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REFRIGERATING APPARATUS OF DISSIMILAR METALS

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2 Sheets-Sheet 1

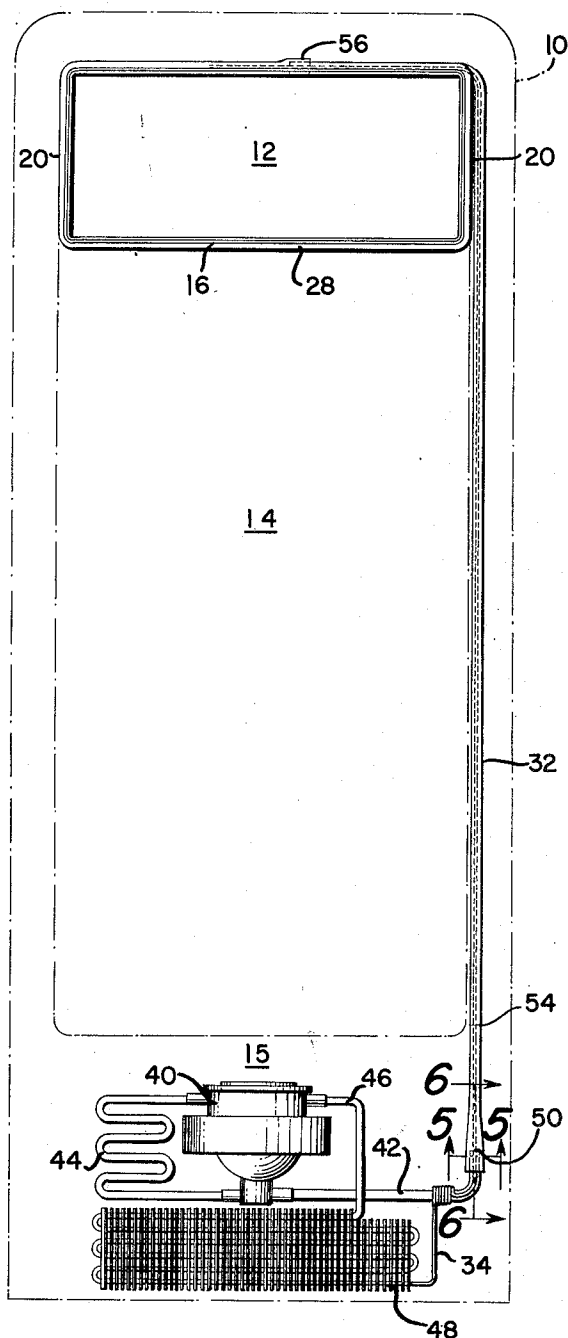
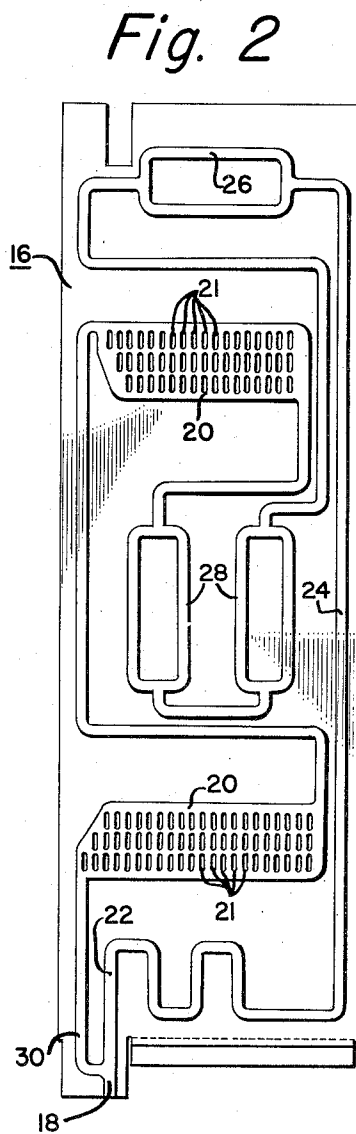


Fig. 1



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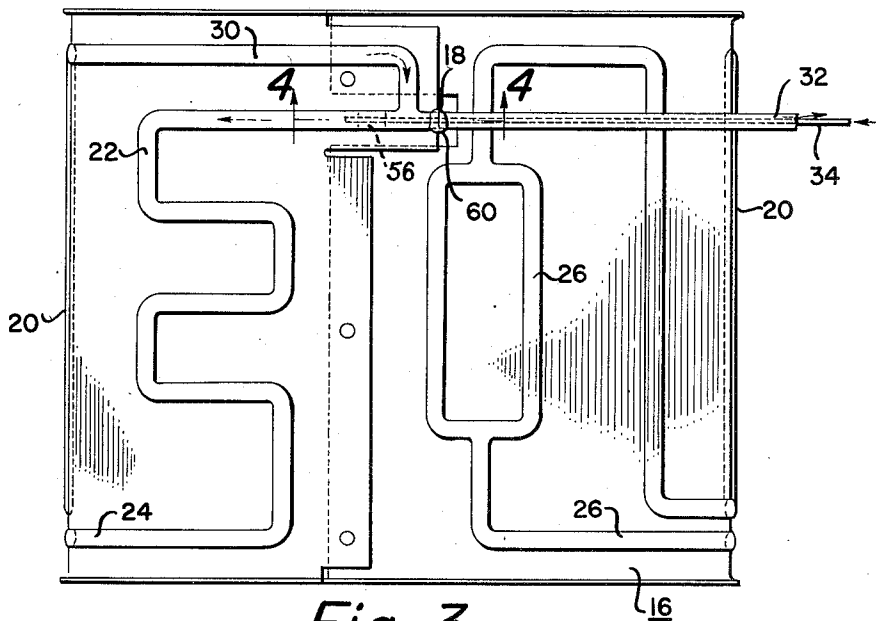


Fig. 3

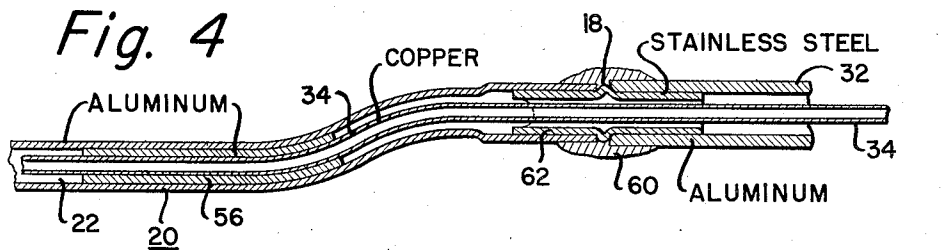


Fig. 4

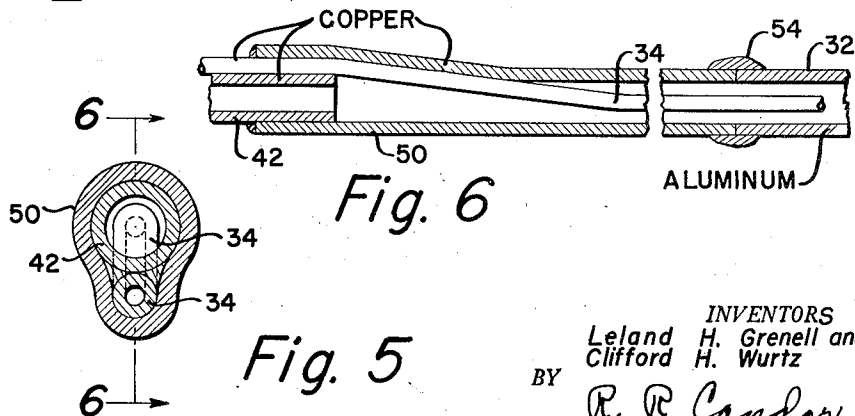


Fig. 6

Fig. 5

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REFRIGERATING APPARATUS OF DISSIMILAR METALS

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9 Claims. (Cl. 62—116)

This invention relates to a refrigerating apparatus and more particularly to a refrigerator for use in preserving foods.

It is an object of this invention to provide an improved arrangement of manufacturing a refrigerator in which some of the parts are made of aluminum and other parts are made of copper.

It is another object of this invention to reduce the cost of a refrigerator by reducing the number of joints which must be made in the refrigerant lines.

More particularly it is an object of this invention to so construct and arrange the suction and liquid lines leading to the evaporator that only one exposed joint needs to be made between the aluminum portions of the system and the copper portions of the system.

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 front elevational view largely diagrammatic showing the invention as applied to a modern home refrigerator;

Figure 2 is a developed view showing the arrangement of passages in the sheet metal evaporator;

Figure 3 is a top view of the evaporator showing the connection between the suction and liquid lines and the evaporator;

Figure 4 is a fragmentary sectional view taken substantially on line 4—4 of Figure 3 showing the manner in which the refrigerant lines are connected to the evaporator;

Figure 5 is a fragmentary sectional view taken substantially on line 5—5 of Figure 1; and,

Figure 6 is a fragmentary sectional view taken substantially on line 6—6 of Figure 1.

Referring now to Figure 1 of the drawing wherein a preferred embodiment of the invention is shown, reference numeral 10 generally designates a conventional refrigerator cabinet having a first food compartment 12 in which frozen foods are adapted to be stored and a second food storage compartment 14 in which unfrozen perishable foods are adapted to be stored. The freezing compartment 12 is formed by means of a one piece plate type evaporator 16 of the type made by the roll-forming process disclosed in our copending application Ser. No. 366,699, filed July 8, 1953, now Patent No. 2,712,736. As more fully set forth in said copending application, the evaporator passages are formed in a single sheet while the sheet is flat as shown in Figure 2 and this sheet is then bent into box-like formation as shown in Figure 1 so as to form the top, bottom and side walls of the freezing compartment. In bending the sheets into the box-like formation, the ends of the sheet come together at the top of the evaporator as best shown in Figure 3 and both the liquid and suction line connections are

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made to the plate evaporator at the point 18 in a manner to be more fully explained hereinafter.

As best shown in Figure 2, accumulator portions 20 are formed in the sheet metal evaporator so as to be located in the vertical portions of the box-shaped evaporator. Each accumulator chamber is substantially rectangular in form and has a large number of obstructions 21 formed between the inlet and outlet thereof. These obstructions are formed by welding the side walls of the accumulator together at each of the areas 21. The liquefied refrigerant first enters the serpentine passage 22 formed in the top wall of the evaporator and then flows through a passage 24 which conveys the refrigerant to the parallel refrigerant passages 26 also located in the top wall of the evaporator. The refrigerant leaving the passages 26 is then directed into two sets of parallel passages 28 formed in the bottom wall of the evaporator from whence the liquid refrigerant flows into the two accumulator sections 20 in series refrigerant flow relationship. Reference numeral 30 designates the outlet line leading from the last of the accumulators to the suction line 32.

The evaporator 16 and the major portion of the suction line 32 are preferably made of aluminum as aluminum is a very good conductor of heat and is much less expensive than copper, but the lines which are connected to the aluminum parts are most conveniently made of copper.

It has been found to be considerably more difficult and consequently more expensive to make a fluid-tight joint between a copper tube and an aluminum tube than between two copper tubes and consequently the cost of the system can be reduced by reducing the number of fluid-tight joints required between the copper and the aluminum. In the system shown, this has been done by arranging the fixed restrictor which is a copper tube within the suction line 32 in a manner to be explained more fully hereinafter.

The refrigerant liquefying apparatus comprises a conventional sealed motor-compressor unit 40 which has a short section 42 of copper tubing connected to the inlet of the compressor. This short section of copper tubing is connected to the longer section of aluminum tubing 32 which extends from the machinery compartment to the top of the aluminum evaporator 20. The compressed refrigerant leaving the compressor is first circulated through a superheat removing coil 44 and is then returned to the motor-compressor dome before being discharged through a short section of tubing 46 which leads to the usual refrigerant condenser 48. The liquid refrigerant leaving the condenser 48 enters a small capillary tube 34 which is made of copper and which conveys the liquid refrigerant into the evaporator 20.

A special adaptor 50 is provided within the machinery compartment 15 and is so constructed and arranged that it serves to direct the capillary tubing 34 from a point outside the suction line 42 to within the suction line as best shown in Figure 6. The adaptor 50 is made of copper and it is therefore relatively easy to provide a fluid-tight joint between the adaptor 50 and the line 42 at the point where the capillary tube 34 enters the suction line 32. The upper end of the copper adaptor 50 is joined to the lower end of the aluminum suction line 32 at point 54.

The joint between the upper end of the adaptor 50 and the lower end of the aluminum suction line 32 is the only fluid-tight joint required to be made between the copper and the aluminum parts, as the joint between the outlet end of the copper capillary tube 34 and the inlet passage 22 of the aluminum evaporator need not necessarily be a fluid-tight joint as the pressure difference

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between opposite sides of the joint is negligible and any leakage which might take place would not be to the outside atmosphere.

As best shown in Figures 3 and 4, the capillary tube 34 projects into the inlet refrigerant passage 22 of the evaporator a distance great enough to accommodate a tubular plug or sleeve element 56 beyond the point where the outlet passage 30 connects to the suction line 32. The sleeve 56 has an internal diameter large enough to receive the capillary tube 34 and an external diameter just large enough to allow the sleeve to be introduced into the refrigerant passage 22. Since the difference in pressure at the opposite ends of the sleeve 56 is negligible there is little tendency for either liquid refrigerant or refrigerant vapor to leak past the sleeve. Any clearance which may initially exist between the sleeve and the associated tubing may be eliminated by applying pressure to the outer surface of the tubing 22 at the point where the sleeve 56 is located or the clearance between the sleeve and the adjacent sections of tubing may be eliminated by arc welding the sleeve to the tubing. The joint 60 between the upper end of the aluminum suction line 32 and the evaporator 20 is preferably formed in the manner shown in Figure 4. In making this latter joint a stainless steel insert 62 is preferably used as shown for preventing distortion of the aluminum adjacent the joint during the process of welding the joint.

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 refrigerating system, an aluminum evaporator having a refrigerant passage formed therein; a compressor having an inlet and an outlet; a condenser; refrigerant flow connections between said compressor, condenser and evaporator; said refrigerant flow connections comprising a copper liquid line having its one end connected to the outlet of said condenser and having its other end projecting into the interior of said refrigerant passage formed in said evaporator; a suction line having an aluminum portion connected to the outlet of said passage a first copper portion connected to the inlet of said compressor, and a second copper portion comprising an adaptor connecting said first copper portion to said aluminum portion; said copper liquid line entering said suction line at the connection between said first and second copper portions and extending through the interior of said second copper portion and said aluminum portion.

2. In a refrigerating system, an aluminum evaporator having a refrigerant passage formed therein; a compressor having an inlet and an outlet; a condenser; refrigerant flow connections between said compressor, condenser and evaporator; said refrigerant flow connections comprising a copper capillary tube liquid line having its one end connected to the outlet of said condenser and having its other end projecting into the interior of said refrigerant passage formed in said evaporator; a suction line having an aluminum portion connected to the outlet of said passage and a copper portion including a first section connected to the inlet of said compressor, and a second section comprising an adaptor connecting said first copper section to said aluminum portion; said copper liquid line entering said suction line at the point of connection between said first and second copper sections and extending through the interior of said second copper section and said aluminum portion; and a sleeve surrounding said liquid line at the point where said liquid line projects into the refrigerant passage of said evaporator and serving to seal the inlet of said evaporator passage from the outlet of said evaporator passage.

3. In a refrigerating system, an aluminum evaporator having a passage segment formed therein communicating with both the inlet and outlet of said evaporator, a compressor, a condenser, refrigerant flow connections be-

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tween said compressor, condenser and evaporator, said refrigerant flow connections comprising a copper liquid line having its one end projecting through said passage segment into the inlet of said evaporator, a suction line having an aluminum portion connected at its one end to said passage segment, a copper adaptor having a first end connected to the other end of said aluminum suction line, said adaptor having a copper suction line projecting into the second end of said adaptor, said copper liquid line entering said adaptor at said second end, said copper suction line being connected to said compressor and said copper liquid line being connected to said condenser, and a sleeve surrounding said liquid line at the point where said liquid line enters the inlet of said evaporator and serving to seal the inlet of said evaporator from the outlet of said evaporator, said insert comprising an aluminum sleeve.

4. In a refrigerator, a cabinet having a food storage compartment therein, an evaporator in said compartment, refrigerant liquefying means for supplying liquid refrigerant to said evaporator and for withdrawing vaporized refrigerant from said evaporator, said evaporator having a refrigerant passage formed therein, said passage having an inlet end and an outlet end merging into a common passage, refrigerant flow means connecting said evaporator in refrigerant flow relationship with said refrigerant liquefying apparatus and including an inlet tube member extending into said inlet end of said refrigerant passage for delivering liquid refrigerant into said refrigerant passage, said refrigerant flow means including an outlet tube member surrounding said inlet tube member and connected to the outlet end of said common passage for withdrawing refrigerant vapor from said refrigerant passage, and means adjacent the entrance of said inlet end of said passage for blocking the flow of refrigerant between the outer wall of said inlet tube and the inner wall of said refrigerant passage.

5. In a refrigerator, a cabinet having a food storage compartment therein, an evaporator in said compartment, refrigerant liquefying means for supplying liquid refrigerant to said evaporator and for withdrawing vaporized refrigerant from said evaporator, said evaporator having a refrigerant passage formed therein, said passage having an inlet end and an outlet end merging into a common passage, refrigerant flow means connecting said evaporator in refrigerant flow relationship with said refrigerant liquefying apparatus and including an inlet tube member extending into said inlet end of said refrigerant passage for delivering liquid refrigerant into said refrigerant passage, said refrigerant flow means including an outlet tube member surrounding said inlet tube member and connected to the outlet end of said common passage for withdrawing refrigerant vapor from said refrigerant passage, and means adjacent the entrance of said inlet end of said passage for blocking the flow of refrigerant between the outer wall of said inlet tube and the inner wall of said refrigerant passage, said last named means comprising a sleeve surrounding said inlet tube and filling the space between said inlet tube and the inner wall of said refrigerant passage.

6. In a refrigerator, a cabinet having a food storage compartment therein, an evaporator in said compartment, refrigerant liquefying means for supplying liquid refrigerant to said evaporator and for withdrawing vaporized refrigerant from said evaporator, said evaporator having a refrigerant passage formed therein, said passage having an inlet end and an outlet end merging into a common passage, refrigerant flow means connecting said evaporator in refrigerant flow relationship with said refrigerant liquefying apparatus and including an inlet tube member extending into said inlet end of said refrigerant passage for delivering liquid refrigerant into said refrigerant passage, said refrigerant flow means including an outlet tube member surrounding said inlet tube member and connected to the outlet end of said common passage for

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withdrawing refrigerant vapor from said refrigerant passage, and means adjacent the entrance of said inlet end of said passage for blocking the flow of refrigerant between the outer wall of said inlet tube and the inner wall of said refrigerant passage, said last named means comprising a sleeve surrounding said inlet tube and filling the space between said inlet tube and the inner wall of said refrigerant passage, said inlet tube being insertable into and slidable within said sleeve.

7. In a refrigerating system, an aluminum evaporator having a passage for refrigerant therein, a compressor, a condenser, refrigerant flow connections between said compressor, condenser and evaporator, said refrigerant flow connections comprising a suction line having an aluminum portion connected to said aluminum evaporator in communication with said refrigerant passage and a copper liquid feed line disposed within said aluminum portion for supplying liquid refrigerant into said evaporator, means for preventing liquid refrigerant entering said evaporator through said liquid line from entering said suction line without first flowing through said evaporator passage, said suction line having a copper portion connected to one end of said aluminum portion and forming an adaptor through which said liquid feed line enters the suction line.

8. In a refrigerating system; an evaporator having a refrigerant passage provided with an inlet end, an outlet end and a common entrance means communicating with said inlet end and said outlet end; refrigerant liquefying apparatus for supplying liquid refrigerant to said inlet end of said passage and for withdrawing vaporized refrigerant from said outlet end; refrigerant flow connections between said evaporator and said refrigerant liquefying means; said connections including a liquid line having a portion slidably passing through said common entrance means and extending into said inlet end of said passage and a suction line surrounding a portion of said liquid line and connected to said common entrance

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means, and means on said liquid line adjacent the inlet end of said refrigerant passage for blocking the flow of refrigerant between the outer surface of said liquid line and the inner surface of said inlet end of said refrigerant passage.

9. In a refrigerating system; a plate type evaporator having a refrigerant passage formed between two plates and provided with an inlet end, an outlet end and a common entrance means, said entrance means extending to one edge of said plate type evaporator and communicating with said inlet end and said outlet end; refrigerant liquefying apparatus for supplying liquid refrigerant to said inlet end of said passage and for withdrawing vaporized refrigerant from said outlet end; refrigerant flow connections between said evaporator and said refrigerant liquefying means; said connections including a liquid line having a portion slidably passing through said common entrance means and extending into said inlet end of said passage and a suction line surrounding a portion of said liquid line and having its one end welded to the edge of said plate type evaporator in alignment with said common entrance means, and means on said liquid line adjacent the inlet end of said refrigerant passage for blocking the flow of refrigerant between the outer surface of said liquid line and the inner surface of said inlet end of said refrigerant passage.

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