Feb. 24, 1942. A. F. CARROLL 2,274,127

EXPANSION VALVE

Filed Feb. 16, 1939

Fig: 1

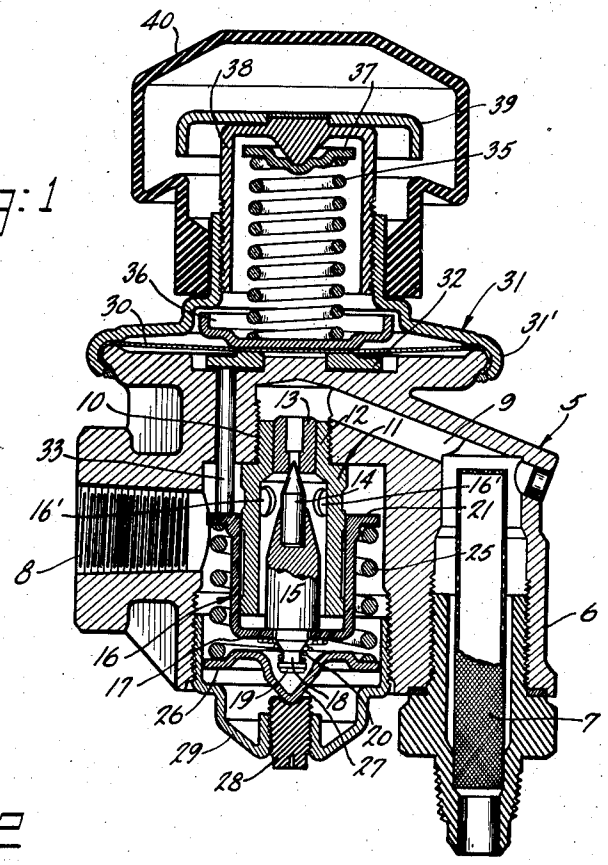


Fig: 2

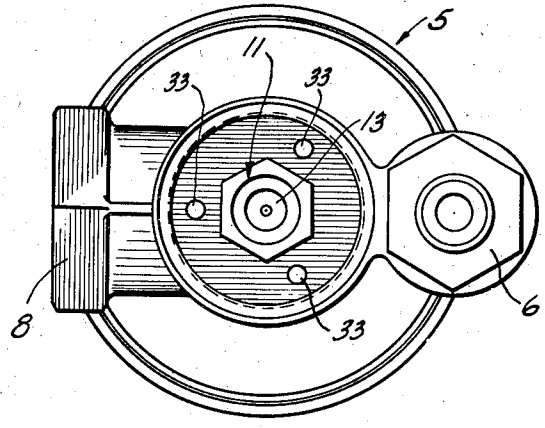
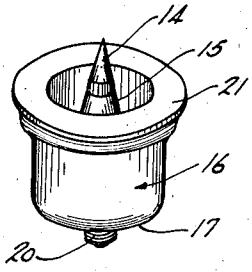


Fig: 3



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EXPANSION VALVE

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4 Claims. (Cl. 251—145)

This invention relates to an improvement in expansion valves for use with refrigerators and designed to feed the refrigerant into the evaporator in correct proportions to maintain maximum evaporator efficiency without frost-back to the compressor unit and also to prevent the flow of refrigerant during the off period.

One of the principal objects of the invention is to simplify and compact the construction of the valve possessed of these advantages and capacities and this in such a way as to assure its efficiency under conditions of actual use and yet make it practical to produce the valve economically and by means of facilities and from materials ordinarily available.

A further and more specific object of the invention is to improve the mounting and action of the valve so as to make it self-alining, render it capable of maintaining a constant evaporator pressure and assure its efficient and normal action even though the valve casing be subjected to such rough usage as to be slightly distorted.

A still further object of the invention is to provide a device of this character and having the advantages mentioned and wherein fine accurate adjustment is provided for permitting accurate adjustment of the valve to the system.

Another object of the invention is to provide a valve of this character which may be used with either sulphur dioxide, Freon or methylchloride and has an adjustable range from 20" vacuum to 30 lbs. pressure.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawing forming a part of this specification, and in which:

Figure 1 is a view in diametrical vertical cross section showing an automatic expansion valve embodying the present invention, parts being shown in elevation for the sake of illustration;

Figure 2 is a view in bottom plan of the structure shown in Figure 1 with the lower end cap and associated parts removed from the valve; and

Figure 3 is a perspective view of the valve proper and its mounting and guiding means.

Referring to the drawing, the numeral 5 designates the valve casing or body which may be a brass forging and which is provided with an inlet fitting 6 equipped with a strainer 7 and adapted for connection to the liquid feed and an outlet fitting 8 adapted for connection to the evaporator (not shown). An inlet passage 9 leads from the inlet fitting to a ported partition 10 which is interposed between the inlet passage 9 and the outlet. A cylindrical valve guide 11 is provided with a reduced and externally threaded extension 12 which is threadedly interconnected with the inner peripheral wall of the ported partition. The reduced extension 12 of this guide is provided with a valve seat 13 which is press fitted and soldered in place. A needle valve 14 coacts with the valve seat 13 and is carried and suitably secured in a valve holder 15. The valve holder 15 is floatably mounted in a cup-shaped piston or guide 16 which has a cylindrical body portion telescoping or slidably fitting over the valve guide 11. The end wall 17 of the guide 16 is provided with an opening at its center through which a reduced extension 18 of the valve holder 15 extends. The extension 18 has a head 19 at its lower end and a spring 20 is interposed between the head 19 and the lower face of the end wall 17 of the guide 16 to provide a floating or self-centering mounting for the valve holder and valve. The open end of the valve guide 16 is provided with an outwardly extending annular flange 21. Passages 16' provided in the fixed valve guide provide for free flow of the liquid from the interior of the guide to the outlet side of the valve.

A coil spring 25 encircles the guide 16 and at one end abuts its flange 21 and at its other end engages an adjustable abutment 26. The abutment 26 is provided with a conical bearing portion 27 engaging a correspondingly formed seat in the plug 28 which is threaded and soldered to an end cap 29 threadedly interconnected with the lower end of the valve body and also soldered thereto. The cap 29 and its plug 28 are factory set so that the compression of the spring 25 is accurately predetermined.

A diaphragm 30 is clamped between the upper end of the valve body and a head or bonnet 31. The periphery of the head or bonnet 31 is formed around the periphery of the valve body as indicated at 31' so as to be mechanically connected and hermetically sealed to the valve body and to the peripheral portion of the diaphragm 30.

The underside of the diaphragm is provided with a pad 32 which is engaged with the upper ends of push pins 33 slidably interfitted in openings in the valve body and engaged at their lower ends with the flange 21 of the valve guide. Preferably three such push pins 33 are provided, as illustrated in Figure 2. The diaphragm is loaded by means of a spring 35, the lower end of which rests in a spring seat 36 flatly engaged with the diaphragm and the upper end of which is engaged by a spring seat 37 controlled as to position by means of an adjustable cap 38 equipped with a knob 39 to facilitate its manipulation. The cap 38 has its cylindrical body portion externally threaded and threadedly engaged with the internal threads of an upstanding cylindrical extension of the head or bonnet 31. To adjust the valve all that need be done is to turn the knob 39 by ¼ turn, allowing sufficient time between

adjustments to secure a steady gauge reading. (Turning screw "in" (clockwise) increases back pressure; turning "out" (counter-clockwise decreases back pressure.) After proper pressure reading has been obtained, the valve is in correct adjustment. A breather cap 40 of live rubber may be provided to seal absolutely tight against air or moisture and prevent freeze-up of the head.

There is sufficient clearance between the outer surfaces of the push pins and the walls of the openings in which they slide to permit the pressure on the outlet side of the valve to act on the underside of the diaphragm.

As indicated, the inlet 7 of the valve is connected to the liquid feed line of the refrigerating system and the outlet 8 is connected to the evaporator thereof. Hence the evaporator pressure is exerted on the underside of the diaphragm and tends to flex it upwardly, allowing the needle valve 14 to close under the influence of its spring 25. In this position of course, no refrigerant flows. When the evaporator temperature has become warm enough to close the contact in the control switch of the refrigerator, the compressor thereof starts, which has the effect of lowering the pressure in the evaporator. When the pressure drops to the lower operating point predetermined by the adjustment of the valve, the diaphragm 30 flexes downwardly under the influence of spring 35. Such downward flexure of the diaphragm acts through its pad 32, through the push pins 33 and piston or guide 16 to pull the needle valve downwardly away from its seat, the action of the spring 25 being overcome. This allows the refrigerant to flow past the valve seat 13, through the openings 16', to the outlet 8 and thus to the evaporator. The pressure increase caused by the boiling of the liquid admitted to the evaporator tends to re-close the needle valve, while any reduction of evaporator pressure tends to cause the needle valve to open. During operation, at any valve opening, the evaporator pressure just counterbalances the spring 35 and the diaphragm is balanced. Any slightest change in pressure will tend to increase or decrease the needle valve opening thereby maintaining a constant evaporator pressure. When the compressor stops, the increased pressure closes the needle valve tightly until the next operating cycle.

In its opening and closing, the valve is guided by the special intersleeving arrangement or telescopic arrangement of the tubular valve guides and this guiding action is carried out by structure spaced from the inner peripheral wall of the valve housing and completely housed and protected, so much so that even though the valve body itself be distorted, the guiding action will not be impaired.

While I have shown and described one construction in which the invention may be advantageously embodied, it is to be understood that the construction shown has been selected merely for the purpose of illustration or example and that various changes in the size, shape and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

The invention claimed is:

1. In a diaphragm controlled expansion valve, a casing having a recessed chamber extending inwardly from the periphery thereof, said chamber having an inlet opening, a valve seat in said opening, a hollow sleeve extending adjacently from said seat, outlet passages in said sleeve adjacent said seat, a cup-shaped member fitting over and around said sleeve, a valve carried by the bottom of said cup-shaped member and extending upwardly within and spaced from said sleeve and adapted to engage said valve seat, a spring abutment on the upper edge of said cup-shaped member, a plug for said recessed chamber having a spring abutment fitting within said chamber, and a spring positioned in said chamber and acting between said abutments.

2. In a diaphragm controlled expansion valve, a casing having a recessed chamber extending inwardly from the periphery thereof, said chamber having an inlet opening, a valve seat in said opening, a hollow sleeve extending adjacently from said seat, outlet passages in said sleeve adjacent said seat, a cup-shaped member fitting over and around said sleeve, a valve carried by the bottom of said cup-shaped member and extending upwardly within and spaced from said sleeve and adapted to engage said valve seat, a spring abutment on the upper edge of said cup-shaped member, a plug for said recessed chamber having a spring abutment fitting within said chamber, and a spring encircling said cup-shaped member and acting between said abutments.

3. In a diaphragm controlled expansion valve, a casing having a recessed chamber extending inwardly from the periphery thereof, said chamber having an inlet opening, a valve seat in said opening, a hollow sleeve extending adjacently from said seat, outlet passages in said sleeve adjacent said seat, a cup-shaped member fitting over and around said sleeve, a needle valve floatably carried by the bottom of said cup-shaped member and extending upwardly within and spaced from said sleeve and adapted to engage said valve seat, a spring abutment on the upper edge of said cup-shaped member, a plug for said recessed chamber having a spring abutment fitting within said chamber, and a spring positioned in said chamber and acting between said abutments.

4. In a diaphragm-controlled expansion valve, a casing having a recessed chamber extending inwardly from the periphery thereof, an inlet opening in the top of said chamber, an outlet opening in the side of said chamber, a cylindrical valve guide spaced from the walls of said chamber and extending downwardly from said inlet opening, a valve seat at the top of and within said guide, an aperture in the wall of said guide adjacent said seat providing a passageway from said inlet opening to said chamber and said outlet opening, a valve-holding member having a cylindrical portion telescoping over and slidably guided by the outer surface of said valve guide, a valve carried on the bottom of said valve-holding member and projecting upwardly within said valve guide to engage with said seat and spaced from the walls of said guide, a spring abutment on the upper edge of said valve-holding member, a plug for said recessed chamber, and a spring acting between said abutment and said plug.

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