June 11, 1957 C. H. WURTZ 2,795,113

REFRIGERATING APPARATUS

Filed July 8, 1953 2 Sheets-Sheet 1

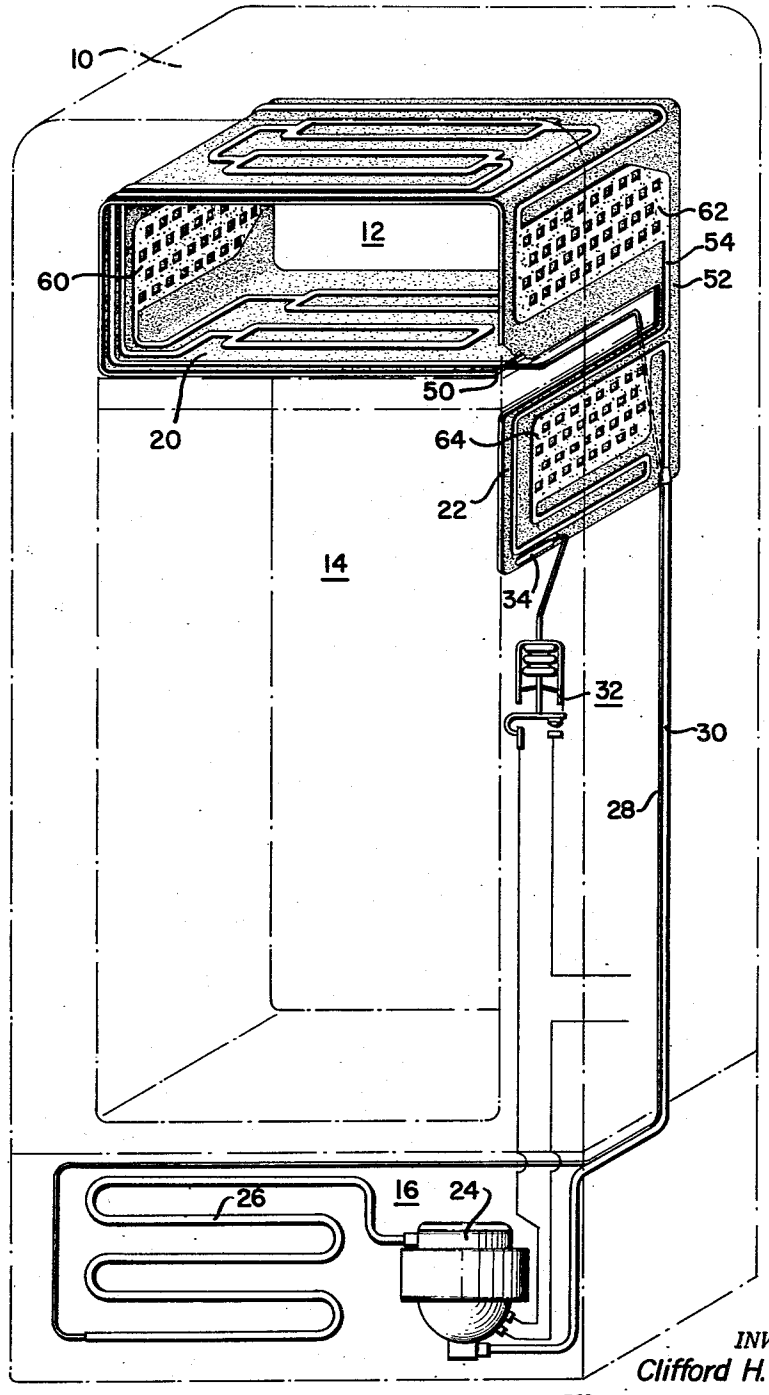


Fig. 1

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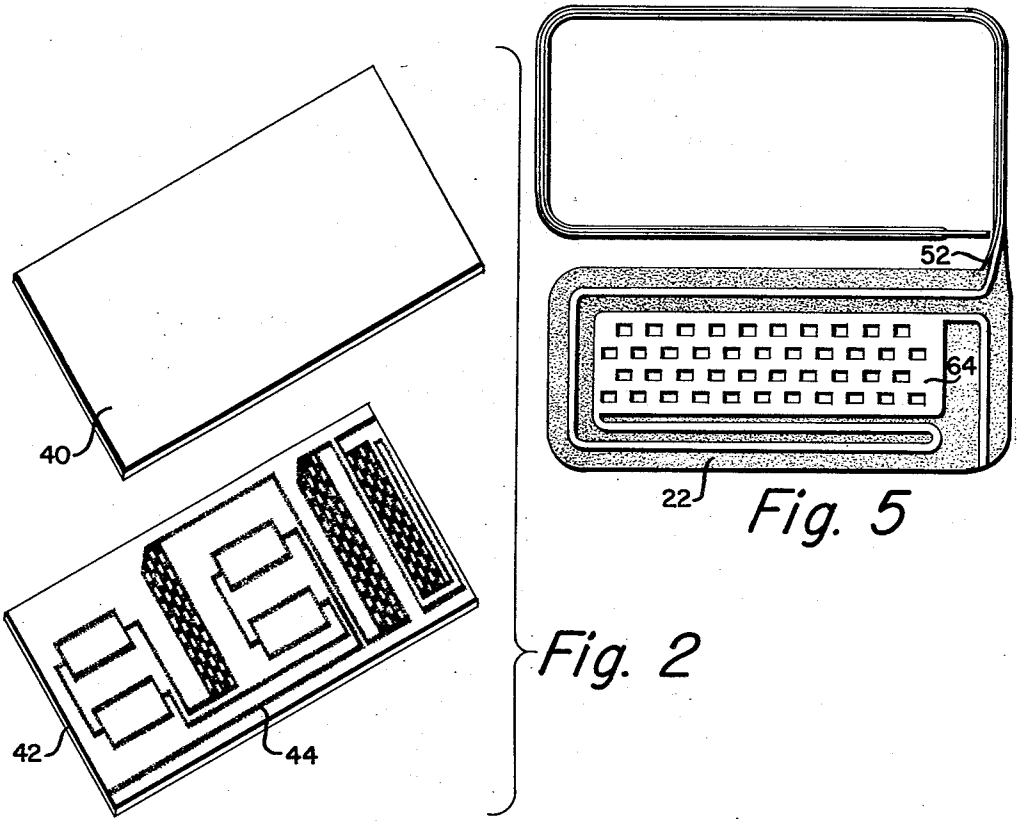


Fig. 2

Fig. 5

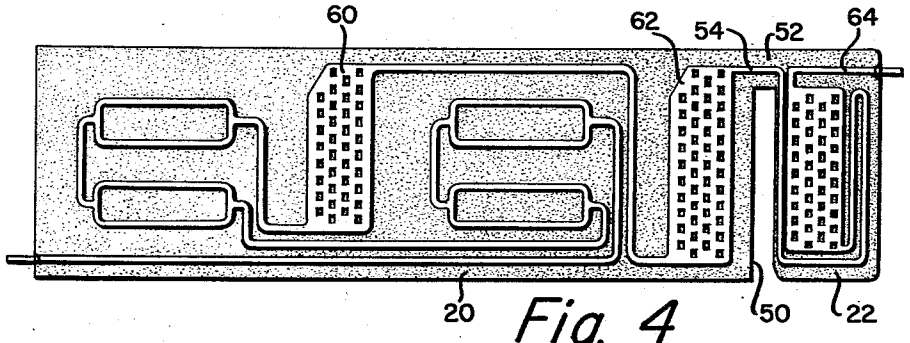


Fig. 4

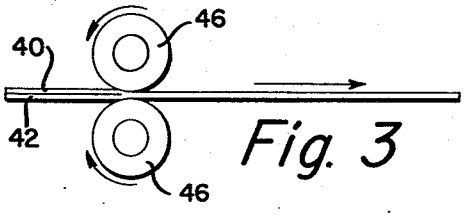


Fig. 3

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REFRIGERATING APPARATUS

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Application July 8, 1953, Serial No. 366,700

9 Claims. (Cl. 62—4)

This invention relates to refrigerating apparatus and more particularly to a multiple compartment refrigerator for storing foods at two different temperatures.

It is an object of this invention to reduce the cost of manufacturing the evaporators used in a multiple compartment refrigerator.

More particularly it is an object of this invention to use a single roll-forged evaporator unit having two connected sections located in separate food compartments.

Another object of this invention is to provide an improved method of manufacturing heat exchangers which makes it possible to manufacture a unitary device having two spaced evaporator sections joined together by an integrally formed neck.

Still another object of this invention is to provide an improved arrangement for supporting an evaporator in a refrigerator.

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 is clearly shown.

In the drawings:

Figure 1 is a perspective view largely schematic showing the invention applied to a modern refrigerator;

Figure 2 is an elevational view showing the plates used in fabricating the evaporator assembly;

Figure 3 is a side elevational view showing the plates passing between a pair of forging rollers;

Figure 4 is a plan view of the evaporator assembly after the internal passages have been dilated but before the evaporator sections have been bent into final shape; and,

Figure 5 is a fragmentary front elevational view showing the relationship of the evaporators after installation in the refrigerator.

Referring now to the drawing wherein a preferred embodiment of the invention has been shown, reference numeral **10** generally designates a conventional refrigerator cabinet having an insulated frozen food storage compartment **12** in the upper portion thereof, an insulated but relatively higher temperature food storage compartment **14** in the mid portion, and an uninsulated machinery compartment **16** arranged in the lower portion as shown. In order to simplify the disclosure no door has been shown whereas either one or two doors would be provided for closing the openings to the compartments in accordance with standard practice. A first evaporator section **20** is provided for refrigerating the frozen food storage compartment **12** and a second evaporator section **22** is provided for refrigerating the compartment **14** in which the unfrozen foods are adapted to be stored. A refrigerant liquefying system comprising a motor-compressor unit **24** and a condenser **26** is mounted in the machinery compartment **16** and serves to supply liquid refrigerant through a fixed restrictor tube **28** to the first evaporator section **20** and to withdraw vaporized refrigerant from the second evaporator section **22** through the suction line **30**. As explained more fully hereinafter the evaporator sections are arranged in series refrigerant flow relationship.

A thermostatically operated switch **32** which includes a bulb **34** arranged in contact with the lower edge of the evaporator section **22** is used for starting and stopping the motor-compressor unit **24** in response to refrigeration requirements. The switch **32** is of the type which is adapted to close the circuit to the motor-compressor unit when the temperature of the bulb **34** is a few degrees above the melting temperature of the frost which may form on the evaporator section **22** during the "on" cycle and is adapted to open the circuit when the temperature of the bulb approaches 0° F. The relative sizes of the evaporators and the arrangement of the passages therein are such as to provide for automatic defrosting of the evaporator section **22** during the "off" cycle without defrosting the evaporator section **20**. This principle of operation is more fully set forth in my copending application S. N. 272,962, filed February 23, 1952, now Patent No. 2,672,023.

In order to reduce the number of parts required for the refrigerator and in order to reduce the cost of manufacture of the parts, the evaporator sections **20** and **22** are made in one piece by a roll-forging operation. As shown in Figure 2, a pair of plates **40** and **42** are superimposed upon one another with a pattern of stop-weld material **44** coated on the one plate. These two plates are then passed between a pair of heated pressure rollers **46** which serve to roll-forge the plates **40** and **42** together into one composite plate in accordance with the teachings in Long application S. N. 151,591, filed March 24, 1950, now Patent No. 2,662,273. As explained in the said Long application the roll-forging operation serves to reduce the thickness of the plates and to materially elongate the plates without materially widening the plates. The stop-weld material provided between the plates prevents the sheets from adhering to one another throughout the coated area. Following the roll-forging operation fluid-under-pressure is supplied between the plates so as to dilate the plates for the purpose of forming regrigerant passages corresponding to the pattern of the stop-weld material. The dilating process is done while the plates are supported between two rigid flat surfaces as fully explained in the aforementioned Long application.

As best shown in Figures 1, 2 and 4, the stop-weld material is so applied that the internal refrigerant passages extend throughout the major portion of the plate and in effect form two spaced evaporator sections connected in series refrigerant flow relationship. A slot **50** is cut into the one side of the composite plate after the roll-forging operation as shown in Figure 4 so as to separate the evaporator section **20** from the evaporator section **22** except at the narrow neck **52**. This narrow neck includes a refrigerant passage **54** which connects the evaporator section **20** in series with the evaporator section **22**. Installing the evaporator sections **20** and **22** in the cabinet the evaporator section **22** may be arranged adjacent the side wall of the cabinet as shown in Figure 1 or if desired the narrow neck portion **52** can be twisted as shown in Figure 5 so as to cause the evaporator section **22** to lie parallel to the rear wall of the compartment **14**.

It will be noted that the pattern of the stop-weld material is such that multipassage accumulator chambers **60** and **62** are provided in the evaporator section **20** in the vertical end walls of the evaporator section **20**. A third and similar accumulator formation **64** is provided in the evaporator section **22**. These accumulator sections **60**, **62** and **64** are in effect relatively narrow receptacles which are forge-welded together throughout a plurality

of points so as to produce a waffle-like pattern. By virtue of this construction it is possible to use accumulators having flat side walls without the danger of these walls bulging outwardly in operation as the largest unsupported flat surface in any one region is relatively small in comparison with the overall size of the accumulator chamber. The points at which the walls of the accumulator are welded together are staggered with the result that any refrigerant vapor bubbles entering the lower portion of the accumulator chamber will be required to follow a zigzag path through the accumulator chamber. It will be noted that in each case the accumulator chamber has its inlet adjacent its bottom and its outlet adjacent the top. It will also be noted that the refrigerant passages in the two evaporator sections **20** and **22** are connected in series and are in effect one continuous passage in one single plate.

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, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a household refrigerator having a low temperature food compartment and a relatively high temperature food compartment, evaporator means for refrigerating said compartments, said evaporator means comprising a one-piece roll-forged plate evaporator having a first section located in said low temperature compartment and having a second section located in said relatively high temperature compartment and connected to said first section by means of a relatively narrow neck portion, and means for supplying liquid refrigerant to said sections in series.

2. In a household refrigerator having a low temperature food compartment and a relatively high temperature food compartment, means for insulating said food storage compartments from one another, evaporator means for refrigerating said compartments, said evaporator means comprising a one-piece roll-forged plate evaporator having a first section located in said low temperature compartment and having a second section located in said relatively high temperature compartment and means for supplying liquid refrigerant to said sections in series and means responsive to the temperature of said second section for starting and stopping the operation of said means for supplying liquid refrigerant to said sections.

3. Evaporator means for use in a multiple compartment refrigerator comprising a unitary plate having internal passages formed therein, said plate having a first box-like portion adapted to refrigerate a first of said compartments and having a second depending plate-like portion adapted to refrigerate a second of said compartments, said second portion being connected to said first portion by means of a relatively narrow neck formed integrally with said first and second portions, one wall of said box-like portion being arranged in a substantially vertical plane, an accumulator and disengaging chamber formed within said wall having an inlet adjacent the top of said chamber and having an outlet adjacent the bottom of said chamber, and means for directing refrigerant leaving said outlet into said second evaporator portion.

4. Evaporator means for use in a two temperature refrigerator comprising a unitary plate type evaporator having internal passages formed therein, said evaporator having a first box-like portion adapted to refrigerate a first compartment and having a second depending plate-like portion adapted to refrigerate a second compartment, said second portion being connected to said first portion through a relatively narrow neck formed integrally with said first and second portions, one wall of said box-like portion being disposed in a substantially horizontal plane so as to form a support for articles to be frozen and a second wall thereof being disposed in a vertical plane, an accumulator chamber formed within said second wall and having an inlet adjacent the top of said chamber and having an outlet adjacent the bottom of said chamber, the opposite walls of said chamber being attached to one another throughout a plurality of spaced areas so as to prevent distortion of the walls at high internal pressures, and means for directing refrigerant leaving said outlet into said second evaporator portion, said second evaporator portion having a circumferentially disposed refrigerant passage and a substantially centrally disposed accumulator chamber, the outlet of said circumferentially extending passage being connected to the bottom of said centrally disposed accumulator chamber.

5. Evaporator means for use in a two temperature refrigerator comprising a unitary plate type evaporator having internal passages formed therein, said evaporator having a first box-like portion adapted to refrigerate a first compartment and having a second depending plate-like portion adapted to refrigerate a second compartment, said second portion being connected to said first portion through a relatively narrow neck formed integrally with said first and second portions, one wall of said box-like portion being disposed in a substantially horizontal plane so as to form a support for articles to be frozen and a second wall thereof being disposed in a vertical plane, an accumulator chamber formed within said second wall and having an inlet adjacent the top of said chamber and having an outlet adjacent the bottom of said chamber, the opposite walls of said chamber being attached to one another throughout a plurality of spaced areas so as to prevent distortion of the walls at high internal pressures, and means for directing refrigerant leaving said outlet into said second evaporator portion, said second evaporator portion having a circumferentially disposed refrigerant passage and a substantially centrally disposed accumulator chamber, the outlet of said circumferentially extending passage being connected to the bottom of said centrally disposed accumulator chamber, said centrally disposed accumulator chamber having the opposite walls thereof attached to one another throughout a plurality of spaced areas.

6. Evaporator means for use in a two temperature refrigerator comprising a unitary plate type evaporator having internal passages formed therein, said evaporator having a first box-like portion adapted to refrigerate a first compartment and having a second depending plate-like portion adapted to refrigerate a second compartment, said second portion being connected to said first portion through a relatively narrow neck formed integrally with said first and second portions, one wall of said box-like portion being disposed in a substantially horizontal plane so as to form a support for articles to be frozen and a second wall thereof being disposed in a vertical plane, an accumulator chamber formed within said second wall and having an inlet adjacent the top of said chamber and having an outlet adjacent the bottom of said chamber, the opposite walls of said chamber being attached to one another throughout a plurality of spaced areas so as to prevent distortion of the walls at high internal pressures, and means for directing refrigerant leaving said outlet into said second evaporator portion, said second evaporator portion having a circumferentially disposed refrigerant passage and a substantially centrally disposed accumulator chamber, the outlet of said circumferentially extending passage being connected to the bottom of said centrally disposed accumulator chamber, the opposite walls of said internal passages and said accumulator chambers comprising substantially parallel flat surfaces.

7. Evaporator means for use in a two temperature refrigerator comprising a unitary plate type evaporator having internal passages formed therein, said evaporator having a first box-like portion adapted to refrigerate a first compartment and having a second depending plate-like portion adapted to refrigerate a second compartment, said second portion being connected to said first portion through a relatively narrow neck formed integrally with

said first and second portions, one wall of said box-like portion being disposed in a substantially horizontal plane so as to form a support for articles to be frozen and a second wall thereof being disposed in a vertical plane, an accumulator chamber formed within said second wall and having an inlet adjacent the top of said chamber and having an outlet adjacent the bottom of said chamber, the opposite walls of said chamber being attached to one another throughout a plurality of spaced areas so as to prevent distortion of the walls at high internal pressures, and means for directing refrigerant leaving said outlet into said second evaporator portion, said second evaporator portion having a circumferentially disposed refrigerant passage and a substantially centrally disposed accumulator chamber, the outlet of said circumferentially extending passage being connected to the bottom of said centrally disposed accumulator chamber, the opposite walls of said internal passages and said accumulator chambers comprising substantially parallel flat surfaces, said opposed walls being uniformly spaced from one another throughout.

8. The method of manufacturing an evaporator assembly for a multiple compartment refrigerator which comprises roll-forging two substantially rectangular plates together with a stop-weld material between the plates in a pattern to form two separate and spaced evaporator circuits in spaced portions of the resulting composite plate but connected together by a refrigerant passage, thereafter slitting said composite plate so as to physically separate said portions throughout the major width of said composite plate said method including the step of dilating said plates following the step of roll forging so as to form refrigerant passages corresponding substantially to the pattern of said stop weld material.

9. The method of manufacturing an evaporator assembly for a multiple compartment refrigerator which comprises roll-forging two substantially rectangular plates together with a stop-weld material between the plates in a pattern to form two separate and spaced evaporator circuits in spaced portions of the resulting composite plate but connected together by a refrigerant passage, thereafter slitting said composite plate so as to physically separate said portions throughout the major width of said composite plate and thereafter bending the composite plate to obtain the desired angular relationship between the various parts of the evaporator assembly said method including the step of dilating said plates following the step of roll forging so as to form refrigerant passages corresponding substantially to the pattern of said stop weld material.

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