Feb. 25, 1964 J. W. JACOBS 3,122,006

REFRIGERATING APPARATUS INCLUDING CABINET STRUCTURE

Filed May 24, 1962 3 Sheets-Sheet 1

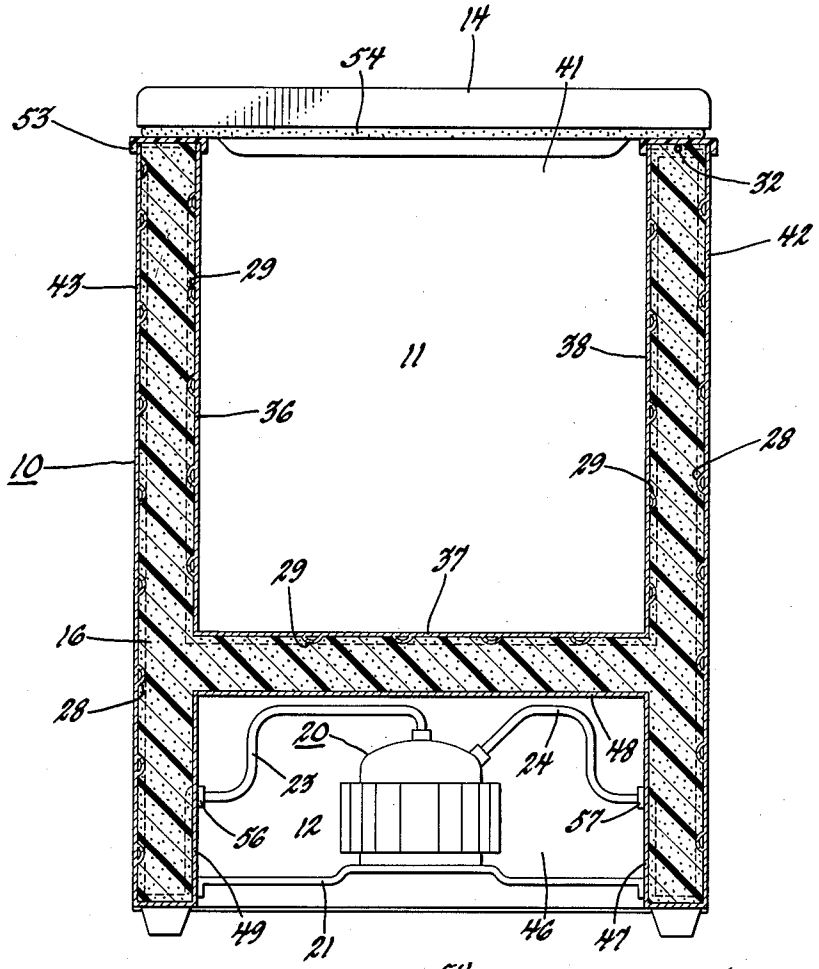

Fig. 2

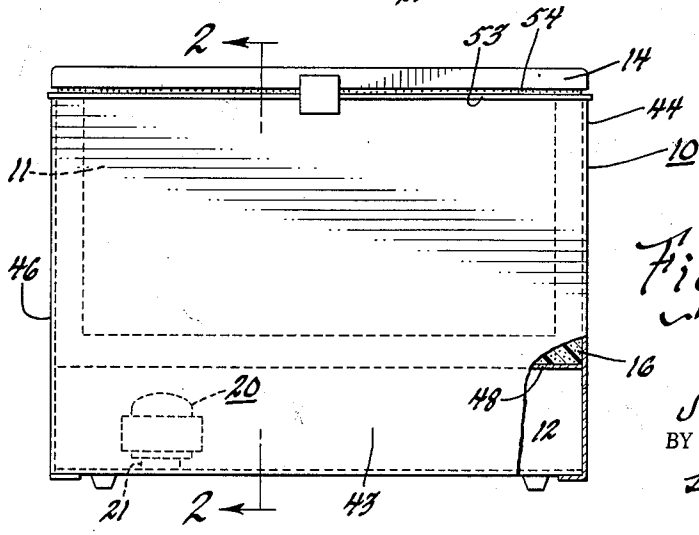

Fig. 1

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Filed May 24, 1962 3 Sheets-Sheet 2

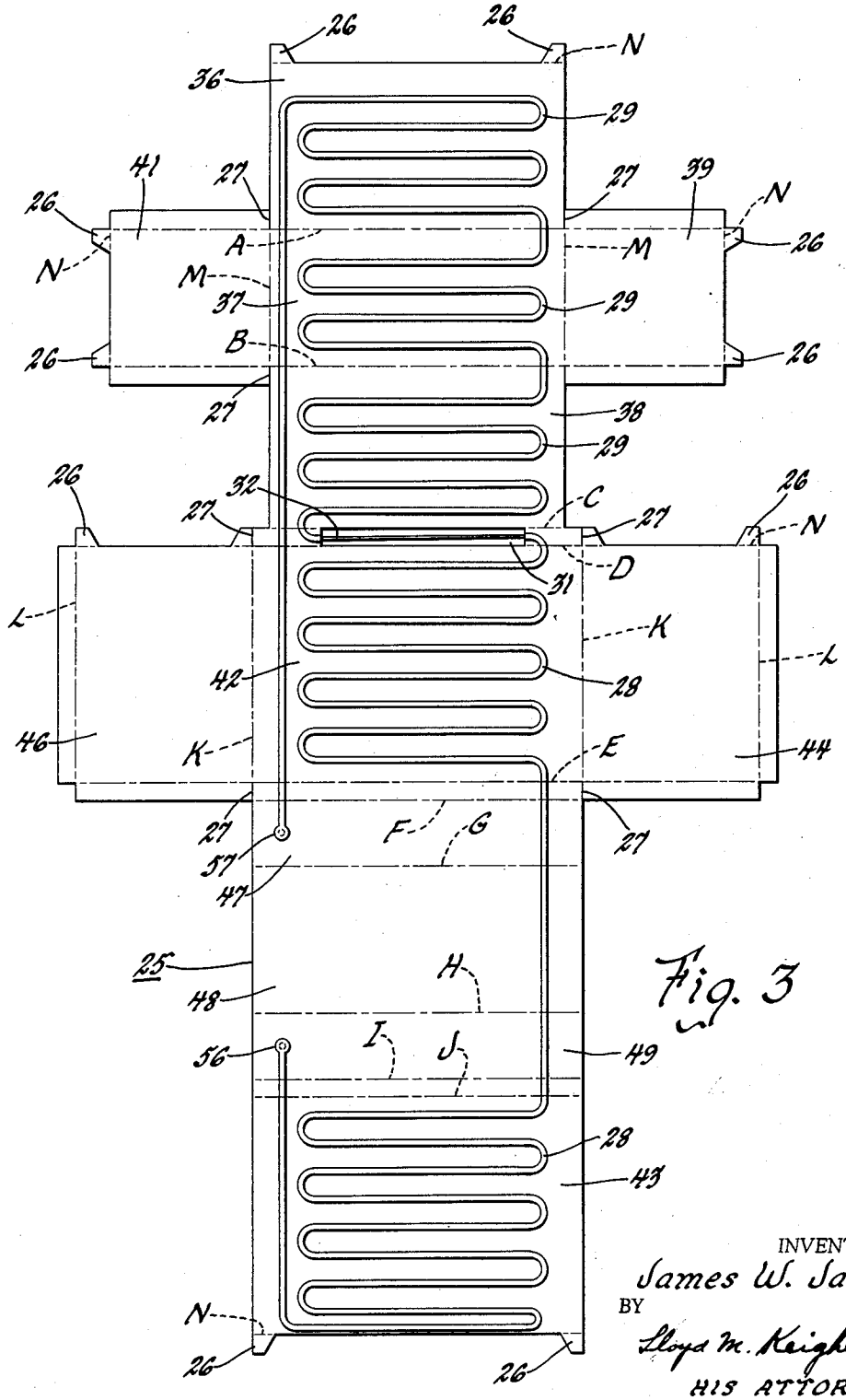

Fig. 3

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Filed May 24, 1962 3 Sheets-Sheet 3

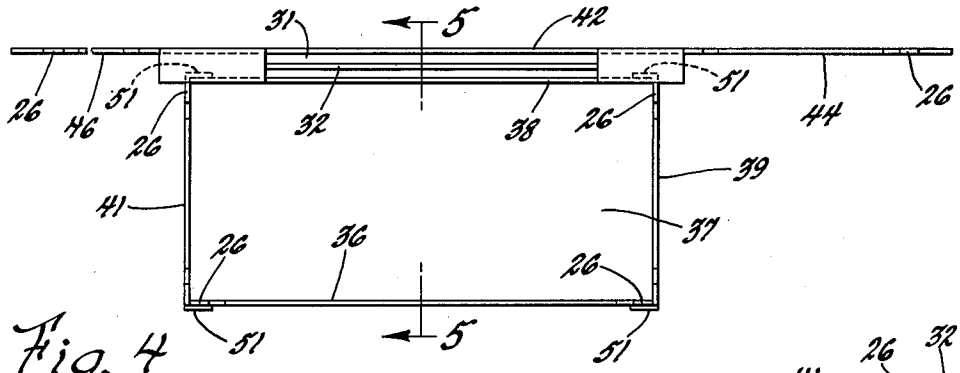

Fig. 4

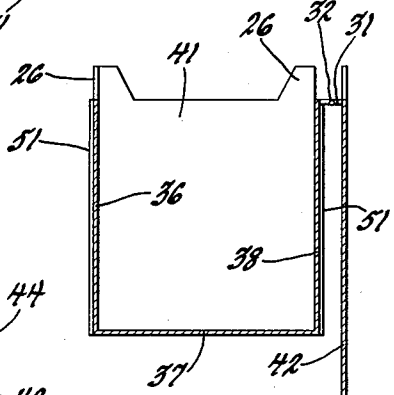

Fig. 5

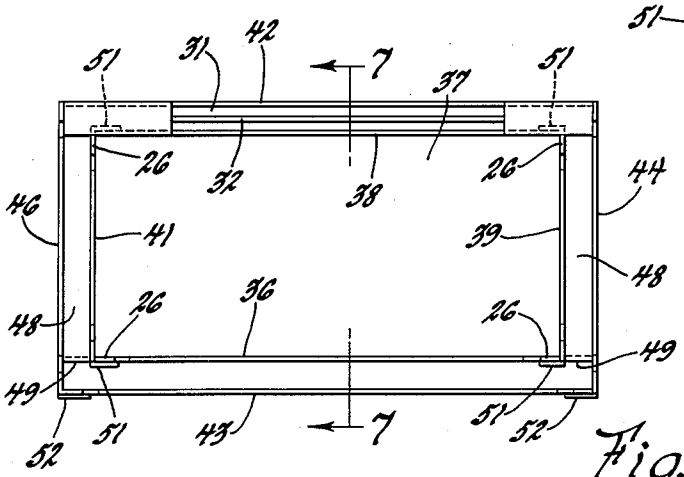

Fig. 6

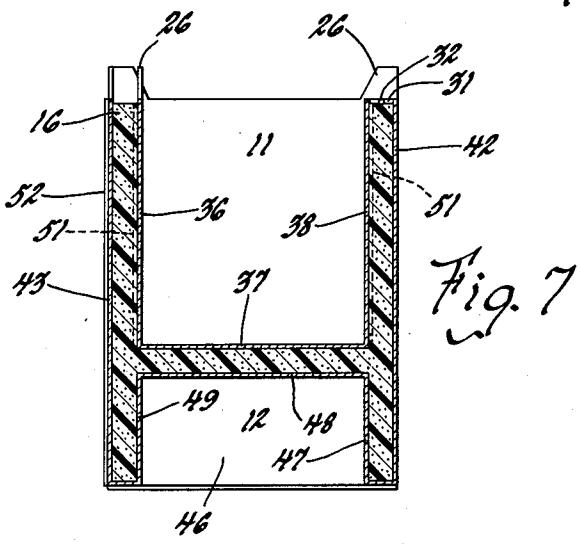

Fig. 7

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3,122,006
REFRIGERATING APPARATUS INCLUDING CABINET STRUCTURE

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4 Claims. (Cl. 62—453)

This invention relates to refrigeration and particularly to a unitary refrigerating apparatus including a cabinet and a refrigerating system associated therewith.

Roll pressure bonded or welded sheet meal heat exchangers for refrigerating systems are now well known and the advent of such renders it possible or feasible to inspire further innovations utilizing this idea. I am aware of the fact that others have provided several versions of this principle in order to simplify construction of refrigerators and parts of a refrigerating system associated therewith. However, I propose an improvement in the art whereby a single pressure welded plate member is employed to construct substantially all walls of a refrigerator cabinet and a complete refrigerating system therein both forming integer components of the cabinet structure.

An object of my invention is to provide a novel and simple refrigerator cabinet of low manufacturing costs having a refrigerating system incorporated in the construction of the cabinet whereby the necessity of separately mounting some individual elements of the system therein is eliminated.

Another object of my invention is to construct a combined refrigerator cabinet and refrigerating system from a prefabricated pressure welded substantially flat plate member having refrigerant passages formed in portions thereof which member is multibent and folded to define outer walls of the cabinet and a plurality of walls of a food storage chamber therein with the passages in certain portions of the member providing a refrigerant evaporator in the system extending along walls of the chamber and exposed to the interior thereof for cooling same and with the passages in certain other portions of the member providing a refrigerant condenser in the system extending along a cabinet outer wall and exposed to air ambient thereto.

In carrying out the foregoing objects it is a further object of my invention to bend and fold a single pressure welded plate member with edges of the folds secured together to define a double walled box-like cabinet structure defining walls of a food storage chamber, walls of a machine compartment therein in the cabinet within which an element of a refrigerating system is mounted and outer walls of the cabinet and to foam insulation between the double walls of the structure for bonding them together to thereby increase the structural strength of the cabinet construction.

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 embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a front view of a refrigerating apparatus including a top opening freezer or frozen food storage refrigerator cabinet constructed in accordance with my invention showing a portion of the cabinet broken away to illustrate a machine compartment therein;

FIGURE 2 is an enlarged vertical sectional view of the refrigerating apparatus taken on the line 2—2 of FIGURE 1;

FIGURE 3 is a plan view of the present prefabricated

pressure welded plate member with refrigerant passages formed therein trimmed and readied to be bent and folded for the purpose herein disclosed;

FIGURE 4 is a broken top view of the plate member enlarged over FIGURE 3 with certain portions of the member bent or folded to provide walls of the chamber of the cabinet structure;

FIGURE 5 is a broken vertical sectional view taken on the line 5—5 of FIGURE 4 showing other portions of the plate member yet to be bent and folded;

FIGURE 6 is a top view of the plate member with other portions thereof bent and folded to provide a double walled box-like structure; and

FIGURE 7 is a vertical sectional view taken on the line 7—7 of FIGURE 6 of the box-like structure with insulation disposed between double walls thereof.

Referring to the drawings, for illustrating my invention, I show in FIGURES 1 and 2 thereof a refrigerating apparatus including a horizontally elongated top opening chest-type refrigerator cabinet 10 comprising a plurality of walls defining a freezing or frozen food storage chamber 11 and a machine or the like compartment 12 beneath the food chamber. The open top of cabinet 10 is normally closed by an insulated door structure 14 hingedly mounted on the cabinet in any suitable or conventional manner for vertical swinging movement relative thereto. At least walls bounding chamber 11 have insulating material 16 disposed therebetween as is conventional in the art. The interior of food chamber 11 may contain shelves or slidable baskets, bins or the like for storage of frozen foods therein or for foods to be frozen in the chamber. A refrigerating system is associated with cabinet 10 and comprises, in accordance with my invention, refrigerant flow passages formed in portions of a prefabricated pressure welded flat plat member which is bent and folded with edges of folds thereof secured together to provide the double walled box-like cabinet structure as will be hereinafter more fully described. The refrigerating system incorporated in cabinet 10 includes refrigerant evaporating passages in several walls of food chamber 11 exposed to the interior thereof for cooling same and refrigerant condensing passages in several outer walls of the cabinet exposed to air ambient thereto. The refrigerating system also includes an electrically energizable motor drivingly connected to a refrigerant compressor both enclosed in a casing and forming a sealed motor-compressor unit 20. Unit 20 is mounted within compartment 12 upon a bracket or the like support 21 secured in any suitable or conventional manner to walls of cabinet 10. Short noninsulated end walls of compartment 12 may be louvered or perforated for permitting heat generated by unit 20 to escape from this compartment. The compressor of unit 20 has refrigerant inlet and discharge conduits or pipe connections 23 and 24 (see FIGURE 2) with refrigerant passages formed in the pressure welded plate member utilized in constructing walls of cabinet 10 connecting the unit, through a wall of compartment 12, to the refrigerant condensing and refrigerant evaporating passages of the refrigerating system in closed series flow relationship with one another. Refrigerator cabinet 10 is of a well-known character and is disclosed merely to illustrate the present invention and should not be restrictive to a type or design cabinet to which same is applicable.

A prefabricated roll pressure welded one-piece substantially flat plate-like member herein utilized to provide the cabinet 10 and elements of the refrigerating system incorporated therein is shown in FIGURE 3 of the drawings. Such a plate member may be formed in accordance with the teachings in the G. R. Long Patent No. 2,662,273 dated December 15, 1953 and the C. H. Wurtz

et al. Patent No. 2,712,736 dated July 12, 1955 and is now well known to those familiar with the art. The plate member comprises two aluminum alloy sheets which are superimposed upon each other after coating or applying to an inner face of one of them a predetermined pattern of stop weld material for preventing uniting of the sheets therealong during pressure welding thereof. The thickness of the sheets is reduced and they are welded together along contacting surfaces at all points except where the sheets have been precoated with the stop weld material to provide a composite homogenous member. The internal unbonded patterns or portions in the homogenous plate member, formed by the stop weld material, are then pressure separated or dilated in at least one direction to form passages therein with walls of the passages bulged preferably outwardly from only one face thereof. Referring now to FIGURE 3, the pressure welded plate member **25** is trimmed or cut to a specified size and configuration as shown therein to provide a plurality of tabs **26** at edges of certain portions thereof and is slit on short lines indicated by the reference numerals **27**. Passages **28** formed in member **25** provide a refrigerant condenser element and passages **29** provide a refrigerant evaporator element for a refrigerating system. It is to be noted that the end of one set of passages **28** and **29** is separated by a cut-out part **31** of plate member **25** and that a separate capillary tube **32** is brazed into the open ends of passages **28** and **29** thereat which tube provides a refrigerant restrictor or expanding element for the refrigerating system. A plurality of dot-dash lines, particularly lines identified at A, B, C, D, E, F, G, H, I, J, K, L, M and N, are extended across plate member **25** in FIGURE 3 and indicate points at which portions thereof are bent and folded, as will be hereinafter described, to construct the box-like cabinet structure **10**. Before proceeding with a description of the bending, folding and securing together of various portions of pressure welded plate member **25** it is desired, in order to better understand the multifolding operations or steps, to explain that the portions thereof indicated at **36**, **37**, **38**, **39** and **41** are intended to define or provide walls of food chamber **11** of cabinet **10**. Portions thereof indicated at **42**, **43**, **44** and **46** are intended to define or provide outer walls of cabinet **10** spaced from the walls of chamber **11** and portions **47**, **48** and **49** of the plate member are intended to provide the top and long side walls of machine compartment **12** of the cabinet. Due to the large size of plate member **25** necessary to construct the cabinet of the present disclosure refrigerant passages in portions of this member are not shown in FIGURES 4 to 7 inclusive of the drawings for sake of clarity in describing the multifolding stages or steps. Plate member **25** is bent along lines D, C, B and A into the rectangular box form shown in FIGURE 4 of the drawings with portion **37** folded to form a bottom wall for chamber **11** and with portions **36** and **38** folded to form upright long sides of chamber **11**. Wing portions **39** and **41** are bent along lines M and folded in another direction, with respect to the folding of portions **36**, **37** and **38** to provide upright end walls of chamber **11** with portion **38** paralleling but spaced from portion **42** (see FIGURE 5). The edge parts of portions or walls **39** and **41** adjacent and along lines A and B outwardly beyond slits **27** are folded over, on lines A and B, to overlap and are secured, by aluminum brazing as at **51**, to corner edges of portions or walls **36** and **38** (see FIGURE 4). Refrigerant evaporating passages **29** of the refrigerating system associated with cabinet **10** are, by the bending and folding operations just described, located in bottom wall **37** and in the two upright long walls **36** and **38** of chamber **11**. Plate member **25** is further bent along the lines E, F, G, H, I and J and folded with portions **42** and **43** thereof defining the outer long side walls of cabinet **10** and with wing portions **44** and **46** bent along lines K and folded at a right angle with respect to portion **42** to provide the outer ends of the cabinet (see FIGURE 6). In FIGURE 7 of the drawings the bent and folded portions **48**, **47** and **49** of plate member **25** are shown as defining the top and upright long inner side walls respectively of machine compartment **12**. The edge parts of portions **44** and **46**, extending from portion **42**, adjacent and along line E outwardly beyond slits **27** are folded over, on line E, to overlap and are secured, also by aluminum brazing as at **52**, to corner edges of portion or wall **43** (see FIGURE 6). It is to be understood that the sequence in which portions of plate member **25** are bent and folded along the plurality of fold lines may, insofar as the present invention is concerned, be varied to suit conditions in the bending and folding operations so long as the double walled box-like cabinet structure, as shown in FIGURE 7, is provided with the desired inner and outer spaced-apart walls.

With portions or walls of cabinet **10** formed and secured together as disclosed in FIGURE 7 of the drawings the space between inner and outer walls thereof is now to be filled with the insulating material **16**. The insulating material may be discharged into spaces between inner and outer walls of cabinet **10** to expand therein and be permitted to set whereby the insulation bonds these walls together to provide a rigid box-like structure of great structural strength. It is desired to utilize a lightweight, structurally strong plastic insulating material such, for example, as polyurethane which is now well known to those skilled in the insulation art. After the insulating material **16** has been foamed into place, tabs **26** at the top of portions of the box-like structure or on top of edges of walls **36**, **39**, **41**, **43**, **44** and **46** are bent over upon one another, along lines N, and brazed together. In order to reduce conduction between different wall portions of the cabinet structure tabs **26** may, if desired, be insulated from one another and secured to each other by nonmetallic screws or fasteners. The tabs **26** provide securing points about the top of cabinet **10** for screws or the like which mount a cover or molded plastic collar **53** (see FIGURES 1 and 2) thereon adapted to be engaged by a gasket **54** on door **14** for sealing the access opening of food storage chamber **11**. Combined gusset plate and glider elements are secured to bottom corners of cabinet **10** to support same on a floor or the like. Mounting bracket **21** carrying motor-compressor unit **20** thereon is secured in any suitable or conventional manner to inner leg portions **47** and **49** of machine compartment **12** of cabinet **10**. Thereafter conduits **23** and **24** are connected to the casing of unit **20**, containing the refrigerant compressor, and to one end **56** of condenser passage **28** and to one end **57** of evaporator passage **29** respectively (see FIGURES 2 and 3) to complete the refrigerating system associated with or incorporated in the unitary box-like cabinet construction **10**. Any desirable thermostatic switch means (not shown) as is conventional in the art may be employed to control starting and stopping of the electric motor in unit **20** to drive the refrigerant compressor therein. Operation of unit **20** causes refrigerant to evaporate in evaporator passages **29** within the bottom **37** and the two long upright walls **36** and **38** of chamber **11** exposed to the interior thereof for cooling same. The evaporated refrigerant is withdrawn from passages **29**, by way of connection **57** and conduit **24**, compressed by the compressor and forwarded, through conduit **23** and connection **56**, to the refrigerant condensing passages **28** in two outer long upright walls **42** and **43** of cabinet **10**. Condenser passages **28** are exposed to air ambient the cabinet which air cools and liquefies refrigerant in the passages whereby liquid refrigerant is directed through restrictor tube **32** back into the evaporator **29** in a series flow circuit. Exterior wall surfaces of cabinet **10** may be anodized and colored or they may be treated and then coated with paint or enamel.

It should, from the foregoing, be apparent that I have made an improvement in the refrigeration art by providing from a single pressure welded plate member a unitary

refrigerator cabinet and a plurality of elements of a refrigerating system incorporated in the cabinet. The bending and folding of various portions of the plate member as disclosed provides a refrigerant evaporator in several adjacent walls of a food chamber of the cabinet to insure a cooling capacity for the chamber which is sufficient to maintain a below-freezing temperature therein. After fashioning the cabinet structure in accordance with the present multifolding innovation there are a minimum of mechanical connections remaining to complete the closed refrigerating system associated with the cabinet. By the arrangement herein disclosed component elements of a unitary structure are manufactured at low cost thus reducing the retail price of same to the public. My invention is to be distinguished from prior structures wherein a pressure welded plate member of a refrigerating system is formed to provide elements thereof removably attached to a separate cabinet construction.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In combination, a cabinet and a refrigerating system associated therewith, said refrigerating system comprising:

(*a*) a prefabricated pressure welded substantially flat plate-like member having refrigerant passages formed in portions thereof,

(*b*) said member being bent and folded along predetermined lines to define a plurality of adjacent walls of a food storage chamber, walls of a machine compartment beyond said chamber in the cabinet and outer walls of said cabinet spaced from the chamber walls,

(*c*) insulating material disposed in the space between said chamber walls and said cabinet outer walls,

(*d*) said refrigerating system including a motor-compressor unit mounted in said machine compartment and having conduit connections with refrigerant passages within said cabinet walls defining member,

(*e*) the passages in certain portions of said member providing a refrigerant evaporator in said system extending along adjacent walls of said food chamber exposed to the interior thereof for cooling same,

(*f*) the passages in certain other portions of said member providing a refrigerant condenser in said system extending along at least one cabinet outer wall exposed to air ambient the cabinet,

(*g*) means interposed between and communicating with said condenser and said evaporator for restrictively directing refrigerant from the condenser into the evaporator, and

(*h*) said conduit connections connecting the compressor of said unit, said condenser and said evaporator in closed series refrigerant flow relationship.

2. In combination, a cabinet and a refrigerating system associated therewith, said refrigerating system comprising:

(*a*) a prefabricated pressure welded substantially flat plate member having refrigerant passages formed in portions thereof,

(*b*) said plate member being bent and folded along predetermined lines with edges of the fold secured together to provide a rigid double-walled box-like structure defining a plurality of adjacent walls of a food storage chamber therein and a plurality of outer walls of said structure spaced from and bounding walls of said chamber,

(*c*) insulating material foamed and set in the space between said inner and said outer walls of said box-like structure to bond them to one another for increasing the structural strength of said cabinet,

(*d*) said refrigerating system including a motor-compressor unit having conduit connections with refrigerant passages in said cabinet wall defining member,

(*e*) the passages in certain portions of said member providing a refrigerant evaporator in said system extending along adjacent inner walls of said food chamber exposed to the interior thereof for cooling same,

(*f*) the passages in certain other portions of said member providing a refrigerant condenser in said system extending along at least one cabinet outer wall exposed to air ambient the cabinet,

(*g*) means interposed between and communicating with said condenser and said evaporator for restrictively directing refrigerant from the condenser into the evaporator, and

(*h*) said conduit connections connecting the compressor of said unit, said condenser and said evaporator in closed series refrigerant flow relationship.

3. In combination, a cabinet and a refrigerating system associated therewith, said refrigerating system comprising:

(*a*) a prefabricated pressure welded substantially flat plate member having refrigerant passages formed in portions thereof,

(*b*) said plate member being bent and folded along predetermined lines with edges of the folds secured together to provide a bottom and upright walls of a rectilinear food storage chamber, walls of a machine compartment beyond said chamber in the cabinet and outer walls of said cabinet spaced from and bounding walls of said chamber,

(*c*) said chamber having an access opening in a wall of said cabinet normally closed by a door,

(*d*) insulating material foamed and set in the space between at least said walls of the food chamber and outer walls of the cabinet for increasing the structural strength of said cabinet,

(*e*) said refrigerating system including a motor-compressor unit mounted in said machine compartment and having conduit connections with refrigerant passages within said cabinet wall defining member,

(*f*) the passages in certain portions of said member providing a refrigerant evaporator in said system extending along the bottom and two upright walls of said rectilinear food chamber exposed to the interior thereof for cooling same,

(*g*) the passages in certain other portions of said member providing a refrigerant condenser in said system extending along a cabinet upright outer wall exposed to air ambient the cabinet,

(*h*) means interposed between and communicating with said condenser and said evaporator for restrictively directing refrigerant from the condenser into the evaporator, and

(*i*) said conduit connections connecting the compressor of said unit, said condenser and said evaporator in closed series refrigerant flow relationship.

4. In combination, a cabinet and a refrigerating system associated therewith, said refrigerating system comprising:

(*a*) a prefabricated pressure welded substantially flat plate member having refrigerant passages formed in portions thereof,

(*b*) said plate member being bent and folded along predetermined lines with edges of the folds secured together to provide a bottom, upright long side and upright end walls of a rectilinear food storage chamber, walls of a machine compartment below said chamber in the cabinet and outer side and end walls of said cabinet spaced from and bounding walls of said chamber, at least two of the outer side walls being opposed,

(*c*) said chamber having an access opening in the top of said cabinet normally closed by a door,

(*d*) insulating material foamed and set in the space between at least said walls of the food chamber and outer walls of the cabinet for increasing the structural strength of said cabinet,

(*e*) said refrigerating system including a motor-compressor unit mounted in said machine compartment and having conduit connections with refrigerant passages within said cabinet wall defining member,

(*f*) the passages in certain portions of said member providing a refrigerant evaporator in said system extending along said bottom and said long upright side walls of the rectilinear food chamber exposed to the interior thereof for cooling same,

(*g*) the passages in certain other portions of said member providing a refrigerant condenser in said system extending along two opposed cabinet upright outer side walls exposed to air ambient the cabinet,

(*h*) means interposed between and communicating with said condenser and said evaporator for restrictively directing refrigerant from the condenser into the evaporator, and

(*i*) said conduit connections connecting the compressor of said unit, said condenser and said evaporator in closed series refrigerant flow relationship.

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