Sept. 26, 1950 J. R. ZWICKL 2,523,529

ELIMINATOR FOR REFRIGERATION SYSTEM EVAPORATORS

Filed July 1, 1949 2 Sheets-Sheet 1

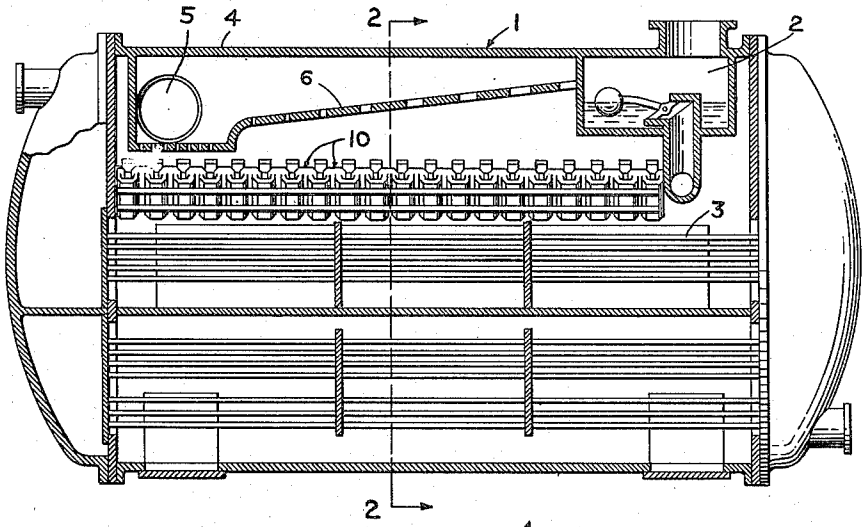


FIG. 1

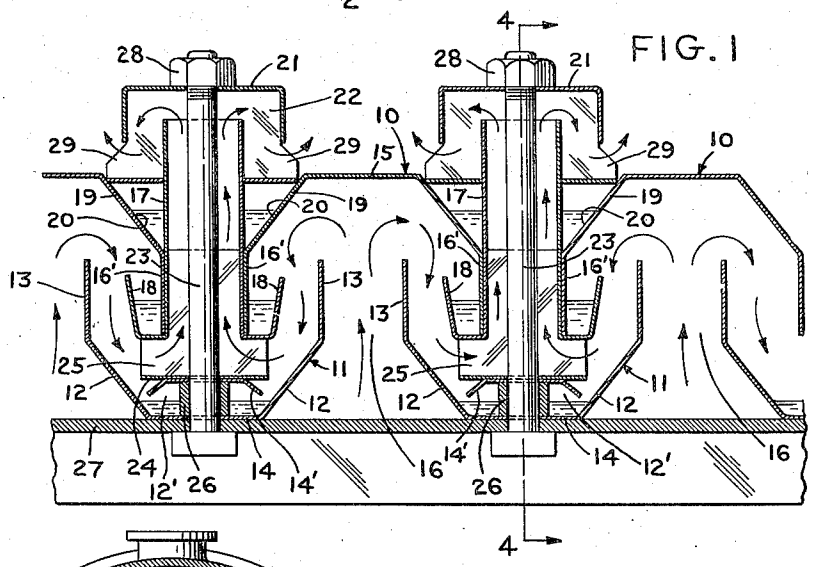


FIG. 3

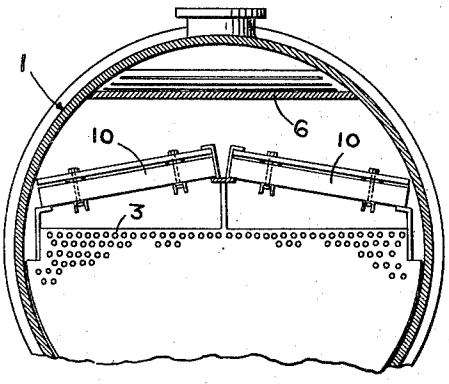


FIG. 2

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ELIMINATOR FOR REFRIGERATION SYSTEM EVAPORATORS

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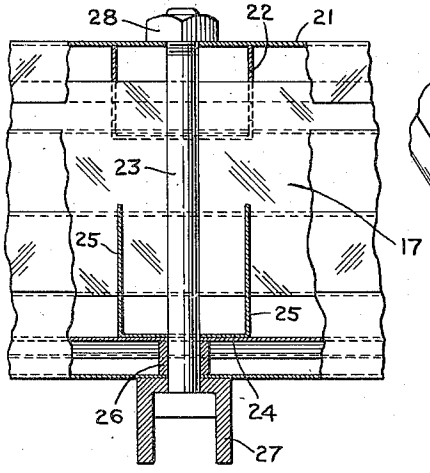


FIG. 4

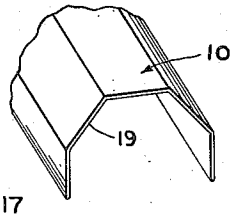


FIG. 5

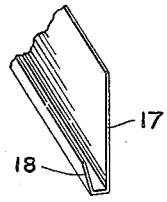


FIG. 6

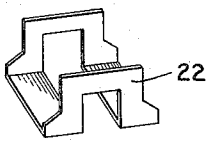


FIG. 7

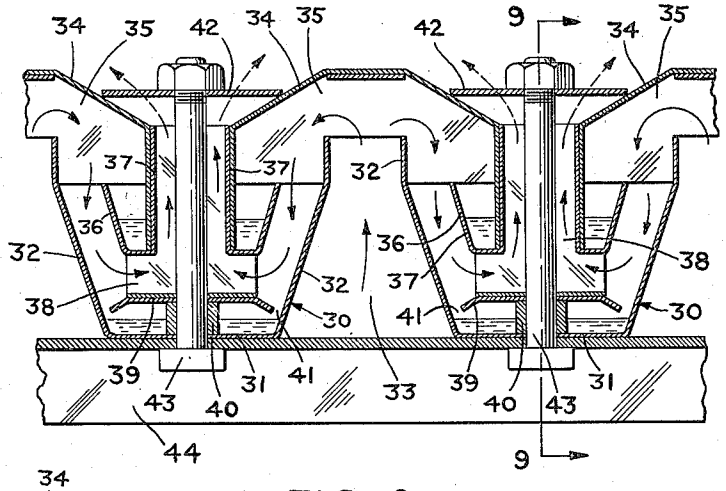


FIG. 8

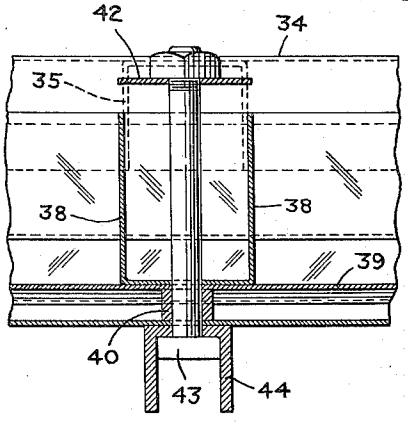


FIG. 9

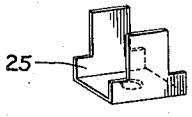


FIG. 7a

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ELIMINATOR FOR REFRIGERATION SYSTEM EVAPORATORS

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Application July 1, 1949, Serial No. 102,592

8 Claims. (Cl. 183—75)

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This invention relates to heat exchange apparatus and, more particularly, to coolers or evaporators of the type employed in refrigeration systems of the closed circuit compression type employing a volatile refrigerant as a coolant.

More specifically, the invention relates to an eliminator for use in such coolers or evaporators for eliminating any unvaporized liquid from the refrigerant vapor prior to its delivery from the cooler to the compressor of the refrigerant system.

An object of the present invention is to provide an eliminator as specified which will provide a sinuous path including a plurality of impingement and drip surfaces through and against which the refrigerant vapor with any entrained liquid passes on its way from surface contact with the tubes of the cooler thereby eliminating the entrained liquid by separation from the vapor.

A further object of the present invention is to provide an eliminator as specified which is made up of a plurality of standard parts of uniform structure thereby simplifying the construction and assembly of the eliminator and permitting eliminators for different conditions to be assembled from standard parts.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing an eliminator for use in refrigeration system evaporators or coolers of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a longitudinal section through a cooler or evaporator showing the improved eliminator therein.

Figure 2 is a cross section taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged cross section through the eliminator structure.

Figure 4 is a fragmentary longitudinal section taken on the line 4—4 of Figure 3.

Figure 5 is a fragmentary perspective view of one of the elements or parts of which the eliminator is assembled.

Figure 6 is a fragmentary perspective of another of the elements or parts of the eliminator.

Figure 7 is a perspective of another of the elements or parts of the eliminator.

Figure 7a is a perspective view of still another of the elements or parts of the eliminator.

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Figure 8 is a cross section of a modified form of the eliminator.

Figure 9 is a fragmentary longitudinal section taken on the line 9—9 of Figure 8.

Referring more particularly to the drawings, 1 indicates a cooler or evaporator such as is used in closed refrigeration systems utilizing a volatile refrigerant, and the refrigerant passing into the cooler or evaporator through the inlet structure 2 has surface contact with the tubes 3 through which a liquid passes and which is cooled by the evaporation of the refrigerant within the shell 4 of the cooler. The evaporated refrigerant passes out of the cooler through an outlet 5 to a compressor (not shown) where it is compressed and recirculated through the system (not shown). In the drawing, a distributor plate 6 is shown as positioned near the top of the shell 4 through which distributor plate the refrigerant vapor passes on its way to the outlet 5.

Liquid refrigerant to a certain degree is entrained with the refrigerant vapor and passes upwardly therewith to the outlet 5. However, it is desirous to remove the entrained liquid refrigerant from the refrigerant vapor prior to the delivery of the refrigerant vapor to a compressor (not shown). For this purpose an eliminator structure 10 is located in the cooler or evaporator 1 above the banks of tubes 3 and below the distribution plate 6.

The eliminator 10 separates the liquid refrigerant fom the refrigerant vapor and this is accomplished by passing the refrigerant vapor with its entrained liquid refrigerant through a series of sinuous paths and against impingement surfaces in the eliminator and the separated out liquid refrigerant is collected and returned to the cooler or evaporator or to any other suitable or desirable location.

The eliminator 10 is made up of a plurality of parallel sinuous flow path members extending longitudinally of the shell 4 and arranged to extend across the shell or diametrically thereof as shown in Figure 2 of the drawings.

The elements or sections of which the eliminator is made up are in themselves each made up of a plurality of elements or parts and they are arranged to provide alternate downwardly opening inlet sections and alternate upwardly opening outlet sections.

The alternate upwardly opening outlet sections include channel members 11 formed of suitable sheet metal and extending the full length of the eliminator section. The elements 11 are substantially U-shaped in cross section differing

from the shape of a U in that the lower portions 12 of their sides are angled sharply with respect to the parallel upper portions 13 of the sides and the flat bottoms 14. The straight parallel portions 13 of the sides of the channel members 11 extend into the downwardly opening sides or ends of channel member 15 which are constructed identically with the channel members 11 but are disposed in reversed position so as to provide downwardly opening longitudinally extending channels between two adjacent upwardly opening flow guiding separation channels formed by the members 11. The adjacent or facing straight sides of two adjacent elements 11 are spaced in the inverted members 15 as clearly shown in Figure 3 of the drawings so as to provide an upwardly extending downwardly opening inlet 16, the mouth of which flares owing to the inclined portions 12 of the sides of the members 11. The straight portions 16' of the sides of the inverted channel members 15 extend downwardly into the upwardly opening members 11 and engage against the sides of an upflow channel forming member 17 which extends longitudinally of the eliminator and has its lower end open to the interior of the channel member 11, while its upper end opens outwardly above the uppermost portions of the inverted members 15. The lower edges of the upflow channel forming member 17 may be shaped to provide longitudinally extending outwardly opening collection channels 18 for collecting separated out liquid refrigerant or, if it is so desired, the collection channels 18 may be made of separate pieces of sheet material and attached to the upflow channel forming members 17.

The inclined portions 19 of the sides of the inverted members 15 extend to and have edgewise engagement with the upflow channel-forming member 17 so as to provide a second series of liquid refrigerant collection channels 20. Downwardly and laterally opening channels are formed above the upper outlet ends of the upflow channels 17 by members 21 which are held in spaced relation above the inverted elements 15 by means of substantially U-shaped supporting spacers 22. The spacers 22 are cut out to engage over the upper ends of the upflow channel members 17 and the baffle plates and the downwardly and laterally channel-forming members 21 are rigidly held in position and the various elements or parts forming the eliminator are held connected firmly and in position by means of bolts 23 which extend vertically through the upflow channel-forming members 17 through the bases 24 of the supporting spacers 25, spacing washers 26 and the bottoms of the channel-forming elements 11. The bolts 23 extend into and through supporting channel irons 27 and nuts 28 are threaded on the ends of the bolts to tightly clamp all of the elements in proper connected position. The supporting spacers 25 are located in the upwardly opening channel forming members 11 at longitudinally spaced points along the members 11 so as to divide the interiors of the channels into longitudinal sections which correspond to the longitudinal sections provided by the supporting spacers 22.

In operation, the refrigerant vapor with its entrained liquid refrigerant passes upwardly through the inlet 16 into the inverted channel elements 15 which direct it laterally so that it impinges against the inner surfaces of the inclined portions 19 which directs it downwardly in a slightly lateral direction about the outer surfaces of the troughs 18. The downwardly flowing refrigerant impinges against the sloping wall or inclined portions 12 and is turned upwardly into the upflow channel, doing so it deposits liquid on the inclined portions 12 which liquid enters the bottom of the member 11 wherein a collecting channel is formed. The collecting channel 12' is formed by the bottom 14 of the member 11 and the inverted cover 14'. The cover 14' prevents the liquid from being whipped out of the collecting channel 12' by the gas as it rushes around the corner into the upflow channel. Merging from the upflow channel the refrigerant vapor impinges against the members 21 and is directed laterally and downwardly and again laterally and out of the eliminator through the open spaces 29 for passage to the outlet 5. The direction of the refrigerant vapor in the sinuous paths and its impingement against the various surfaces separates out the liquid which drips or drops into the collecting channel 12' and the troughs 18 and 20 from which it passes to any suitable point. The eliminator is inclined slightly longitudinally so that the liquid refrigerant collected in the respective troughs may flow therefrom.

Figures 8 and 9 of the drawings show a modified form of the eliminator, the various sections of which are made up of identical elements connected to provide the complete eliminator. In this modified form the elements 30 comprise flat bottom forming sections 31 and upwardly extending substantially parallel sections 32 which are spaced to provide longitudinally extending inlet channels 33 which open out into inverted or downwardly opening channels formed by the elements 34. The elements 34 are substantially the same shape as the elements 11 and 15 and they are held in proper spaced relation with respect to the outlets of the inlet channels 33 by transversely extending baffles 35. The lower edges of the baffles 35 rest upon the upper edges of the sides 32 of the elements 30 and upon the upper edges of the inner sides 36 of the drainage trough forming elements 37. As clearly shown in Figure 8 of the drawings, the elements 30 are substantially U-shaped in cross section forming upwardly opening flow guiding separating channels in connection with the inverted elements 34 and two adjacent elements 34 are held in proper spaced relationship with two adjacent elements 30 by separation distance pieces 38 which engage the trough forming members 37. A horizontally extending lower baffle 39 is held in proper spaced relation from the bottoms 31 of the elements 30 by suitable spacing collars 40 and the distance pieces or supporting spacers 38 rest upon these horizontal baffles 39. The baffles 39 are narrower than the bottoms of the elements 30 so as to provide longitudinally extending passages 41 to permit separated out liquid refrigerant to pass into the bottoms of the elements 30 below the baffles 39. Anchoring washers 42 are provided which engage the elements 34. Bolts 43 are inserted through the washers 42, baffles 39, spacing collars 40 and bottoms 31 into supporting channel irons 44 for connecting all of the elements making up the eliminator. In this construction, the refrigerant vapor with entrained liquid passes upwardly through the inlet channel 33 into the laterally and downwardly opening channel formed by the element 34, and thence downwardly about the troughs 36 and upwardly through the upwardly opening upflow channels

formed in the elements 30 and thence to the outlet of a cooler or evaporator.

Like in the preferred form shown in Figures 1 to 7 of the drawings, the various sections of the eliminator are each made up of a plurality of parts or elements which are identical in each section and can be quickly and easily assembled and rigidly connected in such assembly. Therefore, eliminators of various widths, i. e., composed of various members of longitudinally extending sections may be made up from stock parts to fit the conditions in which they are to be used.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In an eliminator in the cooler of a refrigerating system in which a volatile liquid refrigerant is employed, an assembled housing including a plurality of alternate upwardly open and downwardly open flow guiding separation channels having lateral communication one with the other, means in said channels forming collection channels for separated out liquid, said collection channels discharging collected liquid at one end of the assembled housing, said flow guiding separation channels formed of approximately identically shaped elements arranged in alternate reverse relationship, the sides of said elements forming the upwardly opening flow guiding channels extending into the downwardly opening flow guiding channels and the sides of the downwardly opening channels forming elements extending into the upwardly opening flow guiding channels to form sinuous paths for vapor, the facing sides of the elements forming the downwardly opening channels spaced to provide an upflow outlet chute for vapor and entrained liquid to leave the flow guiding channels, and means forming downwardly and laterally opening flow guiding channels located above the outlets of said outlet chutes, parts of the sides of the elements forming the downwardly opening channels disposed at acute angles to the sides of the upflow chutes to form collection channels for collecting liquid separated out in said downwardly and laterally opening channels, longitudinally spaced laterally extending supporting spacers in said downwardly and laterally opening channels and longitudinally spaced laterally extending supporting spacers in said upwardly opening flow guiding separation channels.

2. In an eliminator for use in the cooler of a refrigerating system in which a volatile liquid refrigerant is employed, an assembled housing including a plurality of alternate upwardly open and downwardly open flow guiding separation channels having lateral communication with each other, said flow guiding separation channels formed of upper and lower approximately identically shaped elements arranged in alternate reverse relationship, upflow channel forming members including spaced parallel sides between the adjacent sides of each pair of the upper separation channel forming members and having their lower ends opening out into the lower separation channel forming members, the upper ends of said upflow channel forming members extending above the uppermost parts of the upper separation channel forming members, supporting spacers engaging the sides of said upflow channel forming members above the upper separation channel forming members, and downflow guiding members supported by said supporting spacers.

3. An eliminator as claimed in claim 2 including liquid collection channels formed along the sides of said upflow channel forming members and at their lower ends.

4. An eliminator as claimed in claim 2 wherein portions of said upper separation channel forming members cooperate with the parallel spaced sides of said upflow channel forming members to form liquid receiving channels along the sides of the upflow channel forming members.

5. An eliminator as claimed in claim 2 wherein portions of said upper separation channel forming members cooperate with the parallel spaced sides of said upflow channel forming members to form liquid receiving channels along the sides of the upflow channel forming members near the tops thereof and liquid collection channels formed along the sides of said upflow channel forming members at their lower ends.

6. An eliminator as claimed in claim 2 including U-shaped spacers having inverted T-shaped ends the legs of which extend upwardly into the space between the spaced sides of said upflow channel forming members, the bases of said U-shaped spacers forming flow passages leading into the upflow channels and forming a partial cover over liquid collection channels in the bottoms of said lower separation channel forming members.

7. An eliminator as claimed in claim 2 including U-shaped spacers having inverted T-shaped ends the legs of which extend upwardly into the space between the spaced sides of said upflow channel forming members, the bases of said U-shaped spacers forming flow passages leading into the upflow channels and forming a partial cover over liquid collection channels in the bottoms of said lower separation channel forming members, portions of said upper separation channel forming members cooperating with the spaced sides of said upflow channel forming members to form liquid receiving channels along the sides of the upflow channel forming members.

8. An eliminator as claimed in claim 2 including U-shaped spacers having inverted T-shaped ends the legs of which extend upwardly into the space between the spaced sides of said upflow channel forming members, the bases of said U-shaped spacers forming flow passages leading into the upflow channels and forming a partial cover over liquid collection channels in the bottoms of said lower separation channel forming members, portions of said upper separation channel forming members cooperating with the spaced sides of said upflow channel forming members to form liquid receiving channels along the sides of the upflow channel forming members near the tops thereof and liquid collection channels formed along the sides of said upflow channel forming members at their lower ends.

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