Dec. 13, 1932. F. F. BAHNSON 1,891,133

HUMIDITY CONTROLLED VALVE

Filed Aug. 29, 1930 4 Sheets-Sheet 1

Fig. 1.

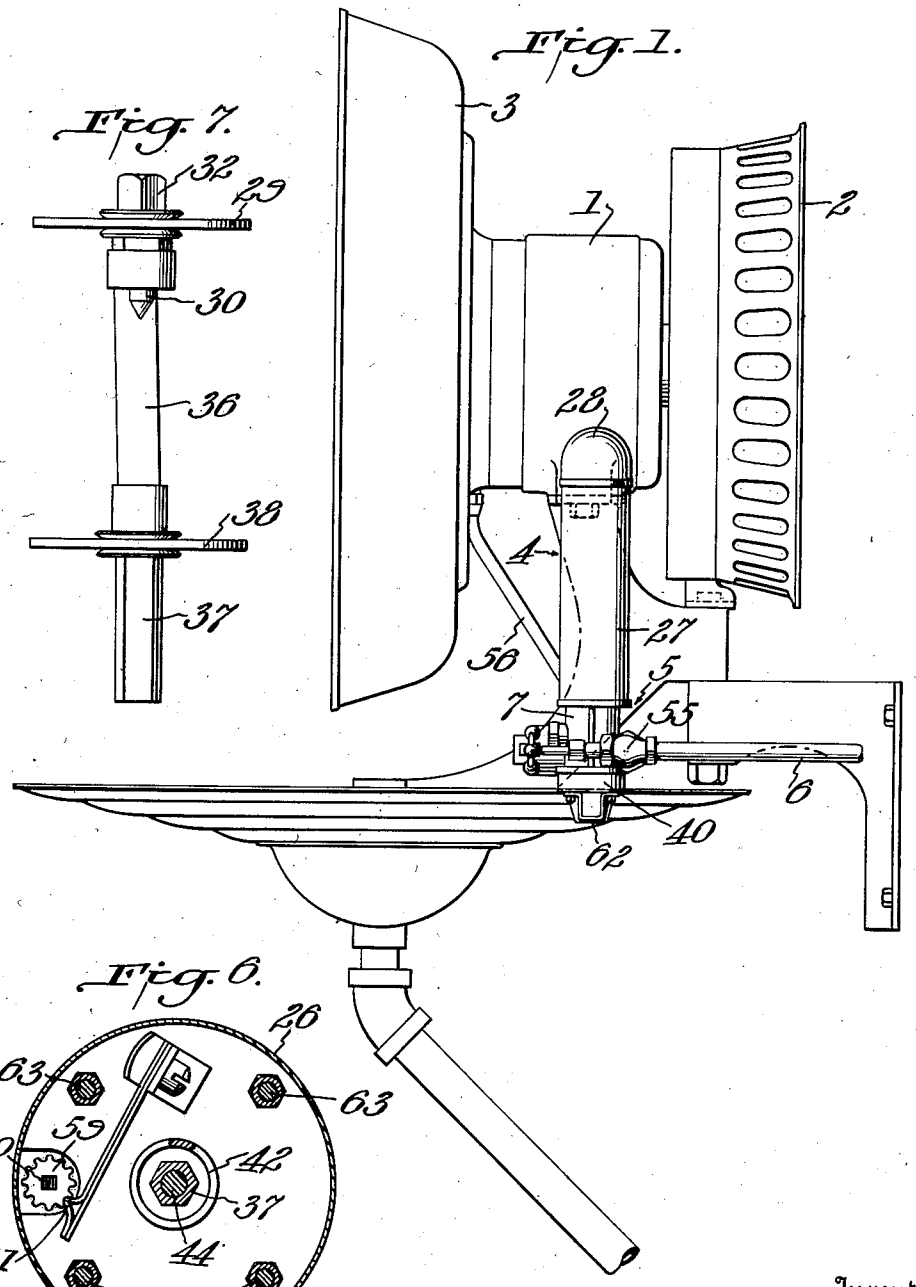


Fig. 7.

Fig. 6.

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HUMIDITY CONTROLLED VALVE

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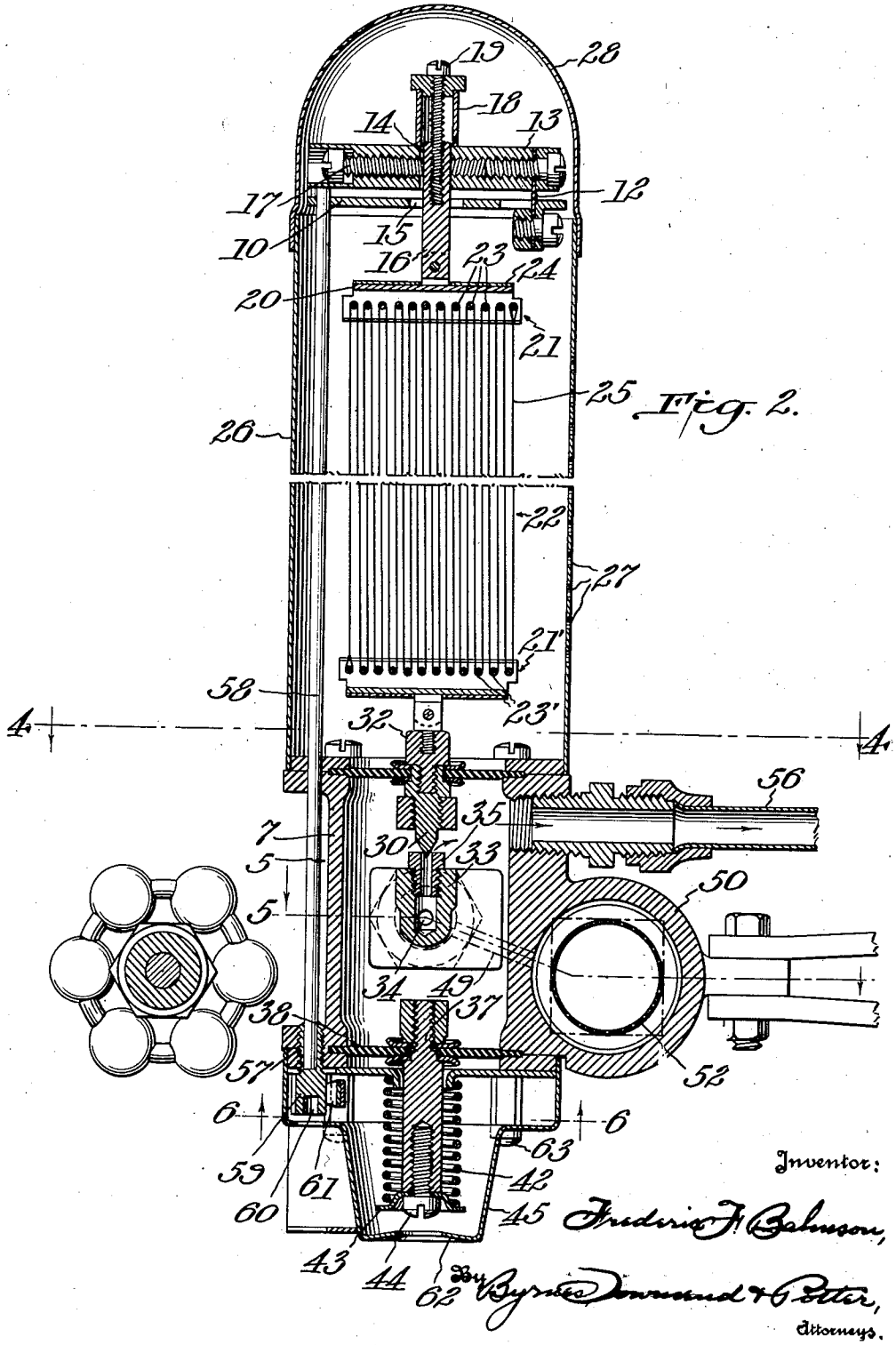


Fig. 2.

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Filed Aug. 29, 1930 4 Sheets-Sheet 3

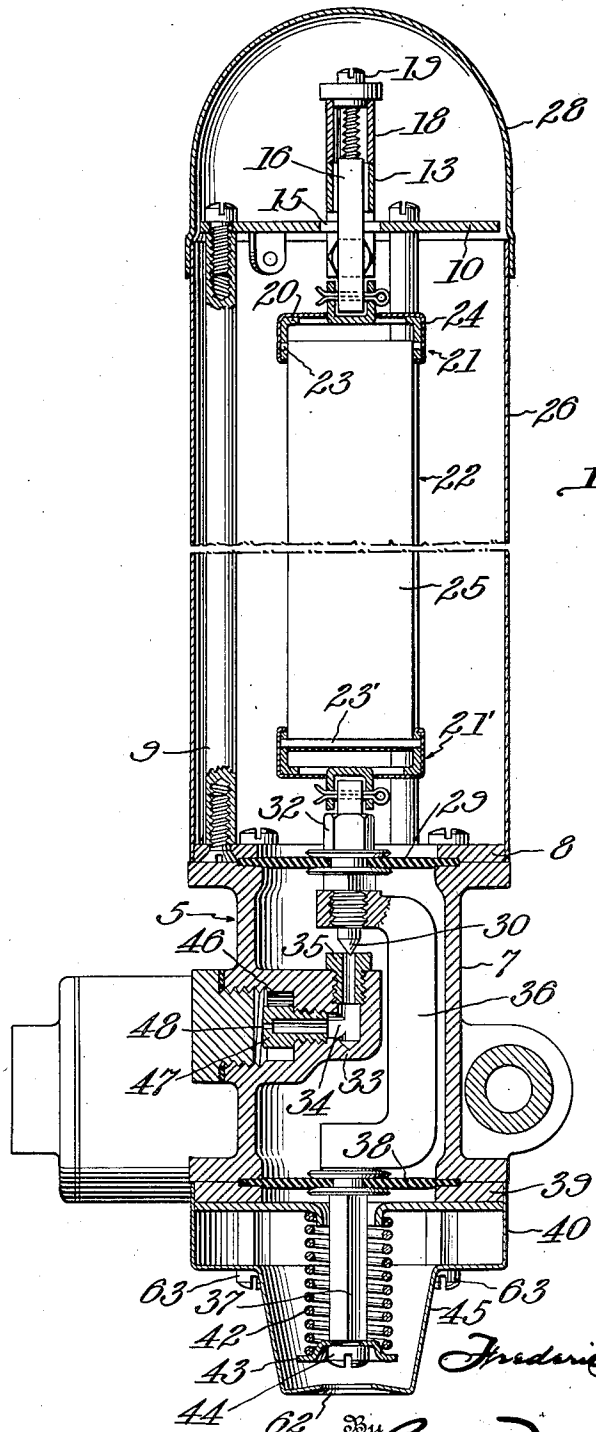


Fig. 3.

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HUMIDITY CONTROLLED VALVE

Filed Aug. 29, 1930 4 Sheets-Sheet 4

Fig. 4.

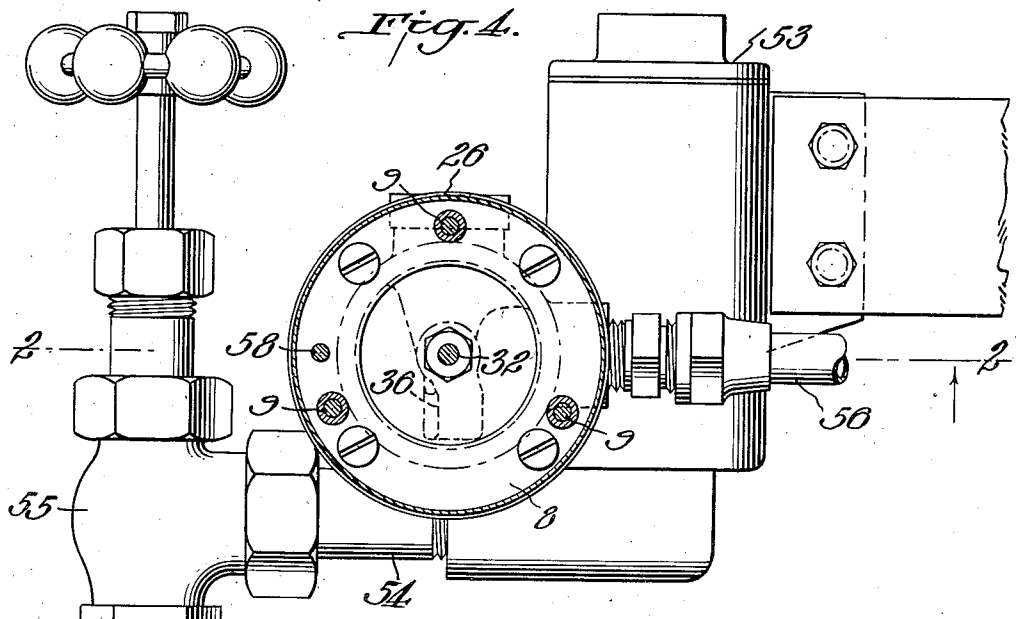
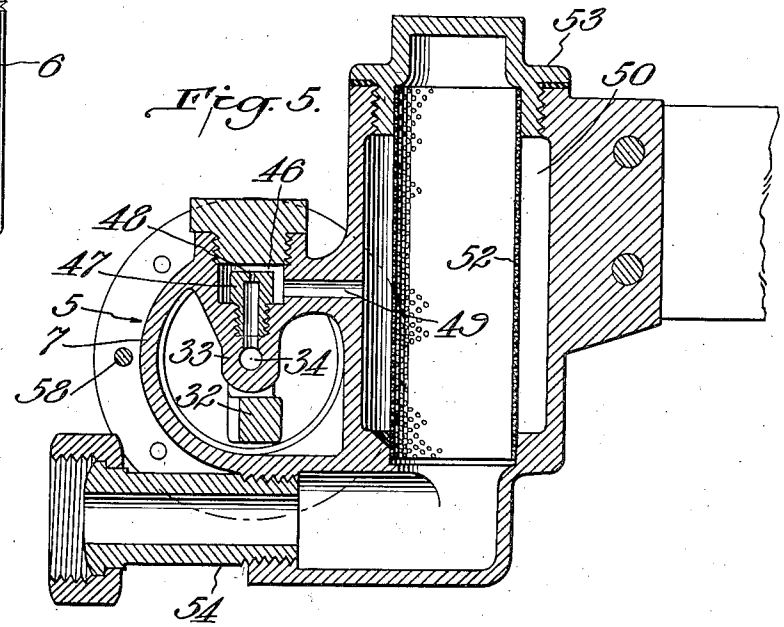


Fig. 5.



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UNITED STATES PATENT OFFICE

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HUMIDITY CONTROLLED VALVE

Application filed August 29, 1930. Serial No. 478,761.

This invention relates to unit control devices for humidifying apparatus and particularly to a novel type of humidity-controlled valve for regulating the supply of water to a humidifier forming a part of a humidifying system.

The device of the present invention is particularly adapted for use with humidifiers of the type having a fan for creating an air stream and a disk rotated by the fan and arranged to throw a fine spray of water into the air stream whereby the water is carried into the area to be humidified.

One of the objects of the present invention is to provide a control device for humidifiers which will be simple and rugged in construction, inexpensive to manufacture and fully automatic in operation.

Another object of the invention is the provision, in humidifying apparatus of the type wherein water is supplied to a humidifier which creates an air stream and projects the water into the air stream, of an automatically operated valve for regulating the supply of water to the humidifier in accordance with the relative humidity of the atmosphere surrounding the humidifier.

Another object of the invention is the provision of a valve of the above type which is so designed that it normally closes the water supply line and is only operative to open the same if all of the elements function properly, whereby no undesirable operation of the humidifying apparatus is possible, such as might be caused by improper functioning of any portion of the control apparatus.

One form of the invention is illustrated in the accompanying drawings wherein:

Fig. 1 is a side elevational view of a humidifier equipped with a unit control device constructed according to the invention,

Fig. 2 is a longitudinal sectional view of the unit control device,

Fig. 3 is a view showing a longitudinal section of the humidifier taken at right angles to the section shown in Fig. 1,

Figs. 4, 5 and 6 are views showing sections taken along lines 4—4, 5—5, and 6—6, respectively of Fig. 2, and

Fig. 7 is a detail view of the valve.

In Fig. 1 is shown a humidifier of the type including a motor driving a fan located within the shield 2 and an atomizing disk within the casing 3. Adjacent the humidifier is a unit control device 4, constructed according to the present invention, which is arranged to regulate the supply of water to the humidifier by operating a control valve 5 in the water supply line 6 in accordance with the relative humidity of the air surrounding the control device 4.

A substantially cylindrical member 7 having flanged, open ends, constitutes the valve housing. Secured on the upper end is a ring 8 on which are mounted three upstanding pillars which carry a platform 10 at their upper ends. Supported on the platform 10 by a leaf sping 12 which is securely clamped in place, is a cross lever 13 through the central portion of which extends an opening 14 which is alined with an opening 15 in the platform 10. An anchor 16 extends through the openings and is held in the lever 13 by a set screw 17 threaded in the lever 13. A collar 18 resting upon the upper surface of the lever 13 supports an adjusting screw 19 which is threaded in the upper end of the anchor 16.

Pivotally connected to the lower end of the anchor is a channel member 20 forming a portion of the end frame 21 of the hygroscopic element 22. Rotatably mounted in the channel are a plurality of rollers 23 which are held in place by a spring clip 24 which fits over the channel 20 and has its edges bent inwardly to engage the edges of the channel flanges. A similar end frame 21′ is disposed opposite the first end frame and strip 25 of hygroscopic material extends between the frames 21, 21′.

One end of the strip 25 is secured to one of the rollers 23 of the upper end frame 21 and the strip is wound over the remaining rollers of the two end frames alternately in a plurality of reverse bends to provide a plurality of strands of material extending between the two end frames, the other end of the strip being secured to the lower end frame 21′. Since only the two ends of the strip 25

are secured to the rollers 23, 23', the intermediate portions are free to run over the rollers, whereby, when a force is applied tending to move the two end frames 21, 21' apart, the portions of the strip move into such positions that each strand carries a proportionate fraction of the total force. The tensile strength of the strip and the number of strands are so chosen that the unit stress exerted on each strand is well below the elastic limit of the material.

Disposed on the upper flanged end of the housing and surrounding the hygroscopic element 22, is a cylindrical casing 26 having a large number of small closely arranged perforations 27 whereby air can freely enter the casing. A dome shaped cover 28 is fitted on the upper end of the cylindrical casing 26, forming with the valve housing 7 and the cylindrical casing 26, a protective housing for the hygroscopic element 22.

Clamped between the ring 8 and the flanged end of the valve housing 7 is a flexible diaphragm 29 which closes the upper end of the casing 7. A valve 30 extends through the diaphragm 29 and has a stem 32 which is pivotally attached to the lower end frame 21'. Projecting inwardly from the wall of the housing 7 is an integral valve seat support 33 in which is arranged an L-shaped passage 34 having a horizontal portion and an upwardly directed vertical portion terminating somewhat below the valve and provided with a valve seat 35 with which the valve cooperates. The valve seat 35 is disposed coaxially with the housing and the valve 30 is arranged to move along the axis of the valve seat 35.

Threaded on the valve 30 is a yoke 36 provided with an offset portion bent around the seat support 33, which yoke extends longitudinally through the housing 7 and is threaded on a stud 37 which passes through a flexible diaphragm 38 clamped between the lower flanged end and a lower ring 39. Secured to the lower ring 39 is a spring plate 40 against which bears one end of a coiled spring 42, the other end being retained by a washer 43 fastened by a screw 44 to the lower end of the stud 37. A cover 45 is disposed over the bottom ring and the spring assembly.

In the end of the seat support 33 adjacent the housing wall 7, is a measuring chamber 46 communicating with the end of the horizontal passage 34. A bushing 47 provided with a measuring orifice 48 is threaded into the end of the horizontal portion of the passage whereby the maximum amount of water that can flow from the chamber 46 into the passage 34 is limited.

Communicating with the measuring chamber 46 is a passage 49 which leads into the central portion of a cylindrical straining chamber 50 formed integral with the housing 7. In the chamber 50 is a cylindrical screen 52 which at one end bears against a flange formed in the chamber wall 7 and at the other end bears against a flanged screw cap 53 that closes the end of the chamber 50.

Threaded in the end of that portion of the housing 7 which forms the straining chamber 50, is an inlet conduit 54 which is connected to the water supply line 6 a manually operated valve is provided for shutting off the water supply for the purpose of repairing or replacing the control unit. An outlet conduit 56 communicates with the valve chamber and leads to a point adjacent distributor.

Threaded into the lower ring 39 is a hollow stud 57 in which rests one end of an elongated adjusting rod 58 which extends through the flanged ends of the housing 7 and through the platform 10, and supports the free end of the cross lever 13. By turning the stud 57, the adjusting rod 58 is moved longitudinally whereby the free end of the cross lever is elevated or depressed. Formed integrally with the stud is a pinion 59 having a square recess 60 for the reception of a key (not shown) by means of which the stud 57 can be rotated. A spring detent 61 cooperates with the teeth of the pinion 59 to prevent undesired rotation of the stud 56. A cap 62 is secured to the lower end of the control device by bolts 63 to form an enclosure for the spring 42.

The operation of the device is as follows:

The humidifier having been mounted in a proper location in the room, the humidity of which is to be controlled, the motor 1 is started and valve 55 is opened to permit water to flow into the straining chamber 50 and from thence by way of the passage 49 into the measuring chamber 46 and through the measuring orifice 48 into the passage 34 in the seat support. Since the valve 30 is normally closed, the water cannot flow into the valve chamber.

If the relative humidity decreases, the hygroscopic strip 25 dries out and contracts. The contraction of the hygroscopic strip 25 lifts the valve 30 from its seat 35 against the force of the spring 42 and water is permitted to flow into the valve chamber and from thence through the outlet conduit 56 to the atomizing disk.

If the relative humidity increases, the hygroscopic strip 25 expands and permits the valve 30 to be moved against the seat 35 by the action of the spring 42 whereby the flow of water is cut off. Since the valve is balanced by the pressure on diaphragms 29 and 38, the water pressure within the housing 7 does not affect the operation of the control device.

Where a fine adjustment of the operating point of the control device is desired, the hollow stud 57 is rotated to move the elon-

gated rod 58 longitudinally of itself, whereby the free end of the cross lever 13 is elevated or depressed. The movement of the cross lever 13 raises or lowers the upper end frame 21 of the hygroscopic element and these displacements, assuming a constant humidity, result in the raising or lowering of the valve 30.

Where a coarse adjustment is desired, the set screw 17 is loosened and the adjusting screw 19 turned to raise or lower the anchor 16 with respect to the cross lever 13. When the adjustment has been made the set screw 17 is again tightened to secure the anchor 16 in the cross lever 13.

It should thus be apparent from the foregoing that the invention provides a control device for humidifiers, which is simple, easily adjustable, certain in operation and fully automatic to control the supply of water to a humidifier in accordance with the relative humidity of the atmosphere, surrounding the humidifier.

Although I have shown and described the invention with reference to a specific form thereof, it is obvious that the invention is not limited to this form and I desire that the appended claims be given the broadest interpretation consistent with their wording and the prior art.

I claim:

1. A unit control device for air conditioning apparatus comprising a housing having inlet and outlet ports, said housing comprising a cylindrical member having a pair of diaphragms closing the ends thereof, means connecting said diaphragms to each other, a valve controlled by said connecting means and cooperating with said inlet port, spring means tending to move said connecting means to seat said valve, a hygroscopic element comprising a strip of hygroscopic material, and means connecting said element to said diaphragm connecting means.

2. A unit control device for air conditioning apparatus comprising a housing having inlet and outlet ports, a valve and valve seat in said housing, opposed openings in the walls of said housing, diaphragms closing said openings, a hygroscopic element mounted on the outside of said housing adjacent one of said openings, and valve-actuating means connected to said diaphragms and to said hygroscopic element.

3. A unit control device for air conditioning apparatus comprising a housing having inlet and outlet ports and an opening in a wall thereof, a valve and valve seat in said housing, means for moving said valve axially, said means including a hygroscopic element and supporting means anchoring the relatively fixed end of said element in alinement with said opening and axially of said valve, a diaphragm closing said opening, and valve-actuating means extending through said diaphragm and connected to the movable end of said hygroscopic element.

4. A unit control device for air conditioning apparatus comprising, a casing having an inlet port, a valve seat and an outlet port, a passage between said inlet port and valve seat, a bushing in said passage and having a measuring orifice therethrough for limiting the rate at which water may flow to said valve seat, a valve cooperating with said seat, a hygroscopic element, and means connecting said element to said valve, whereby said element operates said valve in accordance with the humidity changes in the air adjacent the element.

5. A unit control device for air conditioning apparatus comprising, a substantially cylindrical housing open at both ends and having a valve seat, flexible diaphragms secured over the ends of said housing, a valve in said housing, means connecting said diaphragms to each other and to said valve, and a hygroscopic element connected to said valve.

6. The invention as set forth in claim 5 wherein said valve seat is coaxial with said housing and said connecting means comprises a member extending between the central portions of the diaphragms and having a portion offset around said valve seat.

7. The invention as set forth in claim 5 wherein said connecting means comprises a member extending between the central portions of said diaphragms and wherein is provided resilient means secured to said member for closing said valve.

In testimony whereof, I affix my signature.

FREDERIC F. BAHNSON.