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Benford

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[54] **REFRIGERATION APPARATUS ENCLOSURE STRUCTURE**

[75] Inventor: **Arthur E. Benford,** Evansville, Ind.

[73] Assignee: **Whirlpool Corporation,** Benton Harbor, Mich.

[22] Filed: **Jan. 14, 1974**

[21] Appl. No.: **433,071**

[52] **U.S. Cl.** ..... **312/214;** 52/631; 62/DIG. 13; 220/9 F

[51] **Int. Cl.²** **F25D 23/06;** B65D 25/14

[58] **Field of Search** ..... 312/214, 236, 245; 220/9 F, 9 G; 62/DIG. 3, DIG. 13; 52/631; 161/117

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Primary Examiner—Paul R. Gilliam
Assistant Examiner—Kenneth J. Dorner
Attorney, Agent, or Firm—Hofgren, Wegner, Allen, Stellman & McCord

[57] **ABSTRACT**

A refrigeration apparatus enclosure and method of forming the same wherein an inner laminate wall is provided in an outer cabinet for providing the sheet liner and insulation portions of the refrigeration apparatus enclosure. The laminate wall is folded along lines cut through the insulation to conform to the configuration of the outer cabinet and insulation is provided for filling the resultant voids to complete the enclosure construction. The voids are filled by foamed-in-place plastic which may further serve to bond the laminate wall to the outer cabinet. The rear wall of the cabinet may comprise a flat laminate wall and a divider wall may be provided within the cabinet for dividing the space therein into separate compartments. The divider wall may comprise another laminate wall.

15 Claims, 9 Drawing Figures

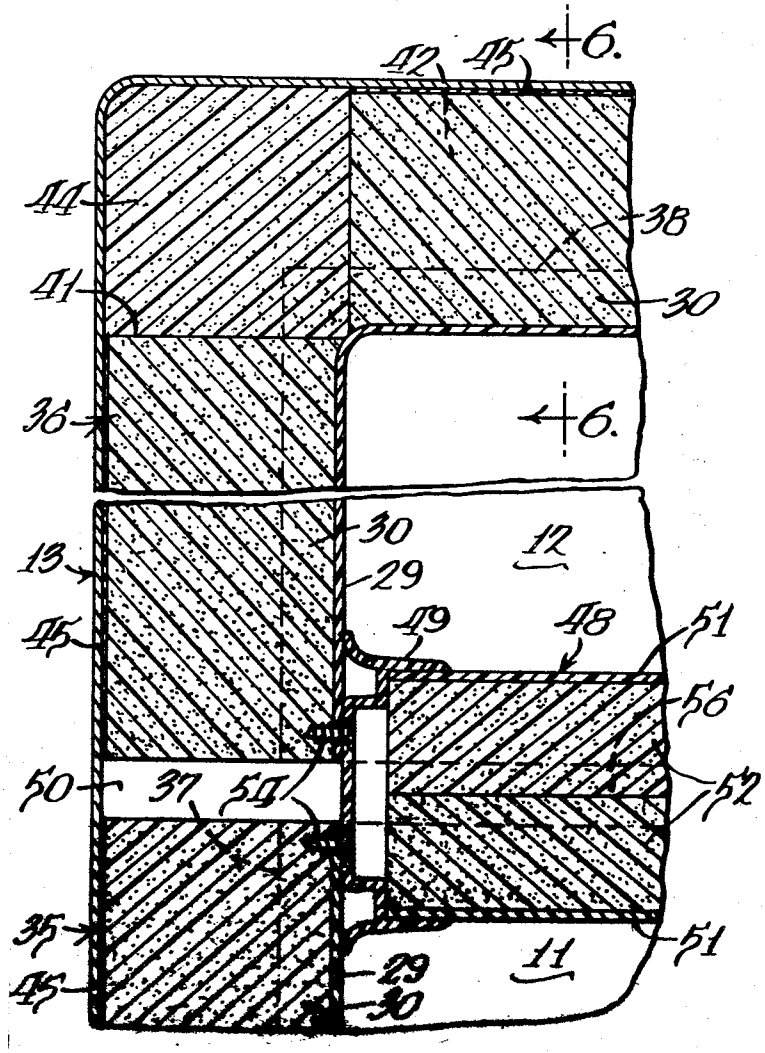


Fig. 1.

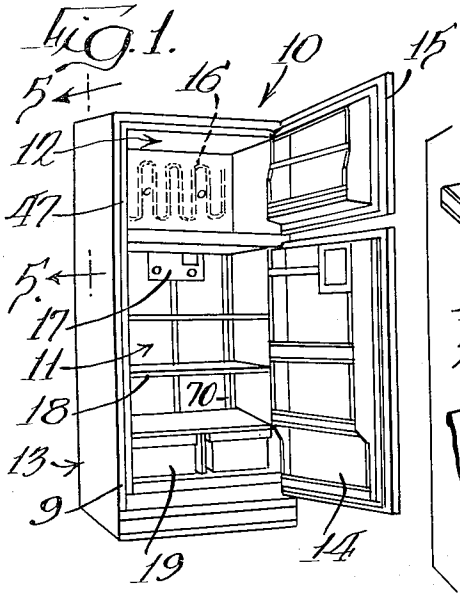


Fig. 2.

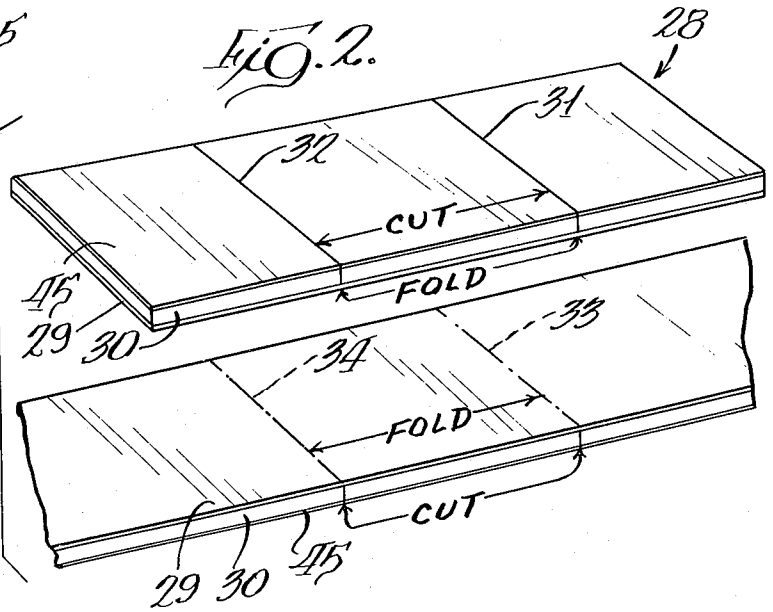
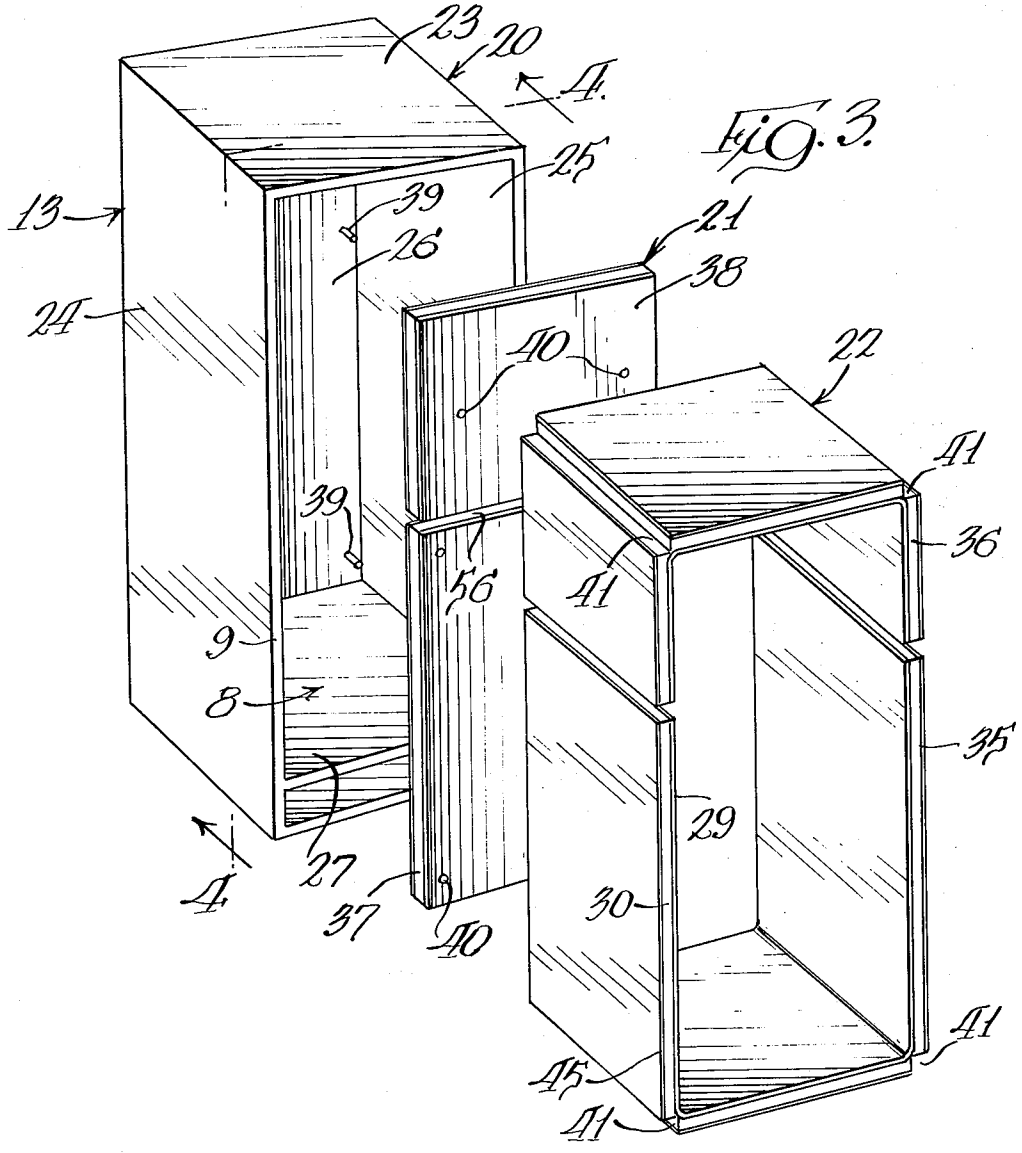


Fig. 3.



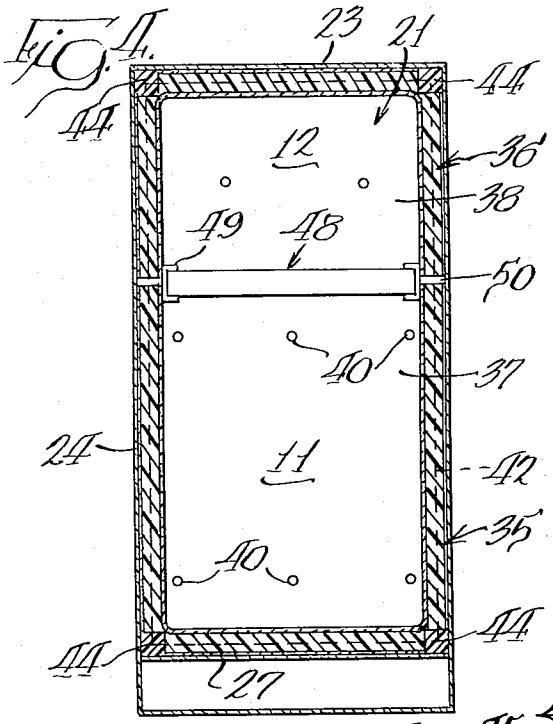


Fig. 4.

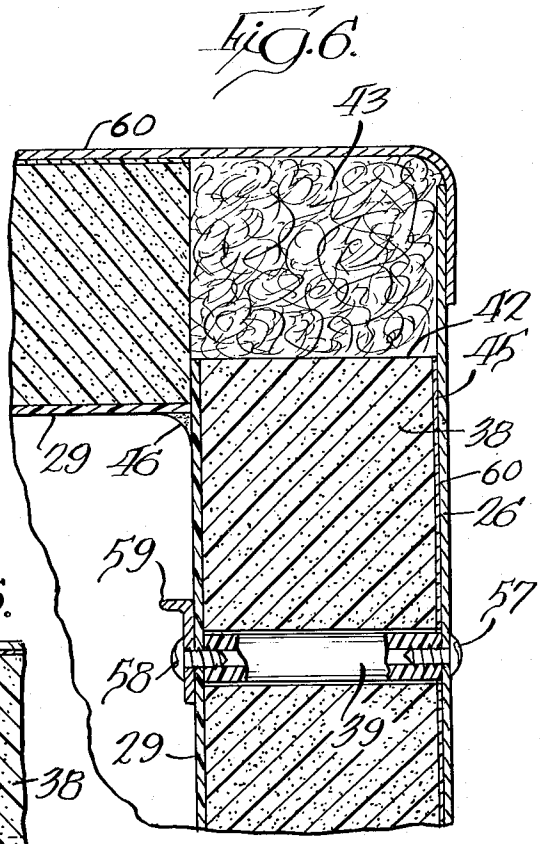


Fig. 6.

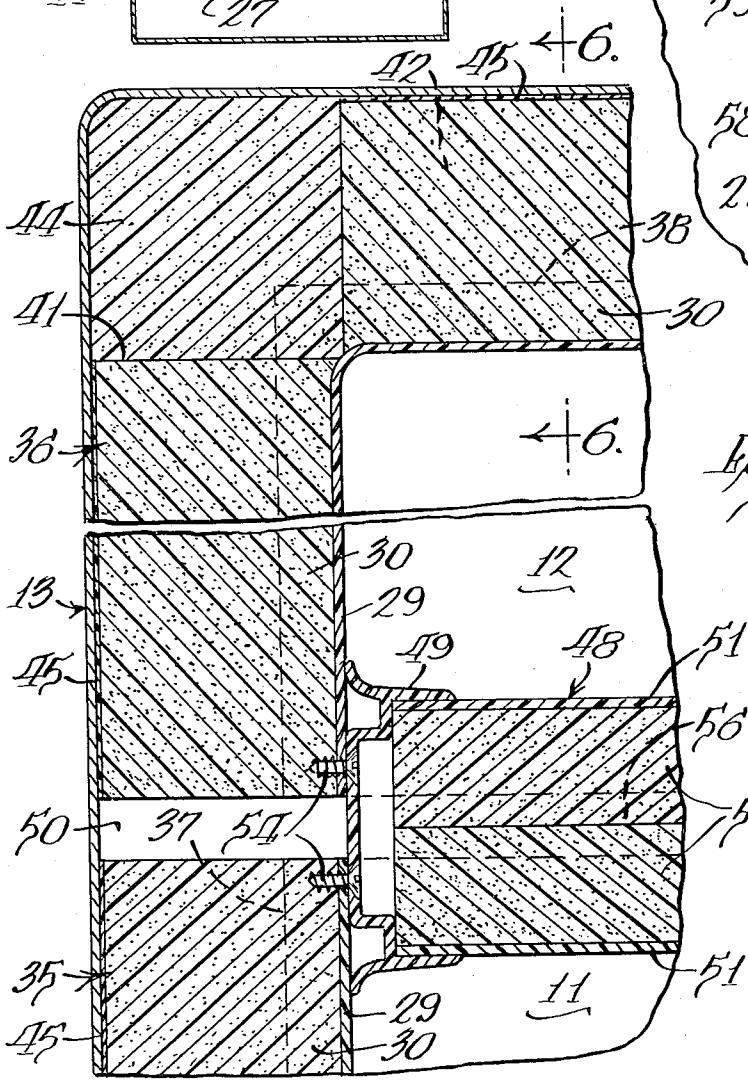


Fig. 5.

Fig. 7.

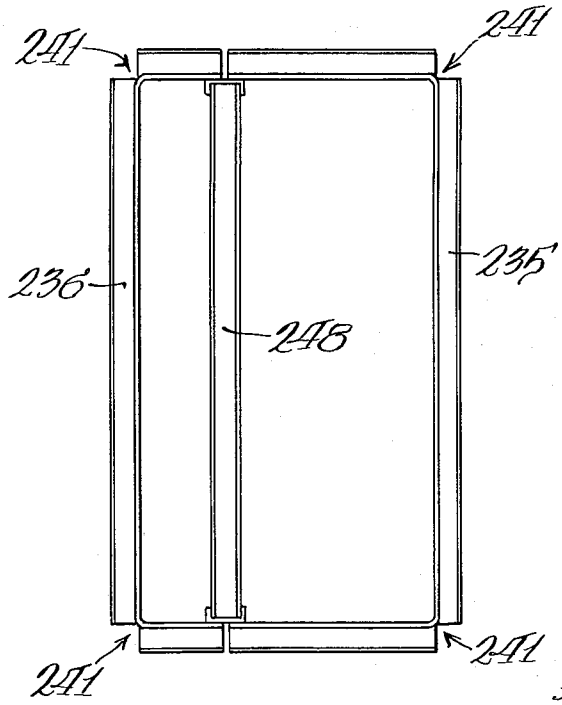


Fig. 8.

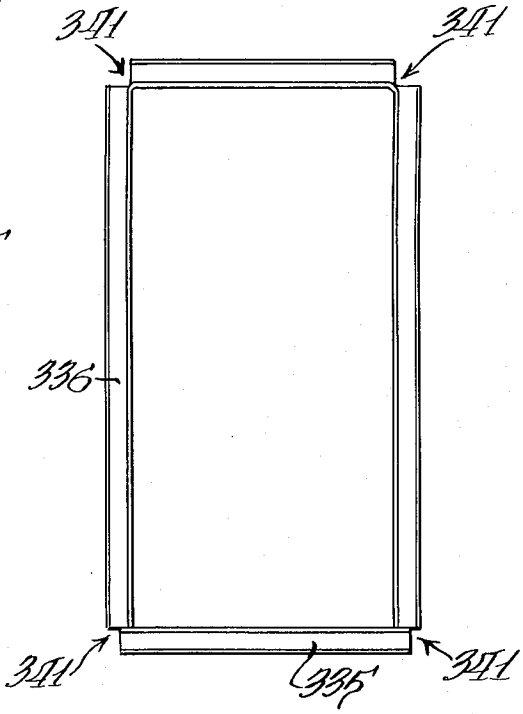
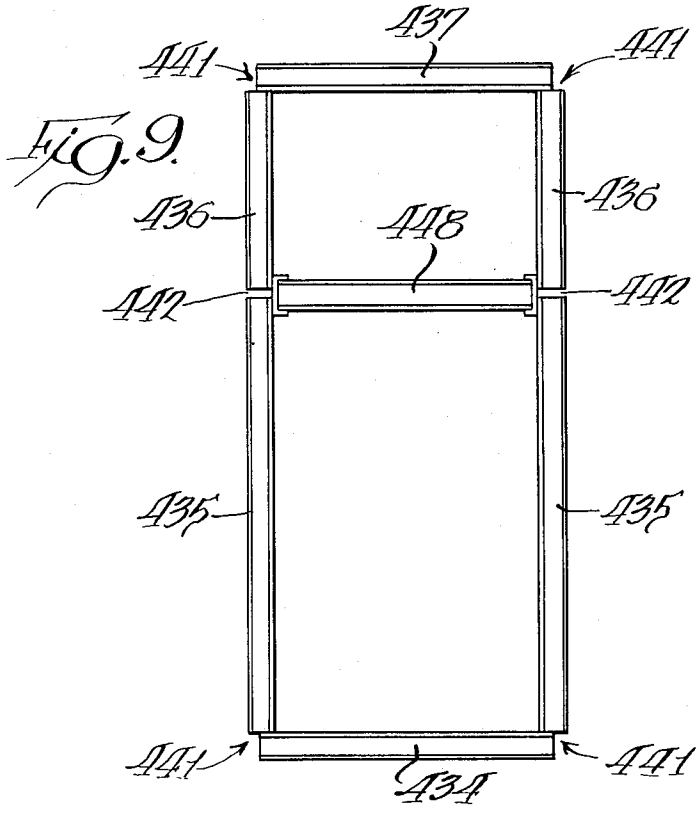


Fig. 9.



REFRIGERATION APPARATUS ENCLOSURE STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to refrigeration appliances, and in particular, to enclosures therefor.

2. Description of the Prior Art

In conventional refrigeration appliance cabinet constructions, an outer metal cabinet is provided having an inner liner which may conventionally be formed of plastic spaced inwardly therefrom to define a space in which is provided suitable insulation. The insulation may be in the form of fiberglass pads and in one improved form, the insulation comprises foamed-in-place insulation. One such foamed-in-place refrigeration apparatus enclosure construction is shown in U.S. Pat. No. 2,962,183 of J. C. Rill, Jr. et al. Such foamed-in-place cabinet constructions are relatively costly as they utilize separate liner elements, relatively costly preparations for the foaming operation, and costly fixtures for accurately retaining the cabinet and liner elements during the foaming operation. The liners are relatively expensive in that they require relatively costly tooling and processing steps, and the cost problems of such conventional foamed-in-place construction are aggravated where a number of different size models must be provided.

One attempted solution to this problem is that shown in U.S. Pat. No. 3,635,536 of Robert Lackey et al., wherein a portable refrigerator is shown as having a low cost cabinet utilizing a foam slab box having integral sides formed of a single sheet of foamed plastic. This patent teaches that if the foamed plastic is formed in a chilled mold process, coating of the inner and outer sides of the sheet may be omitted as the plastic is thusly formed with a thick impervious skin. A similar technique is shown in U.S. Pat. No. 3,014,611 of F. R. Marshall. The box sides are formed from a vee notched laminate slab which permits folding the laminate to the box configuration. Thus the laminate forms the outer cabinet, liner and insulation. The notched corners are foamed with fixtures to cement the panels together after the insertion of a sealing gasket.

SUMMARY OF THE INVENTION

The present invention comprehends an improved refrigeration apparatus enclosure construction including an outer cabinet, an inner laminate wall within the outer cabinet defined by an inner sheet liner and outer insulation extending between the inner sheet liner and the outer cabinet, the inner liner having folded corner portions to conform the laminate to the contours of the outer cabinet, the insulation being cut through at the folded portions to define voids outwardly of the folded liner portions, and foamed-in-place insulation means filling the voids.

The invention further comprehends a method of constructing such a refrigeration apparatus enclosure including the steps of fabricating an outer cabinet, providing a flat laminate of sheet liner and insulation, slitting the insulation along lines corresponding to the corners of the outer cabinet, folding the sheet liner at the slits with the sheet liner disposed inwardly, fitting the folded laminate within the outer cabinet with the outwardly disposed insulation confronting the inner surfaces of the cabinet, and securing the laminate to the outer cabinet including foaming plastic in place within the cabinet in the voids formed between the side of the insulation defining said slits resulting from the folding of the sheet liner.

The invention may be utilized to provide a multiple compartment enclosure including a divider wall between a pair of U-shaped laminate walls defining a pair of refrigeration chambers within the cabinet.

The rear wall of the enclosure may comprise a laminate wall with the rear edge of the U-shaped walls butted thereto. The inner sheet liner is effectively spaced from the outer cabinet by the insulation of the laminate wall construction to provide desired insulation between the liner and outer cabinet. The divider wall may be mounted in the manner of a shelf on suitable brackets provided on the U-shaped walls.

The outer insulation of the laminate wall may include an outer vapor barrier portion. The laminate wall insulation may comprise a rigid urethane foam and the inner sheet liner may be formed selectively of plastic or sheet metal as desired. A bead of adhesive sealant may be utilized to seal the seams between the inner sheet liner portions within the enclosure.

Means may be provided for centering the rear laminate wall within the cabinet to provide a preselected spacing around the sheet liner portion thereof relative to the sidewalls, top wall and bottom wall of the cabinet.

Thus, the refrigeration apparatus enclosure of the present invention is extremely simple and economical of construction while yet providing the highly desirable features discussed above.

BRIEF DESCRIPTION OF THE DRAWING

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

FIG. **1** is perspective view of a refrigeration apparatus having an enclosure embodying the invention;

FIG. **2** is a fragmentary perspective view of a pair of laminate sheets illustrating the process of forming the same into laminate wall elements of the enclosure construction;

FIG. **3** is an exploded perspective view illustrating the arrangement of the laminate walls in constructing the enclosure of the invention;

FIG. **4** is a vertical front section of the enclosure substantially along line **4—4** of FIG. **3** after assembly and having a divider wall therein dividing the space within the cabinet into a pair of refrigeration chambers;

FIG. **5** is a fragmentary enlarged vertical section taken substantially along the line **5—5** of FIG. **1**;

FIG. **6** is a vertical section taken substantially along the line **6—6** of FIG. **5**; and

FIG. **7** is a front elevation illustrating the form of laminate wall arrangement for use in a side-by-side refrigerator-freezer.

FIG. **8** is a front elevation illustrating the form of laminate wall arrangement for use in a vertical freezer.

FIG. **9** is a front elevation illustrating a modified form of laminate wall for use in a refrigerator-freezer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the exemplary embodiment of the invention as shown in FIGS. **1-6** of the drawing, a refrigeration apparatus generally designated **10** illustratively comprises

a refrigerator defining an above-freezing compartment **12** and a below-freezing compartment **11** defined by an insulated enclosure **13** provided with a pair of doors **14** and **15** for selectively closing chambers **11** and **12.** The refrigeration apparatus may include conventional evaporator means **16,** control means **17,** shelves **18** supported by brackets **70,** and drawer means **19.** The present invention is concerned with the forming of the insulated enclosures **13** and as will be obvious to those skilled in the art, it may be utilized with other arrangements of refrigeration appliances, the refrigerator-freezer arrangement of FIG. **1** being illustrative only.

Broadly as shown in FIG. **3,** the invention comprehends providing an enclosure **13** defined by an outer cabinet generally designated **20,** rear wall means generally designated **21,** and wall means **22** cooperating with rear wall means **21** to provide an insulative lining of the cabinet. The outer cabinet may be formed in a conventional manner from suitable material, such as metal, to define a forwardly opening boxlike construction having a top wall **23,** left sidewall **24,** right sidewall **25,** rear wall **26,** bottom wall **27,** and a flange **9** extending around the periphery of the front opening **8.** Wall means **21** and **22** cooperatively provide an inner sheet liner means and a body of insulation between the inner sheet liner means and outer cabinet to form the completed enclosure **13.**

More specifically, as shown in FIG. **2,** the laminate wall means **21** and **22** may be formed from a laminate sheet generally designated **28** defined by a flat sheet liner portion **29** of metal or plastic and a body of insulation **30** bonded between the sheet liner **29** and a thin plastic sheet **45** to form a laminate sandwich which may be provided in continuous length by suitable apparatus (not shown). At spaced intervals, the insulation is cut through such as at slits **31, 32, 33** and **34,** permitting the sheet liner **29** to be folded along the insulation slit lines into a pair of U-shaped laminate wall elements **35** and **36** to define the laminate wall means **22.** The flat laminate sheet **28** may be cut into discrete portions **37** and **38** to form the rear wall means **21,** as shown in FIG. **3.** As shown therein, the first laminate wall element **35** defines an upwardly opening U-shaped configuration and the second laminate wall element **36** defines a downwardly opening U-shaped configuration. The U-shaped configuration and slit insulation allow manipulation of the laminate past the flange **9** when inserting the elements into the cabinet **13** through front opening **8.**

As further shown in FIG. **3,** cabinet rear wall **26** is provided with a plurality of locating support posts **39** and rear laminate wall portions **37** and **38** are provided with a plurality of corresponding openings **40** for receiving the support posts both for locating the rear wall portions **37** and **38** in centered relationship to the walls **23, 24, 25** and **27** of the outer cabinet and for securing the laminate wall portions **37** and **38** to the rear wall **25** of the cabinet.

As may be seen in FIG. **3,** the folded corners of the U-shaped laminate walls **35** and **36** define voids **41.** Further, as shown in FIG. **4,** as the rear laminate walls **37** and **38** are spaced inwardly from the cabinet walls **23, 24, 25** and **27,** respectively, a peripheral void **42** extends fully about the rear laminate wall means **21.** In the illustrated embodiment, void **42** is filled with fiberglass insulation **43** as shown in FIG. **6** which may be installed therein prior to the installation of the U-shaped wall elements **35** and **36.** Peripheral void **42** may alternatively be filled with foamed-in-place insulation. By utilizing the separate confronting U-shaped elements **35** and **36,** different insulation thicknesses in the insulation means of the refrigeration and freezer compartments of the enclosure **13** may be provided. Further, as seen in FIG. **4,** laminate wall elements **35** and **36** may be maintained spaced apart to provide a thermal break in the resultant space **50** between the two compartments as shown in FIG. **4,** space **50** may be filled with foamed-in-place insulation to bond the laminate walls to the cabinet **13** at this point.

As shown in FIG. **5,** the voids **41** may be filled with insulation **44.** In the illustrated embodiment, insulation **44** comprises foamed-in-place insulation which bonds the laminate walls to the outer cabinet **13** at all four corners of the enclosure.

The laminate walls may further be bonded to the cabinet walls by suitable bonding adhesive **60** as desired. In the illustrated embodiment, the plastic sheet **45** of the laminate walls functions as an outer vapor barrier.

As illustrated in FIG. **6,** a bead of flexible adhesive sealant **46** may be laid along the seams between the sheet liner portion of the U-shaped laminate wall elements **35** and **36** and the front surface of the rear laminate wall portions **37** and **38.**

Conventional breaker strip gaskets **47** may be assembled onto the U-shaped wall elements **35** and **36** and flange **9** as shown in FIG. **1.**

As best seen in FIGS. **4** and **5,** the compartments **11** and **12** are separated by a divider wall, or mullion, **48** which is retained between the sidewalls of the enclosure by means of a channel bracket **40** secured to sheet liner **29** of upper U-shaped wall element **36** and sheet liner **29** of lower U-shaped wall element **35** adjacent gap **50** so as to straddle the gap and effectively close the same along the sidewalls of the enclosure. The channel bracket **49** further extends across the rear wall portions **37** and **38** to effectively close the gap **56** between these portions. Divider wall **48,** as best seen in FIG. **5,** may comprise a pair of laminate walls including a sheet liner portion **51** and insulation portion **52** to define a double laminate sandwich having top and bottom metal or plastic sheet liner wall portions exposed to the chambers **12** and **11,** respectively. The bracket may be secured to the liners **29** by suitable fasteners, such as screws, **54.**

While the divider wall **48** effectively covers the gap **56** between the rear wall portions **37** and **38** as well as the gap **50** along the sidewalls of the enclosure, the top chamber **12** is effectively thermally insulated from the lower chamber **11** by the break in the laminate wall means.

The form of the laminate structure for a side-by-side refrigerator-freezer is shown in FIG. **7.** In this embodiment, the two U-shaped elements are horizontally opposed with element **235** in the above-freezing compartment and element **236** in the below-freezing compartment. Divider wall **248** separates the two compartments. The foam is applied in the voids **241.**

For vertical freezers the form of the laminate is shown in FIG. **8,** wherein U-shaped element **336** conforms to the top and sides of the cabinet and portion **335** covers the bottom of the cabinet. The foam is applied in the voids **341.**

A modified form of the invention is illustrated in FIG. **9** for a refrigerator-freezer similar to the refrigerator-

freezer of FIG. 1. In this form, separate laminate portions **434, 435, 436, 437** are utilized to conform to the top, sides and bottom of the cabinet by forming corner portions having voids **441.** A divider **448** is provided to separate the interior into two compartments. Foam is utilized to fill the voids **441** and to adhere the laminate portions to the cabinet. Foam may also be utilized to fill the voids **442** for more stability of the laminate portions.

The mounting posts **39** for locating and mounting the rear wall portions **37** and **38** may comprise plastic posts secured to the outer cabinet by suitable fastening means such as screws **57** and to the inner sheet liner **29** of the rear laminate wall portions by suitable means such as screws **58.** The screws **58** may further serve to mount support brackets **59** to the sheet liner as for carrying the evaporator **16** in the enclosure.

Thus the invention comprehends an improved simplified method of constructing a refrigeration apparatus enclosure wherein a plurality of flat laminates defining an inner sheet liner and an outer insulation are provided. The laminates are folded to conform to the internal configuration of the cabinet after firstly slitting the insulation along the desired fold lines with the laminate elements being firstly cut from a continuous low cost laminate stock material. As indicated above, the stock material may include a vapor barrier as an outer portion of the insulation.

The use of the laminate construction permits adaptation of the internal construction of the enclosure to a wide variety of sizes and shapes of the refrigeration appliance enclosure. As the insulation means of the laminates effectively positions the liner portion in spaced relationship to the cabinet, free foaming of the corner bonding portions may be effected without the need for expensive fixtures and expensive setups or for the use of additional adhesive means. The enclosure arrangement is adapted for use with either hermetic or component hook-up refrigeration systems while yet providing the improved low cost construction of the insulated enclosure. As indicated above, adhesive means, such as adhesive **60,** may be utilized to secure the laminate walls to the cabinet walls if desired, although as indicated above, the foamed-in-place insulation effectively bonds the laminate walls to the outer cabinet effectively eliminating the need for the additional adhesive means **60** and thus effectively minimizing cost.

The foregoing disclosure of specific embodiments is illustrative of the broad inventive concepts comprehended by the invention.

Having described the invention, the embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a refrigeration apparatus enclosure having an outer cabinet, an improved corner construction comprising: inner laminate wall means within said outer cabinet defined by an inner sheet liner and outer insulation extending between said inner sheet liner and said outer cabinet, said inner laminate wall means defining a corner portion conforming to a corner contour of said outer cabinet, said corner portion defining a continuous liner corner portion and a void outwardly of said corner liner portion; and foamed-in-place insulation means filling said void and bonded to all surfaces confronting said void including those of said outer cabinet, said liner, corner portion, and said outer insulation.

2. The refrigeration apparatus enclosure of claim **1** wherein said inner laminate wall means includes an inner laminate wall having said inner liner folded to form at least one of said corner portions and said insulation cut through outwardly of said folded corner portion to define said void at said one corner portion.

3. A refrigeration apparatus enclosure comprising: an outer cabinet defining a back, side, top and bottom walls; a first U-shaped inner laminate wall element within said cabinet defined by an inner sheet liner and outer insulation extending between said inner sheet liner and said outer cabinet, said inner liner of the first element having folded continuous corner portions to conform said first element to the contours of a portion of said outer cabinet walls, said insulation being slit through outwardly from said folded portions to define voids; a second U-shaped inner laminate wall element within said cabinet defined by an inner sheet liner and outer insulation extending between said inner sheet liner and said outer cabinet, said inner liner of the second element having folded continuous corner portions to conform said second element to the contours of another portion of said outer cabinet walls, said insulation being slit through outwardly from said folded portions to define voids; foamed-in-place insulation filling said voids; and an inner laminate wall portion within said cabinet defined by an inner sheet liner and outer insulation extending between said inner sheet liner and said cabinet back wall cooperating with said first and second laminate wall elements to insulatively line the interior of the cabinet.

4. The refrigeration apparatus enclosure of claim **3** wherein said first and second U-shaped laminate wall elements are positioned in confronting relationship.

5. The refrigeration apparatus enclosure of claim **4** including divider wall means extending across the interior of the cabinet for dividing the interior into a plurality of compartments.

6. The refrigeration apparatus enclosure of claim **5** wherein said first and second U-shaped wall elements are spaced apart adjacent said divider wall means.

7. The refrigeration apparatus enclosure of claim **5** wherein said first and second U-shaped wall elements are spaced apart adjacent said divider wall means and said divider wall means covers the gap therebetween.

8. The refrigeration apparatus enclosure of claim **5** wherein said divider wall comprises an insulated wall, and bracket means mounting said insulated wall to said first and second laminate wall elements.

9. The refrigeration apparatus enclosure of claim **4** wherein said cabinet portion defines a lower portion of said outer cabinet including said bottom wall and said first laminate wall defines an upwardly opening U-shaped wall conforming to the contours of said lower portion; and said other cabinet portion defines an upper portion of said outer cabinet including said top wall, and said second laminate wall defines a downwardly opening U-shaped wall conforming to the contours of said upper portion.

10. The refrigeration apparatus enclosure of claim **3** including adhesive means for securing said laminate wall elements to said cabinet.

11. The refrigeration apparatus enclosure of claim **3** including means for securing said laminate wall portion to said cabinet back wall in spaced relationship to said cabinet walls, and insulation means disposed between

the periphery of said third inner laminate wall and said cabinet walls.

12. The refrigeration apparatus enclosure of claim **3** including means for securing said laminate wall portion to said cabinet back wall in spaced relationship to said cabinet walls, and foamed-in-place insulation means disposed between the periphery of said laminate wall portion and said cabinet walls.

13. The refrigeration apparatus enclosure of claim **3** wherein said laminate insulation includes an outer vapor barrier portion.

14. The refrigeration apparatus enclosure of claim **3** including sealant means for sealing said sheet liner of said first and second laminate wall elements to said sheet liner of said laminate wall portion.

15. The refrigeration apparatus enclosure of claim **3** including said first and second U-shaped wall elements spaced apart to define another void, and foamed-in-place insulation filling said other void.

* * * * *