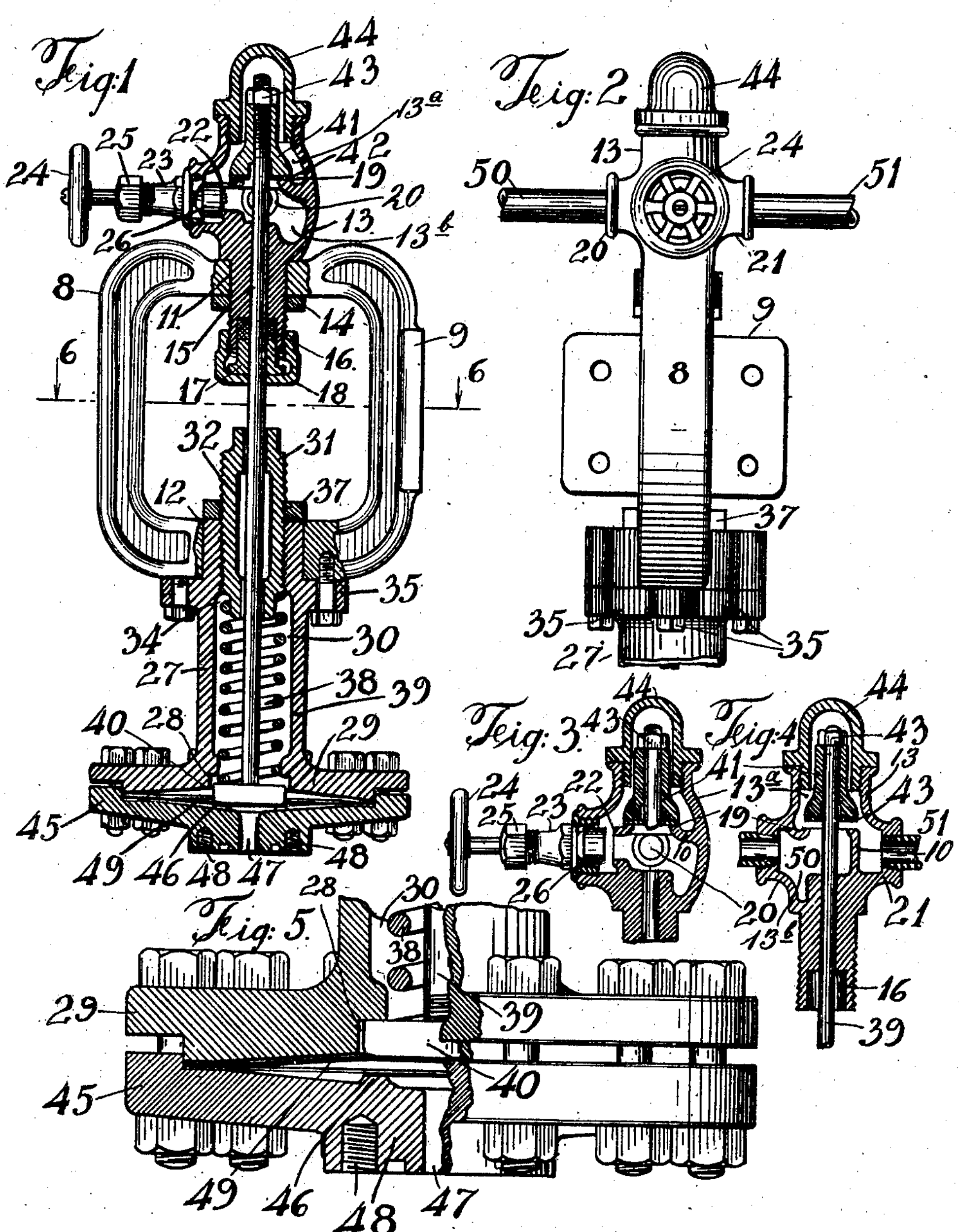
A. C. CULVER.
AUTOMATIC WATER REGULATOR.
APPLICATION FILED AUG. 30, 1910.

985,147. Patented Feb. 28, 1911.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig: 6.

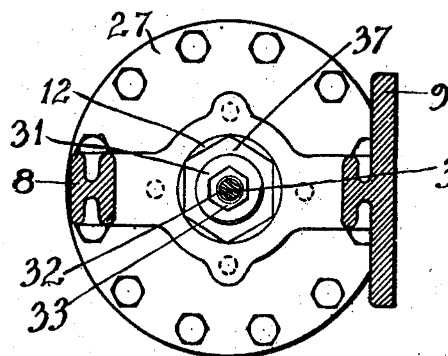
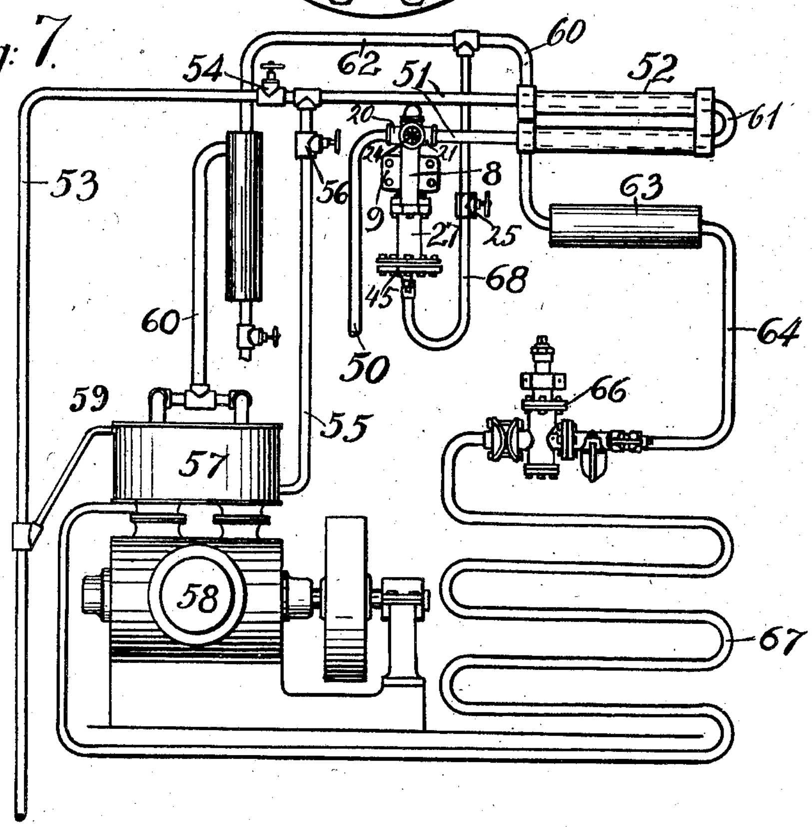


Fig: 7.



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UNITED STATES PATENT OFFICE.

ANDREW CLINTON CULVER, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE AUTOMATIC REFRIGERATING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF NEW JERSEY.

AUTOMATIC WATER-REGULATOR.

985,147. Specification of Letters Patent. Patented Feb. 28, 1911.

Application filed August 30, 1910. Serial No. 579,766.

To all whom it may concern:

Be it known that I, ANDREW CLINTON CULVER, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Automatic Water-Regulator, of which the following is a specification.

My invention relates to improvements in the devices employed for automatically supplying cooling water to the condenser of a refrigerating machine, whether of the compression or absorption type, or of an air compressor, or of other kinds of apparatus where the tension of a gas can be utilized to regulate the flow of such cooling water. It is an improvement on the construction set forth in the United States Patent to Marshall, No. 806,478, dated Dec. 5, 1905. The means employed are as will appear.

In the drawings Figure 1 is a partial right side elevation and a partial vertical section of my invention with its valves closed and diaphragm lowered. Fig. 2 is a front elevation of the upper part of the same structure. Fig. 3 is a partial right side elevation and a partial vertical section of the extreme top of the same structure with its automatic valve closed and its hand by pass valve open. Fig. 4 is a partial vertical section and a partial front elevation of the structure of Fig. 2 at the top. Fig. 5 is an enlarged detail of the lower part of Fig. 1 partially in vertical section and partially in elevation with its diaphragm lifted. Fig. 6 is a horizontal section through the line 6—6 of Fig. 1 looking from above. Fig. 7 is a small front elevation of my invention with diagrammatic connections of a refrigerating system to which it is connected.

A frame 8, as seen from the right in the manner shown in Fig. 1 has substantially the form of a square frame or yoke of I cross section with a plate 9 cast integral with one of the vertical shanks of the yoke as shown in Figs. 1 and 2 to serve as a wall plate for attachment to any convenient vertical surface. In the upper and lower horizontal shanks of the frame and in line with each other are provided openings 11 and 12 respectively. Inserted downward through the opening 11, so as to make a close fit, is the lower part of a valve housing 13, threaded at its lower end and shouldered to seat on the frame 8. The housing is held in its seat by nut 14 screwed on the threaded part of the housing. The lower part of the housing 13 has a vertical bore 15, axially coincident with the opening 11, for the passage of a stem 39 to be described, and at its lower end it is provided with a stuffing box 16 having a gland 17 and a gland nut 18. The interior of housing 13 is divided into an upper and lower chamber 13^a and 13^b separated by a wall 10 in the manner best illustrated in Fig. 4. Chamber 13^a communicates with the outside through inlet 20 and chamber 13^a through outlet 21. Both chambers communicate with each other through a vertical opening formed in wall 10 into a flat valve seat 19, and also through a horizontal opening formed into a flat valve seat 22. (Figs. 1 and 3). With the latter seat coöperates valve disk 26 operated from the outside by hand wheel 24, and with seat 19 coöperates valve 41, preferably faced with leather at 42 and operated by valve stem 39 screwed into valve 41 as shown, so that it may be screwed farther up or down to secure the proper seating of the valve as will be referred to hereinafter. After the proper adjustment is made locknut 43 is tightened. By removing cap 44 screwed into the top of housing 13 access may be had to valve 41 for adjusting purposes.

In the lower horizontal shank of frame 8 which contains opening 12, previously referred to, is secured the diaphragm housing in the manner to be described. This housing consists of an upper member 29 and a lower member 45, which are bolted together as shown in Fig. 1 and the surfaces of which, facing each other, are both concaved as also shown in Fig. 1 so that a steel diaphragm clamped between the two housing members may be deflected upward or downward for the purpose to be described. The upper member 29 has a central cylindrical upward extension with a boring 30 extending into member 29 and contracted at both ends as shown in Fig. 1. Extension 27 is flanged near its upper end at 35 for securing the whole diaphragm housing to frame 8, whereby the upper end of extension 27 is snugly fitted into opening 12 of frame 8. Through boring 30 of extension 27 extends valve stem 39 previously described which carries at its lower end a disk 40 of suitable shape at its lower surface to bear against the center of diaphragm 49. A recess 29 concentrical with but slightly larger than boring 30 is provided in the concave surface of housing member 29 which receives disk 40 when the diaphragm is deflected upward as shown in Fig. 5 and thus serves as a positive stop for the diaphragm in the upward direction. Boring 30 contains a compression spring 38 which bears at its lower end against disk 40 and at its upper end against an adjusting nut 31 threaded into the upper contracted portion of extension 27. This nut is of sufficient length so as to allow for a liberal adjustment of spring 38, whereby, after the adjustment is made, nut 31 is secured in place by means of lock nut 37. Nut 31 has an inner boring which is wide enough to form an annular chamber 32 around stem 39 which passes centrally through this boring, this boring, however, being contracted at both ends of the nut so as to just allow free passage of valve stem 39 through the ends of the nut. As a positive stop for the diaphragm 49 when it is deflected downward by means of the pressure of spring 38, an annular rim 46 distinctly shown in Fig. 5 is provided on the concave surface of lower diaphragm housing 45. The lower diaphragm housing 45 is centrally bossed on the outside for securing a pipe connection to this member. A central boring 47 extends from the outside through boss 48 which communicates with the space of the diaphragm housing below diaphragm 49 so that fluid pressure communicated through boring 47 to the underside of diaphragm 49 may deflect it upward against the tension of spring 38. Boring 30 which contains spring 38, may preferably be partially filled with oil which thus also fills the space above diaphragm 49 so as to prevent rusting of the diaphragm which is preferably of steel.

The automatic water regulator just described is particularly adapted for use in refrigerating systems to control the flow of cooling water by the refrigerant pressure in the system, and I have therefore illustrated how this device is connected in such systems and I shall hereinafter describe its operation in connection with such system, a diagrammatical illustration of which is given in Fig. 7. In this figure, 58 represents the refrigerant compressor, water jacketed at 57. 52 is the condenser connected with the compressor by pipe line 60; 63 is the refrigerant receiver, 66 represents an expansion valve of any suitable type and 67 the expansion coil or coils. Cooling water is supplied to condenser 52 by means of pipe 61 through the condenser and the cooling water supplied from main 50 after leaving condenser 52 may either be led off directly into waste pipe 53 or it may be entirely or partially led by means of pipe 55 through the water jacket 57 of the compressor whence it passes by way of pipe 59 into waste pipe 53, hand valves 54 and 56 being provided to regulate the quantity of water flowing through the compressor waterjacket or flowing directly into waste pipe 53. Before water supply pipe 50 enters condenser 52, the water regulator described hereinbefore is interposed so that the water is supplied to the regulator through inlet 20 and leaves the device through outlet 21 previously referred to. To boss 48 of lower diaphragm housing 45 is connected pipe 68 which is branched off from the refrigerant supply pipe 62 so that the pressure of the refrigerant in the high pressure side of the system is communicated to the lower side of diaphragm 49. With the whole system out of operation the tension of spring 31 acting upon the diaphragm is adjusted so that the diaphragm is deflected downward in which position water valve 41 in chamber 13 is held tightly on its seat so that no water can enter the cooling system through pipe 50 (it being assumed that hand valve 24 which forms a by pass for the water around valve 41 is closed). If now the compressor starts to operate and the refrigerant pressure in pipe 62 increases to a certain predetermined point, this pressure will at such point deflect diaphragm 49 upward against the tension of spring 38 so that water valve 41 is lifted from its seat and water commences to flow from supply pipe 50 into the cooling system. The more the pressure in pipe 62 rises, the higher valve 41 is lifted, of course within the limits set by the diaphragm structure previously described. The cooling of the refrigerant in the condenser having the effect of reducing its pressure, the diaphragm 49 will be gradually deflected downward by action of spring 38 so that soon an equilibrium will be reached at which enough cooling water will be supplied to the system to sufficiently cool the high pressure refrigerant to prevent further rise of its pressure. When the pressure in the system recedes, valve 41 is closed by the action of spring 38 and waste of water is thus prevented.

The particular advantage of my improved water regulator is that at such places where a stuffing box should be provided it has to be packed only against water pressure, which is comparatively low, and not against the refrigerant pressure. In order not to interrupt the water supply in case the diaphragm chamber should have to be opened for repairs while the plant is in operation, by pass valve 24 may be opened so that now water can pass directly through the water regulator from inlet 20 to outlet 21, without valve 41 being open. It is of course understood that a valve 70 must be provided in pipe 68 so as to prevent escape of refrigerant while the diaphragm chamber is open to the atmosphere.

I claim:

1. In a device of the character described, the combination with a valve housing having an inlet and an outlet chamber adapted to conduct cooling liquid and a valve controlling the communication therebetween, a valve stem for operating said valve, a diaphragm housing below said valve housing and in line therewith containing a diaphragm suitably exposed at one side to fluid pressure and abutting at the other side against said valve stem, and a compression spring on said stem tending to press it against said diaphragm and against said fluid pressure to seat said valve, means for adjusting the tension of said spring, said diaphragm housing having an upward extension containing said spring and adapted to be filled with suitable non-corrosive liquid, and a hand-controlled by pass valve around said cooling liquid valve connecting the inlet and outlet chamber thereof.

2. In a device of the character described, the combination with a rectangular frame, a valve housing supported in the upper side of said frame having an inlet and an outlet chamber adapted to conduct cooling liquid, and a valve controlling the communication therebetween, a valve stem for operating said valve, a diaphragm housing supported in the lower side of said frame and in axial alinement with said valve housing, said diaphragm housing containing a diaphragm suitably exposed at one side to fluid pressure and abutting at the other side against said valve stem, said diaphragm housing having an upward extension, a compression spring on said stem disposed in said upward extension and tending to press said stem against said diaphragm and against said fluid pressure to seat the valve, means for adjusting the tension of said spring, and a hand controlled by-pass valve in said valve housing for connecting said inlet and outlet chamber around the stem controlled valve, said upward extension adapted to contain suitable non-corrosive liquid.

ANDREW CLINTON CULVER.

Witnesses:
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