

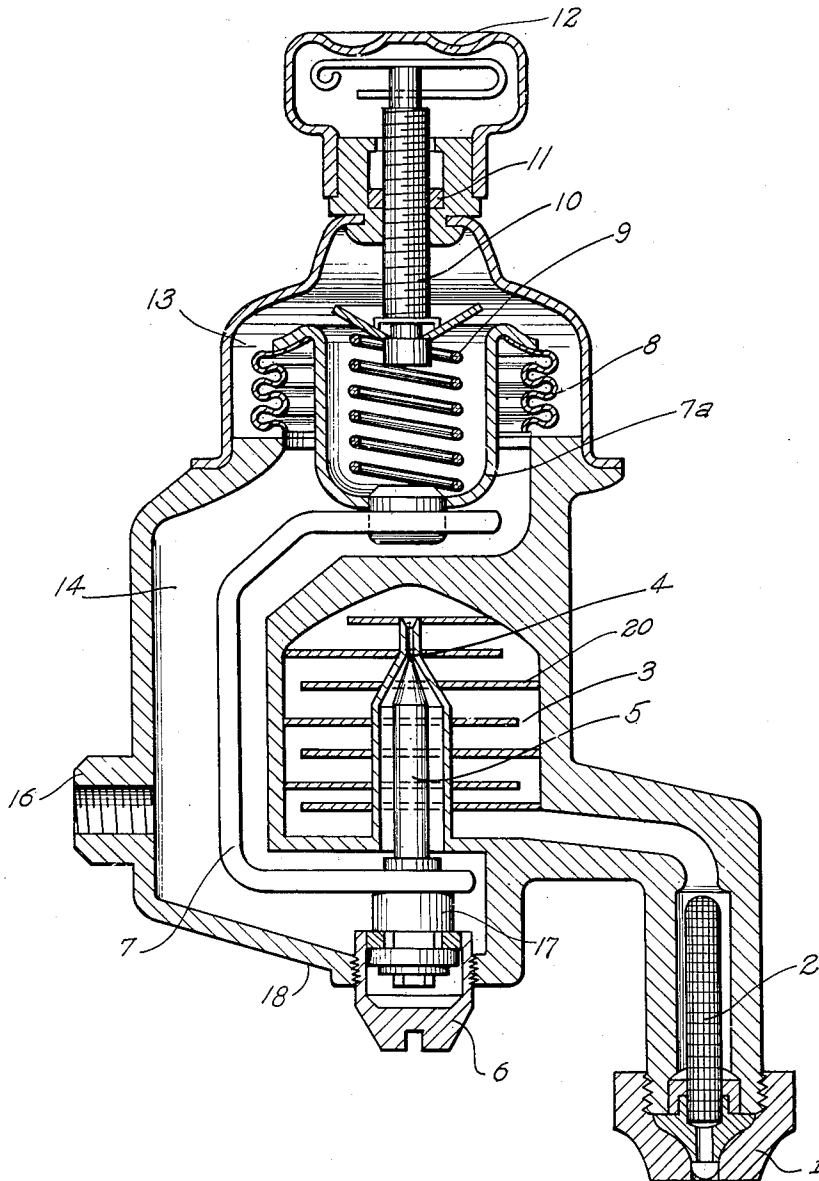
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C. S. MARTIN

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REFRIGERANT EXPANSION VALVE

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Inventor
Clyde S. Martin

By *W. H. Brown, Reisman & Davidson*
Attorneys

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REFRIGERANT EXPANSION VALVE

Clyde S. Martin, Miami, Fla.

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1 Claim. (Cl. 62—127)

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This invention relates to an expansion valve for refrigerating systems.

It is an object of this invention to provide an improved valve of the type referred to, which is simple in construction, inexpensive to manufacture, durable in service, and efficient in operation.

Another object of this invention is to provide a valve of the type referred to, which minimizes sticking of the movable parts under the conditions of service.

Other objects will appear to those skilled in the art from a reading of the following specification.

The accompanying drawing illustrates a preferred embodiment of the invention, but it is understood that modifications may be made therein without departing from the spirit of the invention as hereinafter claimed.

The figure represents a vertical section through the new and improved expansion valve.

The function of the expansion valve in a refrigerating system is to receive liquid refrigerant under high pressure from a condensing unit and permit it to expand into a low-pressure liquid and vapor mixture before being sent to a vaporizer to absorb heat. The valve shown herein is an automatic pressure-expansion valve, but the invention is equally applicable to the type of valve known as the thermostatic expansion valve.

At the bottom of the illustrated device is an inlet connection 1 from a condensing unit. The conduit from the inlet connection 1 contains a metal strainer 2 and emerges into a domed inlet chamber 3. A valve orifice 4 is positioned near the top in the center of the chamber 3, and a valve needle 5 is adapted to move vertically to cooperate with the orifice 4 to allow passage therethrough downwardly of the liquid from the inlet chamber 3, as will be described more particularly hereinafter.

The valve needle 5 is carried by a needle base 17 which is movably mounted within a hollow plug 6, the plug 6 being removably secured in the housing 18.

The needle 5 is vertically movable by means of a yoke 7, the yoke 7 having its lower portion secured to the needle base 17. The upper portion of the yoke 7 is fastened to the bottom of a cup-shaped member 7a, which in turn is attached to the top of an expandible bellows 8 in the upper portion of the valve. A coil spring 9 bears against the member 7a to balance the needle 5, and an adjusting screw 10, which may be set manually, determines the tension of the adjusting spring 9 to control the amount of refrigerant permitted to pass through the orifice 4. The upper portion of

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the adjusting screw 10 may be sealed with packing 11, and the top enclosed with a cap 12.

It will be seen, therefore, that the bellows 8 divides the valve into two chambers, an upper bellows chamber 13 which may be open to atmospheric pressure, and a lower expansion chamber 14 in which the high-pressure liquid refrigerant from the inlet chamber 3 may expand into liquid at lower pressure.

The lower portion of the valve contains an outlet connection 16 leading to the vaporizer, where the refrigeration takes place.

The inlet chamber 3 of the valve contains a plurality of interdigitating horizontal partitions 20, to force the liquid entering from the connection 1 to take a circuitous path upwardly before reaching the orifice 4.

In the operation of the device, liquid refrigerant enters through the inlet connection 1, and after passing through the strainer 2 takes a circuitous path through the partitions 20 before reaching the orifice 4 at the top of the domed chamber 3. When the needle 5 is open, the refrigerant will flash down past the needle 5 into the expansion chamber 14, where of course it will have a lower pressure than in the inlet chamber 3.

When the pressure in the expansion chamber 14 is lowered by the suction of the compressor to a predetermined point, the suction will pull against the bellows 8. The pressure within the bellows chamber 13 remaining at atmospheric pressure, the bellows 8 will be compressed downwardly, and the cup-shaped member 7a will be forced downwardly, against the tension of the spring 9. When the cup-shaped member 7a is forced down, it will carry the yoke 7 with it, and the valve needle 5 will also be lowered to open the orifice 4 from the inlet chamber 3 into the expansion chamber 14. When a sufficient amount of liquid refrigerant has gone through the outlet connection 16 into the vaporizer and has vaporized therein, the resultant increased pressure in the vaporizer will be communicated back to the expansion chamber 14, increasing the pressure in this expansion chamber 14. The increase in pressure will force the cup-shaped member 7a upwardly, and both the atmospheric pressure in the chamber 13 and the adjusting spring 9 will pull the yoke 7 upwardly, forcing the valve needle 5 back into the orifice 4 and closing the passage to the refrigerant in the chamber 3. This process of flow and stop is continual and automatic.

It will be observed that the orifice 4 of the valve needle 5 is in the path of the relatively

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warm liquid refrigerant coming from the condensing unit through the inlet connection 1. This refrigerant is usually 80° to 100° Fahrenheit. The partitions 20 in the chamber 3 are made of metal, and are consequently good thermal conductors. As a result, the orifice 4 and the operative portion of the valve needle 5 will be maintained relatively warm. Heretofore, the expansion of liquid refrigerant from high-pressure to low-pressure has resulted in the absorption of heat by the liquid and the consequent cooling of the surroundings. As a result, the devices of the prior art have been subjected to the formation of ice at the orifice of the valve needle. The formation of such ice has very often frozen the needle completely shut, thus not allowing the passage therethrough of any refrigerant, or, if the needle is frozen only partially open, a steady stream of refrigerant passes therethrough with resultant ill effects. Since the valve of the present invention keeps the orifice 4 and the needle 5 at a relatively high temperature, the formation of ice will be prevented. Even if such ice is momentarily formed, it will be quickly melted. Further, the pre-cooling of the refrigerant in the device makes it more efficient in removing heat from the space to be refrigerated.

By determining the tension of the adjusting spring 9, the screw 10 controls the amount of refrigerant permitted to pass from the inlet

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chamber 3 to the expansion chamber 14, and consequently the pressure in the vaporizer and the amount of refrigeration in the refrigerating system.

I claim:

In an expansion valve for refrigerating systems, a domed inlet chamber for holding liquid refrigerant at high pressure, a series of interdigitating heat-transfer baffles fixed to the walls of said inlet chamber, an orifice axially centered in said inlet chamber at the top thereof and leading downwardly to an expansion chamber, said heat-transfer baffles adapted to convey heat from said inlet chamber to the walls of said orifice, and a needle valve responsive to pressure in said expansion chamber movable in said orifice.

CLYDE S. MARTIN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,659,918	Lipman	Feb. 21, 1928
1,719,841	Hull	July 9, 1929
1,779,409	Chilton	Oct. 28, 1930
1,988,289	Wittelman	Jan. 15, 1935
2,071,935	Muffy	Feb. 23, 1937