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REFRIGERATING APPARATUS

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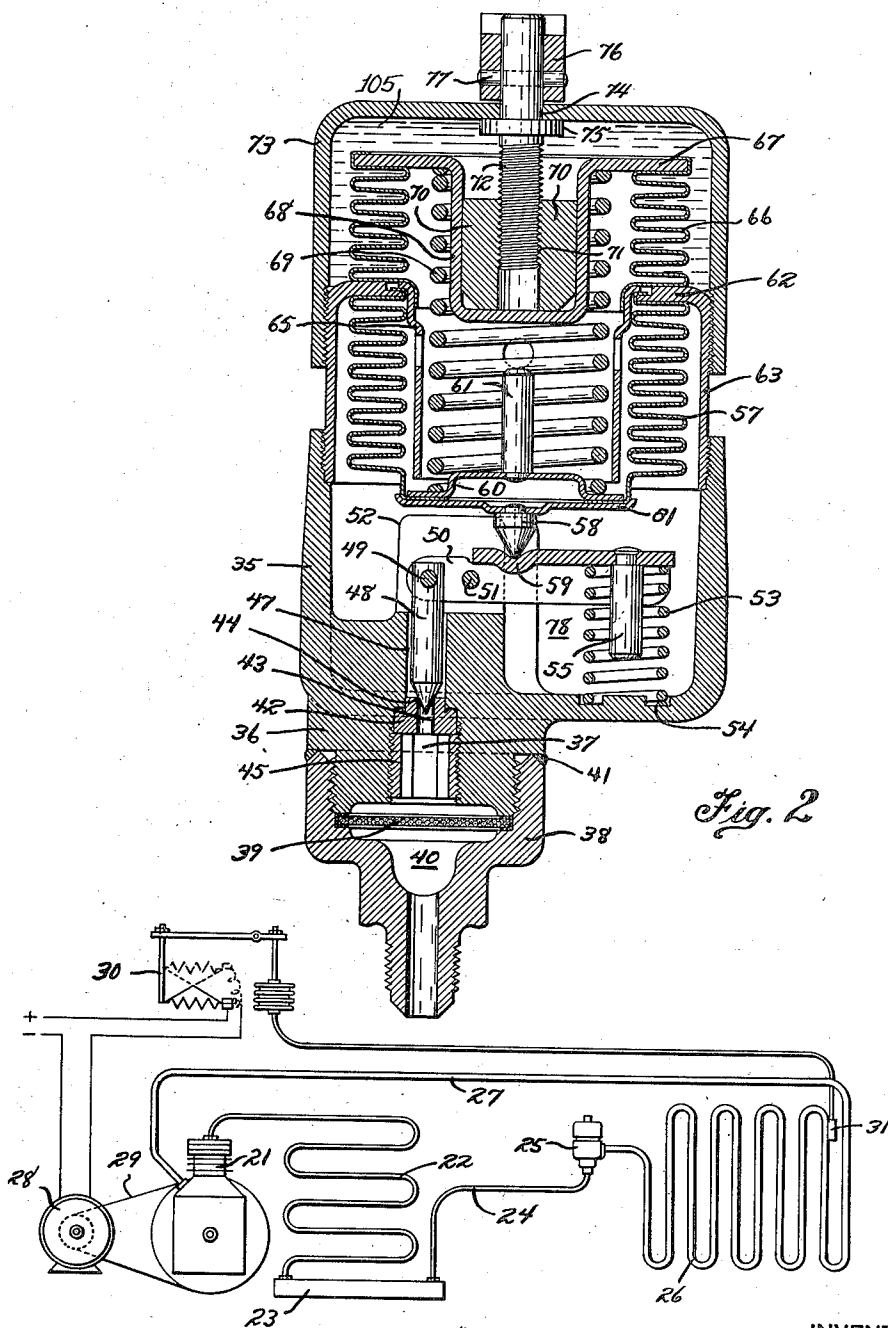


Fig. 1

Fig. 2

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REFRIGERATING APPARATUS

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5 Claims. (Cl. 50—26)

This invention relates to refrigerating apparatus and more particularly to refrigerant expansion valves therefor.

There has been considerable trouble with refrigerant expansion valves on account of moisture laden air entering portions of the valve which are normally cold because of the presence of liquid refrigerant within the valve structure. This moisture is condensed and frozen upon movable parts thereof, preventing proper operation and proper adjustment of the valve.

Consequently, the objects of my invention include the provision of an improved enclosed refrigerant expansion valve having an improved adjustment means and improved means for excluding moisture laden air from coming in contact with the movable parts of the valve.

It is another object of the invention to provide improved means for flushing the valve.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a diagrammatic illustration of a refrigerating system of the direct expansion type including my improved expansion valve; and

Fig. 2 is a sectional view of my improved refrigerant expansion valve of the automatic type shown in Fig. 1.

Referring to the drawing, there is shown for the purposes of illustrating my invention, a refrigerating system of the direct expansion type including a compressor 21 for compressing the refrigerant and for forwarding the compressed refrigerant to a condenser 22 where the compressed refrigerant is liquefied and collected in the receiver 23. From the receiver 23, the liquid refrigerant is forwarded through a conduit 24 to my improved refrigerant expansion valve 25 which permits the liquid refrigerant under control of pressure within the evaporator 26 to pass into the evaporator. In the evaporator 26, the liquid refrigerant vaporizes under reduced pressure and is returned to the compressor 21 through the return conduit 27. The compressor 21 is driven by an electric motor 28 through suitable pulley and belt means 29. The operation of the electric motor 28, and consequently the compressor 21, is controlled by a thermostatic snap acting switch means 30 which is operated by a volatile fluid contained in the thermostatic bulb 31 adjacent the evaporator 26.

Referring more particularly to Fig. 2 for the

construction of my improved expansion valve, there is shown a lower valve casing 35 having a cup-shaped upper portion and a lower valve housing 36 containing a refrigerant passage 37. A coupling member 38 is threaded into the lower portion of the valve portion 35 and holds a strainer 39 in a strainer chamber 40. The threaded joint of the coupling member 38 with the valve housing 36 is sealed by the solder 41. The refrigerant passage 37 connects with the strainer chamber 40 and is provided with a removable valve seat member 42 provided with an aperture 43, for permitting the flow of refrigerant therethrough, and at the upper end of the aperture 43, there is a valve seat 44. The valve seat member 42 is held in place by a threaded bushing 45.

Above the valve seat 44 a refrigerant passage 47 extends in a vertical direction in axial alignment with the passage 37 and contains a needle valve 48 which has its conical lower end adapted to seat upon the valve seat 44. The upper end of the needle valve 48 is connected by means of a pin 49 to a lever 50 which is pivoted by means of a pin 51 to a pair of bosses 52 formed integral with the casing 35. Upon the other side of the fulcrum pin 51 there is provided a coil spring 53 having its upper end resting against the lower side of the lever 50 and its lower end seated within a recess 54 in the bottom wall of the casing 35. A locating pin 55 has its upper end fixed to the lever 50 and extends downwardly therefrom within the coil spring 53 for holding this spring in its proper place. The refrigerant leaves this refrigerant chamber 78 through a passage 41 at the side as shown in Fig. 1.

The lever 50 is operated to open and close the valve means, comprising the needle valve 47 and its seat 44, by means of a bellows mechanism 57 which has a conical shaped button 58 at its lower end which rests in a notch 59 provided in the top surface of the lever 50. The conical shaped button 58 is riveted to an outer bottom plate 61 upon the lower end of the bellows 57. The outer bottom plate 61, in cooperation with the inner bottom plate 60, seals and closes the lower end of the bellows 57. The inner bottom plate 60 supports a flushing pin 61 which extends upwardly therefrom. The upper end of the bellows 57 is sealed to an in-turned flange 62 provided upon the upper end of a cylindrical-shaped member 63 which forms a part of the casing of the valve. The lower end of the cylindrical member 63 is threaded into the upper portion of the casing 35 and is sealed thereto by means of solder. An inner cy-

lindrical member 65 also has its upper end fastened to the flange 62 of the cylindrical member 63 and extends downwardly, forming a stop member within the bellows 57 to prevent excessive collapse of the bellows 57 and thus prevent injury thereof.

A second bellows 66 has its lower end sealed to the flange 62 and the inner cylindrical stop member 65. This second bellows 66 extends upwardly and has its upper movable end closed by a movable adjusting plate 67 to which the upper end of this second bellows is sealed. The adjustable upper plate 67 has a depressed center portion 68 and a coil spring 69 of the compression type surrounds this depressed portion 68 and extends between the upper end of the adjustable plate 67 and the inner bottom plate 60. This coil spring 69 transmits force from the movable end of the second bellows 66 to the lower bellows 57. Within the depressed portion 68 of the adjustable plate 67 there is secured an adjusting block 70 having a threaded aperture 71 therein. An adjusting screw 72 has its lower end threaded into the adjusting block 70 and its upper end is supported by means of an inverted cup-shaped casing member 73 which has its lower end threaded to the upper end of the outer cylindrical member 63. Preferably, this threaded joint between the outer cylindrical member and the inverted cup-shaped member 73 is sealed by means of solder. An aperture 74 in the flat top of the cup-shaped member 73 serves as a bearing for the adjusting screw 72. The adjusting screw 72 is provided with a collar 75 on the inside of the casing member 73 which bears against the bottom side of this member. On the outside of the casing member 73 there is provided suitable manual operating means 76 such as a handle member which is pinned by means of a pin 77 to the upper end of the adjusting screw 72. If desired, this upper chamber 105 formed between the second bellows 66 and the casing 73 may be provided with glycerin, hard grease or petroleum jelly, to prevent any moisture from condensing and freezing in the folds of the second bellows 66 or upon the adjusting screw 76. The second bellows 66 seals the interior of the lower refrigerant responsive bellows 57.

The operation of my improved automatic valve is as follows. When there is an ample amount of refrigerant in the evaporator 26 and the pressure in the evaporator 26 is high, there will be a similar high pressure within the lower refrigerant chamber 78 of the valve 25. This high pressure will act upon the lower bellows 57 which is exposed to the pressure of the refrigerant after it has passed through the valve means and this pressure will move the lower end of the bellows 57 upwardly, compressing the coil spring 69 a slight amount and permitting the compression spring 53 to extend and to pivot the lever 50 counter-clockwise to press the needle valve 48 against the seat 43 to prevent the flow of refrigerant until the pressure within the evaporator has been reduced by the operation of the compressor 21. When the pressure within the evaporator 26 has been reduced, the coil spring 69 will move the lower end of the refrigerant bellows 57 downwardly against the pressure of the spring 53 to turn the lever 50 clockwise and to lift the needle valve 48 from its seat 43 to allow refrigerant to flow from the liquid conduit 24 into the chamber 78 and from thence into the expansion coil 26.

The coil spring 69 and the interior of the lower refrigerant bellows 57 are sealed from external

air by means of the upper or second bellows 66 and the adjusting plate 67. This prevents the freezing of any moisture upon the interior of the bellows 57. The second bellows 66 is enclosed by the casing member which normally prevents moisture from freezing upon the second bellows 66. Since the second bellows 66 is not in direct contact with the refrigerant, it does not become as cold as the lower bellows and moisture is less likely to freeze thereon.

By turning the handle 76 the adjusting plate 67 is moved either upwardly or downwardly to change the tension of the spring 69 which in turn changes the point at which the pressure within the evaporator is insufficient to hold the valve means closed. By my construction an effective seal for the pressure operated bellows is provided notwithstanding the fact that an externally controlled manual adjusting means is provided.

Inasmuch as dirt or other particles are sometimes of such fineness as to pass through the strainer 39 and occasionally become lodged between the needle valve 48 and its seat 44 to hold the needle valve slightly open, it has been found desirable to provide a simple means for positively opening the valve means to flush the valve by allowing a comparatively large amount of liquid refrigerant to pass through for a short time in order to dislodge any particles preventing the proper closing of the needle valve 48. For this reason I have provided the flushing pin 61 mounted upon the inner bottom plate 60 of such a length that when the handle 76 is turned a sufficient amount the bottom portion of the adjusting plate 67 will engage the top of the flushing pin 61 to turn the lever 50 clockwise to positively raise the needle valve 48 to open the valve means. In this way my manual adjusting means is used both to adjust the valve and to flush the valve.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A valve including a casing enclosing a chamber, valve means for controlling the flow of a fluid, said chamber being in open communication with said fluid, a bellows structure within said casing, said bellows structure having closed movable ends and having an intermediate portion sealed to and fixed to said casing, a coil spring exerting force against the movable ends of the bellows structure enclosed within the bellows structure, one end of said bellows structure being connected with said valve means, said bellows structure being filled with a gas, and adjusting means for moving the other end of said bellows structure without affecting the support for the bellows structure for adjusting the tension of said coil spring within the bellows structure.

2. An expansion valve including a casing having a fluid chamber therein, said casing having an inner annular flange, a bellows having one end sealed to the flange and having the other end closed and extending into said fluid chamber, fluid conduit means communicating with said fluid chamber, valve means for controlling the flow of fluid through said fluid conduit means, said valve means being operatively connected with the closed movable end of said bellows, a second bellows having one end sealed to the flange and extending in the opposite direction from said

first mentioned bellows, said second bellows having its movable end closed, said first and second bellows being filled with a gas, spring means for transmitting force from one of the closed movable ends to the other, and manually operable adjusting means for moving the closed end of the said second bellows to adjust said spring means and said first mentioned bellows and said valve means operatively connected thereto, said casing extending and enclosing said second bellows and said manual adjusting means having a manual operating portion outside of said casing.

3. An expansion valve for refrigerating apparatus including a casing enclosing a chamber, a bellows structure within said chamber, said bellows structure having closed movable ends and having an intermediate portion sealed to the casing forming two sub-chambers each containing one of the movable ends of said bellows structure, valve means operatively connected with the movable end of said bellows structure located in one of said sub-chambers for controlling the flow of refrigerant through the casing, said bellows structure being filled with a gas, means for transmitting force from one of the movable ends of the bellows structure to the other end, and adjusting means for moving the end of the bellows opposite to the end connected to the valve means for adjusting the operation of the valve means, said adjusting means having manual control means extending outside of the casing, said adjusting means having a portion located within one of said sub-chambers, said last mentioned sub-chamber containing a non-freezing solution for preventing freezing of moisture therein.

4. An expansion valve including a casing enclosing a chamber, a bellows structure within said chamber, said bellows structure having closed

movable ends and having an intermediate portion sealed to the casing forming two sub-chambers each containing one of the movable ends of said bellows structure, a fluid conduit means having a portion in communication with one of said sub-chambers forming a fluid containing sub-chamber, valve means operatively connected with the movable end of said bellows structure located in said last mentioned fluid sub-chamber for controlling the flow of fluid through said fluid conduit means, said bellows structure being filled with a gas, means for transmitting force from one of the movable ends of the bellows structure to the other end, and adjusting means for moving the end of the bellows opposite to the end connected to the valve means for adjusting the operation of the valve means, said adjusting means having manual control means extending outside of the casing, and means operated by said manual control means including positive structural means for positively opening the valve means to flush the valve.

5. An expansion valve including an enclosure having a bellows forming a wall portion of the enclosure, a valve means for controlling the flow of a fluid, said enclosure being in open communication with said fluid in the valve means, a second bellows for sealing and enclosing one side of the first mentioned bellows, resilient force transmitting means exerting force from one of said bellows to another, manually controllable adjusting means for moving the second bellows to adjust the valve means, and means operated by the manually controllable adjusting means including positive structural means for positively holding the valve means in open position.

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