July 12, 1955 C. H. WURTZ ET AL 2,712,736

REFRIGERATION EVAPORATOR

Filed July 8, 1953

3 Sheets-Sheet 1

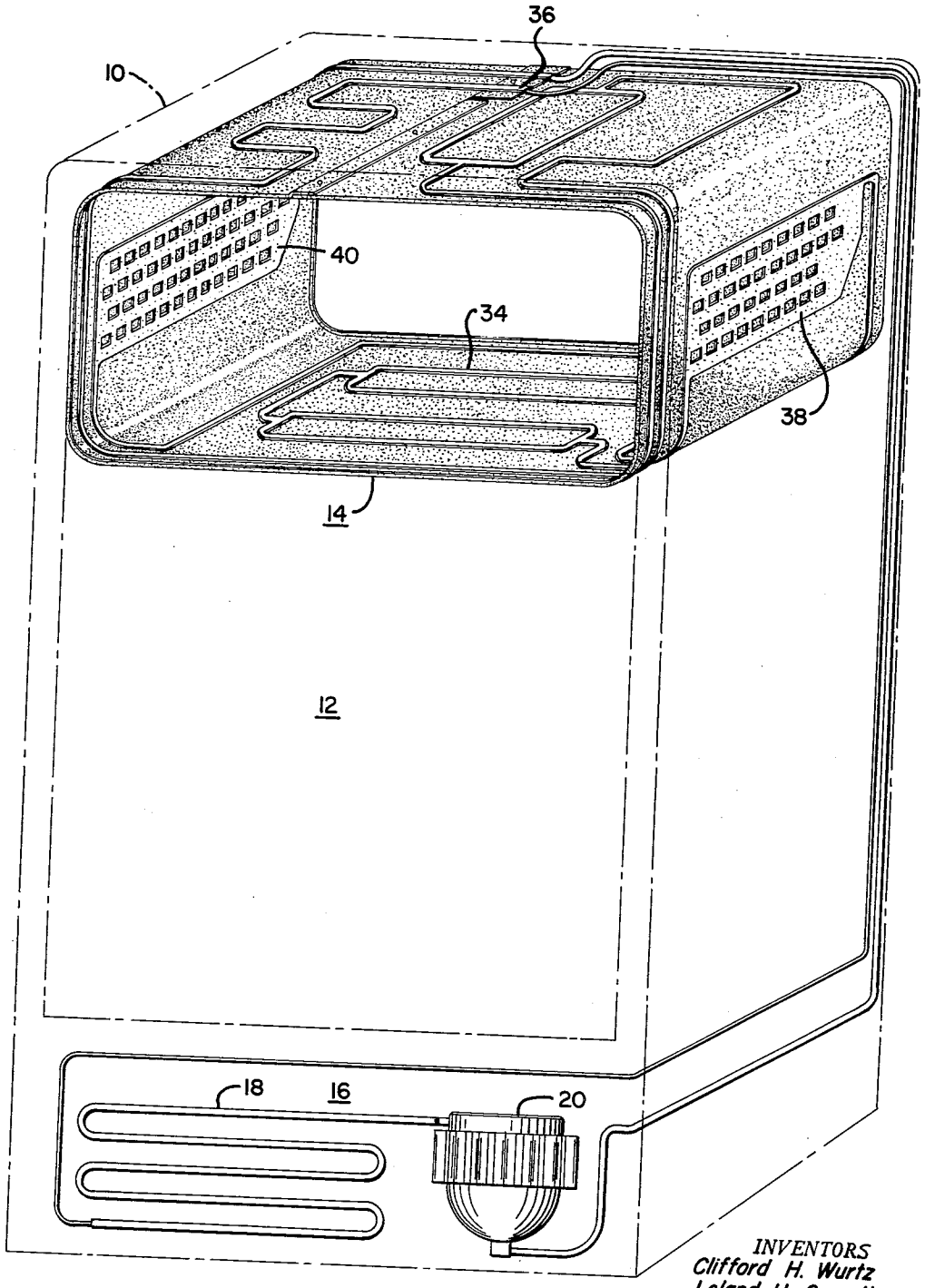


Fig. 1

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3 Sheets-Sheet 2

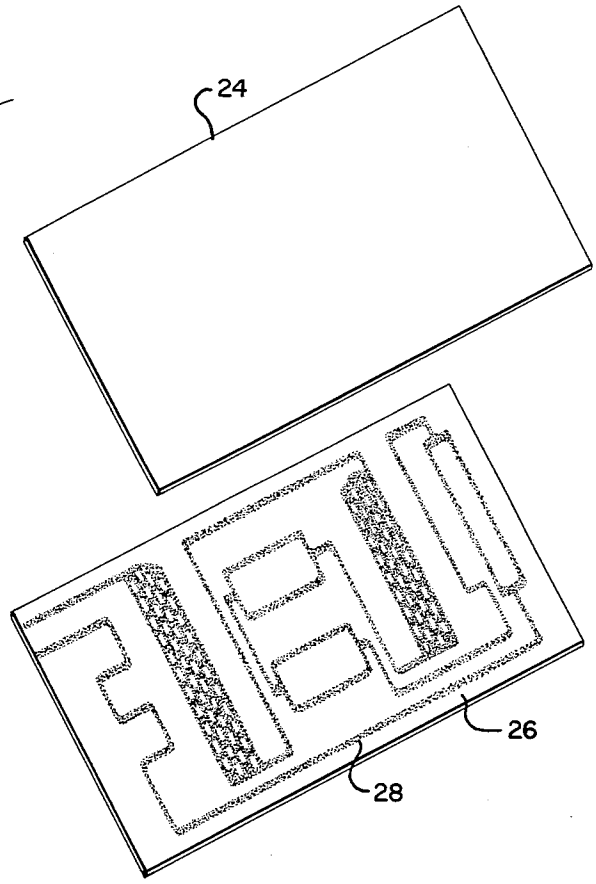


Fig. 2

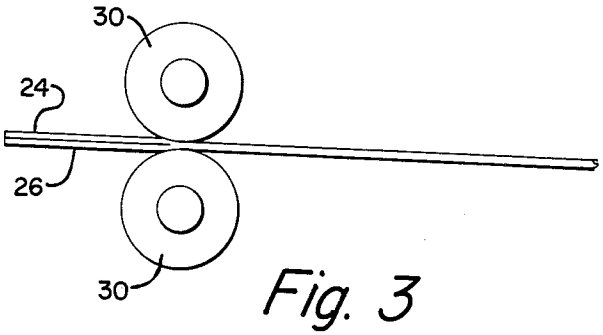


Fig. 3

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3 Sheets-Sheet 3

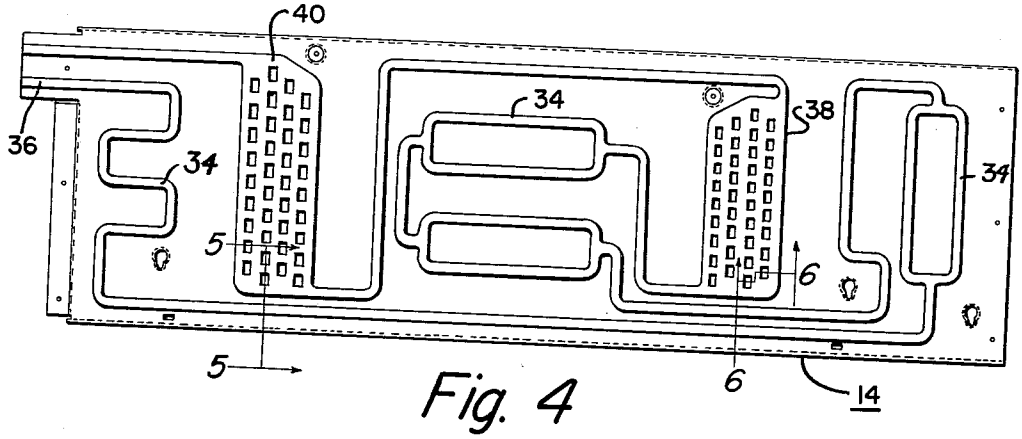


Fig. 4

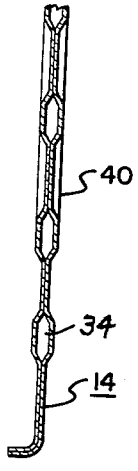


Fig. 5

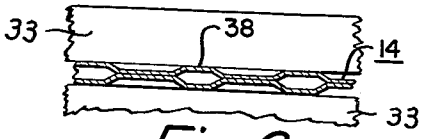


Fig. 6

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REFRIGERATION EVAPORATOR

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Application July 8, 1953, Serial No. 366,699

2 Claims. (Cl. 62—126)

This invention relates to refrigerating apparatus and more particularly to a combination evaporator and accumulator and its method of manufacture.

It is an object of this invention to provide an improved method and apparatus for disengaging liquid refrigerant from refrigerant vapors and for accumulating the disengaged liquid in a roll-forged plate type evaporator.

The advantages of manufacturing evaporators by the roll-forging process have long been recognized but a number of problems presented themselves when it came to manufacturing roll-forged evaporators requiring accumulators or so-called header or boiler sections. The present known processes for manufacturing roll-forged evaporators make it impossible to conveniently form chambers of any appreciable size in the main body of a roll-forged evaporator. One of the reasons for this is that the pressures required to dilate the internal passages in the roll-forged evaporator are so great that it would be difficult, if not impossible, from a practical standpoint to dilate the larger passages without rupturing the walls thereof or unduly distorting the metal adjacent the larger passages. It is now present practice to confine the plate type evaporator between two flat plates during the dilation process and to thus limit the distance which the plates are separated. This practice results in the formation of flat walled refrigerant passages. If a flat walled accumulator of any appreciable size were to be formed in an evaporator by conventional methods, the refrigerant pressures generated within the system would be sufficiently great to cause the flat walls to bulge outwardly in use and thereby distort the evaporator. It is an object of this invention to form a flat walled accumulator capable of withstanding high pressures without any distortion.

Another object of this invention is to make it possible to form an accumulator as an integral part of a roll-forged evaporator.

Another object of this invention is to make an accumulator which occupies a minimum amount of valuable space.

Still another object of this invention is to provide an improved accumulator and disengaging chamber in a roll-forged evaporator which may be formed simultaneously with the formation of the usual refrigerant passages.

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 partly schematic showing the invention applied to a refrigerator;

Figure 2 is a perspective view showing the sheets used in manufacturing the combined evaporator and accumulator;

Figure 3 is a fragmentary side elevational view showing the plate type evaporator and accumulator in the process of construction;

Figure 4 is a plan view of the evaporator and accumulator after the passages have been dilated but before the plate has been bent into the form shown in Figure 1;

Figure 5 is a fragmentary sectional view taken substantially on line 5—5 of Figure 4; and,

Figure 6 is a fragmentary sectional view taken substantially on line 6—6 of Figure 4 but adding the heavy backing plates used in the process of dilating the refrigerant passages.

Referring now to the drawing wherein a preferred embodiment of the invention has been shown, reference numeral 10 generally designates a conventional refrigerated cabinet having a food storage compartment 12 in which an evaporator 14 constructed in accordance with my invention is mounted. The cabinet includes the usual refrigerant liquefying compartment 16 in which a condenser 18 and a sealed motor-compressor unit 20 are mounted. For purposes of illustrating the invention, the evaporator 14 has been shown mounted in the upper portion of the food compartment in accordance with common practice.

The evaporator is made by the roll-forging method disclosed in Long application Ser. No. 151,591, filed March 24, 1950, now Patent No. 2,662,273 and Simmons application Ser. No. 289,729, filed May 24, 1952.

As best shown in Figure 2, a pair of metal plates 24 and 26 are first superimposed upon one another with a stop-weld material 28 applied to the face of one of the plates in a predetermined pattern. The plates preferably have an original thickness of .08" and are adapted to be roll-forged together by passing the plates between a pair of heated pressure rollers 30 so as to reduce the thickness of the plates and to forge the contacting surfaces of the plates together at all points except where the plates have been precoated by the stop-weld material. The stop-weld material used in the manufacture of the plates preferably consists of a water suspension of colloidal graphite, ground oyster shells, and sodium silicate. The roll-forging operation greatly elongates the sheets but does not materially widen the sheets so the pattern of the stop-weld material applied to the one sheet must be foreshortened accordingly as shown in Figure 2. After the plates have been roll-forged together the internal passages of the plates are dilated by subjecting the same to a fluid pressure while the plates are confined between two flat dies 33 in the manner fully explained in said Long and Simmons applications. When the composite plate comes out from between the rollers and while it is being dilated, it is in the flat shape whereas in its final form it is bent into the shape shown in Figure 1 of the drawing. The edges and ends of the sheet are trimmed and suitable mounting holes are punched after the roll-forging operation.

As best shown in Figures 2 and 4 of the drawing, the pattern of the stop-weld material is such that tortuous refrigerant passages 34 are formed in the plate and these passages serve as the main refrigerant passages of the evaporator. The liquid refrigerant is fed into the passages 34 through the inlet line 36. At least some of the refrigerant vaporizes in the passages 34 whereby a mixture of liquid and vapor is fed into an accumulator formation 38 in one side wall of the evaporator. A corresponding accumulator section 40 is provided in the opposite side wall of the evaporator and is connected in series with the section 38.

It will be noted that each accumulator section is in effect a large flat chamber wherein a plurality of spaced welded connections are provided between the opposite side walls which make it possible to subject the accumulator to high internal pressures without danger of

rupturing or distorting the flat side walls of the accumulator. The largest unsupported surface of the accumulator is not great enough to be distorted by the highest pressures encountered in a refrigerant evaporator.

Each of these accumulators is capable of storing an appreciable quantity of liquid refrigerant therein and by virtue of the arrangement of the inlet and outlet to each of the accumulators as well as the arrangement of the multiplicity of obstructions to the flow of refrigerant from the inlet of each accumulator to the outlet of the accumulator it serves as an effective means for disengaging the refrigerant vapor from the liquid refrigerant after the mixture of refrigerant and vapor enters the accumulator.

By virtue of the fact that the accumulator sections are formed in the vertical portions of the evaporator and by virtue of the fact that the incoming mixture of vapor and liquid refrigerant enters each accumulator adjacent the bottom thereof and is required to follow a tortuous path before leaving the upper portion of the accumulator it is obvious that the accumulator also serves very effectively to prevent slugs of liquid refrigerant from being carried along with bubbles of refrigerant vapor passing upwardly through the liquid refrigerant in the accumulator.

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, a roll-forged evaporator having a refrigerant passage formed therein, one portion of said refrigerant passage having an enlargement therein adjacent the outlet thereof arranged in a vertical plane and serving as an accumulator chamber, said enlargement having relatively flat substantially parallel side walls spaced a distance substantially corresponding to the distance between the walls of said passage, said side walls being forge-welded together at a plurality of spaced points so as to prevent bulging of said walls when subjected to high internal pressures.

2. In a refrigerant system, a roll forged evaporator having a refrigerant passage formed therein, one portion of said refrigerant passage adjacent the outlet thereof having an enlargement therein arranged in a vertical plane and serving as an accumulator chamber, said enlargement having side walls spaced a distance substantially corresponding to the distance between the walls of said passage, said side walls being forge-welded together at a plurality of space points so as to prevent bulging of said side walls when subjected to high internal pressures, said enlargement having a vertical extent and a horizontal extent several times as great as the distance between the walls of said enlargement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,985,931	Kucher	Jan. 1, 1935
2,085,191	Hastings	June 29, 1937
2,156,544	Raskin	May 2, 1939
2,481,512	Hubbell	Sept. 13, 1949
2,496,558	Philipp	Feb. 7, 1950