Sept. 8, 1936. S. V. COOK ET AL 2,053,251

REFRIGERATING APPARATUS

Original Filed Nov. 3, 1930 7 Sheets-Sheet 1

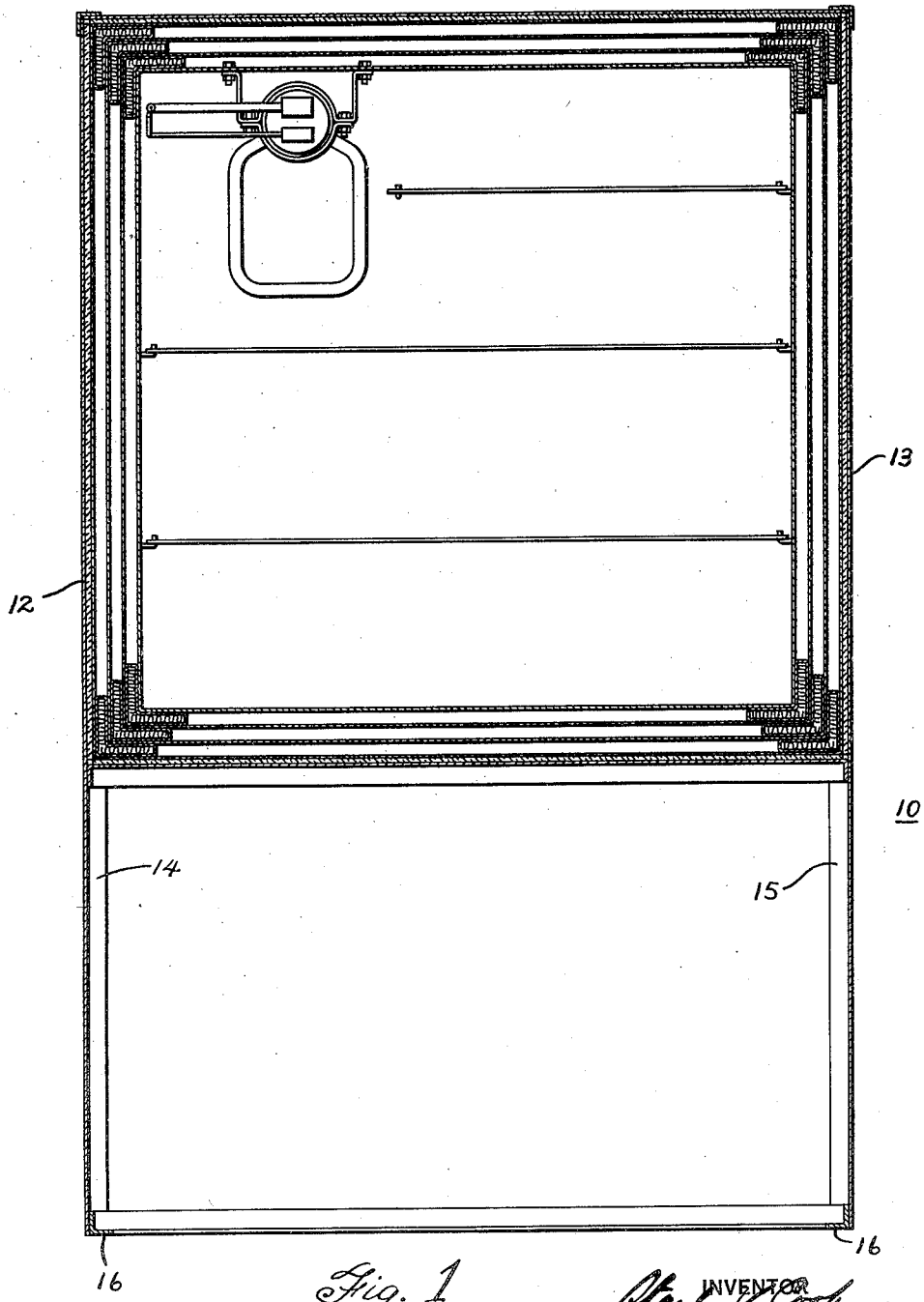

Fig. 1

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Sept. 8, 1936. S. V. COOK ET AL 2,053,251

REFRIGERATING APPARATUS

Original Filed Nov. 3, 1930 7 Sheets-Sheet 2

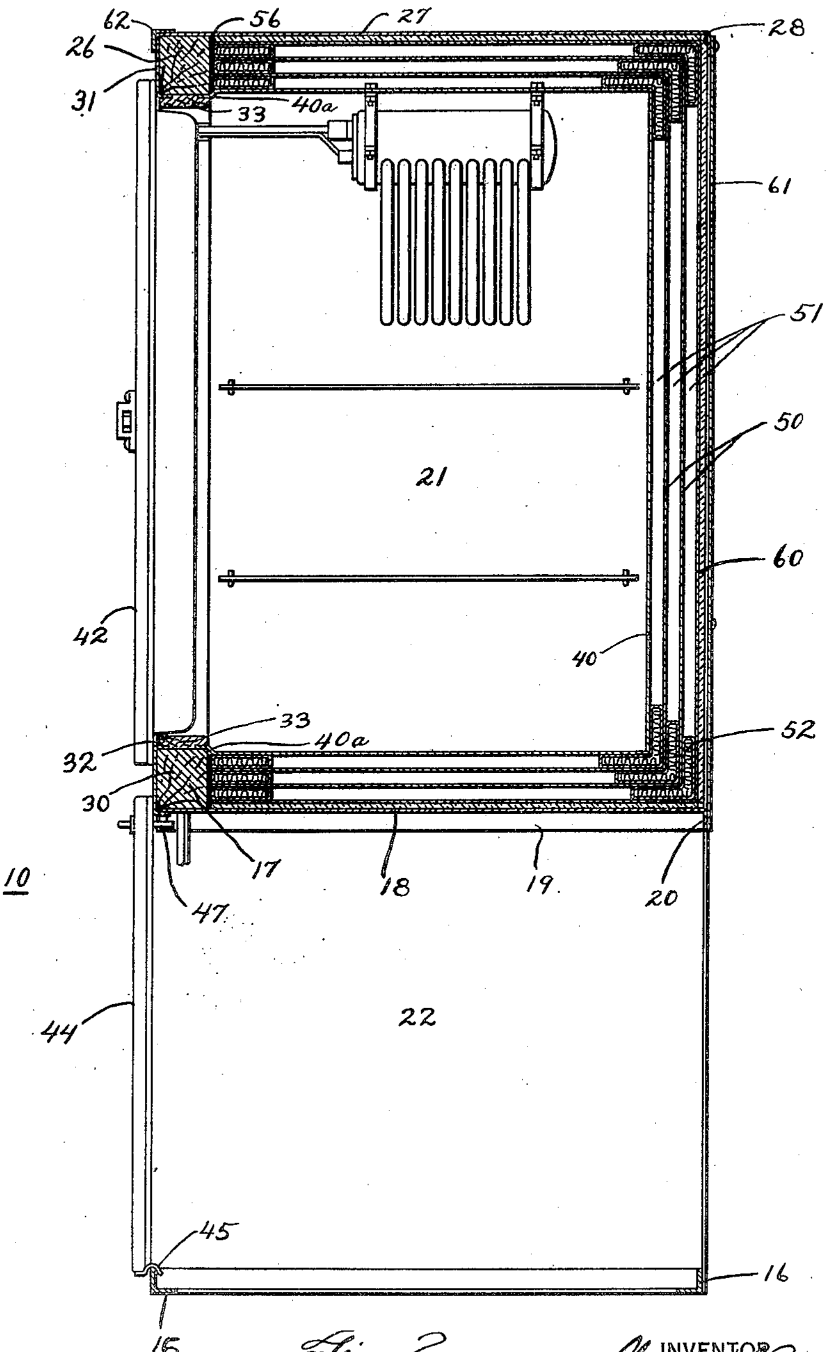

Fig. 2

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Sept. 8, 1936. S. V. COOK ET AL 2,053,251

REFRIGERATING APPARATUS

Original Filed Nov. 3, 1930 7 Sheets-Sheet 3

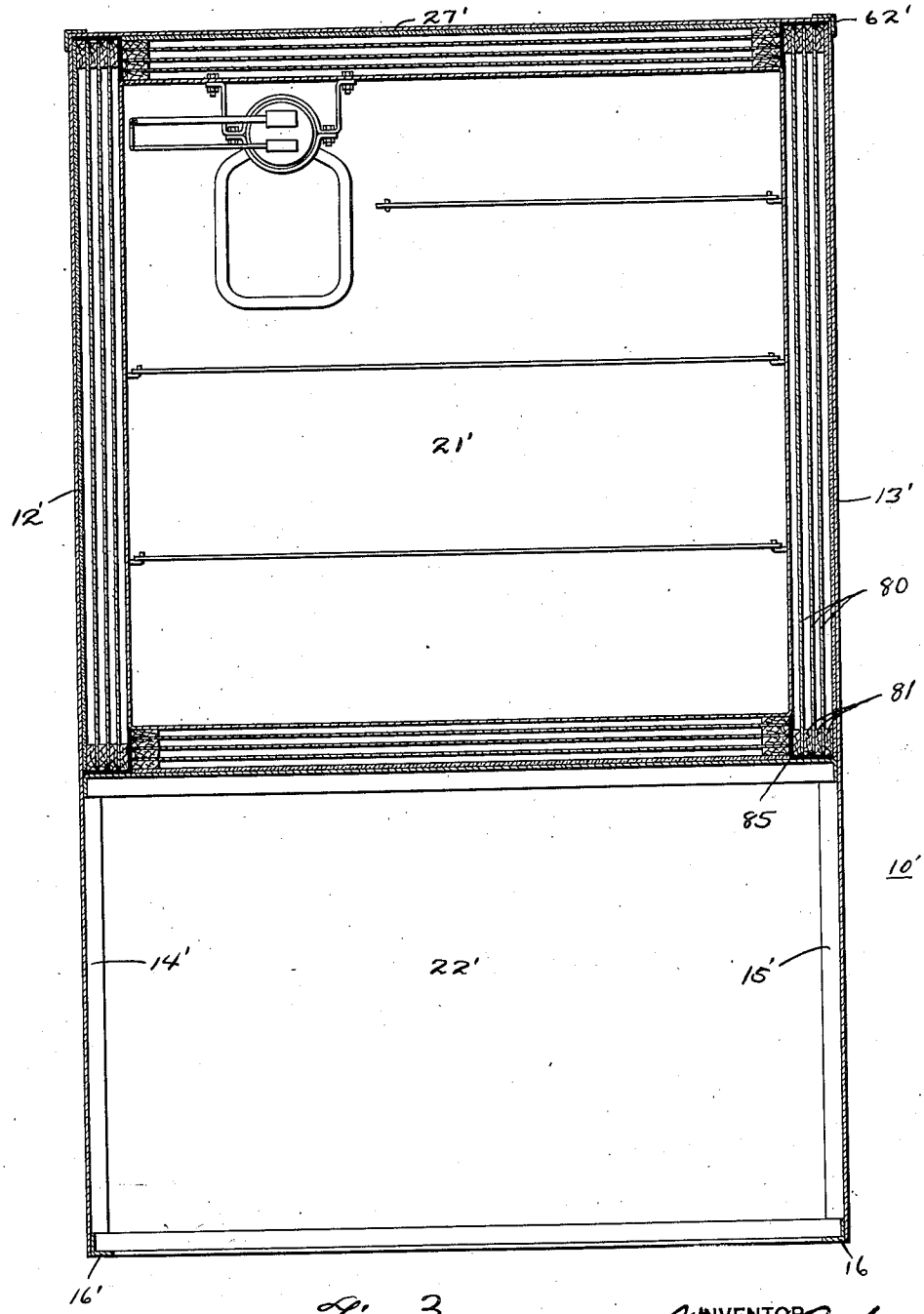

Fig. 3

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Sept. 8, 1936. S. V. COOK ET AL 2,053,251

REFRIGERATING APPARATUS

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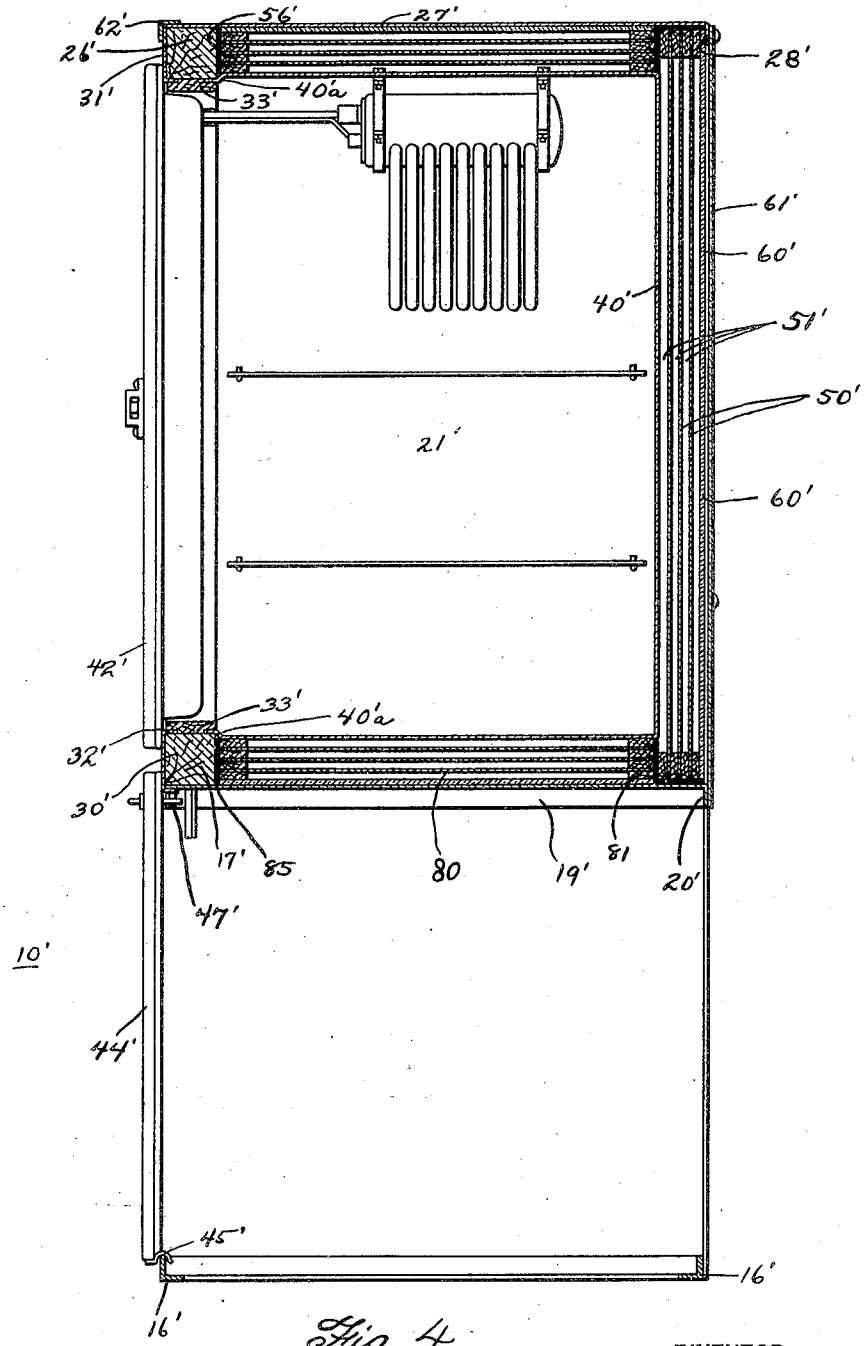

Fig. 4

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Sept. 8, 1936. S. V. COOK ET AL 2,053,251

REFRIGERATING APPARATUS

Original Filed Nov. 3, 1930 7 Sheets-Sheet 5

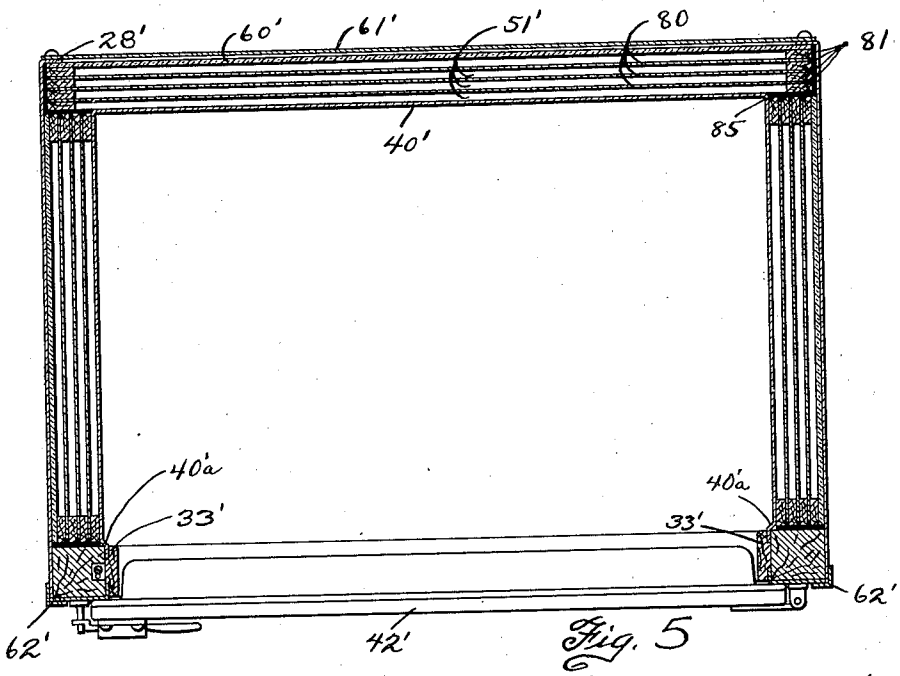

Fig. 5

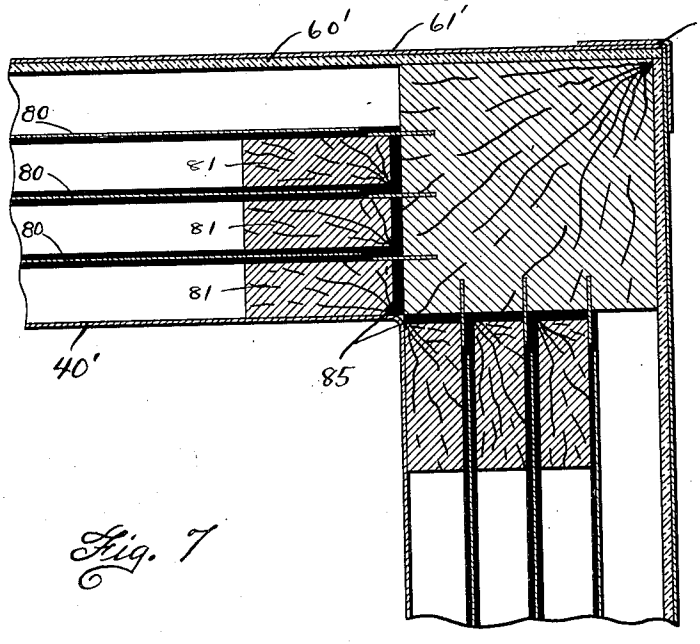

Fig. 7

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REFRIGERATING APPARATUS

Original Filed Nov. 3, 1930 7 Sheets-Sheet 6

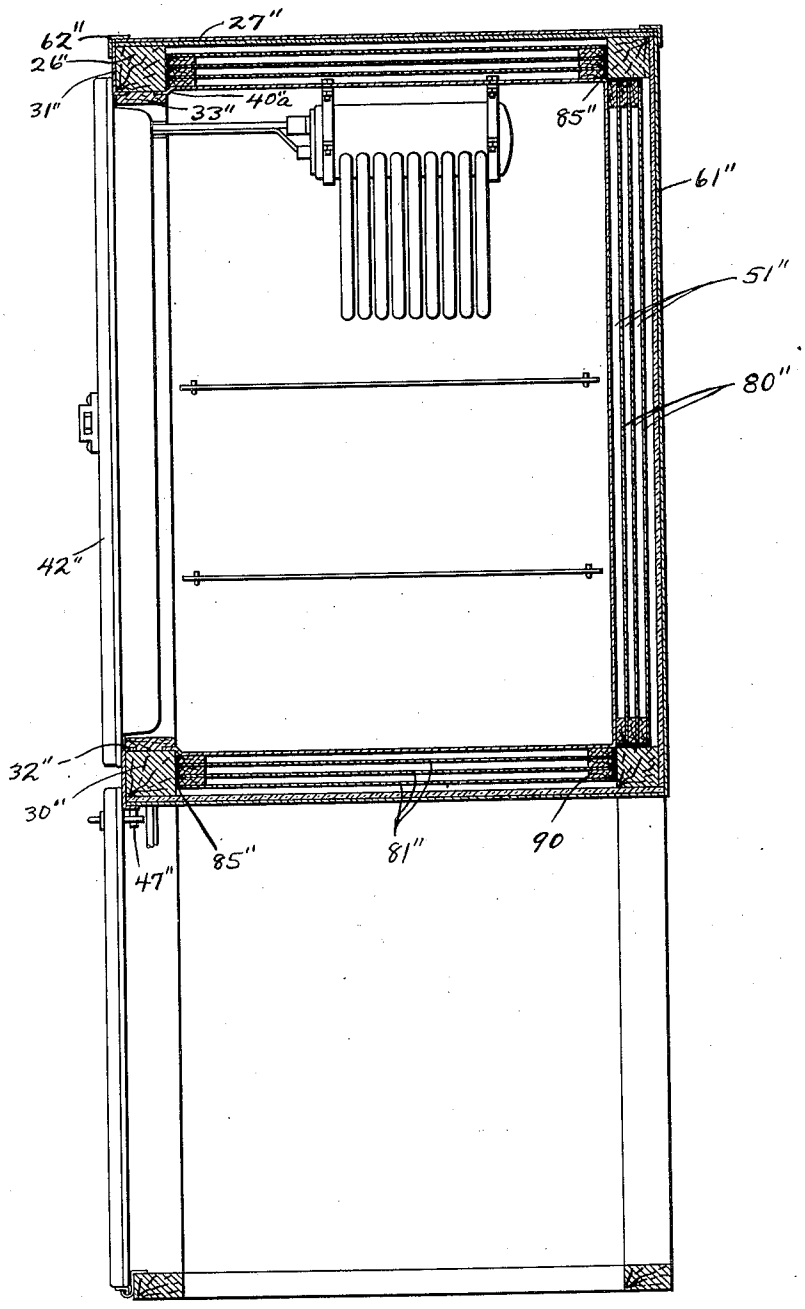

Fig. 6

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REFRIGERATING APPARATUS

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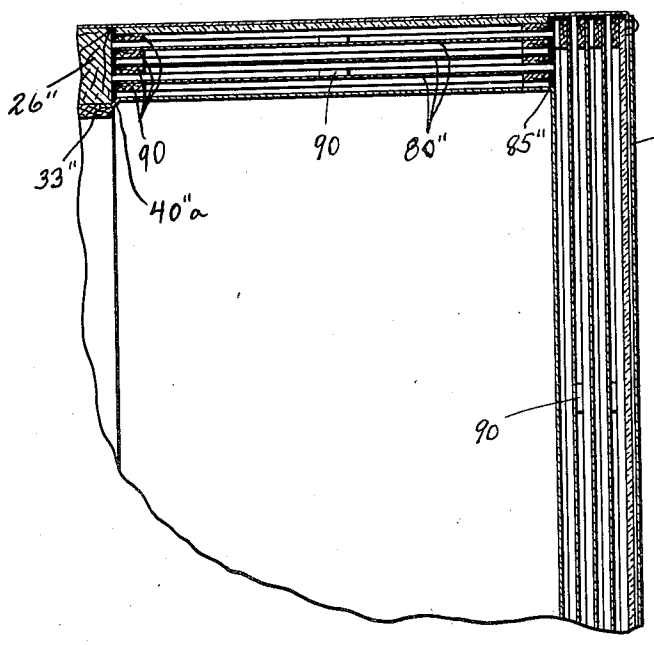

Fig. 8

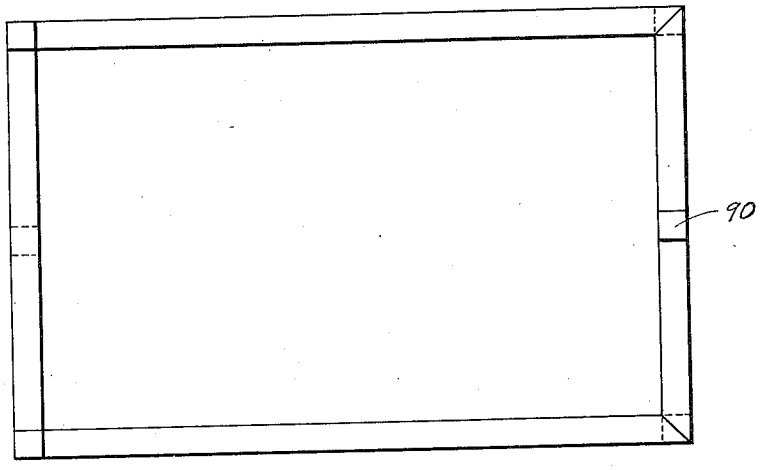

Fig. 9

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Patented Sept. 8, 1936 2,053,251

UNITED STATES PATENT OFFICE

2,053,251

REFRIGERATING APPARATUS

Stanley V. Cook and Frederic L. Chase, Dayton, Ohio, assignors, by mesne assignments, to General Motors Corporation, a corporation of Delaware

Application November 3, 1930, Serial No. 492,944
Renewed January 31, 1936

8 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 unsuccessful for the reason that radiant heat will pass freely through air, and in addition convection currents set up therein, will transfer large amounts of heat therethrough. 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 of such thickness that they can be readily formed to any desired shape. It has been found that these bright metal surfaces of aluminum 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. In addition it has been found that air spaces bounded by such bright surfaces need not necessarily be made extra small in size or width to decrease the convection currents, for the reason that such convection currents are dependent to a great extent on radiant heat.

An attempt to adapt such thin 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 walls as to maintain it taut at all times, while at the same time preventing the transfer of heat through these supporting means. Thirdly, the foil being metal, 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 our invention particularly relates, having for one of its objects to provide a cabinet construction which will be capable of utilizing the thin metal foil to an advantage while at the same time eliminating all of its disadvantages. More particularly it is an object of this invention to provide a cabinet construction wherein all metallic cries are adequately deadened, rupturing of the foil is prevented, and a transfer of heat through the supporting members is eliminated.

A further object of this invention is to provide a substantially all metal cabinet, light and extremely durable in construction, yet having incorporated therein means for preventing almost entirely the transfer of heat from the exterior to the interior thereof.

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 present invention are clearly shown.

In the drawings:

Fig. 1 is a front vertical sectional view of a refrigerator cabinet embodying features of this invention;

Fig. 2 is a vertical section taken transversely to the section shown in Fig. 1;

Fig. 3 is a front vertical section of a modified form of cabinet construction embodying features of this invention;

Fig. 4 is a vertical section taken transversely to the section shown in Fig. 3;

Fig. 5 is a horizontal section taken through the food compartment of the cabinet shown in Figs. 3 and 4;

Fig. 6 is a vertical section of a modified form of cabinet construction also embodying features of this invention;

Fig. 7 is an enlarged sectional view of a section of the cabinet shown in Fig. 6;

Fig. 8 is a detailed sectional view of a modified form of cabinet construction also embodying features of this invention; and

Fig. 9 is a view in elevation of the top of the cabinet shown in Fig. 8.

In order to illustrate the various features of this invention we have disclosed in Figs. 1 and 2 a refrigerator cabinet generally designated by the reference character 10. This cabinet includes outer side panels 12 and 13 of relatively stiff sheet metal provided with inwardly extending flanges 14 and 15 respectively which flanges may be either at the back edges or back and front edges, and may be secured together in proper spaced relation by means of angle irons 16 extending around all four lower edges of the cabinet. The outer panels including the outer side panels 12 and 13 form the outer sheet metal lining of the cabinet. Intermediate the top and bottom of the outer side panels 12 and 13, there is provided a wood frame member 17 extending longitudinally along the front of the cabinet and secured to the side panels at its side edges. Secured to the underside of the wood frame member 17 is a bottom metallic plate 18 extending rearwardly and provided with down-turned flanges 19 at its side edges secured in any convenient manner to the side panels 12 and 13 respectively. This bottom plate

18 is also provided with a rear down-turned flange 20 contacting the rear panel of the cabinet as more fully set forth hereinafter. Thus the cabinet is divided into an upper food storage compartment 21 which may be cooled in any convenient manner, for instance, by the evaporator disclosed therein, and with a machine compartment 22 which may for instance house the refrigerating machine.

Extending across the front of the cabinet and secured to the upper ends of the side panels 12 and 13 is a second wood frame member 26, to the top of which is secured the top outer panel 27, the top panel 27 extending rearwardly and being provided with down-turned rear flange 28 overlapping the back of the cabinet. Although not shown on the drawings, it should be understood that upright wood frame members extend vertically between the frame members 17 and 26 at the front edges of the side panels 12 and 13, to thereby form an opening for access to the food compartment 21. This structure, although not shown, is similar to that disclosed in Fig. 5 showing a modified form of cabinet. Horizontal metal strip covers 30 and 31 are secured to the outside surface of the wood members 17 and 26 respectively and these strips, provided with inwardly extending flanges 32 adjacent the door opening, may be held in position by means of small blocks 33 of wood or any other insulating material secured to the wood members 30 and 31. Or, if desired, blocks 33 may be used as finishing strips, and other means, such as screws may be used to hold panels 30 and 31 in position.

It should be understood that similar vertical metal strips are secured to the outside of the vertical wood frame member in a manner similar to the disclosure in Fig. 5 and that such strips are held in position by wood or other blocks similar to those shown at 33 in Fig. 2. The inner lining 40 of the compartment 21 is formed by a metal lining secured at its front edges to the wood frame members 17 and 26 and to upright wood frame members not shown, preferably by nailing the offset portion 40a to the frame members such as 17 and 26. This lining 40 may be a one-piece lining insertable as a unit into the cabinet or it may be made up of a plurality of sections properly and adequately secured together at its edges in any convenient manner as by welding. It should be noted that the edges of the lining 40 are located between the blocks 33 and the frame members 17 and 26, and in this manner the break between the outer panels 30 and 31 and the inner lining 40 prevents the transfer of heat from the exterior of the cabinet inwardly along the metallic lining.

Carried by the upright wood frame members, not shown, is a closure member 42 pivoted thereto and adapted to close the door opening leading to the food storage compartment 21. Door 44 for closing the opening to the machine compartment is provided, this door being pivoted to the front angle iron as shown at 45 and being provided at its upper end with a slip catch shown at 47.

The upper food compartment 21 is provided with insulated walls to prevent the transfer of heat therethrough. In Figs. 1 and 2 the walls of the food compartment 21 are shown as including a plurality of layers of thin metallic foil 50 spaced apart to provide air spaces 51. These spaces 51 may be of any thickness designed to prevent convection currents. It has been found that a thickness of substantially one-half inch for the air spaces gives satisfactory results. These layers of metal foil are secured in proper spaced apart relation by means of blocks 52 of non-conducting material, which blocks in this particular modification are shown as corrugated paper. The edges of the air spaces, or in other words around the edges of the walls, there is provided an asphaltic material 56 for sealing the air spaces against the ingress of moisture. Thus it will be seen that there is provided in the walls of the compartment 21 a plurality of air spaces bounded on substantially all sides by the highly polished aluminum foil, and spaced apart by material capable of transferring but very small amounts of heat. The inner corrugated paper blocks 52 may be pasted to the lining 40 and the first layer of foil pasted to the other side of the blocks. Another set of blocks may be pasted over the foil and first set of blocks and so on.

In this case, various ways of applying the metallic foil are possible. For instance, a long continuous strip, approximately as wide as the cabinet is deep, may be wound continuously around the supporting corrugated paper blocks. For instance, the one end of the metallic foil may be secured to the upper side of the corrugated paper block at the top of cabinet, and the foil may then be wound downwardly along one side of the cabinet, across the bottom thereof and then upwardly along the other side and thence across the top and over the top of the next block of supporting corrugated paper and so on spirally until the proper number of air spaces are formed. The back of the cabinet may then be enclosed in the proper way by individual lengths of metallic foil joining the edges of the spirally wound foil. After the air spaces have been properly sealed the cabinet may be finished.

The foil 50, being metallic, care must be taken to prevent the transfer of the so-called metallic cry from the walls thereof. To accomplish this purpose, we provide an exterior covering 60 of what is known as chipped board or any other sound deadening material such as felt, asbestos, wall board, or the like. This material may be placed within the exterior panels of the cabinet so as to perform an additional function set forth hereinafter. The rear panel 61 which may be a metal panel if desired, is then secured to the back of the cabinet by means of bolts or rivets extending therethrough into the side flanges 14 and 15 of the side panels 12 and 13 respectively. This rear panel 61 may also be secured down to the flange of the top metallic member 27 and if desired, to the down-turned flange 20 of the bottom plate member 18.

Either before the various panels are assembled or after the cabinet has been totally assembled, all the various metallic panels may be coated with some finishing material such as porcelain to provide the proper finish. Thus the cabinet will be both inside and outside porcelain enameled, and in addition will be easily cleaned and have a decidedly good appearance. The edge strips 62 which may also be of metal, may then be secured in position to cover up the unsightly appearance of the adjacent edges of the various metal panels. Thus the chip-board 60 being positioned directly adjacent the enameled outer panels, acts to prevent chipping of the enamel.

It should be noted that the cabinet disclosed in Fig. 1 is substantially all metal in construction, having no corner posts of wood or other material. It should also be noted that the walls thereof are composed of substantially nothing but air spaces and an extremely light metallic foil, thereby reducing the weight of the entire cabinet many

times, while at the same time providing a cabinet extremely strong and durable in construction. The advantage of such a light cabinet, equally as well insulated as a much heavier cabinet, is apparent when the initial transportation cost is considered.

Referring now to Figs. 3, 4, and 5, we have disclosed a modified form of cabinet embodying further features of this invention. The exterior cabinet construction per se is substantially the same as that disclosed in Figs. 1 and 2, and the parts of Figs. 3, 4, and 5 which are similar to corresponding parts in Figs. 1 and 2 have been indicated by the same reference characters primed. That is to say, the cabinet is constructed substantially without any wooden frame members, being composed of outer metal panels and inner metal linings held in spaced apart relation by means of metal plates and angle irons substantially as disclosed in Figs. 1 and 2. The wall structure per se differs slightly in that sheets of thin metallic aluminum foil 80 are held in spaced apart relation by means of wood blocks or strips 81. In this modification, the sheets of metal foil consist of a number of sheets cut to the size of each wall. In addition, the individual sheets may be secured to the wood blocks or strips by pasting or may be held therebetween merely by friction. The wall structure may be assembled by securing one set of blocks or strips to the metal lining 40' and then by pasting or otherwise securing a sheet of metal foil 80 to the upper side of the blocks or strips of the top wall and to the outer side of the blocks or strips of the side and rear walls and to the under side of the blocks or strips of the lower walls. Another set of blocks or strips may then be secured above the first set of blocks or strips with the sheets therebetween, and so on until the desired number of air spaces have been formed. After the desired number of air spaces have been formed, the air spaces are sealed against the ingress of moisture by means of asphaltic material generally designated at 85 which may be poured while hot and which will solidify in position upon cooling. Thus, in this modification the wall structure may be built up quickly and easily into a plurality of air spaces bounded on substantially all sides by means of metallic aluminum foil. In this modification the cabinet itself will be extremely light and durable substantially as the cabinet disclosed in Figs. 1 and 2 in view of the fact that the insulating material will be composed almost wholly of air. It should be noted in this modification also the metallic rattling sound or cry due to the metal itself is deadened in substantially the same way as in the first modification, that is by the use of chip-board enclosing all walls of the cabinet.

Fig. 6 discloses a still further modification of this invention in that the invention is incorporated with a cabinet having a wooden frame rather than a metal frame as disclosed in Figs. 1 to 5, and the parts of Fig. 6, which are similar to corresponding parts in Figs. 1 and 2 have been indicated by double primes. The wall structure or insulating material is disclosed as substantially the same as that in Fig. 5. That is to say, the individual air spaces are formed by individual sheets of metal foil placed one upon the other with the intermediate spacing blocks therebetween. The air spaces are also sealed against the ingress of moisture by the asphaltic or other moisture excluding material as designated at 85''. It should be understood that in this modification the metallic foil may be wound about the blocks in substantially the same way as the foil is wound about the corrugated blocks disclosed in Fig. 1, it being the purpose of Fig. 6 to merely disclose a wooden frame cabinet having incorporated in the walls thereof an insulating material composed of a plurality of air spaces.

In Figs. 8 and 9 there is disclosed a still further modification wherein the metallic strips 80 are spaced apart by staggered wood blocks 90. The purpose of this arrangement is to more nearly prevent the transfer of heat from one supporting block 90 to the other. In the modification disclosed in Figs. 8 and 9, as well as the modification disclosed in Fig. 6, the rattling of the metal is deadened in substantially the same way as in the first modification. That is to say, the chip-board or other sound deadening material is located along the inside of the outer panels.

While, throughout the specification, mention has been made of a thin metallic aluminum foil, it should be understood that any bright metallic surface may be used. That is to say, in place of a bright metallic foil, any supporting structure such as corrugated paper or wooden blocks, may be covered with a bright surface, for instance by spraying thereon a thin layer of a bright metallic paint such as aluminum paint.

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. A cabinet including inner and outer linings spaced apart by non-conducting material and thermally insulated from one another, insulating material in the space between said linings, said insulating material including spaced sheets of thin bright metallic foil forming air spaces therebetween, said sheets being held in spaced apart relation by means of non-conducting structural material arranged at the corners of the cabinet, said sheets and structural material being stacked one upon the other.

2. A cabinet including inner and outer linings spaced apart by non-conducting material and thermally insulated from one another, insulating material in the space between said linings, said insulating material including spaced sheets of thin bright metallic foil forming air spaces therebetween, said sheets being held in spaced apart relation by means of non-conducting structural material arranged at the corners of the cabinet, and sound deadening material placed outside the outer sheet of bright metallic foil said sheets and spacing material being stacked one upon the other.

3. A refrigerator cabinet including an inner sheet metal liner, outer sheet metal walls spaced from said sheet metal liner and thermally insulated therefrom, a plurality of sheets of bright metallic foil between said inner sheet metal liner and said outer sheet metal walls, a plurality of structural non-conducting strips for supporting said sheets of bright metallic foil in spaced relation providing relatively thin air spaces between the sheets, said sheets and strips being stacked one upon the other, and means for preventing the access of external air and moisture to the air spaces.

4. A refrigerator cabinet including an inner sheet metal liner, outer sheet metal walls spaced

from said sheet metal liner and thermally insulated therefrom, a plurality of sheets of bright metallic foil between said inner sheet metal liner and said outer sheet metal walls, a plurality of structural non-conducting strips arranged at the edges of the sheets for supporting said sheets of bright metallic foil in spaced relation providing relatively thin air spaces between the sheets, said sheets and strips being stacked one upon the other, said sheets of foil having their edges tightly held between said strips, said structural strips being fastened together.

5. A refrigerator cabinet including an inner sheet metal liner, outer sheet metal walls spaced from said sheet metal liner and thermally insulated therefrom, a plurality of sheets of bright metallic foil between said inner sheet metal liner and said outer sheet metal walls, a plurality of structural non-conducting strips arranged at the edges of the sheets for supporting said sheets of bright metallic foil in spaced relation providing relatively thin air spaces between the sheets, said sheets of foil having their edges tightly held between said strips and fastened to said strips by an adhesive, said sheets and strips being stacked one upon another and fastened together by an adhesive, and means for preventing the access of external air and moisture to the air spaces between the sheets of foil.

6. A refrigerator cabinet including an inner sheet metal liner, outer walls spaced from said sheet metal liner and thermally insulated therefrom, a plurality of bright metal surfaced heat reflecting sheets between the inner liner and the outer walls, a plurality of sets of structural non-conducting strips arranged at the edges of the sheets for supporting the sheets in spaced relation providing relatively thin air spaces between the sheets, said sheets and strips being stacked one upon the other, said sheets having their edges tightly held between the strips, and a material between and separating the adjacent sets of strips.

7. A refrigerator cabinet including an inner sheet metal liner, outer walls spaced from said sheet metal liner and thermally insulated therefrom, a plurality of bright metal surfaced heat reflecting sheets between the inner liner and the outer walls, a plurality of sets of structural non-conducting strips arranged at the edges of the sheets for supporting the sheets in spaced relation providing relatively thin air spaces between the sheets, said sheets and strips being stacked one upon the other, said sheets having their edges tightly held between the strips, and a viscous sealing material between and separating adjacent sets of strips at the edge portions of the inner liner.

8. A structure for enclosing a space to be insulated including inner and outer linings, spaced apart by non-conducting material and thermally insulated from one another, insulating material in the space between said linings, said insulating material including spaced sheets of flexible material forming air spaces therebetween, said sheets having bright heat reflecting surfaces and being held in spaced apart relation by means of non-conducting structural material arranged at the corners of the structure, said sheets and structural material being stacked one upon the other.

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