

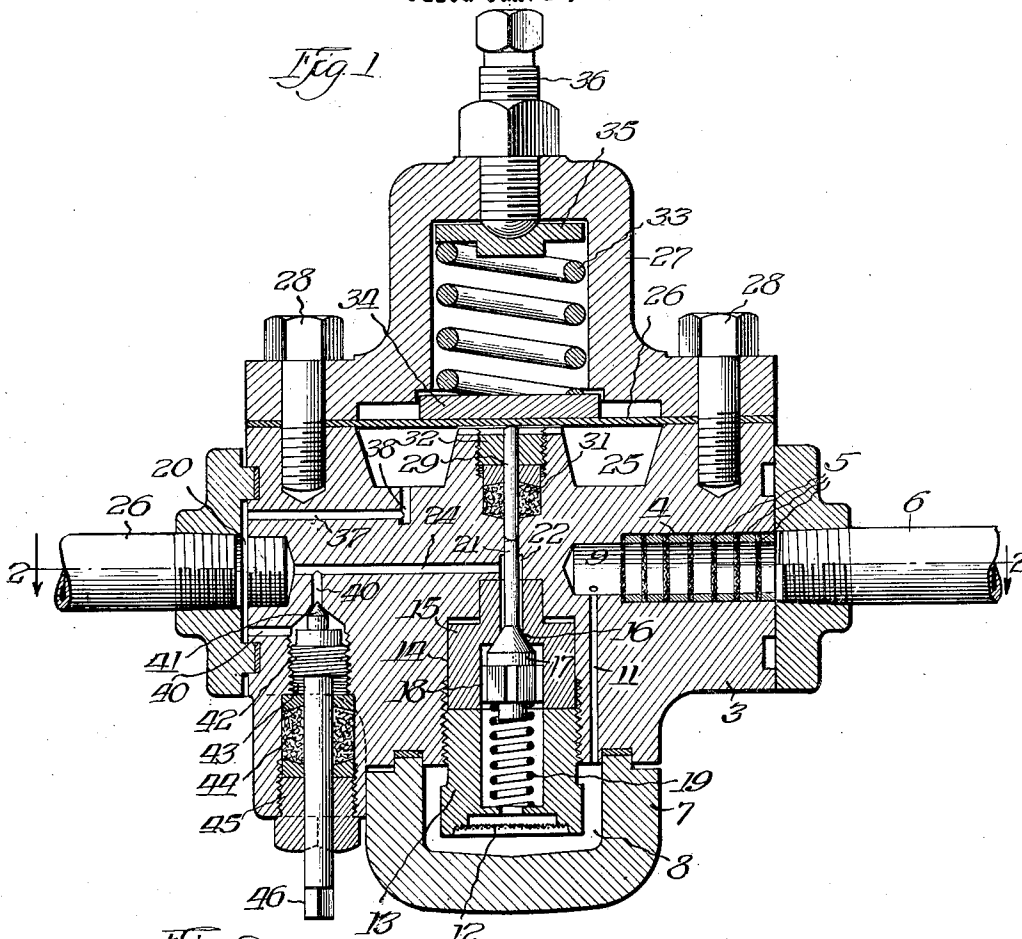
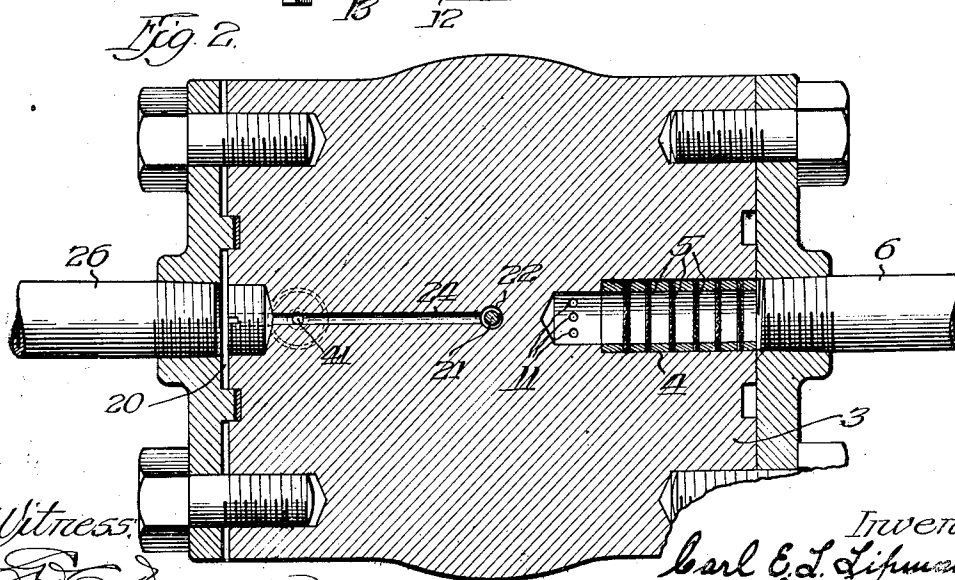
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EXPANSION VALVE

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EXPANSION VALVE.

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This invention pertains to expansion valves, more particularly of the type adapted for use in refrigerating apparatus.

is regulated by a manually controlled valve which is never fully closed.

A preferred embodiment of my invention is illustrated on the accompanying drawings.

Referring to the drawings:

Fig. 1 is a vertical sectional view through an expansion valve embodying my invention; and

Fig. 2 is a horizontal sectional view on the line 2—2 of Fig. 1.

Referring to the drawings more in detail, reference character 3 indicates generally a block forming the body of the valve casing, this block being bored and shaped to accommodate the various apparatus, as will be later explained. At one side the block is bored as indicated at 4, to provide a screen chamber in which are located a series of screens 5, through which the refrigerating medium in liquid condition delivered from the condenser by the pipe 6 passes.

The lower portion of the valve casing is formed by cap 7 attached to the block 3 and forming a chamber 8, between which and the extension 9 of the screen chamber 4, communication is established through a series of ducts 11. The medium which has passed through the screens 5 flows through these ducts 11 into the chamber 8, and thence upwardly from the center of this chamber through another screen 12.

The screen 12 is carried at the lower end of the hollow plug 13 threaded into the bore 14 formed in the block 3, and this plug holds in place in this bore a valve seat member 15 provided with an inclined seat 16. Beneath this seat there is disposed the shut off valve indicated by reference character 17, the valve being centered by suitable guide wings 18 and being normally urged toward its seat by a light coiled expansion spring 19. The stem 21 of the valve projects upwardly into a passage 22 formed in the block 3.

A delivery passage 24 formed in the block 3, communicates with the passage 22 so that the liquid delivered past the valve 17 is discharged through this passage 24 into an outlet chamber 20, with which the pipe 26 leading to the evaporation coils is connected.

The upper portion of the block 3 is cored to provide an annular chamber 25, over which is disposed a flexible diaphragm 26,

Valves for this general purpose are designed to regulate the flow of the refrigerating medium from the condenser to the evaporation or cooling coils. The medium on the condenser side of the valve is in liquid condition, and when it passes the restricted valve it is permitted to expand, by reason of the pressure reduction, into gaseous form. Since the expansion customarily takes place within the valve casing, the heat absorption makes the casing very cold and, consequently, frosts not only on the outside of the casing, but also on the inside. In these valves also it has been customary to control the operation of the expansion valve by the high pressure fluid refrigerating medium acting upon a diaphragm. The low temperature of the valve casing previously mentioned, resulting in the formation of frost on the inside of the casing and in the passage or passages leading to the diaphragm chamber, restricts these passages and sometimes completely stops them up, thus rendering the valve completely inoperative, or at least greatly reducing its accuracy.

One of the primary purposes of my present invention is to provide an expansion valve for the purpose indicated, in which the liquid refrigerating medium will not be permitted to expand from a liquid into a gaseous condition until it has passed approximately entirely through the valve casing, thus preventing the casing from frosting and causing the moving parts of the valve to stick.

Another object is to actuate the valve controlling diaphragm solely by the gaseous refrigerating medium after it has been permitted to expand, with the result that no opportunity is afforded for expansion of the liquid in the diaphragm chamber or around the moving parts of the apparatus, and, consequently, danger of frosting and interference with the operation of the valve is reduced to a minimum.

A further object is to prevent wire drawing and reduce the wear on the pressure controlled valve by causing this valve to act merely as a shut off valve which in operation is either fully opened or fully closed.

The expansion of the refrigerating medium

clamped at its margins between the upper face of the block 3 and the horizontal flange of a top cap 27 secured by bolts 28, or otherwise, to the block. A stem or rod 29 extending between the upper end of the valve stem 21 and the lower face of the diaphragm 26 passes through a packing gland 31, which may be regulated by manipulation of an adjustable plug 32 threaded into a tapped opening in block 3, whereby leakage of the liquid refrigerating medium from the passage 22 upwardly into the diaphragm chamber 25 is precluded. The diaphragm is normally urged downward by an expansion spring 33 located in the cap 27 and disposed between a disc 34 upon the top of the diaphragm 26 and a disc 35, the position of which may be regulated by manipulation of an adjusting screw 36, accessible at the top of the valve. By adjustment of this screw the tension of the spring 31 may be regulated and controlled.

Pressure is admitted to the diaphragm chamber 25 from the outlet chamber 20 through a duct comprising a horizontal leg 37 paralleling the duct 24 and a vertical leg 38 leading from the leg 37 to the chamber 25, as will be apparent from Fig. 1. When the pressure in the outlet chamber 20 becomes sufficiently great to lift the diaphragm 26 against the force of the spring 31, as for instance when the machine is shut down, the valve 16 is closed by the spring 19 and the flow of the medium through the valve casing is shut off. When the pressure in the delivery chamber 20 and the diaphragm chamber 25 is decreased by starting the compressor, the diaphragm lowers, thereby opening the valve 17 so as to permit the refrigerating medium to flow again through the valve casing.

In order to prevent the expansion of the refrigerating medium from a liquid into a gaseous condition as soon as it has passed the valve 17, I have provided in a continuation 40 of the passage 24, a restriction which serves as the expansion valve proper and retains the medium in the passage 24 under sufficient pressure to prevent evaporative expansion therein. This restriction comprises an adjustable needle valve 41, equipped with a threaded shoulder 42, which is threaded into a tapped bore 43 formed in the block 3. A packing gland 44 surrounding the needle beneath the shoulder prevents leakage longitudinally of the needle. The pressure of this packing gland may be controlled by an adjustable plug 45 in the usual manner. The outer end of the needle 41 is polygonal in shape, as indicated at 46, to accommodate a wrench, or the like, by which the needle may be adjusted, and its inner end is tapered and intercepts the duct 40 to restrict the flow of refrigerating medium through the duct into the chamber 20.

In the operation of the apparatus the flow of liquid refrigerating medium is regulated, and controlled by the valve 41, the adjustment of which is manually accomplished. The liquid therefore is not permitted to expand into gaseous form until it has passed substantially through the valve casing, but is maintained in liquid condition by the restricting needle 41, which is set to restrict the flow through the duct 26 in conformity with the refrigerative work required. The liquid in the duct 24 is, therefore, maintained under sufficient pressure to prevent gasification until it passes the restricting needle 41, whereupon, as it enters the delivery chamber 20, it expands and assumes a gaseous condition. Pressure in the chamber 20 is transmitted through the duct consisting of the horizontal and vertical legs 37 and 38, to the diaphragm chamber 25, where, acting upon the lower face of said diaphragm, it controls the opening and closing movements of the valve 17. The spring 33 is adjusted to hold the valve 17 open until a predetermined pressure in excess of the normal working pressure is built up in the chamber 20, whereupon the valve 17 will close to shut off further flow of refrigerating medium through the casing.

It will be observed that the construction of the apparatus is such that none of the refrigerating medium in liquid form is permitted to enter the diaphragm chamber 25, since the packing 31 precludes leakage along the rod 29, and the pressure duct establishes communication between the diaphragm chamber and the delivery chamber 20 only. Furthermore, wearing and wire drawing of the valve 17 are reduced to a minimum by reason of the fact that this valve serves merely as a shut off valve.

It should be understood that the structural details shown and described are illustrative only of the principles of my invention, and that various modifications may be resorted to without departing from the essence of the invention defined in the following claims.

I claim:

1. An expansion valve comprising a casing provided with inlet and delivery chambers, a valve seat removably disposed in said casing, a hollow plug removably retaining said seat against displacement, a plurality of passages, leading from said inlet chamber to the inlet end of said plug, a valve arranged to engage said seat, a passage extending from said seat to said delivery chamber, a diaphragm, a diaphragm chamber, an operating rod extending from said diaphragm to the stem of said valve, a packing gland surrounding said rod, an adjustable restriction in said passage, and a passage establishing communication between said delivery chamber and said diaphragm chamber.

2. An expansion valve comprising a block formed to provide inlet and delivery chambers and a passage connecting the same, a diaphragm chamber formed in the upper 5 portion of said block, a diaphragm disposed over said chamber, a cap disposed over said diaphragm, an adjustably mounted spring within said cap acting upon said diaphragm, a removable valve seat in said block, a valve adapted to engage said seat, a connection 10 between said valve and said diaphragm, a packing gland through which said connection extends, and an adjustable restricting member accessible from outside the valve casing.

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