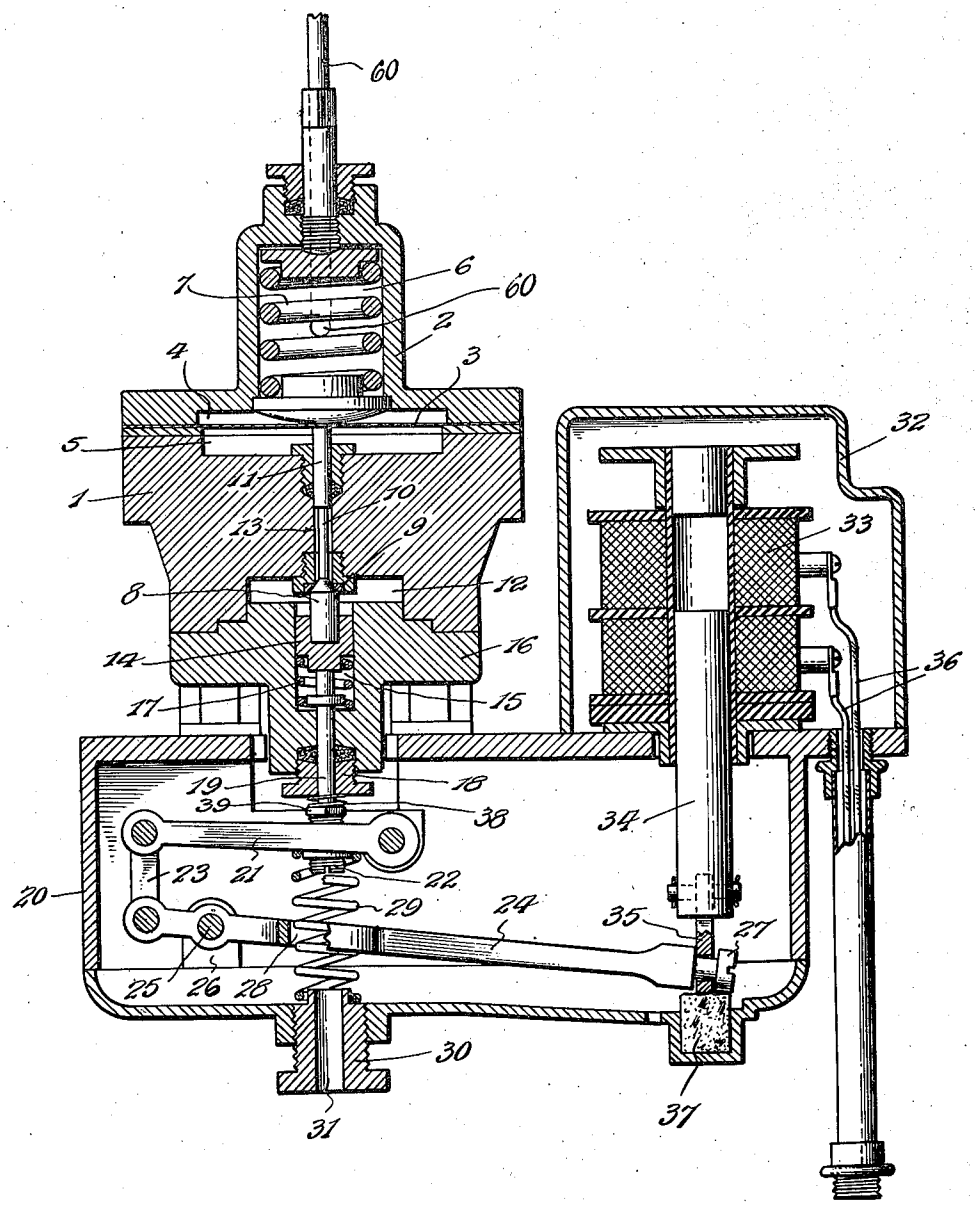
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VALVE CLOSING MECHANISM

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VALVE-CLOSING MECHANISM

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This invention relates to valve opening and closing means and is intended more particularly for application to the expansion valve of a refrigerating machine. In expansion valves of refrigerating machines, especially in that type wherein the suction pressure of the machine is governed by the gas pressure above the diaphragm, the valve will not close completely when the machine shuts down, owing to the rise in temperature and consequent rise in pressure of the gas in the thermal unit which pressure is applied to the upper side of the diaphragm in opposition to the pressure on the under side thereof from the valve proper and the elements tending to seat the valve. It is, therefore, the object of my invention to provide means whereby the valve will be quickly opened when the machine starts to operate and will be positively closed when the machine stops, and one embodiment of the invention is illustrated in the accompanying drawing.

The drawing is a vertical section through an expansion valve having the present invention applied thereto, the section being taken in a plane at a right angle to and extending across the path followed by the refrigerant in passing through the valve.

Referring particularly to the drawing, the numeral 1 indicates a valve body having a bonnet 2 bolted upon its upper side, and 3 designates a diaphragm secured by and between the valve body and the bonnet and extending through a chamber defined by a shallow recess 4 in the bottom of the bonnet and a corresponding recess 5 in the top of the valve body. The bonnet contains a chamber 6 within which are means for applying pressure to the upper side of the diaphragm 3, such means generally consisting of an expansion spring, such as indicated at 7. This chamber 6 is in communication through a tube 60 with the thermal chamber of the thermal unit of the plant so that the pressure in the chamber 6 corresponds to the pressure in the thermal chamber. It will be understood that the temperature of the returning refrigerant is communicated through the wall of the thermal chamber to the gas in said chamber and the pressure of said gas correspondingly increased or decreased. The pressure of the gas is applied through the chamber 6 to the diaphragm. Within the valve body is a cylindrical valve 8 which moves upwardly to engage a valve seat 9 and also bears against the reduced lower portion or valve pin 10 of a plunger 11 having its upper end in contact with the under side of the diaphragm. The refrigerant from the cooling coils enters a chamber 12 around the valve 8, below the seat 9 therefor, and passes into the expansion coils through an outlet located above the valve seat and in communication with the bore 13 around the valve pin 10. These elements are well known in the art and the specific operation of the same need not be further described.

In the illustrated embodiment of the present invention, the valve 8 is supported in a valve rest or carrier 14 which is slidably mounted in a bore 15 formed through a cap 16 which is bolted or otherwise firmly secured to the bottom of the valve body, and an expansion spring 17 disposed within the bore and bearing between the bottom of the same and the lower side of the carrier tends constantly to raise the carrier and the valve and hold the valve in closed position. Slidably mounted through the bottom of the cap 16 and a packing gland 18 is a plunger 19 which has its upper end in contact with the under side of the valve carrier 14 when the valve is closed, the lower end of the plunger extending downwardly from the gland 18, as shown. Bolted or otherwise rigidly secured to the valve body and the cap 16 below the latter is a housing 20 within which is fulcrumed a lever 21 which extends across the path of the plunger 19 and through which is fitted a screw 22 bearing against and supporting the lower end of the plunger. The lever 21 extends to a point near the end of the housing 20 and has pivoted to its free end a link 23 which depends therefrom and is pivoted to the end of a lower lever 24. The lower lever 24 is fulcrumed, as at 25, upon lugs 26 within the housing and adjacent the pivotal con-

nection with the link 23 while the greater length of the lever extends toward the opposite end of the housing and is equipped at its extremity with a headed stud 27 for a purpose which will presently appear. Alined axially with the plunger 19 and the screw 22, an opening 28 is formed through the lower lever 24 and a strong expansion spring 29 passes through the opening and has its upper end bearing against the upper lever 21 and its lower end resting upon a plug 30 fitted in the bottom of the housing 20 and having threaded connection therewith whereby it may be axially adjusted to vary the tension of the spring 29, as may be desired. This plug 30 is also formed with an axial bore 31 whereby a screw driver or similar tool may be inserted to engage the lower end of the screw 22 and adjust the same to attain accuracy in the operation of the mechanism.

The housing 20, it will be noted, extends to one side of the valve body 1 and upon the extended portion of the housing is mounted a casing 32 within which is an electro-magnet comprising solenoid windings 33 and a core 34 which extends downwardly into the housing and is equipped at its lower end with an eye 35 engaged with the headed stud 27, as shown. Electric conductors 36 connect the windings 33 with the working circuit of the refrigerating machine so that the solenoid will be energized when the machine is working and will be instantly de-energized when the machine shuts down. To avoid breakage or other damage to the main lever 24 and the core when they descend, a cushion or buffer 37 is provided in the bottom of the housing 20 immediately under the eye 35 and the free end of the lever 24, as shown. This buffer may be of rubber, cork, felt or any other shock-absorbing material.

The operation of the device will, it is thought, be readily understood from the foregoing description, taken in connection with the accompanying drawing. The springs 17 and 29 normally apply upward pressure to the valve 8 which tends to seat the valve. When the machine starts to operate and the circuit is closed, the solenoid is energized and the core 34 is consequently instantly raised so that the lower longer lever 24 swings upwardly through its larger arm and downwardly through its shorter arm, thereby causing the upper lever 21 to move downwardly against the force of the spring 29. The screw 22 carried by the lever 21 will, of course, drop with it and the plunger 19 will be otherwise unsupported so that it will at once move downwardly under the influence of its own weight and a tension spring 38, acting downwardly on a nut 39 secured on the plunger, to a sufficient degree to permit the valve 8 to open and work freely, the pressure upon the upper side of the diaphragm 3 at this time being greater than the pressure exerted by the spring 17. When the machine stops, the solenoid is, of course, de-energized and the weight of the core 34, together with the weight of the longer arm of the lever 24 connected with the core, causes an instant descent of the same which swings the lever 21 upwardly, the weight of the lever 24 and the core being thus applied in unison with the expansive force of the spring 29 so that the plunger 19 will be raised and the valve positively seated and it will be held seated until the solenoid is again energized.

My device operates directly upon the valve and is much simpler in construction and, therefore, cheaper to make than other devices which are known to me. Should there be an interruption in the power supply so that the working circuit is broken, the valve will immediately close and prevent flooding of the refrigerant into the expansion coil, but all other devices now known to me are so arranged that they are dependent on the power supply to effect closing.

Having thus described the invention, I claim:

1. The combination with an upwardly seating valve, of a plunger exerting upward pressure against the valve, a lever mounted below the plunger, a support for the plunger carried by the lever and adjustable axially of the plunger, a spring acting on the lever for normally holding the lever in raised position to maintain the valve in closed position, and means for rocking the lever whereby to withdraw the support from the valve and permit the valve to open.

2. The combination with an upwardly seating valve, of a plunger exerting pressure against the valve to seat the same, a system of levers acting on the plunger with the weight of the system normally holding the plunger in raised position, and an electromagnet arranged to rock the system of levers in opposition to the weight thereof and permit descent of the plunger and opening movement of the valve.

3. The combination of an upwardly seating valve, an upper one-armed lever normally exerting upward pressure against the valve to seat the same, a lower two-armed lever having its longer arm extending beyond the vertical plane of the fulcrum of the upper lever, a link connection between the shorter arm of the lower lever and the free end of the upper lever, a solenoid arranged above the free end of the lower lever and including a vertically movable core, and a pivotal and slidable connection between the lower end of the core and the free end of the lower lever.

4. The combination of an upwardly seating valve, a system of levers normally exerting upward pressure against the valve to hold the same seated, means for rocking the levers whereby to withdraw the supporting

pressure from the valve and permit the same to open, and a buffer arranged below the free end of the lowest lever of the system to cushion descent of the same.

5. The combination of an upwardly seating valve, a lever fulcrumed at one end below the valve and extending across the axial plane of the valve, a screw fitted through said lever, a plunger resting on said screw and arranged to bear against the valve, a housing for the lever, a plug in the bottom of the housing having a bore therethrough to permit access to the screw for adjusting the same, a second lever fulcrumed in the housing below the first-mentioned lever and having link connection with the free end thereof, said second lever having an opening therethrough alined axially with said screw, and means acting on the free end of the second lever to rock both levers and permit opening of the valve.

6. The combination of an upwardly seating valve, a lever mounted below the valve, a plunger supported by said lever and bearing against the valve, a housing for the lever, a plug adjustably fitted in the bottom of the housing, an expansion spring resting at its lower end upon the plug and bearing at its upper end against the lever, and means tending normally to hold the lever in raised position with the valve closed and operable to rock the lever downwardly and permit the valve to open.

In testimony whereof I affix my signature.

JOHN L. SHRODE. [L. S.]