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REGULATING VALVE FOR REFRIGERATING SYSTEMS

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Fig. 1

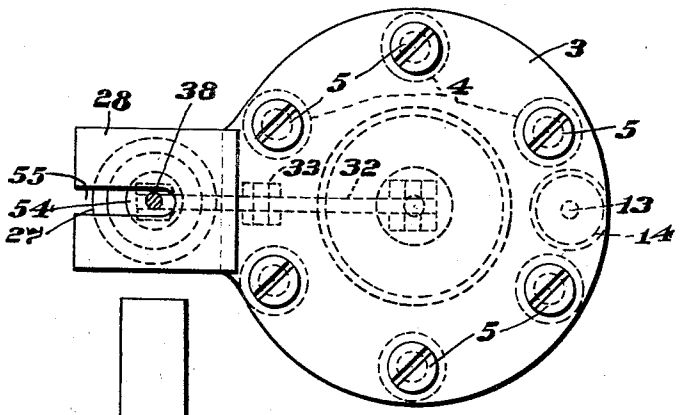
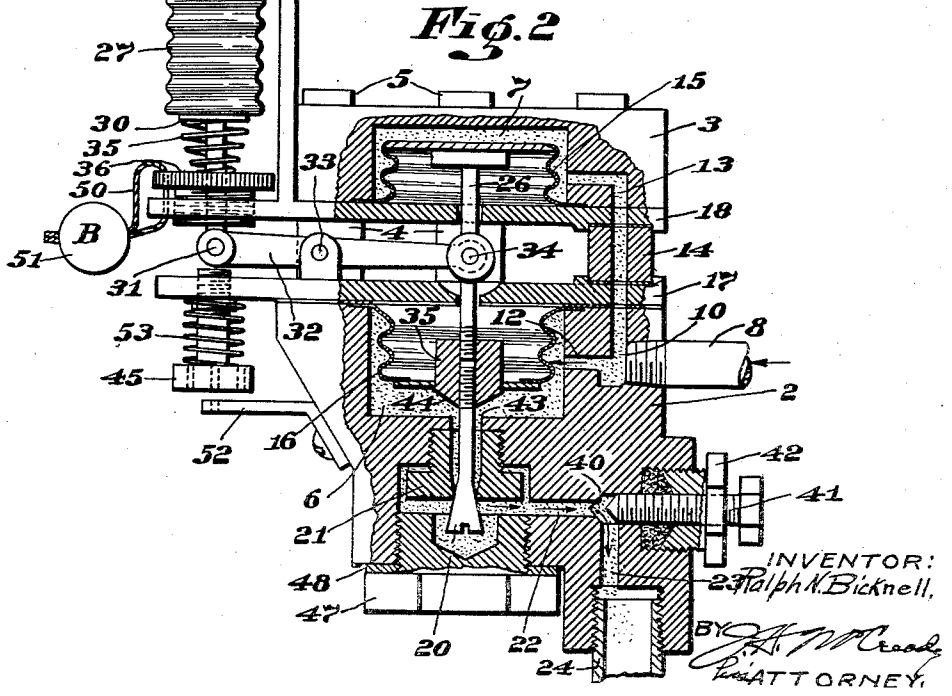


Fig. 2



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REGULATING VALVE FOR REFRIGERATING SYSTEMS

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4 Claims. (Cl. 236—99)

This invention relates to refrigerating systems and is more especially concerned with the controlling apparatus for such systems.

In refrigerating systems of the expansion type, a pressure reducing valve or regulating valve is provided to control the flow of high pressure fluid into the expansion coil, and automatic means operates said valve in accordance with the refrigerating requirements. After such a system has been in operation for a time, the valve seat or the valve plunger, or both, become worn and it is necessary to replace them. It is one of the objects of this invention to facilitate the making of repairs of this kind.

Further objects of the invention are to devise a more accurate controlling mechanism, to provide for the convenient shifting of the control from one type to another, and to protect the controlling apparatus against tampering.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawing, and the novel features will be particularly pointed out in the appended claims.

In the drawing,

Figure 1 is a plan view of a valve structure embodying this invention; and

Fig. 2 is a side elevation, partly in section, of the structure illustrated in Fig. 1.

The construction shown in the drawing comprises a valve casing which consists of two parts, namely, a main section 2 and a supplemental section 3. The latter is superposed upon the former but is separated from it by spacing collars 4, the two sections being secured rigidly together by a series of screws 5 which extend through said collars. Fluid receiving chambers 6 and 7 are formed in the respective casing sections 2 and 3, and the high pressure refrigerant is led into the casing through a pipe 8. The intake port 10 into which this pipe opens communicates directly with the chamber 6 through a duct 12, while a free flow for this high pressure refrigerant into the upper chamber 7 is provided through another duct or passage 13, a portion of this passage extending through a spacing collar or sleeve 14. Gaskets at the opposite ends of this collar provide tight joints between it and the casing members against which it bears. Mounted in the casing section 3 is a flexible diaphragm or bellows 15, the lower end of which is expanded and soldered or brazed to the lower surface of said section. Similarly supported in the chamber 6 of the lower section 2 is another flexible diaphragm or bellows 16 sealed in a like manner to the upper surface of this member. These two casing sections also include heads 17 and 18, respectively, which consist essentially of plate-like members with certain bosses and lugs formed on them, and these parts are rigidly secured in their operative positions by the screws 5 above mentioned.

The valve per se comprises a tapered plunger 20 cooperating with a seat formed in a relatively stationary valve member 21. A passage is provided through this member for the flow of the refrigerant into the low pressure chamber 22 and thence through a duct 23 into the intake end 24 of the expansion coil. As will be evident from an inspection of Fig. 2, the valve plunger is threaded into a plug 35 carried by the diaphragm 16 and the two diaphragms are rigidly connected together by a rod 26. It will also be seen that the space between the casing sections 2 and 3 is open to the atmosphere and that the apertures in the heads 17 and 18 through which the rod 26 projects affords ample clearance for the movement of the rod and admits atmospheric pressure to the inner surfaces of the diaphragms 15 and 16. The outer surfaces of these diaphragms, however, are subjected to the pressure of the refrigerant. This construction, therefore, equalizes the action of the high pressure refrigerant on the valve structure so that the operating mechanism for the valve is not compelled to work against this pressure.

Any suitable type of automatic valve operating mechanism may be used. A typical arrangement consists of a bellows 27 mounted between the horizontal arm 28 of a bracket secured to the head 18 and the head 30 of a plunger, the lower end of which is pivoted at 31 to the outer end of a lever 32, fulcrumed at 33 on the head 17, the opposite end of said lever being pivoted at 34 to the rod 26 which connects the two diaphragms 15 and 16. A spring 35 is interposed between the head 30 and an adjusting screw 36 which is threaded into an extension of the head 18 and serves to hold some degree of pressure on the bellows. The operating pressure, however, is provided by some suitable fluid sealed in the bellows, and in the bulb 37 connected to the bellows, by capillary tubing 38, as is usual in controls of this type.

Assuming that a fluid is used in the bellows 27 and its bulb 37, which contracts down to a certain critical temperature, at approximately which it is desired to maintain the refrigerator, and thereafter begins to expand, it will be evident that as the temperature is approached the bellows 27 will contract, such effect being aided by the spring 35.

The upward movement of the outer end of the lever 32 so produced will be transmitted through the diaphragms to lower the valve plunger 20, thus allowing an increased flow of refrigerant from the high pressure chamber 6 through the low pressure chamber 22 and into the expansion coil 24. This will increase the refrigerating effect, and after a time will so reduce the temperature in the refrigerating chamber and the bulb 37 located therein, that the bellows 27 will be expanded by this lower temperature. Such a movement of the bellows will be transmitted through the connections just described and will seat the valve 20, or at least so reduce the flow of refrigerant through it that the refrigerating action will be modified in the desired manner.

After a time it will become necessary to replace the valve plunger 20 or its seat 21, or both. In order to facilitate this operation a valve seat 40 is formed at substantially the junction of the low pressure chamber 22 with the duct 23, and this seat is arranged to be engaged by a screw threaded valve plunger 41, extending through a stuffing box, and threaded through the packing gland 42 for said box. By turning this plunger, any flow of fluid out of the low pressure chamber can be shut off. Also, a valve seat 43 is formed at the upper end of the passage through the main valve and is arranged to be engaged by the tapered end 44 of the plug 35. Normally the range of movement of the valve plunger 20 is such that the plug 44 remains entirely out of contact with the seat 43. However, by turning up the screw 45 so that it will engage the outer end of the lever 32, the face 44 may be forced against the seat 43, thus shutting off any escape of high pressure refrigerant through the regulating valve into the low pressure chamber 32. At this time, therefore, the passages through which refrigerant normally flows are closed at both the high pressure and low pressure sides of the regulating valve.

It will be observed that the regulating valve is located in a chamber which opens to the outer surface of the casing, and that this chamber is normally closed by the plug 47 and gasket 48. Consequently, by backing out this plug, access is afforded to said valve. The plunger 20 may be unscrewed and removed, and the seat element 21 may also be unscrewed and taken out, the head of this seat being constructed to take a socket wrench, spanner wrench, or some other tool by means of which it may be removed. A new seat and a new plunger may then be inserted, and the plug 47 screwed back into place, after which the valves 41 and 44 may be opened, thus re-establishing a normal operating condition.

It should be observed that in effecting this replacement of the valve parts, no substantial body of air is admitted to the refrigerating system. This is important for the reason that the entrance of any substantial proportion of air into an expansion system of this type would interfere seriously with the operation of the refrigerator. In addition, this arrangement provides for the quick and easy replacement of the valves without requiring the removal of the refrigerant from the system, which is at present necessary in many, if not all, of the commercial systems of this type.

The temperature at which the regulating valve will be opened by the thermostatic control can be regulated by turning the screw 36. In order to prevent tampering with this adjusting device, it is preferable to drill a series of holes through the flange of the screw 36 and another hole through the end of the extension of the head 18 so that a sealing wire 50 may be run through registering holes in these two parts and secured with a seal 51. Similar holes may also be provided in the screw 45 and in a bracket 52 fixed to the casing 2 to receive a seal, so that tampering with this screw also will be prevented.

In some systems, instead of using a thermostatic control, the regulating valve is adjusted into a predetermined open position so that a controlled flow of refrigerant will take place continuously from the high pressure side through into the expansion chamber. Such a regulation is provided in the arrangement shown by the screw 45. A shift from the thermostatic control to the manually regulated control may be effected, whenever desired, simply by turning up the screw 45 to the degree necessary to produce the desired conditions. Preferably a spring 53 is interposed between the head of the screw 45 and the part 17 to prevent any tendency of the screw to rattle and to assist in holding the screw in its adjusted position.

Provision is also made for the convenient replacement of the bellows 27 in the event that it, or the parts 37 and 38 associated with it, become defective for any reason. For this purpose the upper end of the bellows is provided with a disk-shaped end and the lower surface of the bracket 28 is recessed, as shown at 54, to receive said end. Also, the bracket is slotted, as illustrated at 55 in Fig. 1. Consequently, in order to remove the bellows it is simply necessary to depress it against the pressure of the spring 35 until the disk is disengaged from the socket 54, and then to slide it out of place, the tube 38 sliding through the slot 55. A new bellows may be substituted by a reversal of these operations.

An important advantage of this arrangement is that it produces a substantial increase in accuracy of operation of the control due to the fact that the two bellows 15 and 16 are balanced against each other and are both open to the atmosphere. In the usual commercial valves of this general character, a single bellows is used with the action of the high pressure refrigerant approximately balanced by a spring. This balance obviously is disturbed by changes in temperature, as for example when such a system is located in the cellar where the temperature may vary from, say, 65° to 70° in the summer to 40° in the winter. The system shown in this application, however, always remains in balance, regardless of these changes in temperature.

It should be observed that all of the operating parts for the valve are out in the open atmosphere where they are readily accessible, and the presence of stuffing boxes through which the moving parts must work is avoided. No sealing devices other than the bellows 15 and 16 thus are required. In addition, the fact that the high pressure refrigerant is in contact with all of the operating parts immediately associated with the valve plunger 20 is of advantage in preventing the frosting of this valve or its seat, it being understood that the high pressure refrigerant is relatively warm, always being above the freezing point of water.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.

Having thus described my invention, what I desire to claim as new is:

1. In a regulating valve for refrigerating sys-

tems, the combination of a valve casing having high pressure and low pressure chambers therein, a valve seat having a passage therethrough connecting said chambers, a plunger for engaging said seat, two opposed flexible diaphragms, a rod connecting said diaphragms, means for conducting the high pressure fluid to one side of each diaphragm to cause them to oppose each other and to exert a balancing action on said rod, said valve plunger being connected to one of said diaphragms to be moved thereby, an operating lever connected with said rod, a second valve plunger carried by the latter diaphragm, and a seat in said casing through which said passage extends and arranged to be engaged by said second plunger.

2. In a regulating valve for refrigerating systems, the combination of a valve casing having high pressure and low pressure chambers therein for the refrigerant, a removable valve seat having a passage therethrough connecting said chambers, a plunger for engaging said seat, two flexible diaphragms mounted on the same side of the valve and connected with said valve plunger, whereby said valve seat is removable without disturbing the diaphragms, means for maintaining the high pressure refrigerant in contact with one side of each diaphragm to cause said diaphragms to oppose each other and to exert a balancing action on said valve plunger, and means for moving said plunger relatively to its seat to operate the valve.

3. In a regulating valve for refrigerating systems, the combination of two flexible diaphragms, means connecting said diaphragms in opposed relationship to each other, a casing in which said diaphragms are operatively supported, means cooperating with said diaphragms and said casing to conduct the high pressure refrigerant into said casing and to maintain it in contact with one side only of each of said diaphragms so as to cause the two diaphragms to exert a balancing action on each other and to transmit the heat of the high pressure refrigerant to the diaphragms, a valve comprising a plunger both of said diaphragms being mounted on the same side of the valve, and a removable seat for said plunger, said seat having a restricted passage therethrough for the flow of the high pressure refrigerant, and means for operating said valve plunger automatically in response to predetermined conditions.

4. In a refrigerating system of the expansion type and in which a regulating valve controls the flow of refrigerant from the high pressure chamber in the system to the expansion coil, a valve structure comprising a valve casing having high pressure and low pressure chambers therein for the refrigerant, a valve seat having a passage therethrough connecting said chambers, a plunger for engaging said seat, two flexible diaphragms connected with said valve plunger, means for maintaining the high pressure refrigerant in contact with one side of each diaphragm to cause said diaphragms to oppose each other and to exert a balancing action on said valve plunger, means for moving said plunger relatively to its seat to operate the valve, means in said valve structure operable to shut off the flow of refrigerant to and from said valve seat, said casing having an opening extending from the outer surface thereof to said valve seat and said plunger, and a closure for said opening removable to permit access to said seat and plunger, said seat and plunger being removable and replaceable through said opening when said closure is removed.

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