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MECHANICAL REFRIGERATION APPARATUS

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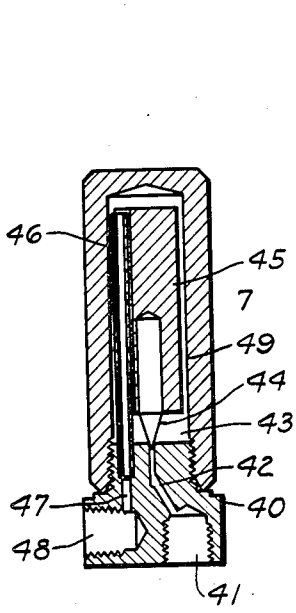


Fig. 2

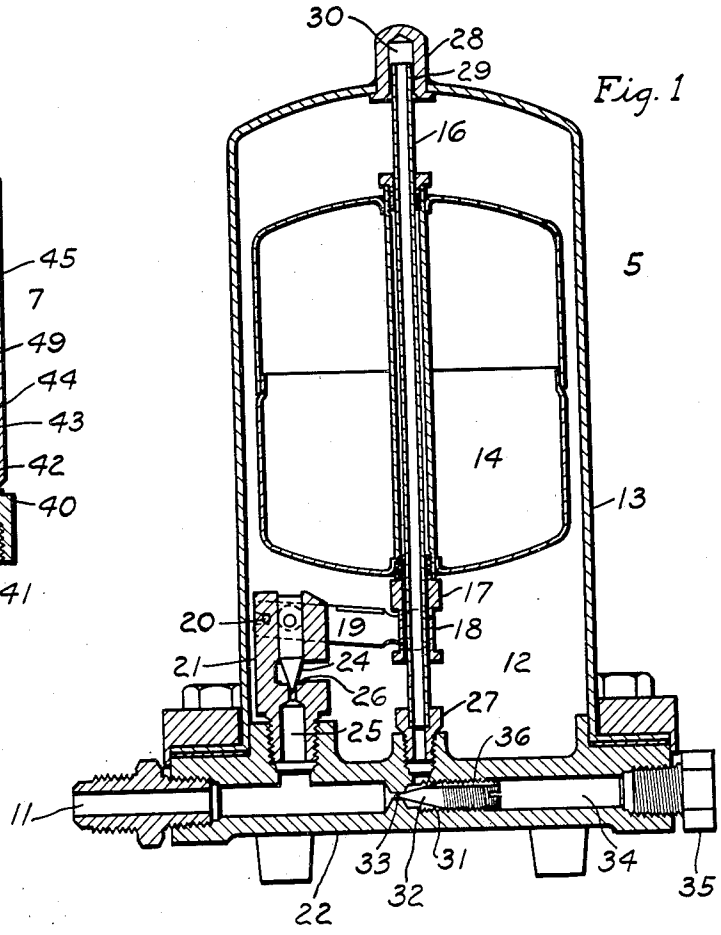
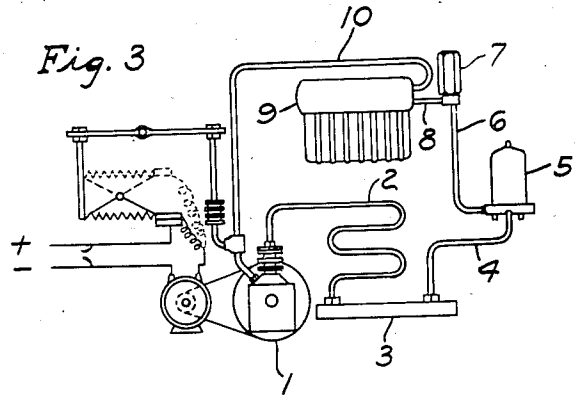


Fig. 1

Fig. 3



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MECHANICAL REFRIGERATION APPARATUS

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12 Claims. (Cl. 62—127)

My invention relates to expansion devices and more particularly to a high side float mechanism and means for maintaining it in efficient operation. The purpose of my invention is to produce an apparatus for a novel fluid expansion system which is free from any defects due to entrapped vapor or air.

Another purpose of my invention is to produce in an expansion system a high side float mechanism which can be placed at any point in the refrigeration line, and in which a novel cushioned check valve prevents the frosting of the expanded refrigerant lines between the float mechanism and any desired point.

A further purpose of my invention is to produce in a high side float mechanism a by-pass from the gas pocket above the liquid surface to the outgoing refrigerant line or to the atmosphere so that entrapped gas will be allowed to escape automatically and prevent the float operated valve from becoming vapor bound.

A still further purpose of my invention is to equip the refrigerant line leading from the expansion valve to the cooling chamber with a loaded cushioned check valve designed to meet any desired pressure and which will admit the passage of refrigerant only when flooded with the liquid refrigerant.

A still further object of my invention is to produce in a mechanical refrigeration apparatus an expansion system wherein the float control mechanism is equipped with an automatic vapor by-pass from the gas pocket above the float to the outlet or the surrounding atmosphere to eliminate what is known as a vapor bound float and which is equipped with a cushioned check valve arrangement to permit it to be located wherever desired in the line without troublesome frosting of the refrigerant line leading to the cooling coils.

In pursuance of the foregoing objects, I aim to provide a new and improved float control which can be located at any point in the expansion line. Further objects and advantages will be more apparent as the description proceeds, taken in connection with the drawing which forms a part of this specification.

Fig. 1 is a sectional view of the high side float mechanism.

Fig. 2 is a sectional view of a loaded check valve.

Fig. 3 shows a diagrammatic representation of the two devices in position in a conventional type of refrigeration apparatus.

While my invention is susceptible of embodiment in many different forms, I have shown in the drawing and will herein describe in detail one such embodiment, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

A frequent source of trouble in systems of mechanical refrigeration occurs in float valves when used on the high pressure side of the refrigerant line. The expansion valve is usually controlled by a float riding on a body of liquid refrigerant. If for any reason the system is shut off for a period of time, there is a tendency for gas to form in the float chamber which forces the float to a position closing the expansion valve and holds it there, preventing its reopening when operation is resumed thus resulting in a condition commonly known as a vapor bound float. In apparatus used heretofore a manual release has been provided to correct the condition at such time as it occurs. On occasions also when the expansion valve is located remote from the cooling coils, there is likely to be condensation on the refrigerant line from the valve to the coils and other defects productive of inefficient and further unsatisfactory operation.

The apparatus forming the subject of this application successfully avoids these difficulties by supplying an expanded refrigerant line under control at all points, by providing a continuous controlled release of vapor collecting in the float chamber and making possible by means of a newly designed check valve the efficient operation of this device regardless of the particular location of the expansion valve.

A diagrammatic representation of the usual refrigerant cycle is shown in Fig. 3 wherein a compressor 1 drives the compressed refrigerant through a condenser 2 and into the receiver 3 from which it passes through pipe 4 to the high side float mechanism represented generally as 5 and shown in detail in Fig. 1. The liquid raises a float ball within 5 allowing the liquid to expand over through the tube 6 into the check valve indicated as 7 which is shown in Fig. 2. From 7 the refrigerant continues through pipe 8 into the cooling system 9 and out again through the tube 10, returning to the compressor as shown. The term refrigerant has been used herein to indicate the combination of compressible gas and oil commonly used in such apparatus.

The float mechanism designated generally as 5 shown in detail in Fig. 1 is the more or less

usual type but in which is incorporated novel features forming part of the substance of this invention for which a patent is solicited.

The liquid refrigerant after compression and condensation flows from pipe 4 and into chamber 12 of casing 13 through an inlet not shown, but which is at right angles to the outlet indicated at 11. Within casing 13 is a float 14 which is supported by the body of liquid refrigerant accumulated in the chamber 12. Float 14 surrounds and slides up and down on a tubular member 16. Attached to the bottom of 14 is a sleeve 17 into which fits the disc-like end 18 of an arm 19 pivoted at 20 to plug 21. The plug in turn is screwed into base 22 and has formed through it part of the passage to the outlet. Pivoted also to the arm 19 is a needle valve 24 seated in valve opening 26. A passage 25 leads from valve opening 26 to the outlet designated at 11. The tubular member 16 is set in a hollow plug 27, which is also screwed into the base 22. The member 16 extends upward through float 14 and is supported in the recess 30 of cap 28 held in the casing 13. Tubular member 16 is surrounded at this point with an annular passage 29 to permit access to the tube from the upper section to chamber 12.

Diametrically opposite outlet 11 is a threaded passage 31 into which fits the needle valve 32 which is adjustable in and out. Needle valve 32 seats in an opening 33 and allows passage of a regulated amount of gas from the tube 16 to outlet 11. Needle valve 32 is slotted or flattened at 36 to permit passage of gas from tubular member 16 to the space 34, which can be opened to the atmosphere by removing plug 35 which is also removable for manual adjustment of the valve 32.

Outlet 11 connects by a tube designated as 6 to the check valve 7 shown in detail in Fig. 2. Tube 6 enters the base plug 40 of valve 7 at 41. A passage 42 leads upward into chamber 43 within valve 7. A needle valve 44 is seated in the mouth of the passage 42 and is loaded with a metal or other weight 45. The inner face 49 of the valve casing forms a guide for the weight and attached valve. A vertical tube 46 extends from base 40 upward in a groove cut in the side of weight 45. Tube 46 is open at the top to chamber 43 and is frozen in base plug 40, through which a passage 47 leads to outlet 48.

In operation, the refrigerant gas, which may be sulphur dioxide, methyl chloride, freon or other common refrigerant is compressed at 1, condensed in coil 2 and forced as a liquid through pipe 4 into the float mechanism 5. Here it fills chamber 12 until the level is such that float 14 is lifted, which in turn lifts the needle valve 24, opening the passage 25 and allowing the liquid refrigerant to flow therethrough and expand. The expanded refrigerant continues through tube 6 and enters check valve 7 through passage 42 from whence, when the pressure is sufficient to overcome the weight 45, it enters chamber 43 and fills the chamber to a point near the top. When the chamber is full the refrigerant descends tube 46 to pass outward and ultimately to the cooling coils.

What usually happens is that this valve chamber becomes completely filled with oil carried by refrigerant which acts as a buffer to keep the valve from chattering while in actual operation.

When the cycle is discontinued the supply of refrigerant is cut off and needle valve 24 closes. Subsequently gas pressure tends to build up in chamber 12. In a long defrosting cycle or shut down the liquid in the float chamber 12 becomes greatly vaporized and accumulates as a high pressure vapor in the top portion of the chamber and the level of the liquid as a result of vaporization will recede to such an extent that on resumption of operation the liquid depth will not be sufficient to open the float and allow any expansion. Opening needle valve 32 to allow a slight leak will establish communication between the upper end of cup 28 and the outlet 11 thereby allowing any accumulation of high pressure gas to constantly escape, altho in such small amounts as not to impair materially the efficiency of the machine. The potential vapor-bound condition can therefore never exceed the pressure for which the valve 7 is designed.

When the refrigeration machine is again started, altho it is impossible to immediately draw any liquid past the needle valve 24, due to the fact that the liquid is not sufficient to raise the float, the pressure in the chamber 12 will be sufficiently low to allow additional liquid to be forced into it in such quantity as will raise the float and again open valve 24, allowing a resumption of operation.

By a proper proportioning of the weight of the member 45 and, by means of the entrance level of pipe 46, the depth of the bath of fluid, it is possible to predetermine the working pressure in the tube 6 for a refrigeration system having a definite set of operating characteristics.

We have also provided a slot or groove 36 on the side of the screw needle valve 32, which means can be used to manually purge the interior of the float chamber 12 of air or high pressure gas by removing the plug 35 and allowing this gas to flow out to the atmosphere.

I claim:

1. In a mechanical refrigerator an expansion system including a high side float mechanism and a check valve, said float mechanism comprising a high pressure float chamber, a fluid inlet thereto, a float operable to move vertically on a body of liquid within said chamber, a fluid outlet means, an adjustable valve in the outlet means controlled by the position of the float, a passage connecting a space above said liquid body with said outlet means; said check valve forming a part of said outlet means and comprising a valve chamber, a loaded valve, a passage leading outward from the top of said chamber and operable, when the chamber is flooded, to maintain a flow of refrigerant in said outlet means at a predetermined pressure.

2. In a mechanical refrigerator an expansion system including a high side float control mechanism and a check valve, said float control mechanism comprising an inlet, an outlet means, an expansion valve leading to the outlet means and a float, a restricted by-pass for gas from a space above said float to said outlet means, said check valve forming a part of said outlet means and comprising a loaded valve operable on submergence by a refrigerant flowing therethrough to maintain a flow of predetermined pressure through said outlet means.

3. In a mechancal refrigerator an expansion system including a float control mechanism and a check valve, said float control mechanism comprising an inlet, a valve means, an outlet means and a chamber containing a float, a by-pass for gas from said chamber to said outlet means; said check valve forming a part of said outlet means and comprising a loaded valve operable on submergence by a refrigerant flowing therethrough

to maintain a flow of predetermined pressure through said outlet means.

4. In a mechanical refrigerator an expansion system including a float control mechanism and a check valve, said float control mechanism comprising an inlet, an outlet means, an expansion valve leading to the outlet means and a chamber containing a float, means forming an automatic escapement for gas from said chamber, said check valve forming a part of said outlet means and comprising a loaded valve operable on submergence by a refrigerant flowing therethrough to maintain a float of predetermined pressure through said outlet means.

5. In a mechanical refrigerator an expansion system including a float control mechanism and an outlet means therefrom, a manually adjustable vent comprising part of said means, a check valve in said outlet means comprising a valve chamber, a loaded valve member therein, an inlet to said chamber and an open outlet at the top of said chamber of full line capacity, operable to conduct refrigerant therefrom only when the chamber has been flooded thereby by said refrigerant.

6. In a mechanical refrigerator an expansion system including a float control mechanism and a check valve, said float control mechanism comprising an inlet, an expansion valve leading to an outlet and a chamber containing a float, a passage for gas from said chamber to said outlet forming a guide for said float, a needle valve in said passage forming an adjustable restriction for the passage and simultaneously operable to vent said system to the atmosphere; said check valve comprising a loaded valve operable on submergence by a refrigerant flowing therethrough to maintain a flow of refrigerant of predetermined pressure through said outlet.

7. In a refrigerator an expansion system including a float control means for governing the flow of refrigerant, a chamber, means forming a stationary vent communicating with a restricted gas vent means therefrom, a float in said chamber contiguous to the walls thereof and guided by said stationary vent means, the action of said float being cushioned by fluid contents of said chamber.

8. In a refrigerator expansion device, a float control for governing the flow of a refrigerant, including a chamber, a float therein, an inlet and an outlet for said device, venting means for said chamber leading to said outlet, an adjusting means for said venting means operable to vary the capacity thereof, and simultaneously to provide by the same adjusting means a means for purging the chamber into the atmosphere.

9. In a mechanical refrigerator an expansion system including a float control mechanism comprising a float chamber, a fluid inlet thereto, a float operable to move vertically on a dense body of fluid within said chamber, a less dense body of fluid above said dense body of fluid, a fluid outlet means comprising an adjustable expansion valve controlled by the vertical position of said float, and means forming a restricted passage within said chamber having a manual adjustment operable from the outside independently of said control mechanism, to maintain a constantly open independent connection between said less dense body of fluid and said outlet, said adjustment being operable to purge said chamber.

10. In a mechanical refrigerator an expansion system including a high side float control mechanism and an outlet means therefrom, means forming a manually adjustable vent comprising part of said outlet means, a check valve in said outlet means comprising a valve chamber, a loaded valve member, means forming an open outlet passage within said valve of full line capacity constituting a part of said outlet means and operable to conduct a flow of refrigerant from the top of said chamber to a continuity of said outlet means only when there has been flooding of the valve chamber, said valve being operable to maintain a flow of refrigerant in said outlet means at a predetermined pressure.

11. In a mechanical refrigerator, an expansion system including a float control mechanism comprising means forming a float chamber for retaining a body of liquid and a body of gas above the liquid, a fluid inlet to said chamber and a fluid outlet means therefrom, a float operable to move vertically on the body of liquid, an automatic adjustable expansion valve in the fluid outlet means and an auxiliary valve outlet means, said auxiliary valve being manually adjustable while the float is in operation, means forming a stationary passage in the float chamber being operable as a guide for the float during its vertical movement, and means forming a connecting conduit from said stationary passage to provide for communication between the body of gas in the chamber and the fluid outlet means.

12. In a refrigerator expansion device, a float control means for governing the flow of refrigerant comprising means forming a chamber, a fluid inlet to said chamber and an outlet means therefrom, a float in said chamber, means forming a vent from the chamber for maintaining said chamber purged of excess gas, and a restricting member in said vent for establishing a constantly open uniform passage to the outlet means during operation of said device, said restricting member being provided with means for making an adjustment thereof from outside the device, and means associated with the restricting member for externally purging said chamber through the vent.

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