

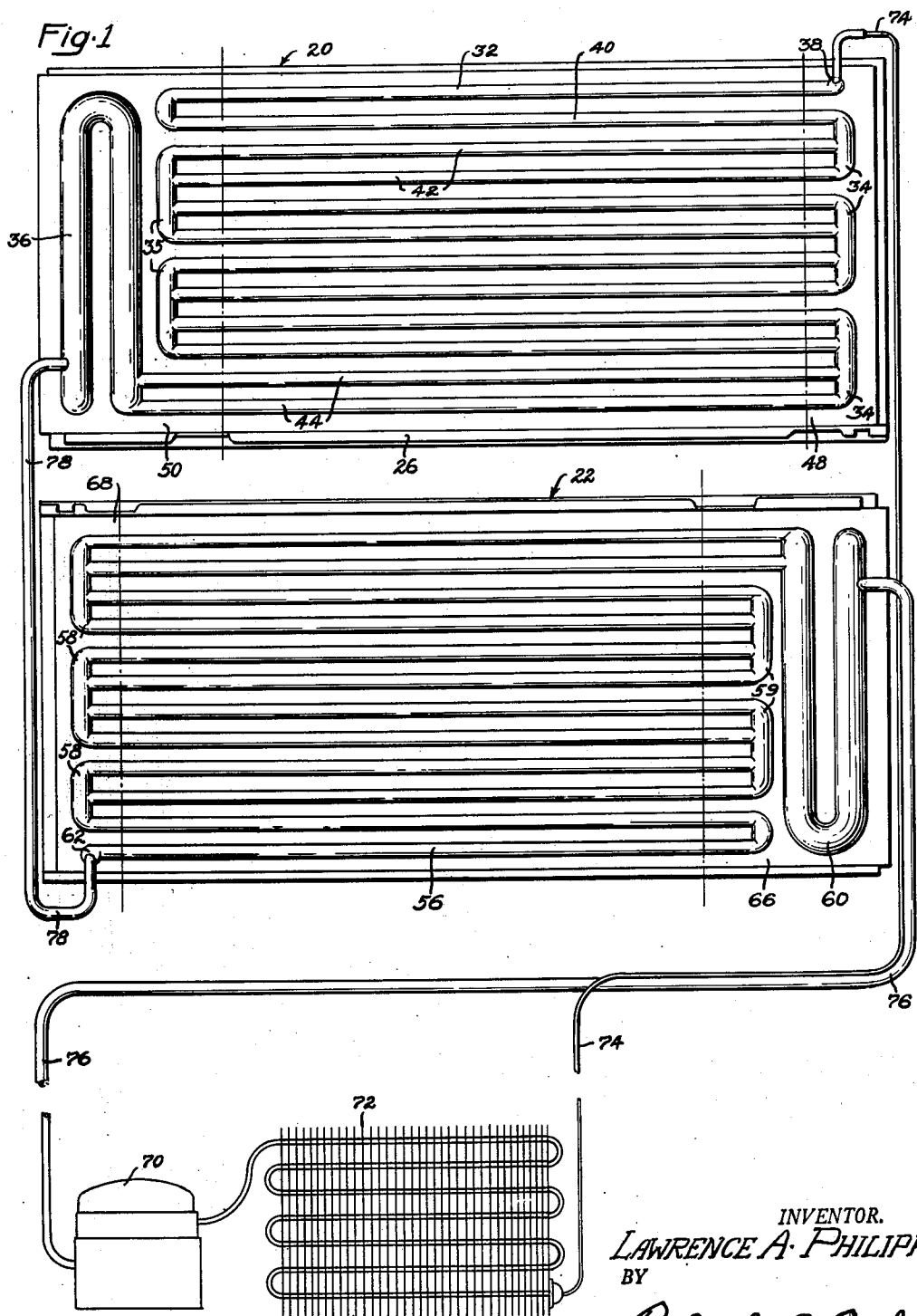
Dec. 2, 1952

L. A. PHILIPP
REFRIGERANT EVAPORATOR

2,619,811

Filed May 2, 1950

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig 2

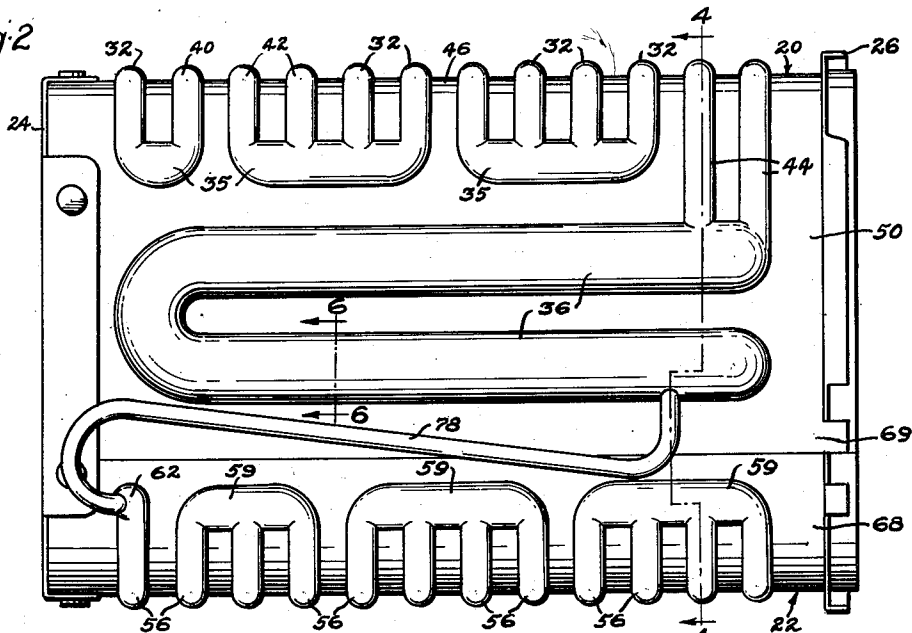
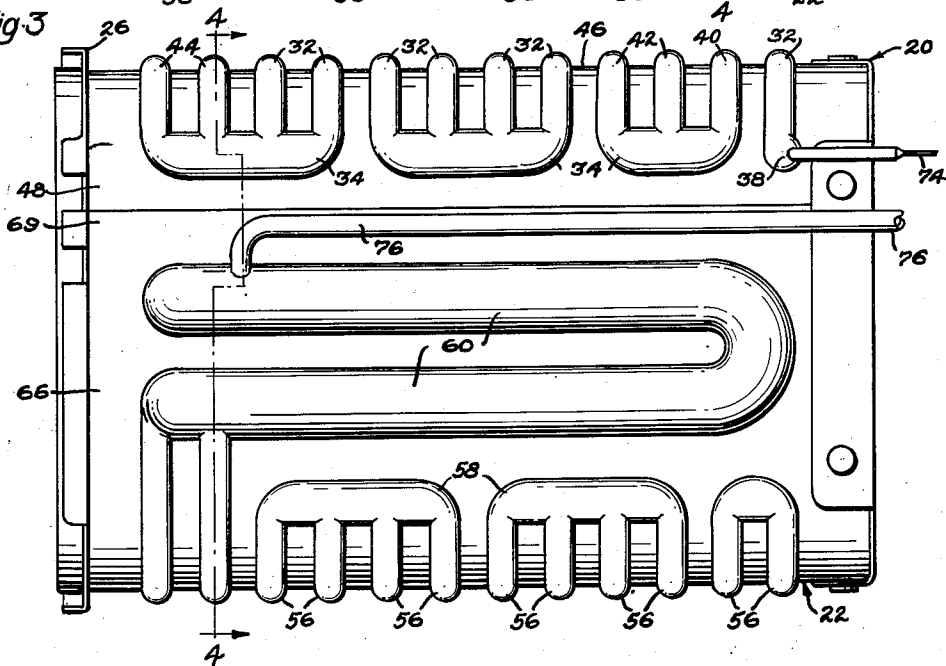


Fig 3



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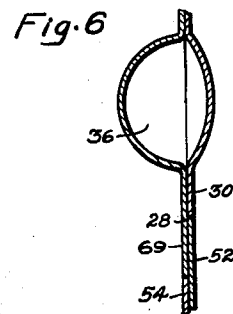
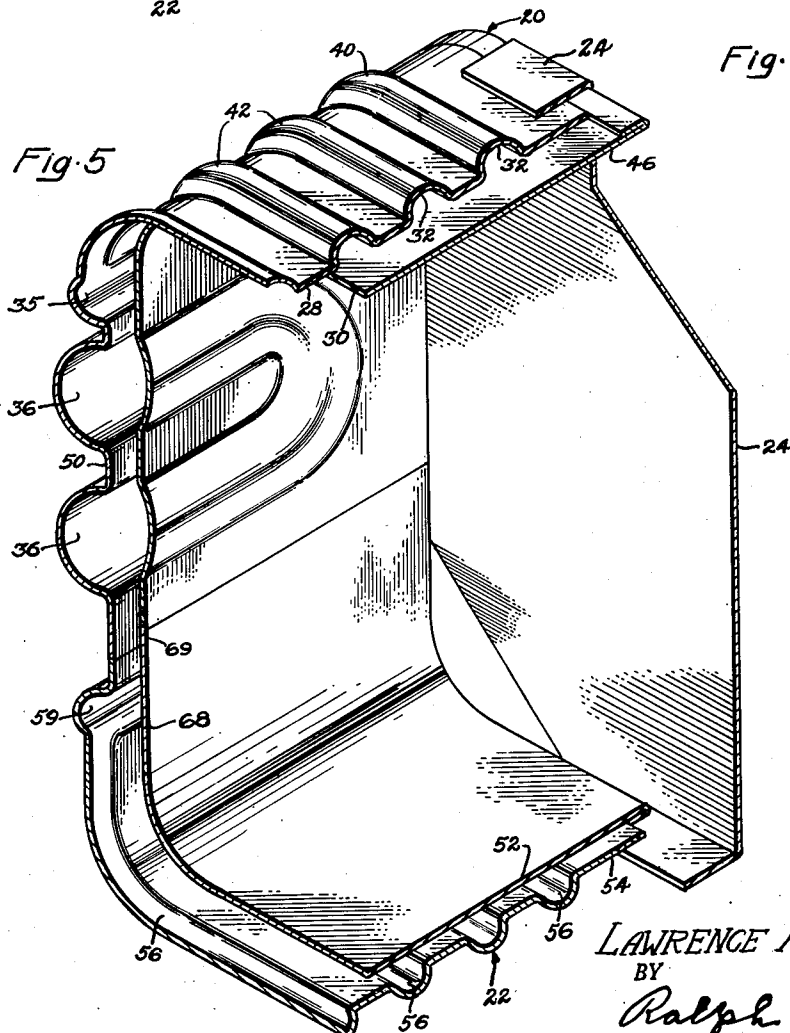
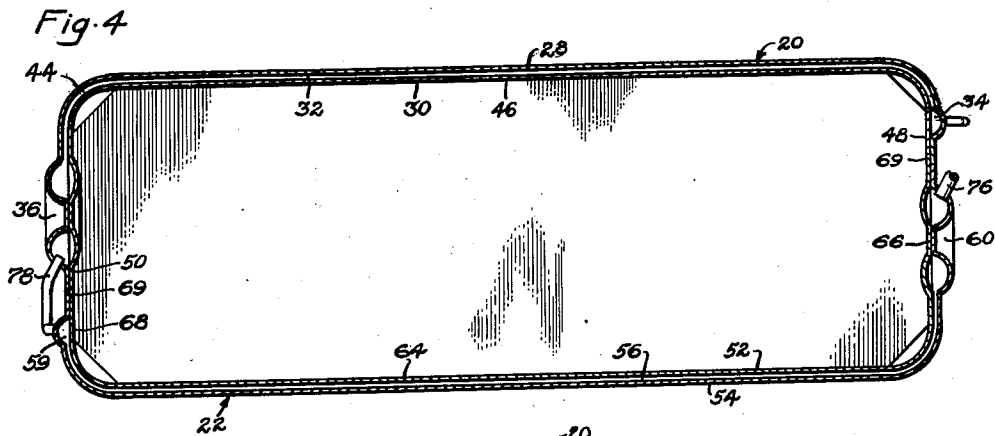
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UNITED STATES PATENT OFFICE

2,619,811

REFRIGERANT EVAPORATOR

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Application May 2, 1950, Serial No. 159,507

5 Claims. (Cl. 62—126)

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This invention relates generally to refrigerating apparatus and particularly to refrigerant evaporators therefor.

One of the objects of the present invention is to provide an improved refrigerant evaporator, including a container and a refrigerant passage on walls of the container arranged to obtain substantially equal distribution of refrigerant over the container wall surfaces.

Another object of the invention is to provide a direct expansion, refrigerant evaporator having an improved arrangement of refrigerant passages to effect a decrease in pressure drop of refrigerant between the inlet and the outlet of the evaporator.

Another object of the invention resides in the arrangement and location of a plurality of refrigerant manifolds in a series, refrigerant circuit to increase efficiency of refrigerant evaporators.

Another object of the invention is to provide in a refrigerant evaporator, relatively small and large capacity refrigerant manifolds to effect directional flow control of the refrigerant with accompanying increase in refrigerator efficiency.

Another object of the invention resides in the provision of a container of two similar, refrigerant evaporator sections and in the arrangement of a refrigerant passage including a plurality of relatively small capacity manifolds and relatively large capacity manifolds on the container sections.

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 invention is clearly shown.

In the drawings:

Fig. 1 is the view shown in flat of my refrigerant evaporator together with units of a refrigerating system shown diagrammatically;

Fig. 2 is a view of one end of the evaporator;

Fig. 3 is a view of the other end of the evaporator;

Fig. 4 is a vertical sectional view of the evaporator, taken along the line 4—4 of either Fig. 2 or Fig. 3;

Fig. 5 is an isometric view of the evaporator; and

Fig. 6 is an enlarged, fragmentary section view of the evaporator, taken along the line 6—6 of Fig. 2.

Referring to the drawings by characters of reference, my refrigerant evaporator is of sectional construction comprising, an upper section

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20, a lower section 22, and a rear section or rear wall 24. These sections 20, 22 and 24 may be made of any suitable sheet material, such as stainless sheet steel and may be welded or be otherwise suitably secured together. The sections 20, 22 and 24 cooperate in forming a box-like container of general rectangular shape in cross section having a front access opening which may be closed by a door (not shown). Around the access opening, a retainer 26 may be provided for a gasket (not shown) for sealing engagement by the door.

The upper evaporator section 20 is made of a pair of super-imposed flat metal sheets 28, 30 of rectangular shape, formed or embossed to provide a refrigerant passage 32, a plurality of relatively small manifolds 34, a second plurality of relatively small manifolds 35, and a relatively large manifold or header 36. The sheets 28, 30 of the evaporator upper section 20 may be welded or be otherwise suitably secured together flat in a suitable manner such that the joints between the sheets at the passages and at the manifolds 34, 35 are fluid tight or leakproof.

Adjacent one corner of the secured together sheets 28, 30, the refrigerant passage 32 is provided with a refrigerant inlet 38, and from this inlet, the refrigerant passage 32 extends longitudinally of the rectangular sheets following a circuitous or sinuous path in a manner to provide parallel runs between and spaced crosswise of the sheets. The second of these runs from the inlet 38, as at 40, leads into the first of the relatively small manifolds 34 from which two runs, as at 42, lead into the next of the relatively small manifolds 35 and thereafter pairs of runs lead into and other pairs of runs lead out of successive manifolds 34, 35 on across the sheets until toward the end of the passage 32 two parallel runs, as at 44, of the sinuous passage connect communicatively to one end of the relatively large refrigerant manifold 36. The sheets 28, 30 are bent transversely along the dot and dash bend lines indicated in Fig. 1, to form the upper evaporator section 20. This section has a top wall 46, a relatively short end wall portion 48, and a relatively long, opposite end wall portion 50. As shown, the bend lines are inwardly of the relatively small manifolds 34, 35 or so that these manifolds locate in the end wall portions 48, 50 of the evaporator section. Also in the relatively long end wall portion 50 of the container is the relatively large manifold 36 which I locate immediately below the relatively small manifolds 35. The manifolds 34, 35 are each of a flow capacity

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intermediate the flow capacities of the parallel runs and of the manifold 36. I have found that the provision of the relatively small manifolds 34, 35 arranged as above described, function to control directional flow of the refrigerant through the passage runs. That is, the relatively small manifolds 34, 35 induce the refrigerant to flow from the inlet 38 to the relatively large manifold 36 without deviation or without flowing in the wrong or unintended direction in some of the runs. Also, the manifolds 34, 35 allow or provide for some direct expansion of the refrigerant and I have further found that the presence of these manifolds decreases the pressure drop between the inlet 38 and the relatively large manifold 36. This reduction in pressure drop is due to the fact that the refrigerant is divided by and at the manifolds 34 and travels only half as far from the inlet 38 to the outlet or manifold 36 as it would travel if the manifolds 34 were omitted or if, a single path passage only were employed. The inlet 38 to the passage 32 or to the first of the sinuous passage runs is located together with a number of the manifolds 34 on the relatively short end wall portion 48, and the other of the manifolds 35 together with the larger capacity manifold 26 is located on the relatively long end wall portion 50 of the evaporator upper section.

Similar to the upper evaporator section 20, the lower section 22 is formed of two super-imposed, flat metal sheets 52, 54 which are formed or embossed to provide an evaporator section having a sinuous refrigerant passage 56, a plurality of relatively small refrigerant manifolds 58, a second plurality of relatively small manifolds 59 and a relatively large manifold or refrigerant accumulator 60. The sheets 52, 54 may be welded or be otherwise secured together in any suitable manner to seal the joints between the sheets at the passage 56 and at the manifolds 58, 59, and 60.

Adjacent one corner of the rectangular, secured together sheets 52, 54 is a refrigerant inlet 62 to the sinuous passage 56. From this inlet 62, the refrigerant passage 56 extends longitudinally of the sheets 52, 54, in sinuous fashion to provide a plurality of runs spaced apart substantially from front to rear of the evaporator section 22. At their ends, groups of adjacent runs connect communicatively and respectively with the relatively small manifolds 58 and 59 in the same manner that adjacent, parallel runs of the upper evaporator section are connected to their manifolds 34, 35. When the sheets 52, 54 are bent along the dot and dash bend lines shown in Fig. 1 the sheets are formed to provide a bottom wall 64, a relatively long end wall portion 66, and a relatively short end wall portion 68 of the evaporator lower section 22. The inlet 62, and relatively small capacity manifolds 58 are located on the relatively short end wall portion whereas the other relatively small manifolds 59 and the relatively large manifold or refrigerant accumulator 60 are located on the opposite and relatively long end wall portion 66, above the manifolds 59. The evaporator upper section 20 and lower section 22 are fitted together in a manner such that the long wall portions of one section mate with the short wall portion of the other section to form the end walls of the box-like evaporator. Preferably, the adjacent edges of the section forming sheets are offset, as at 69, to provide a lap joint where the sections may be seam welded with the outer sheets flush.

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From the outlet of the condenser 72, a small diameter or capillary tube 74 delivers refrigerant to the inlet 38 of the evaporator upper section and a return line 76 returns gaseous refrigerant taken from the top of the accumulator 60 to the motor-compressor unit 70.

Refrigerant entering the evaporator 38 passes through the passage 32, the refrigerant being divided by and at the first of the small manifolds 36 to proceed through a pair of the passage runs and thereafter pass through parallel pairs of the runs until the refrigerant enters the first of the large manifolds or header 36. From the large manifold 36, the refrigerant proceeds through the conduit 78 to the inlet 62 of the passage in the evaporator lower section 22 whence the refrigerant passes through the lower evaporator section passage 56 in much the same manner it traversed the upper evaporator section 20. That is, the refrigerant entering the inlet 62 flows through two single runs of the passage 56 and then enters the first of the small manifolds 58 where the refrigerant is divided and some expansion of the refrigerant takes place. Thereafter, the refrigerant flows alternately to opposite end manifolds 58, 59 through pairs of parallel runs of the passage 56 until the refrigerant enters the large accumulator 60 where the gaseous refrigerant is drawn off by the motor-compressor unit 70. It will be seen that by my arrangement of refrigerant passages and manifolds, the refrigerant is divided at the small manifolds and passes through the communicating parallel passages whereby the distance of travel of the refrigerant is reduced about one half with accompanying decrease in pressure drop.

From the foregoing description, it will be noted that I have provided an improved refrigerant evaporator including relatively large and small manifolds which function to effect a general increase in refrigeration efficiency. It will also be noted that I have provided an improved refrigerant evaporator in its construction of two like sections having mating, long and short end wall portions wherein refrigerant manifolds are located for controlling direction of flow of the refrigerant through the top and bottom wall refrigerant passages. In addition, it will be noted that by reason of the sectional construction of my evaporator, the sections may be used singly or they may be used together and that by making the sections alike a material savings in cost of manufacture is effected.

Although only a preferred form of the invention has been illustrated, and that form described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A refrigerant evaporator comprising, a container having top, bottom and end walls, a plurality of spaced parallel runs of a refrigerant passage on said top wall, said runs extending part-way down said end walls and having connecting loops thereon, an inlet and an outlet for said refrigerant passage, a plurality of spaced parallel runs of a refrigerant passage on said bottom wall, the runs of said second passage extending part-way up said end walls having loop portions thereon in vertical spaced relationship to said first loop portions, an inlet and an outlet for said second refrigerant passage, a re-

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frigerant manifold on said one end wall between said loop portions having an inlet connected to the outlet of said first passage, an outlet for said manifold connected to the inlet of said second refrigerant passage, and a refrigerant accumulator on the other of said end walls between the loop portions thereon and connected to the outlet of said second refrigerant passage.

2. A refrigerant evaporator comprising, a top wall having a refrigerant passage, an inlet and an outlet for said passage, opposite end walls each having a plurality of relatively small capacity refrigerant manifolds in communication with said passage intermediate the passage inlet and outlet, a relatively large manifold on one of said end walls connected in communication with the passage outlet, a bottom wall having a refrigerant passage connected in communication with said manifold, an outlet for said second passage, and a relatively large manifold on the other of said end walls communicatively connected to the outlet of said second refrigerant passage.

3. A refrigerant evaporator comprising, a pair of similar sections cooperating to form a container having top, bottom and end walls, one of said sections forming the top wall and having a relatively short end wall portion and a relatively long opposite end wall portion, the other of said sections forming the bottom wall and having a relatively long end wall portion and a relatively short end wall portion reversely arranged with respect to the relatively long and short end wall portions of said one section, a refrigerant passage on said top wall, a refrigerant passage on said bottom wall, a refrigerant manifold on one of said long end wall portions communicatively connecting said passages in series, and a refrigerant accumulator on the other of said relatively long end wall portions communicatively connected to the refrigerant passage on said bottom wall.

4. A refrigerant evaporator comprising, a plurality of spaced parallel runs of a refrigerant passage extending principally in a horizontal plane and having shorter portions extending downwardly in oppositely spaced vertical planes, a plurality of horizontally spaced manifolds in each of said vertical planes connected to said passage runs in the vertical planes, an inlet and an outlet for said passage, a second plurality of spaced parallel runs of a refrigerant passage, an inlet and an outlet for said second passage, said second

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plurality of runs being disposed principally in a horizontal plane spaced from and parallel to the plane of said first parallel runs and having shorter portions extending upwardly respectively in said vertical planes, a second plurality of horizontally spaced manifolds in each of said vertical planes connected to said second passage, a refrigerant manifold in one of said vertical planes between said first and second pluralities of manifolds therein having an inlet connected to the outlet of said first passage, an outlet for said manifold connected to the inlet of said second passage, and a refrigerant accumulator in the other of said vertical planes between said first and second pluralities of said manifolds therein and connected to the outlet of said second passage.

5. A refrigerant evaporator comprising, heat conducting wall means including top, bottom and end walls, a refrigerant passage having a plurality of parallel runs on said top wall extending longitudinally between said end walls, an inlet and an outlet for said passage, a plurality of relatively small capacity refrigerant manifolds on each of said end walls adjacent said top wall and in communication with said passage runs intermediate the passage inlet and outlet, a relatively large refrigerant manifold on one of said end walls connected in communication with the passage outlet, a refrigerant passage on said bottom wall having a plurality of parallel runs extending longitudinally between said end walls, an inlet for said second passage connected in communication with said relatively large manifold, an outlet for said second passage, a second plurality of relatively small capacity manifolds on each of said end walls adjacent said bottom wall and communicatively connected to the runs of said second passage intermediate the inlet and outlet of said second passage, and a relatively large manifold on the other of said end walls communicatively connected to the outlet of said second passage.

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