July 6, 1926. 1,591,302

W. S. FRANKLIN

AUTOMATIC EXPANSION VALVE FOR REFRIGERATING SYSTEMS

Filed June 9, 1925

Fig. 1.

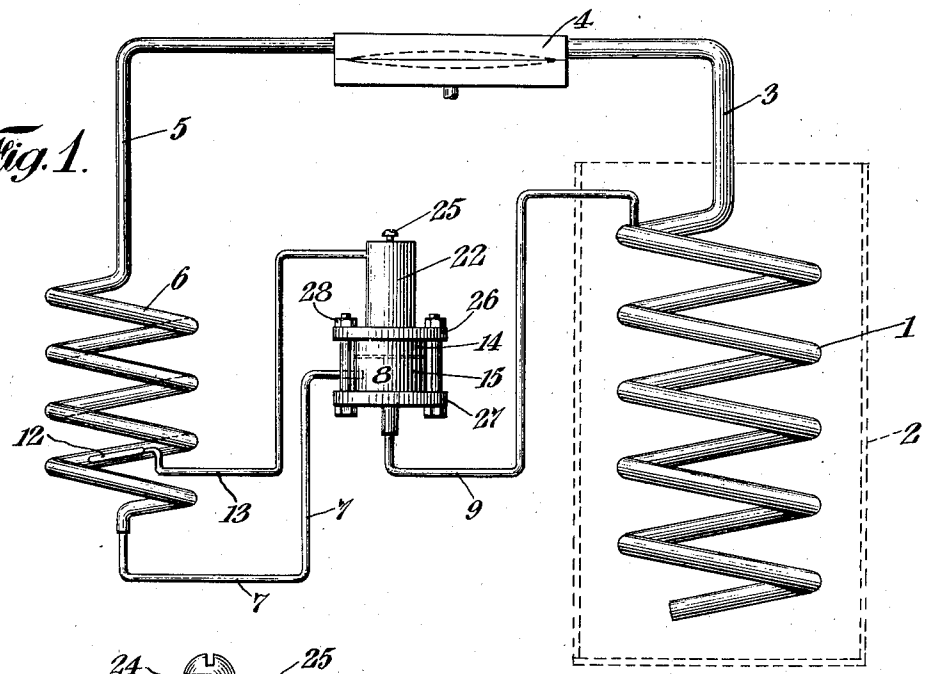
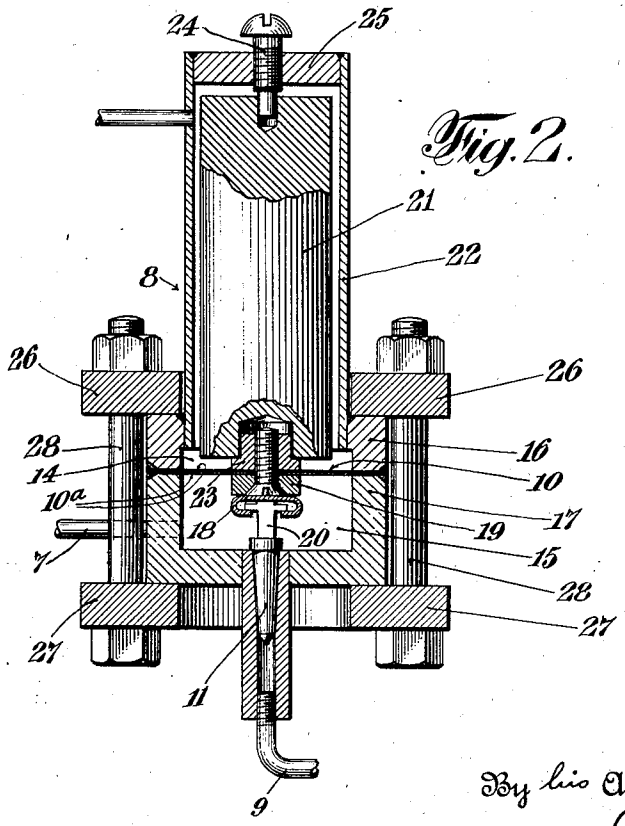


Fig. 2.



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Patented July 6, 1926. 1,591,302

UNITED STATES PATENT OFFICE.

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AUTOMATIC EXPANSION VALVE FOR REFRIGERATING SYSTEMS.

Application filed June 9, 1925. Serial No. 35,878.

The invention relates to refrigerating machines operated by the expansion of suitable working fluid such as anhydrous ammonia and has for its principal object to provide a completely automatic and dependable expansion valve for controlling the flow of the condensed liquid ammonia or other working fluid, from the high pressure condenser coils to the low pressure cooling coils. Further objects and advantages of the invention will be in part obvious and in part particularly pointed out in the description hereinafter contained which, taken in conjunction with the accompanying drawings, discloses a preferred embodiment thereof. Such embodiment, however, is to be considered as merely illustrative of its principles.

In the drawings—

Fig. 1 is a diagrammatic view of a refrigerating system adapted to operate in accordance with the invention;

Fig. 2 is a vertical section of the expansion valve which forms one element of such system.

The invention is illustrated as applied to a simple refrigerating system having cooling coils 1 enclosed within a suitable refrigerating chamber 2 and connected by a pipe 3 to a suitable compressor 4 (preferably of the flexible metal diaphragm type) which compressor withdraws the expanded working fluid from the low pressure coils 1 and delivers it at high pressure through pipe 5 to the condenser coils 6 which in the particular form of the invention which is illustrated, are air-cooled. The condensed working fluid passes from coils 6 through a tube 7 to an expansion valve denoted generally by numeral 8 and from said valve through a pipe 9 back to the cooling coils 1.

As the refrigerating machine operates, the condensed working fluid collects in the bottom coils of condenser 6 and the temperature at this point falls to approximately air temperature, while the upper coils of condenser 6 are kept at a considerably higher temperature by the condensing working fluid. I make use of this temperature difference to operate the expansion valve 8, which valve in the illustrated form of the invention is operated by a flexible diaphragm 10 connected to the valve member 11 and sensitive to pressure differences upon its opposite faces so as to open and close the valve in accordance with pressure conditions affecting the diaphragm.

The pressure on one side of the diaphragm 10 is determined by the temperature adjacent the bottom of the condenser coils 6, whereby the drop in such temperature caused by condensed ammonia or other working fluid will reduce the pressure on one side of the diaphragm and move the latter to open the valve member 11.

As shown, I place what may be termed a thermometer bulb 12 in, or in good thermal relation to one of the lower coils 6, this bulb containing some liquid ammonia and being connected through a tube 13 to a chamber 14 on one side of diaphragm 10. Thus when liquid ammonia is present in the lower coil 6, the vapor pressure in chamber 14 will be reduced and diaphragm 10 will rise to permit the working fluid to flow past valve member 11 to the cooling coils 1. When the condensed ammonia is drawn off, the temperature of bulb 12 and the pressure in chamber 14 will rise, causing the diaphragm to move downwardly and close the expansion valve.

In the illustrated form of the invention, the lower side of diaphragm 10 is exposed to a chamber 15 connected to condenser coils 6 through pipe 7 and is therefore subjected to the vapor pressure in the condenser coils.

In Fig. 2 I have illustrated more in detail one specific construction of expansion valve which may be employed. As shown, the diaphragm member 10 consists of two leaves of thin sheet steel 10^a welded at their peripheries to upper and lower metallic cup-shaped members 16 and 17, which latter form walls for the chambers 14 and 15 respectively.

The lower side of the diaphragm 10 is suitably connected to the expansion valve plunger 11 as by providing a clip 18 on the lower side of a block 19, and secured to the diaphragm, which clip encloses a T-shaped head 20 on the valve plunger.

Although the force exerted upon the diaphragm 10 by the pressure differences above described may be relied upon to close the expansion valve, I prefer to influence the valve as well toward closed position by some device such as the weight 21 enclosed within a cylindrical extension 22 of chamber 14 and resting upon a block 23 secured to the

upper side of the diaphragm 10. The distance through which the weight 21 may move upwardly upon the opening of the valve may be regulated as by providing a suitable screw 24 in the upper end wall 25 of chamber 14.

After the parts have been assembled all joints are preferably welded to insure against leakage, and clamping plates 26 and 27 may also be provided to overlie the cup members 16 and 17, such clamping plates being drawn together by suitable bolts 28.

While a specific embodiment of the invention has been disclosed it will be obvious that many changes may be made therein without departing from its principles as set forth in the following claims:

1. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, an actuating member for said valve, and a device sensitive to temperature changes in a lower condenser coil for controlling the position of said actuating member.

2. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, a chamber containing expansible fluid, means for varying the pressure of such fluid according to the temperature in a lower condenser coil, and an actuating member for said valve responsive to pressure changes in said fluid.

3. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, a chamber containing expansible fluid, means for varying the pressure of such fluid, according to the temperature in a lower condenser coil and a flexible diaphragm exposed to the pressure of said fluid and connected to said valve to actuate the same.

4. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, a chamber containing expansible fluid, means for varying the pressure of such fluid according to the temperature in a lower condenser coil, a second chamber subjected to the vapor pressure in the condenser coils and a flexible diaphragm interposed between said chambers for actuating said valve.

5. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, a chamber containing expansible fluid, means for varying the pressure of such fluid according to the temperature in a lower condenser coil, a second chamber subjected to the vapor pressure in the condenser coils and means subjected to pressure differences between said chambers for actuating said valve.

6. In a refrigerating system, an expansion valve interposed between the condenser and cooling coils, a chamber containing expansible fluid, means for varying the pressure of such fluid according to the temperature in a lower condenser coil, a flexible diaphragm exposed to the pressure of said fluid and connected to said valve to actuate the same, and a weight for urging said valve toward closed position.

In testimony that I claim the foregoing, I have hereunto set my hand this 29th day of May, 1925.

WILLIAM S. FRANKLIN.