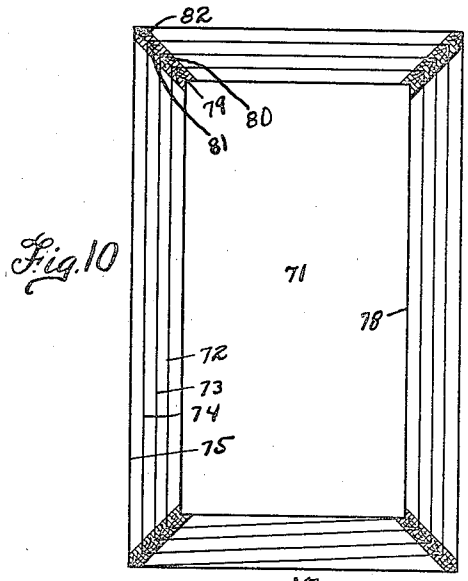

Fig. 10

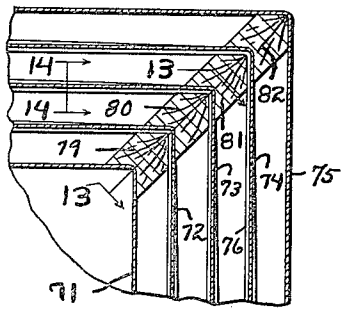

Fig. 11

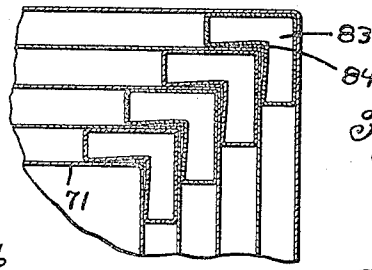

Fig. 12

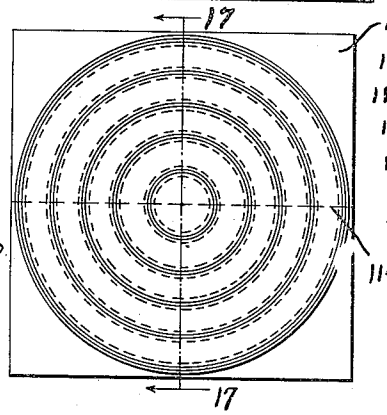

Fig. 16

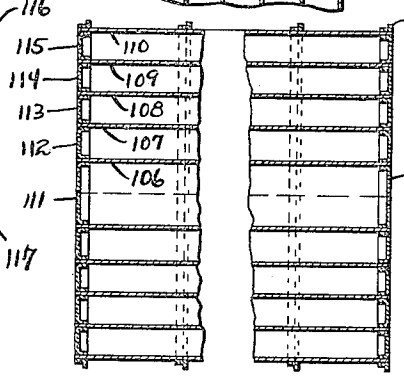

Fig. 17

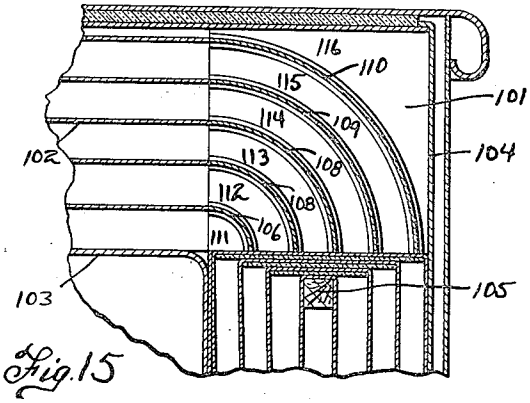

Fig. 15

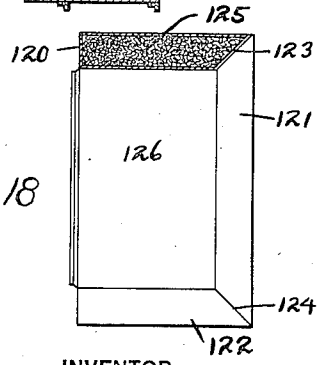

Fig 18

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UNITED STATES PATENT OFFICE

2,057,746

REFRIGERATING APPARATUS

Edmund F. Schweller, Dayton, Ohio, assignor, by mesne assignments, to General Motors Corporation, a corporation of Delaware

Application July 3, 1931, Serial No. 548,583

16 Claims. (Cl. 220—9)

This invention relates to refrigerating apparatus and more particularly to the construction of cabinets, the walls of which are heat insulated to prevent the passage of heat therethrough.

In the manufacture of insulated cabinets, it has been proposed to use air spaces in the walls thereof to prevent the transfer of heat therethrough. Heretofore such practice has been unsatisfactory for the reason that radiant heat will pass freely through air, and, in addition, the convection currents set up therein will transfer large amounts of heat therethrough. To overcome the transfer of radiant heat it has been proposed to provide a dead air space bounded by a thin bright metal foil or leaf, such for instance as bright aluminum foil, for insulating purposes. By the term "metal foil" is meant thin leaves of metal either with or without paper backing of such thickness that they can be readily formed to any desired shape. It has been found that these bright metallic surfaces of foil radiate but very little heat, and consequently it is possible to utilize air spaces lined with such bright surfaces in heat insulating cabinets. By reducing the size of the air space the other objectional feature of air space insulation, namely loss of heat by convection currents, is removed in that convection currents ordinarily set up are decreased to a minimum.

Attempts to adapt such thin bright metallic foil to cabinet construction so as to utilize air spaces in the walls thereof for insulating purposes have met with great difficulty. In the first place, this foil is extremely thin and consequently cabinets must be so constructed as to prevent rupturing of the foil when such cabinets are subjected to the slam test, a test involving the opening and closing of the cabinet door over prolonged periods of time. In addition, the foil must be so supported within the cabinet wall as to maintain it substantially taut at all times, while at the same time preventing the transfer of heat through these supporting means. Thirdly, the foil being metallic, has a tendency to rattle or cause what is known as a metallic cry and great care must be taken to prevent or render inaudible such cries or other noises.

It is to such structure that my invention particularly relates, having for one of its objects to provide a cabinet construction having foil insulation, that is, a cabinet capable of utilizing a thin bright metallic foil to advantage, while at the same time eliminating most of its disadvantages.

More particularly it is an object of the invention to provide the cabinet construction wherein all metallic cries are adequately deadened, rupturing of the foil is prevented, and a proper spacing of the foil is provided.

A further object of the invention is to provide an improved foil construction whereby the layers of foil may be formed by winding a continuous strip of foil continuously around four sides of the cabinet and to provide various constructions of insulated cabinets adaptable for easy and economical assembling.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the invention is clearly shown.

In the drawings

Fig. 1 is a vertical sectional view through the upper portion of a refrigerator cabinet embodying one form of the invention;

Fig. 2 is an enlarged view of an upper corner of Fig. 1;

Fig. 3 is a vertical sectional view along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged view of an upper corner of the cabinet as shown in Fig. 3;

Fig. 5 is a modified form of the corrugated strip shown in Figs. 3 and 4;

Fig. 6 is another modified form of the corrugated construction shown in Figs. 3 and 4;

Fig. 7 shows a form of foil having means to prevent metallic cry;

Fig. 8 shows another form of foil having a modified means for preventing metallic cry;

Fig. 9 shows the form of foil used in the insulation at the back of Fig. 1;

Fig. 10 is a modified form of wound foil insulation;

Fig. 11 is an enlarged view of an upper corner of the insulation shown in Fig. 7;

Fig. 12 shows a modified form of spacing means shown in Figs. 10 and 11;

Fig. 13 is a section on the line 13—13 of Fig. 11;

Fig. 14 is a section on the line 14—14 of Fig. 11;

Fig. 15 is a modified form of the corner construction shown in Fig. 2;

Figs. 16 and 17 are views illustrating the method of making the corner piece shown in Fig. 15, and

Fig. 18 shows a modified form of cabinet construction.

In order to illustrate one aspect of my invention, I have disclosed in Figs. 1 to 4 inclusive a refrigerator cabinet generally designated at 20. This cabinet includes a lower machinery compartment 21 formed by the upright corner members 22 and the horizontal cross members 23. The food storage compartment 24 is supported above the machinery compartment. This food compartment includes a liner 25 which, as shown, may be a one-piece metal porcelain lining secured at its front edges to the horizontal cross beams 27 and similar upright beams, not shown,

forming the rectangular door jamb. A convenient way of securing the liner to the door jamb is shown on the drawings comprising nailing or otherwise securing the front edges of the liner 25 to the rectangular door jamb and then securing over the edges thereof a wooden molding 30 having relatively low conductivity. This molding 30 serves to break the conduction of heat from the exterior of the cabinet to the inner liner 25.

Sheets of metal coated with porcelain or other suitable substances form the outer walls of the cabinet. A sheet metal member 31, preferably coated with porcelain, is provided for covering the rectangular door jamb. Chipboard 32 is placed beneath the sheet metal covering for preventing the chipping of the porcelain. An outer liner 33 of a somewhat similar shape to that of the inner liner 25, but larger, is similarly secured at its front edges to the door jamb 27. A porcelain sheet metal covering 34 is provided on the top of the cabinet spaced from the outer liner by chipboard 35 and the sides of the cabinet are similarly provided with sheet metal covering 36 and 37, are also similarly provided with chipboard 38 which is inserted between the coated sheet metal covering and the outer lining. A sheet metal covering 39 is also provided on the rear wall of the cabinet. A door 40 is provided in the front wall of the cabinet and has a frame 41 provided with an outer sheet metal covering 42, preferably coated with porcelain, and an inner sheet metal covering 43, also coated with porcelain.

Insulation is provided between the inner and outer walls of the cabinet, and more strictly speaking, between the inner and outer liners 25 and 33. Upon four sides of the walls of the cabinet the insulation preferably takes the form of a plurality of alternate corrugated and non-corrugated or plane sheets. As shown, sheets of foil 45 in corrugated form are spaced from each other by sheets of a suitable paper 46 or similar fibrous material. This insulation is preferably provided by winding a continuous strip of corrugated bright metallic foil together with a continuous strip of paper about the inner liner of the cabinet before assembling the liner into the cabinet. The corrugated foil and strip of paper are preferably wound about four sides of the inner liner 25 a plurality of times as shown in Figs. 3 and 4. If desired, instead of the foil being corrugated and the paper being non-corrugated, the paper may be corrugated and the foil may be non-corrugated. In this construction the non-corrugated sheet serves to prevent adjacent corrugated sheets from nesting together which would prevent the formation of the proper size of air spaces. By my improved construction of alternate sheets of corrugated foil and non-corrugated paper, a plurality of air spaces or cells are provided which are bounded by bright metallic foil and paper. The bright metallic foil effectively prevents heat transfer by radiation and a plurality of small air cells has always been considered an effective way to reduce heat leak by conduction and convection. Inasmuch as the bright metallic foil is corrugated and held between sheets of paper, the rattling or metal cry of the foil is prevented.

In winding insulation of this type about four sides of the inner liner, the corners become rounded. When it is desired to use this type of insulation in a cabinet having outer walls with square corners, an insert 47 may be provided to fill in the space between the rounded corners of the insulation and the square corners of the outer walls. These inserts 47 preferably comprise an outer container 48, preferably of paper or cardboard of suitable shape, and a suitably corrugated sheet of bright metallic foil 49 properly distributed within the container 48. Such an insert effectively prevents any convection of air which may be present in the vacant pockets of the adjacent corners of the winding. Such inserts may be omitted if desired.

In Fig. 5 there is shown a modified form of corrugated foil insulation in which the corrugations 50 are not immediately adjacent each other, but are spaced by intermediate straight portions 51. This corrugated foil is wound along with a strip of ordinary paper 52 of suitable composition in the same manner as described above. With this type of construction the amount of foil necessary is reduced and the air spaces are maintained since the sheets of foil are kept properly separated by the spaced corrugations. As in the first described type of foil, the paper may take the place of the corrugated foil and the foil may take the place of the paper, that is, the paper may be corrugated similarly to the foil and have spaced corrugations as shown at 50, while the foil may be non-corrugated.

In Fig. 6 there is shown another modified form of corrugated construction. In this modification the foil 53 is again shown as corrugated, and the paper 54 is shown as non-corrugated. In this modification the tips of corrugations on one side are glued or cemented to one side of the paper. Such a construction strengthens the corrugations and facilitates handling of the foil and paper. If desired, this foil and paper may be used in the form of individual sheets. As mentioned before, the paper may be corrugated and the foil may be non-corrugated.

In order to insulate the rear wall of the cabinet, a frame 55 is provided which is wound in such a manner so as to provide air spaces bounded by the spaced sheets of bright metallic foil. The frame 55 preferably comprises a rectangular wooden structure or other low conducting material. The foil is placed upon the rectangular frame 55 in a peculiar manner. A continuous strip of foil is fastened to one edge of the rectangular frame 55. In Fig. 1, the foil is shown as having one end attached to the lower portion of the rectangular frame 55. The foil is then first wound around the rectangular frame 55 for one complete turn 60, and then spaced cardboard spacing members 56 and 57 are attached to opposite ends of the rectangular frame 55 over the first turn or layer of foil 60 and a complete turn 61 of foil is wound about these spacers 56 and 57. After this, a wider pair of spacing members 58 are fastened to opposite ends of the rectangular frame over the second turn of winding 61 as well as the spacers 56 and 57, and a third turn 62 of foil is wound about the pair of spacing members 58. After the third turn 62 of winding, a third pair of wider spacing members 59 are fastened to the opposite edges of the rectangular frame 55 over the third turn of winding 62 as well as the spacer members 58, and a fourth turn of winding 63 is passed around the third pair of spacing members 59. In this manner, a slab of spaced foil insulation has been produced by a winding method. Preferably the foil upon the frame 55 is embossed with a sort of hammered effect as shown in Fig. 9 in order to prevent the metal cry of the foil

wound upon the frame 55. If desired, however parallel threads may be glued to one or both sides of the foil to prevent metal cry as shown in Fig. 7, or parallel ribbons of glue may be put upon the foil as shown in Fig. 8 to accomplish the same purpose. The door 40 is provided with a similarly wound slab of insulation 64 between its inner and outer covering members or walls and the foil employed is similarly treated to prevent metal cry.

In Figs. 10 to 15 another form of winding structure is shown. In Fig. 10 there is shown an inner liner 71 about which a continuous strip of foil is wound to provide a plurality of layers of foil, 72 to 75 inclusive, in spaced relation. As better shown in Figs. 11, 13 and 14, the foil is provided with threads 76 and 77, preferably arranged alternately on either side of the continuous strip of bright metallic foil. This form of insulation is preferably constructed by fastening one end of the continuous strip of foil together with the threads upon opposite sides of the foil to a portion of an inner liner as shown at 78 in Fig. 10. Spacing members 79 to 82 inclusive having matched V-shaped grooves and corresponding projections on opposite sides which are used to space the layers of the strip of winding so as to provide air spaces therebetween. These spacing members are adapted to fit along four of the edges of the inner liner and also upon each other. The winding is performed in the following manner: after the continuous strip of foil is attached to the inner liner as at 76, the innermost spacing members 79 are fastened, preferably by glue or cement, to the four diagonally opposite edges about which the winding is to take place and the first turn of foil 72 passes around and rests upon the four spacing members 79 which have been fastened to the inner liner; after the first turn is made, the spacing members 80 have their inner grooves glued or cemented in place on top of the first turn of foil directly outside of the spacing members 79; after the spacing members 80 are put in place, a second turn of foil 73 is wound about the spacing members 80 so as to provide a second layer of foil and then similar spacing members 81 are placed at the four corners on top of the second layer of wound foil 73 directly outside of the spacing members 80 and then a third turn of the wound foil is taken about the spacing members 81 and after this similar spacing members 82 are placed on the third turn 74 of the wound foil directly outside of the spacing members 81 and a fourth turn of foil is taken around the spacing members 82 and the loose end of the foil is fastened to the outer layer of foil 79. It will be understood that the winding can be performed without the use of the threads 76 and 77, if desired, but the threads are preferably employed to prevent the rattling and the metallic cry of the foil and also prevent its rupture during the winding operation.

In Fig. 12 a modified form of spacing members 83 is shown. These spacing members are similar to the spacing members 79 to 82 inclusive and also extend across the entire width of one of the edges of the inner liner 71. These spacing members 83 consist of cardboard formed into a hollow angle iron shape. These angular spacing members 83 are preferably provided with gummed paper 84 at their inner corner for attaching to the preceding winding of foil so that the winding operation may be facilitated. By employing spacers of cardboard having hollow angular shape, the conductivity through the spacing members is further reduced. In Fig. 12 no supporting threads 76 and 77 are shown but these may be used in this modification also, if desired.

In Fig. 15 there is shown a modified rear corner construction which may be used with any suitable form of construction, for example, that shown in Figs. 1 to 4 inclusive, or in the construction shown in Figs. 10 to 12 inclusive. By inspection of Figs. 1 and 2, it will be seen that in the rear wall of the cabinet the air spaces provided by the foil wound about the frame 55 extend to the top and bottom of the outer lining 33 as well as to the sides of the outer lining 33 (not shown). The air space next to the rear wall of the inner liner therefore extends to the outer liner 33. By this type of construction some of the heat out of the cabinet may leak into the food storage compartment in this manner, sometimes at a sufficiently rapid rate to cause sweating upon the outer covering of the cabinet. In order to avoid this heat leakage, I have provided an insert 101, shown in Fig. 15, which prevents the inner air spaces in the back wall of the cabinet from extending to the outer wall. In Fig. 15, the foil type of insulation 102 between the top walls of the cabinet may be of any suitable type, for example, that shown in Figs. 1 to 4 inclusive or that shown in Figs. 10 to 12 inclusive. The insulation between the back walls of the inner and outer liners 103 and 104 shown in Fig. 15 terminates opposite the top wall of the inner liner 103. The insulation 102 between the top walls of the cabinet terminates opposite the back wall of the inner liner 102. By thus shortening the back wall and decreasing its width, a space is left around the perimeter around the back wall of the cabinet. This space is preferably filled by the insert 101. This insert consists of a plurality of quarter cylinders 106 to 110 inclusive of thin cardboard having bright metallic foil on one or both sides which are held in spaced relation by webs of cardboard 111 to 116 inclusive, which are glued or cemented thereto. The inserts are preferably formed in the following manner: the cylinders 106 to 110 inclusive, composed of cardboard having bright metallic foil on one or both sides, are placed in concentric relation and spacing discs 111 are glued into both ends of the smaller cylinder or tube 106, a concentric spacing ring 112 is placed within the ends of the tube 107 and without the tube 106; the concentric spacing rings 113 are similarly positioned between the ends of the tubes 108 and 107; still larger concentric spacing rings of cardboard 114 are placed between the ends of the tubes 109 and 108; a pair of larger concentric rings 115 are placed between the ends of the tubes 110 and 109 and the squared rings 116 are placed on the outside of tube 110 at suitable points. All of these parts are suitably glued or cemented together. The cylinders or tubes may be made entirely of a suitable type of bright metallic foil, if desired. After these cylinders are so assembled, they are cut into four parts along the lines 117 and the line 17—17. These assembled quarter cylinders are then used as inserts and placed in the spaces adjacent the perimeter of the rear wall of the cabinet.

In Fig. 18 another type of foil insulation is shown. In this type, containers 120, 121 and 122 made of cardboard of a suitable type are shaped so as to fit within the walls of a refrigerator cabinet and have mitered joints such as are shown at 123 and 124 so that the containers are fit together at the corners of the cabinet. These

containers are preferably filled with a crinkled or corrugated foil insulation 125 so as to provide air spaces therein bounded by bright metallic foil. If desired, the containers may be filled with foil of the type shown in Fig. 6. These containers are placed about the inner liner 126 between the inner and outer walls of the refrigerator cabinet. In this manner the insulation is provided in a form of foil insulation which may be easily handled in the form of slabs.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An insulated storage cabinet having inner and outer walls, and insulation between said inner and outer walls including a plurality of air spaces bounded by sheets of bright metallic foil, said foil being embossed in a hammered form to prevent metal cry.

2. An insulated cabinet comprising inner and outer walls, insulation between said walls including a plurality of sets of sheets in superimposed relation, each set of sheets comprising a corrugated sheet and a non-corrugated sheet, one of said sheets being of bright metallic foil and the other of said sheets being of a non-metallic material.

3. An insulated cabinet comprising inner and outer walls, insulation between said walls including a plurality of sets of sheets in superimposed relation, each set of sheets comprising a corrugated sheet and a non-corrugated sheet, one of said sheets being of bright metallic foil and the other of said sheets being of a fibrous material, the corrugated sheet being attached to the non-corrugated sheet at the tips of the corrugations.

4. An insulated cabinet comprising inner and outer walls, insulation between said walls including a plurality of sets of sheets in superimposed relation, each set of sheets comprising a sheet corrugated at spaced intervals, and a non-corrugated sheet, one of said sheets being of bright metallic foil, and the other of said sheets being of a non-conducting material.

5. An insulated storage cabinet including inner and outer walls, and insulating material between said inner and outer walls including a plurality of sheets of material wound about said inner walls a plurality of times providing a plurality of superimposed layers, one of said sheets of material being corrugated, one of said sheets of material being composed of bright metallic foil, and another of said sheets being composed of fibrous material.

6. An insulated storage cabinet including inner and outer walls, and insulating material between said inner and outer walls, including a plurality of sheets of material wound about said inner walls a plurality of times providing a plurality of superimposed layers, one of said sheets of material being corrugated, one of said sheets of material being composed of bright metallic foil, and another of said sheets being composed of fibrous material, said corrugated sheets being attached to other sheets at the tips of the corrugations.

7. An insulated storage cabinet including inner and outer walls, and insulating material between said inner and outer walls including a plurality of sheets of material wound about said inner walls a plurality of times providing a plurality of superimposed layers, one of said sheets of material being corrugated at widely spaced intervals, one of said sheets of material being composed of bright metallic foil, and another of said sheets being composed of fibrous material.

8. An insulated panel including a core slab, a sheet of bright metallic foil wound about the core slab, a set of spacers fastened to opposite edges of the core slab on top of the winding, and a sheet of bright metal foil wound about said spacers to provide a plurality of spaced sheets of metal foil.

9. An insulated panel including a core slab, a sheet of bright metallic foil wound about the core slab, a set of spacers fastened to opposite edges of the core slab on top of the winding, said sheet of bright metal foil extending around said spacers to provide a second convolution providing a plurality of spaced sheets of metal foil.

10. An insulated refrigerator cabinet including inner and outer walls, and insulation between the inner and outer walls including a plurality of sheets of embossed bright metallic foil held in spaced relation upon a framework of a relatively low conducting material, said foil being embossed for preventing metallic cry.

11. An insulated refrigerator cabinet including inner and outer walls, a separate insulation panel of generally rectangular shape between the inner and outer walls upon one side of the cabinet, said insulation panel including a framework of a low conducting material, a plurality of embossed sheets of bright metallic foil mounted in spaced relation upon the framework forming a plurality of gas spaces between the sheets, said foil being embossed for preventing metallic cry.

12. An insulating structure including a plurality of sheet portions, means for supporting the sheet portions in spaced relation with gas spaces in between, one of said sheet portions having air spaces on each side and having metallic heat reflecting surfaces embossed for preventing metal cry.

13. An insulating structure including a plurality of substantially plane sheet portions, means for supporting the sheet portions in spaced relation with gas spaces in between, one of the sheet portions having air spaces on either side and being of metal heat reflecting foil embossed for preventing metal cry.

14. An insulating structure having a wall portion provided with a hollow enclosure, a sheet of metallic heat reflecting foil within said enclosure dividing said enclosure into a plurality of air spaces, said sheet being embossed for preventing metal cry.

15. An insulating structure having a wall portion provided with a hollow enclosure, a sheet of metallic heat reflecting foil within said enclosure dividing said enclosure into a plurality of air spaces, said sheet being embossed in a hammered form for preventing metal cry.

16. An insulating structure having a wall portion provided with a hollow enclosure, said enclosure being provided with a framework, a sheet of metallic heat reflecting foil supported by said framework in a stretched condition and extending across said enclosure dividing said enclosure into a plurality of spaces, said sheet being embossed for preventing metal cry.

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