Aug. 18, 1931. R. M. HVID 1,819,370

EXPANSION VALVE

Filed Jan. 10, 1931

Fig. 1.

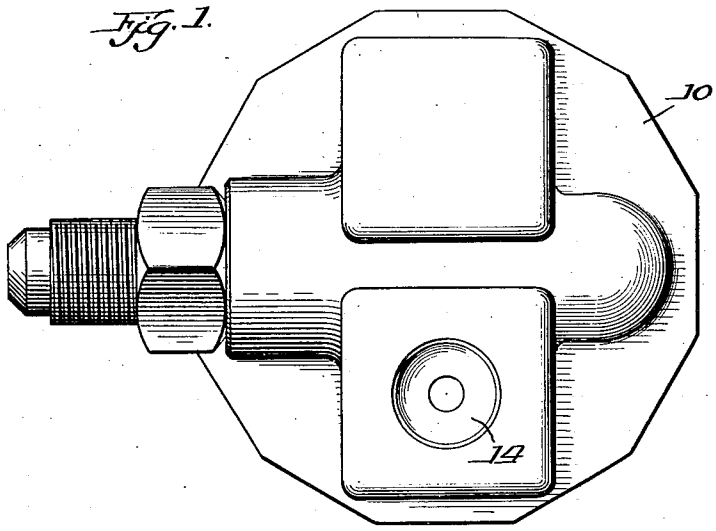
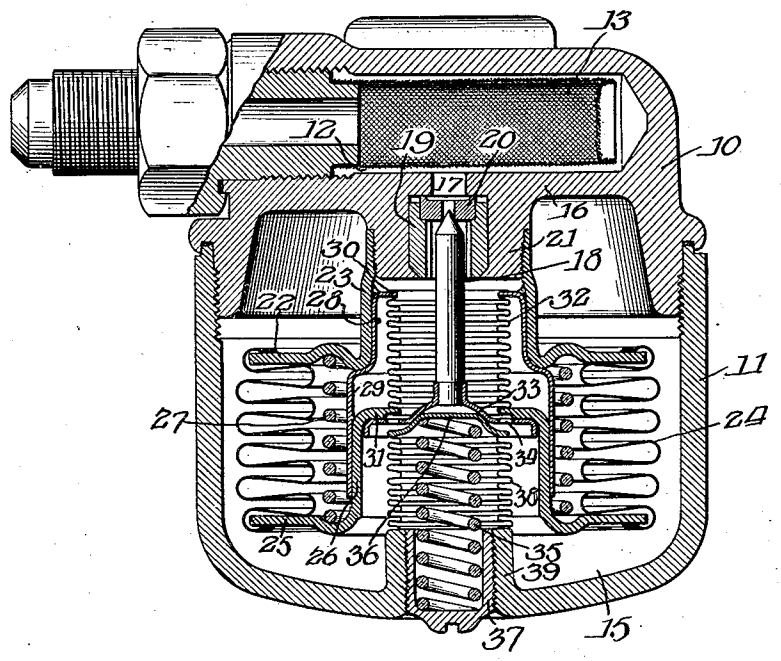


Fig. 2.



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EXPANSION VALVE

Application filed January 10, 1931. Serial No. 507,899.

My invention relates to expansion valves for use in refrigerating machines and particularly to a novel construction having numerous advantages that will be pointed out hereinafter.

An object of my invention is to provide an expansion valve of extreme simplicity and of very small size, one that can be cheaply manufactured and that is adapted for wide variation in the capacity or variation in pressures that may be handled.

A particular object is to provide a construction in which there are no levers used in actuating the valve, and in which all parts are symmetrically arranged with the needle valve as their axis. The conservation of space is accomplished in a simple manner that will be apparent from the following description.

My invention will be more readily understood by reference to the accompanying drawings, in which:

Fig. 1 is a plan view of a valve constructed in accordance with my invention, and

Fig. 2 is a vertical sectional view thereof.

The illustrations on the original drawings filed herewith are intended to be double scale, that is, the illustrations are twice the size of the actual device.

In the drawings I have shown a casing comprising a head 10 and a cup 11 in threaded, air-tight engagement. The head contains an inlet passage 12 for the refrigerating liquid, a pipe nipple projecting into the passage carrying a screen 13. The head also contains an outlet opening 14 in communication with the low pressure space 15 within the cup.

The wall 16 dividing the passage 12 from the low pressure chamber 15 contains a port 17 controlled by a needle valve 18, and incidental guide and seal members 19—20. A boss 21 surrounds the port and acts as a support for the valve controlling mechanism about to be described. This comprises a bellows head having an annular portion or flange 22, and a tubular portion 23 that engages the boss. A bellows 24 constructed in the form of an annulus is secured at one end to the support 22 and at the lower end to a floating head having an annular portion 25 and a tubular portion 26 that projects upwardly into the space at the center of the bellows. A relatively strong spring 27 is interposed between the support and the head, a spring of suitable strength being selected to balance or off-set the expected pressure exerted on the exposed area of the bellows head. This spring is of fixed resistance, that is, no regulating means are provided.

A guide sleeve has a neck 28 which is pressed into the tubular portion 23 of the support, while the depending portion 29 projects downwardly and acts as a guide for the tubular portion 26 of the head. The neck portion 28 has an inwardly projecting flange 30 and the tubular portion 26 has a corresponding flange 31. To these flanges is secured by soldering or welding, a second bellows 32 that surrounds the needle valve 18 and serves to seal the interior of the large bellows 24.

The needle valve has a disc like head 33 a margin of which underlies the flange 31 of the bellows head, the disc having suitable openings 34 thereon to permit the escape of liquid that passes therethrough.

The described parts may be constructed as a unit and then merely threaded into the boss 21.

Variable spring pressure is exerted on the lower end of the needle valve by means of the spring 35, the upper end of which is contained on a cap 36, and the lower end within a screw socket 37 that projects through the lower wall of the cup and is adapted for actuation from the exterior of the casing. In order to seal the interior of the casing against any escape around the

adjusting socket 37, I provide a third bellows 38, soldered at its upper end to the spring cap, and at its lower end to the upwardly projecting boss 39 on the cup. Thus the adjustment of the spring may be changed or the spring removed and replaced without unsealing the casing.

With the parts assembled as shown, with the low pressure chamber 15 in communication with the evaporation chamber of a refrigerating device, and the inlet in communication with the high side of such a device, the operation proceeds as follows: It will be noted that air is trapped within the main bellows and constitutes a variable resistance to compression. To this is added the force of the spring 27. The pressure of the low pressure side is exerted on the bellows head, that force being insufficient to seat the needle valve against the resistance described. The added force necessary to seat the valve is supplied by the spring 35, the regulation of which force is effected from the exterior of the casing. By this means a wide variation in pressures may be handled without change in the proportions of the parts.

The construction as described may be very simply manufactured and assembled, and is adapted to handle any pressures on the low side, from 20 lbs. above atmospheric to 25 inches of mercury below atmospheric. All the parts are symmetrical about the needle valve, thereby avoiding unevenness of valve wear, and conserving space to the greatest extent.

Obviously the construction is capable of some modification, and I do not wish to be limited except as indicated in the appended claims.

I claim:

1. In combination, a casing, a wall therein providing low and high pressure chambers, said wall having a port, a needle valve controlling said port, a bellows in the low pressure chamber, said bellows having an axial opening, one end of the bellows being fixedly connected to said wall, a floating bellows head to which the opposite end of the bellows is connected, means for guiding the reciprocation of said bellows head, means connecting the bellows head and needle valve, a spring tending to expand said bellows and to open said needle valve, a second bellows surrounding the needle valve and connected at one end to said bellows head, a second spring tending to close said needle valve, and a third bellows surrounding said second spring, said second and third bellows and said springs and needle valve being with the axial opening in the first bellows.

2. In combination a casing having a port, a needle valve controlling the port, a bellows within the casing and subject to the pressure to be controlled, said bellows having an axial opening and surrounding said valve and with said valve at its axis, a second bellows within the axial opening of said first bellows and enclosing said valve and sealing the interior of the first bellows, a spring bearing against and longitudinally in line with said valve, and a third bellows enclosing said spring.

3. In combination, a casing having a division wall dividing the interior of the casing into high and low pressure chambers, said wall having a port, a ring bellows mounted in the low pressure chamber, a needle valve controlling said port and connected to said bellows, a spring of fixed resistance tending to open said valve against pressure exerted on said bellows, said valve being located within and at the axis of said ring bellows, a second bellows surrounding the valve and sealing the interior of said first bellows, a spring bearing against and arranged longitudinally of said valve and tending to close said valve, and adjustable means operable from the exterior of said casing for regulating the force of said last named spring.

4. In combination, a casing having a division wall dividing the interior of the casing into high and low pressure chambers, said wall having a port, a ring bellows mounted in the low pressure chamber, a needle valve controlling said port and connected to said bellows, a spring of fixed resistance tending to open said valve against pressure exerted on said bellows, said valve being located within and at the axis of said ring bellows, a second bellows surrounding the valve and sealing the interior of said first bellows, a spring bearing against and arranged longitudinally of said valve and tending to close said valve, a third bellows surrounding said spring, and adjustable means operable from the exterior of said casing for regulating the force of said last named spring.

5. In combination, a casing having a division wall dividing the interior of the casing into high and low pressure chambers, said wall having a port, a ring bellows mounted in the low pressure chamber, a needle valve controlling said port and connected to said bellows, a spring of fixed resistance tending to open said valve against pressure exerted on said bellows, said valve being located within and at the axis of said ring bellows, a second bellows surrounding the valve and sealing the interior of said first bellows, a spring bearing against and arranged longitudinally of said valve and tending to close said valve, a third bellows surrounding said spring, and adjustable means operable from the exterior of said casing for regulating the force of said last named spring, the axes of all said bellows and said springs being

coincident with the longitudinal axis of said needle valve.

6. In combination, a casing, a wall therein having a port, a fixed bellows support, a bellows in the form of an annulus having one end fixed to said support, a bellows head to which the other end of said bellows is secured, a spring interposed between the support and head, a guide sleeve on which said head is guided, a second bellows head at one end in fixed relation and at the other end secured to said head, a needle valve for controlling said port, a second valve for controlling said port, a second spring bearing on the end of said valve and positioned in line therewith, said valve, said springs, said second bellows and said guide sleeve being within the annular opening in said first bellows and all said parts having a coinciding longitudinal axis.

7. In combination, a casing, a wall therein having a port, a fixed bellows support, a bellows in the form of an annulus having one end fixed to said support, a bellows head to which the other end of said bellows is secured, a spring interposed between the support and head, a guide sleeve on which said head is guided, a second bellows held at one end in fixed relation and at the other end secured to said head, a needle valve for controlling said port, a second spring bearing on the end of said valve and positioned in line therewith, and a third bellows surrounding said second spring, all said bellows, said springs and said valve having coincident longitudinal axis.

8. In combination, a casing having a wall providing a port, a boss surrounding the port, a bellows support having an annular flange and a tubular portion threaded on said boss, a ring bellows secured at one end to said flange, a bellows head having an annular flange to which the opposite end of said bellows is secured, and a tubular portion, a sleeve depending from said boss and acting as a guide for the tubular portion of said head, a second bellows connected at one end to said boss and at the other end to the tubular portion of said head whereby to seal the interior of said first bellows, a needle valve controlling said port and arranged axially of both said bellows, said valve having an end disc cooperating with said head for movement therewith, a spring aligned with said valve, a cap overlying said spring and contacting said end disc, a third bellows connected to the cap at one end and to the casing at the other, and spring adjusting means operable from the exterior of the casing.

9. In combination, a casing having a wall providing a port, a bellows support secured to said wall, said support having an annular portion arranged parallel to said wall, a ring bellows secured at one end to said annular portion, a bellows head having an annular portion parallel to the annular portion of said support, to which the opposite end of said bellows is secured, said head having a tubular portion projecting into the center opening in said bellows, a sleeve projecting from said wall and acting as a guide for said tubular portion, a second bellows connected to said sleeve, and at the other end to the tubular portion of said head whereby to seal the interior of said first bellows, a needle valve controlling said port and arranged axially of both of said bellows, means connecting said valve to said bellows head, and spring means acting on said valve tending to close the same.

10. In combination, a casing having a wall providing a port, a bellows support secured to said wall, said support having an annular portion arranged parallel to said wall, a ring bellows secured at one end to said annular portion, a bellows head having an annular portion parallel to the annular portion of said support, to which the opposite end of said bellows is secured, said head having a tubular portion projecting into the center opening in said bellows, a sleeve projecting from said wall and acting as a guide for said tubular portion, a second bellows connected to said sleeve, and at the other end to the tubular portion of said head whereby to seal the interior of said first bellows, a needle valve controlling said port and arranged axially of both of said bellows, means connecting said valve to said bellows head, and spring means, adjustable from the exterior of the casing, tending to seat the valve.

11. In combination, a casing, the head of which provides inlet and outlet openings and a port, a cup depending from said head providing a low pressure chamber and symmetrical valve mechanism arranged in said low pressure chamber and comprising a ring bellows, a bellows support having an upwardly extending tubular portion adapted for gas tight connection to said head, a floating bellows head, a spring tending to expand said bellows, a second bellows contained within the center recess in said first bellows, and serving to seal the same, a needle valve located at the axes of said bellows and adapted to control said port, means connecting the said needle valve to said floating head, and a spring acting vertically on said valve, and adjustable from the exterior of the casing.

12. In combination, a casing, the head of which provides inlet and outlet openings and a port, a cup depending from said head providing a low pressure chamber, a valve mechanism arranged in said low pressure chamber and comprising a ring bellows, a bellows support having an upwardly extending tubular portion adapted for gas tight connection to said head, a floating bellows

head, a spring tending to expand said bellows, a second bellows contained within the center recess in said first bellows and serving to seal the same, a needle valve located at the axes of said bellows and adapted to control said port, means connecting said needle valve to said floating head, a spring acting vertically on said valve and adjustable from the exterior of the casing, and a third bellows enclosing said last named spring and sealing the interior of said casing from outside air.

In testimony whereof I have affixed my signature.

RASMUS M. HVID.