

Feb. 27, 1968

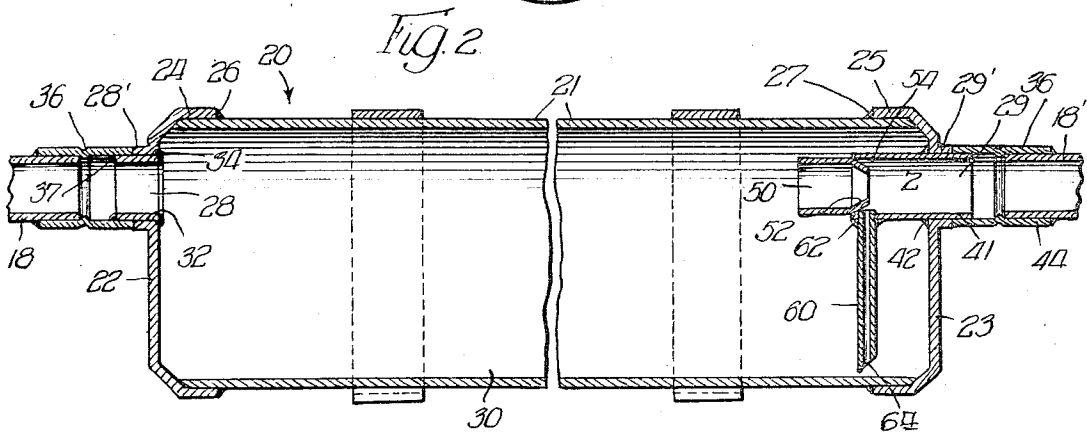
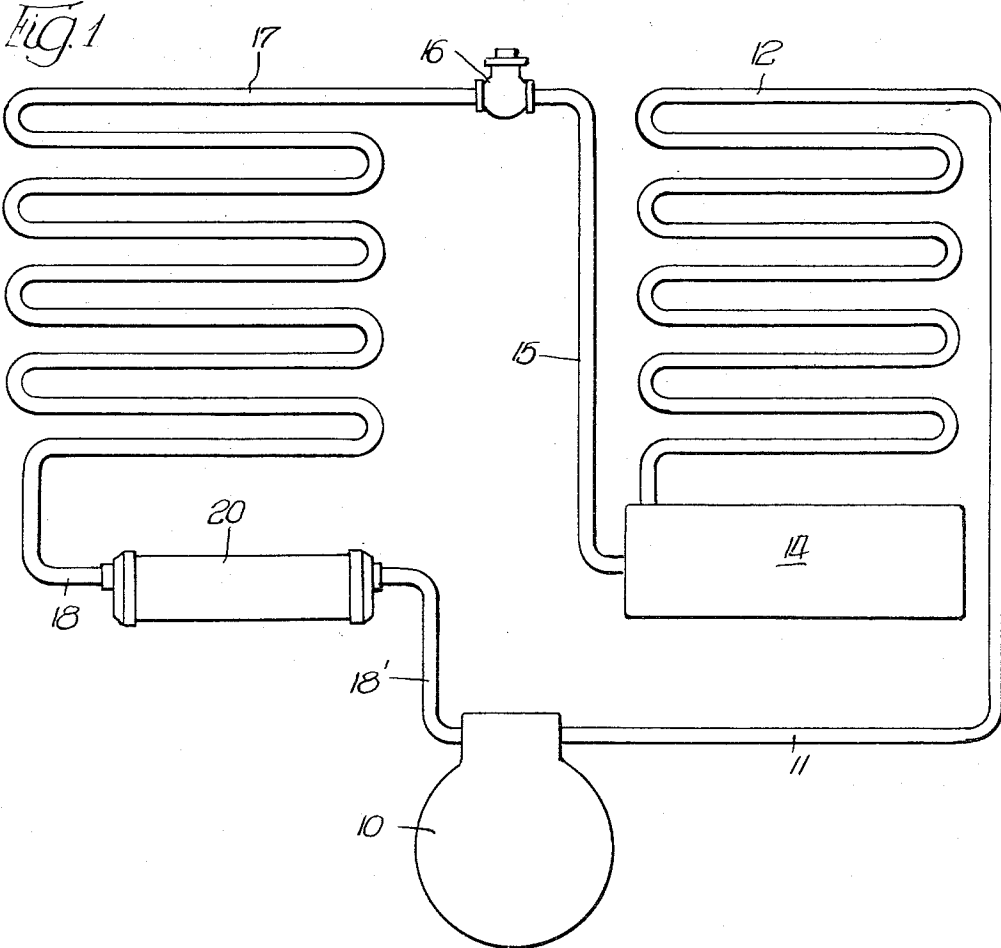
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3,370,440

SUCTION ACCUMULATOR

Filed Jan. 6, 1966

2 Sheets-Sheet 1



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Fig. 3

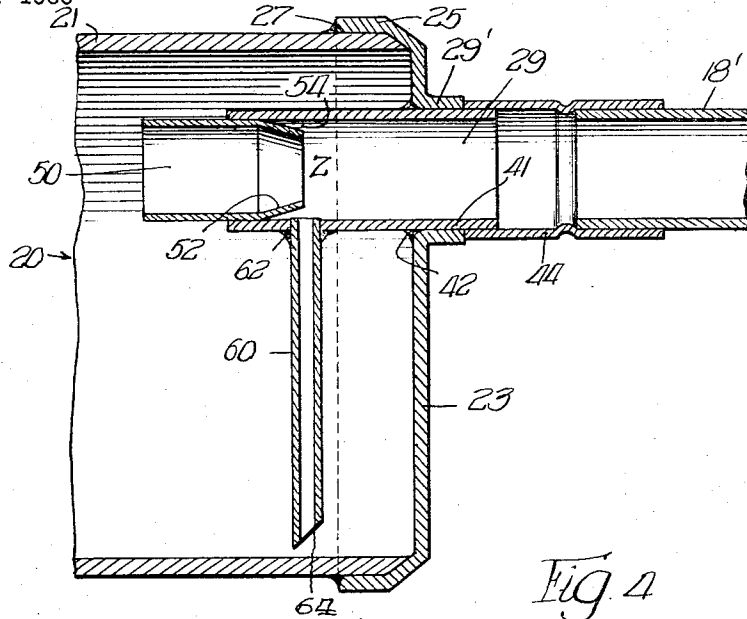


Fig. 4

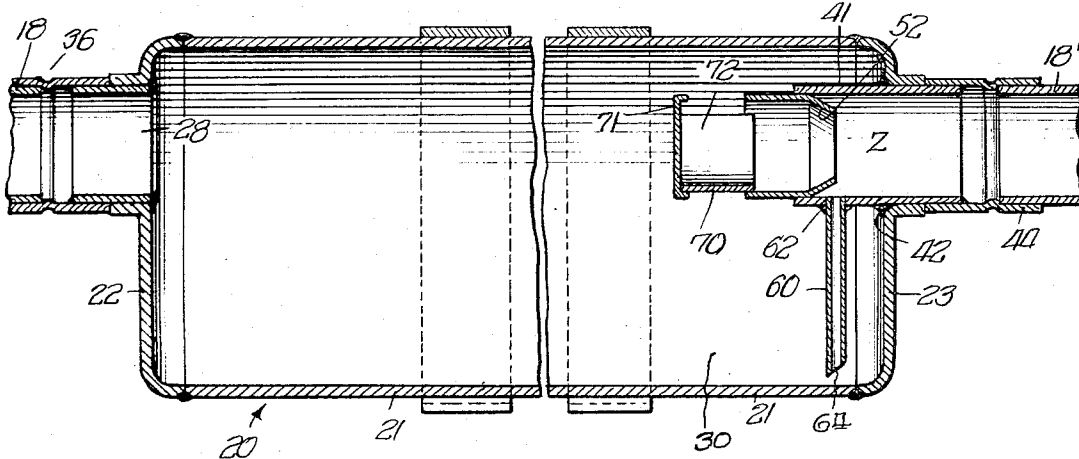


Fig. 6

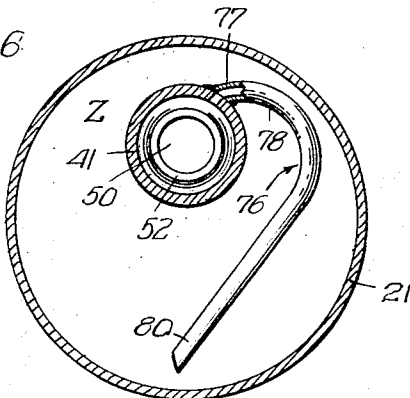
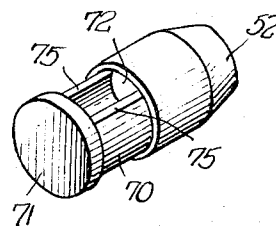


Fig. 5



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3,370,440

SUCTION ACCUMULATOR

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9 Claims. (Cl. 62-503)

ABSTRACT OF THE DISCLOSURE

A suction line accumulator adapted to prevent liquid slugs of refrigerant and/or lubricant from passing into the compressor, together with means in said accumulator for atomizing accumulated liquid refrigerant and/or lubricant and directing the atomized liquids from the accumulator.

The present invention relates to suction accumulators for use in refrigeration systems, heat pump systems and the like. These accumulators are usually installed in the suction line side of the system between the evaporator and the compressor, and are intended primarily to prevent slugs of refrigerant in liquid form from passing into the compressor. The entry of such slugs of liquified refrigerant into the compressor can cause serious damage to the valves, piston, bearings, etc., of the compressor.

Heretofore, the majority of prior accumulators used in such situations merely functioned as sumps in which slugs of liquified refrigerant, together with lubricating oil, accumulated. The liquid refrigerant remained in such sump until conditions prevailed which would permit the liquid refrigerant to evaporate within the accumulator, so that it could then be drawn off as a gas or vapor to the outlet connection leading to the compressor.

However, the lubricating oil will not ordinarily evaporate at the temperatures which vaporize the liquified refrigerant, and hence the oil will become separated or distilled out of the liquified refrigerant and will eventually load up the accumulator with oil, and will reduce the oil level in the crank case of the compressor to a dangerously low level. Prior attempts to suck or drain oil out of the sump have generally resulted in slugs of oil in liquid form and (under some operating conditions) slugs of liquid refrigerant being returned to the compressor with consequent damage to the latter.

The general object of the invention is to avoid the above difficulties, which I have accomplished by providing in the upper portion of the accumulator adjacent the outlet, leading toward the compressor, atomizing means in the form of a venturi type of jet through which the gaseous refrigerant flows at an accelerated velocity for creating a reduced pressure in an atomizing zone at the outlet portion of the venturi jet. A dip tube extends from the lower portion of the sump up into the atomizing zone, so that the reduced pressure in this atomizing zone will draw oil and liquid refrigerant up through the dip tube for effective atomization in this atomizing zone. From this zone the atomized refrigerant and oil travels to the compressor in a vaporous condition where it can be compressed without the possibility of injury to the compressor.

The normal flow of gaseous refrigerant through the venturi type of jet causes an acceleration of velocity, and as this gaseous refrigerant passes out of the venturi jet it reexpands and creates a zone of lower pressure. This zone of lower pressure functions as an atomizing zone in which liquified refrigerant and oil are atomized substantially into a vaporous condition.

In attaining the above principal object, I have provided structural means which is simple and rugged and adaptable to a variety of installations.

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Other objects, features and advantages of the invention will appear from the following detailed description of preferred embodiments thereof. In the accompanying drawings illustrating such embodiments:

FIGURE 1 is a diagrammatic layout of a typical refrigeration system utilizing the improved suction accumulator.

FIGURE 2 is a fragmentary longitudinal sectional view through the accumulator.

FIGURE 3 is a fragmentary sectional view of the venturi jet portion of the accumulator, illustrated on a substantially larger scale.

FIGURE 4 is a view similar to FIGURE 2 but illustrating a modified form of venturi jet apparatus;

FIGURE 5 is a perspective view of this modified venturi jet, removed from the accumulator; and

FIGURE 6 is a transverse sectional view of another embodiment having a different form and arrangement of dip tube.

The conventional refrigeration system shown in FIGURE 1 comprises the compressor 10, the discharge line 11 leading therefrom to the condensor 12 and thence from the condensor 12 to the liquid receiver 14. From the receiver 14 the liquified refrigerant is conducted through line 15 to the metering device or expansion valve 16. From valve 16 the refrigerant flows through the evaporator 17 to perform its cooling function and thence flows through the suction line 18, 18' back to the compressor 10. The improved suction accumulator 20 is interposed in this suction line 18, 18' and it can be located at practically any desired point in the line, the only requirement being that the accumulator be disposed so that the inlet and outlet and venturi jet are in the upper part of the shell 21. FIGURE 1 illustrates the accumulator as being installed substantially above the line of the suction valve on the compressor, but, as above stated, it is to be understood that the accumulator can be otherwise installed, such as in the line of the suction valve, or below such line, if desired. In any of these locations, the refrigerant flows from the evaporator 17 through suction tube 18 to the inlet of the accumulator 20 and thence flows from the outlet of the accumulator through extension suction tube 18' to the inlet of the compressor 10.

Referring now to the construction of the improved accumulator, it will be seen from FIGURES 2 and 3 that it comprises a cylindrical metallic shell 21, preferably composed of steel and disposed horizontally. While shell 21 is shown as relatively long and narrow, its length and diameter may be varied without departing from the scope of my invention. The opposite ends of the shell 21 are provided with inlet and outlet end heads 22 and 23. These end heads are formed with inwardly turned flanges 24 and 25, respectively, which fit snugly over the ends of the accumulator shell and are welded thereto at 26 and 27.

The inlet head 22 is formed with an eccentrically located inlet port 28, and the outlet head 23 is formed with a similar eccentrically located outlet port 29, both of which ports have outwardly projecting cylindrical flanges 28' and 29', respectively. These inlet and outlet end heads are assembled over the ends of the accumulator shell with their inlet and outlet ports 28 and 29 in axial alignment, and disposed at a relatively high level on the accumulator shell. All of the accumulator space lying below such inlet and outlet ports constitutes a sump 30 for the accumulation of slugs of liquid refrigerant, oil, etc.

Mounted within the inlet port 28 to extend outwardly therefrom is a cylindrical extension sleeve 32, which has its inner end brazed or otherwise fastened to the end head 22, as indicated at 34. Mounted over the protruding end of this extension sleeve is a copper coupling sleeve 36 which is brazed at 37 to the extension sleeve.

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The suction line 18 leading from the evaporator 17 has a sweat fit within the coupling sleeve 36. If desired, the inlet port can be located in the top of shell 21 in a known manner and the left end of the shell will then be closed by a head or cap.

Referring now to the outlet end of the accumulator, it will be seen that the outlet port 29 has an extension sleeve 41 which is welded or brazed to the end head at 42. This latter extension sleeve also has a protruding end to which is brazed a coupling sleeve 44. The extending or continuing part 18' of the suction line 18 has a sweat fit within this coupling sleeve 44. The extension sleeve 41 in this instance is substantially longer than the extension sleeve 32, and has its inner end projecting into the accumulator shell. Mounted in this inwardly projecting end is the venturi jet 50 which aids in performing the aforementioned atomizing action. This venturi jet comprises a length of tubing which is cylindrical in its inner end, and has a reducing taper 52 leading outwardly to its outer end. This constricting taper creates an atomizing zone Z which surrounds the venturi taper and also extends axially therefrom. The velocity through this atomizing zone is accelerated; and, moreover, the pressure in this atomizing zone is also reduced. The reduced pressure extends back into the tapering space 54 formed between the cylindrical inner wall of the sleeve 41 and the conical outer surface of the venturi jet.

Extending from the atomizing zone Z downwardly adjacent to the bottom of the sump is a substantially vertical dip tube 60. This dip or atomizing tube 60 extends upwardly through a hole 62 in the extension sleeve 41, in which hole the tube is fastened. The upper extremity of the tube terminates in close proximity to the discharge edge of the atomizing jet, and the tube is preferably disposed with its longitudinal axis extending substantially flush with this discharge edge of the atomizing jet. The lower end of the atomizing tube has a beveled entrance opening 64 disposed in close proximity to the bottom of the sump.

In the operation of the accumulator, all of the refrigerant coming through the suction line 18 in a gaseous state passes directly through the upper portion of the accumulator from the inlet port 28 to the outlet port 29, and thence through suction line 18' to the compressor. On the other hand, such portion of the refrigerant as is in the form of liquified slugs is precipitated out of the flow of refrigerant down into the sump. However, so long as the system is in operation with some gaseous refrigerant flowing therethrough, the venturi jet is exerting an aspirating action on the liquid refrigerant and oil in the sump, drawing the same upwardly through tube 60 to be atomized by the venturi jet. Thus, there is practically no possibility of slugs of liquid refrigerant being carried over into the compressor.

The modification illustrated in FIGURES 4 and 5 is substantially identical to the above-described embodiment, except at the intake end of the venturi jet tube 50. Here, there is fastened a deflector tube 70 having a flanged deflector cap 71. The tube 70, which is mainly cylindrical, has its upper periphery slotted or cut away longitudinally so that there is formed an upper longitudinal slot 72 therein.

In the operation of this modified venturi jet gaseous refrigerant enters the venturi jet tube 50 through slot 72 in the top of the tube 70 and causes an atomizing function as described in connection with FIGURES 2 and 3. Deflector tube 70 and its cap 71 deflect entering surges of liquified refrigerant so that it will not flow into the end of the venturi jet tube 50, and then pass over to the compressor. Liquified refrigerant must rise to the top edges 75 of the slot 72 before it can spill over and enter tube 50.

In FIGURE 6, I have shown a modified form of dip tube 76 having its discharge end 77 opening into the upper portion of the extension sleeve 41. A sweeping curve 78 joins this discharge end with the lower straight inlet end 80, thereby avoiding any sharp angular bends

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in which blockage or restriction might occur. The discharge end 77 is preferably located in the atomizing zone Z, substantially in the same transverse plane with the outlet end of the venturi jet 50. This curved form of dip tube 76, with its higher point of discharge 77, is exemplary of other shapes that the dip tube might take, either for the embodiment shown in FIGURE 3 or for the embodiment shown in FIGURE 4.

While I have illustrated and described what I regard to be the preferred embodiments of the invention, it will be understood that such are merely exemplary, and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In a suction accumulator for a system of the class described which includes a compressor housing and an evaporator, the combination of an accumulator chamber which is adapted to be disposed in the suction line between the outlet of the evaporator and the compressor housing, port means permitting passage of gas and vapor into and out of said chamber, a sump in said chamber for collection of liquids entering the accumulator chamber, and atomizing means in said chamber adapted to atomize collected liquids and direct the from the chamber, said atomizing means comprising a venturi jet having a tapering discharge end positioned to provide an area of low pressure, and a dip tube which extends upwardly from said sump and has its upper end at said area of low pressure outside of and adjacent to said discharge end, whereby liquid is drawn up the dip tube by the venturi jet and projected in an atomized condition into the stream of gas and vapor flowing from said chamber.

2. The combination of claim 1 wherein said port means comprises inlet and outlet ports, and said venturi jet is mounted directly in said outlet port.

3. The combination of claim 1 wherein the port means comprises inlet and outlet ports, and wherein a tubular member is disposed in said outlet port and supports the atomizing means.

4. The combination of claim 1 wherein said accumulator is disposed substantially horizontally, with said port means comprising an inlet port and an outlet port disposed in substantially horizontal alignment in the upper portion of said chamber above said sump.

5. The combination of claim 1 wherein a deflector is disposed at the inlet end of said venturi jet to prevent liquid from entering, said deflector having closed bottom and side walls, and having an opening in its top wall for permitting the passage of gas and vapor.

6. The combination recited in claim 1 wherein said chamber is disposed substantially horizontally and said port means comprises inlet and outlet ports disposed at opposite ends of said chamber, and liquid deflecting means at said outlet port.

7. The combination of claim 1 wherein said port means comprises an inlet port and an outlet port disposed in the upper portion of said chamber above said sump.

8. The combination of claim 1 wherein said port means comprises inlet and outlet ports disposed at different parts of said chamber, and wherein liquid deflecting means is disposed at said outlet port.

9. The combination of claim 1 wherein the dip tube has its lower end in said sump and extends upwardly in a sweeping curve to a discharge end discharging downwardly adjacent said venturi jet.

References Cited

UNITED STATES PATENTS

1,951,915	3/1934	Kagi	62-471
2,121,253	6/1938	McGuffey	62-503 X
3,180,567	4/1965	Quiggle	62-503 X

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