July 6, 1954 D. L. GETZ 2,682,887

LIQUID LEVEL CONTROL MEANS FOR HUMIDIFIERS

Original Filed Sept. 30, 1947 2 Sheets-Sheet 1

Fig-1

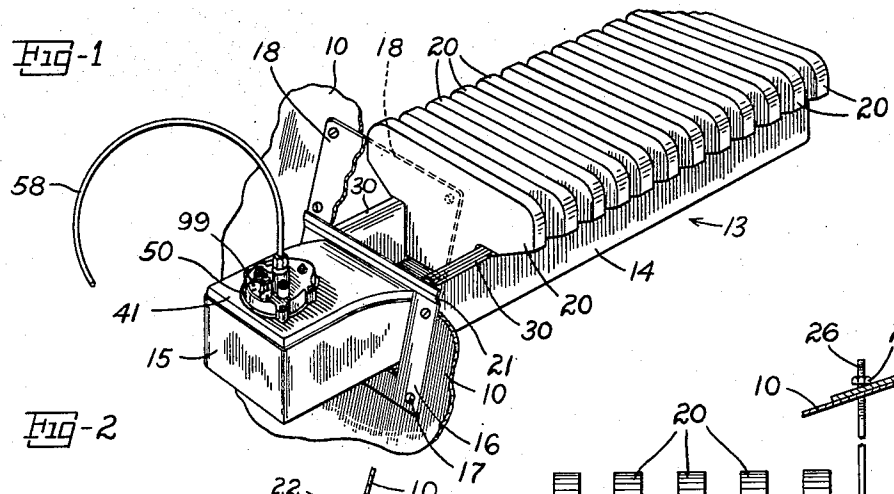


Fig-2

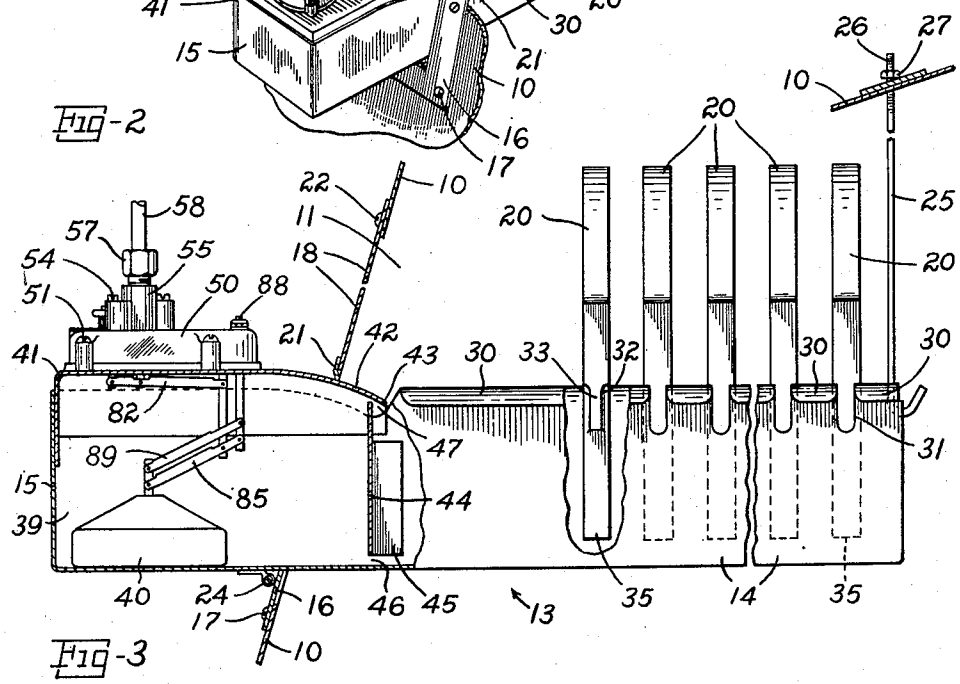
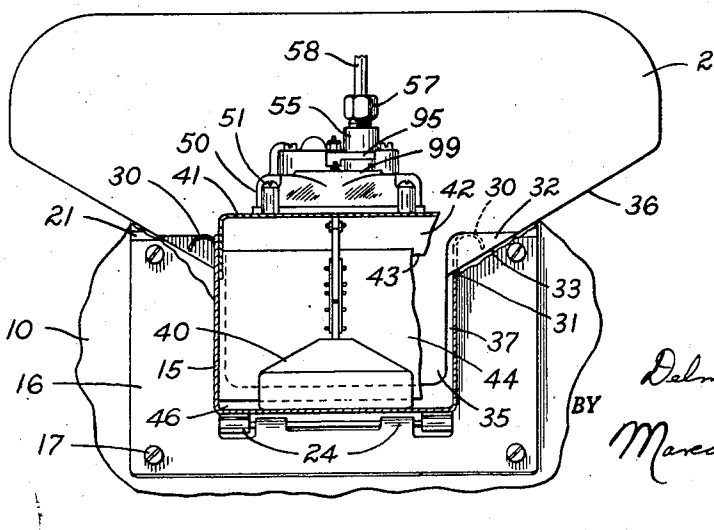


Fig-3



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Fig-5

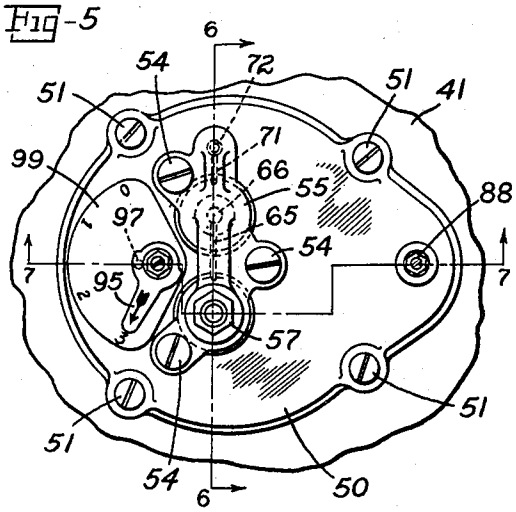


Fig-4

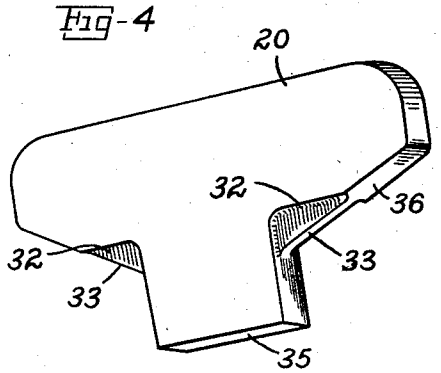


Fig-6

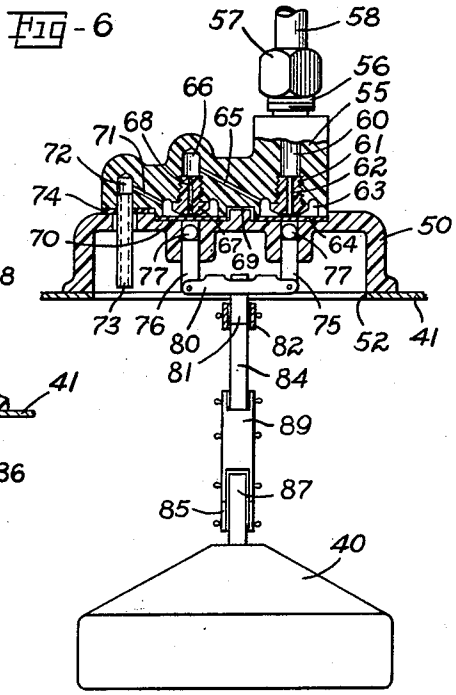
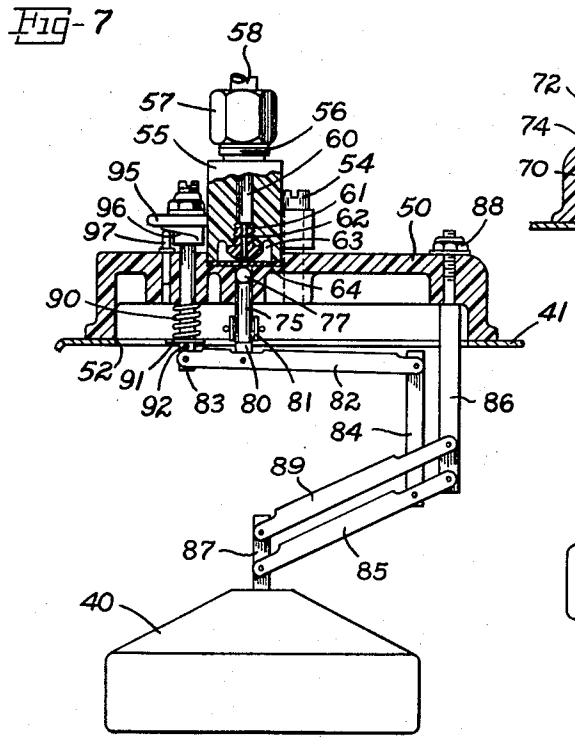


Fig-7



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LIQUID LEVEL CONTROL MEANS FOR HUMIDIFIERS

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6 Claims. (Cl. 137—400)

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This invention relates to humidifiers for use in conjunction with a hot air heating system.

One of the principal objects of the invention is to provide a humidifier of simple and easily assembled construction which can be readily mounted in or on a wall of the bonnet of a hot air furnace or other hot air chamber of a hot air heating system and which will operate effectively and reliably to supply liquid for evaporation within the chamber at an accurately controlled rate in accordance with the desired rate of evaporation.

It is also an object of the invention to provide control mechanism for supplying liquid at a desired rate to a humidifier for evaporation and including a safety device for preventing the accumulation of liquid within the humidifier above a desired level without the necessity of an overflow outlet.

A further object is to provide a device for supplying liquid to a humidifier at a controlled rate for evaporation which includes a normal control valve operable by a float or other member sensitive to the liquid level within the humidifier and which also includes a safety valve for shutting off the liquid supply in the event that the normal control valve fails to operate properly and permits the liquid to rise above the desired level.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing—

Fig. 1 is a perspective view showing a humidifier in accordance with the present invention;

Fig. 2 is a somewhat diagrammatic view showing the humidifier installed in the bonnet of a hot air furnace, the humidifier being shown in side elevation with parts broken away to illustrate details of internal construction and arrangement;

Fig. 3 is a front view of the humidifier with parts broken away to illustrate details of construction and arrangement;

Fig. 4 is a detail view in perspective showing one of the evaporator plates of the humidifier;

Fig. 5 is a top plan view of the liquid supply control mechanism of the humidifier shown in Figs. 1 and 2;

Fig. 6 is a view in vertical section through the liquid supply control mechanism and taken substantially on the line 6—6 of Fig. 5; and

Fig. 7 is a view similar to Fig. 6 taken in section substantially on the line 7—7 of Fig. 5.

Referring to the drawing, which illustrates a preferred embodiment of the present invention, Figs. 1 and 2 show fragments of the wall 10 of

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the bonnet of a hot air furnace, which encloses a hot air chamber 11 wherein the air is heated by the usual heat radiating surfaces of the furnace, not shown. A pan 13 of elongated rectangular shape is mounted with one portion 14 thereof extending interiorly of chamber 11 and another portion 15 extending exteriorly of the chamber 11. As shown in Fig. 2, wall 10 is cut away to receive pan 13 and the mounting plate 16 therefor, which is bolted or screwed to wall 10 as indicated at 17 and apertured to receive the pan. An additional plate 18 is supported for ready removal to provide access to the interior of chamber 11 and the evaporator members such as diffuser plates 20 mounted in pan portion 14, plate 18 being secured in position by means such as a flanged lip portion 21 of plate 16 and screws or bolts 22. The pan 13 is pivotally secured to plate 16 by means of a hinge 24, and the inner end of pan 13 is supported by a hook 25 having its upper end secured for vertical adjustment to the top part of wall 10 by means of a threaded portion 26 and nut 27, the hook 25 and hinge 24 thus cooperating to adjust pan 13 in a vertical plane to the proper horizontal position with respect to either a vertically arranged or inclined wall 10.

The evaporator members 20 are shown as plates of ceramic or other suitable material, and the opposite sides of pan portion 14 include flanged upper edges 30 having spaced slots 31 therein for supporting these plates. Slots 31 are each of lesser width than the plates 20, and each plate has at either side thereof a pair of recessed portions 32 (Figs. 3 and 4) of sufficient depth to leave a central web portion 33 adapted to fit within one of slots 31. The portions of flanges 30 adjacent each slot 31 fit within the recesses 32 of plates 20, as shown in Fig. 3, and thus support the plates in spaced parallel relation and with their lower ends 35 spaced above the bottom of pan 13 for proper circulation of liquid within the pan.

The laterally extended side portions of each plate 20 have their lower edges 36 inclined inwardly, as shown in Figs. 3 and 4, to conduct back to the interior of the pan any liquid accumulating on the plate, instead of permitting such excess liquid to drip onto the radiating surfaces of the furnace. Also, the slots 31 and recessed portions 32 of plates 20 are so proportioned as to leave clearance at 37 above the bottom of each slot for such excess liquid. The number of diffuser plates depends upon the desired rate of evaporation, and the removable portion 18 of the

mounting plate 16 provides for ready removal or addition of diffuser plates as desired to vary the amount of evaporating surface within chamber 11. Accordingly, in order to provide for a substantial range of evaporating rates, the pan 13 should have a substantial number of slots 31 therein, satisfactory results having been obtained with a total of twelve pairs of such slots.

The portion 15 of pan 13 extending exteriorly of wall 10 and chamber 11 forms a chamber 39 receiving a float 40 for controlling the rate at which liquid is admitted to pan 13 in accordance with the desired rate of evaporation. This chamber 39 is provided with a cover 42 which extends interiorly of chamber 11, as shown in Fig. 2, and the inner portion 42 of the cover is curved downwardly to provide for tilting movement with respect to the upper edge of the pan receiving aperture in mounting plate 16. This results in positioning the inner edge 43 of cover 41 at a lower level than the top of the cover, as shown in Fig. 3.

A baffle 44 is mounted in pan 13 between its float chamber portion 15 and the evaporating portion 14. This baffle has flanged side edges 45 which are welded or otherwise secured to the sides of pan 13, and its lower edge is spaced above the bottom of the pan to leave a communicating passage 46 for liquid between the interior of pan portion 14 and the float chamber 39. In addition, as shown in Fig. 2, baffle 44 is positioned externally of the inner end 43 of cover 41, and its vertical dimensions are such that its upper edge is located above the level of the cover edge 43 but below the adjacent portion of the cover to leave a passage 47 between the upper part of float chamber 39 and the interior of chamber 11 for equalizing pressures in the two chambers.

This open intercommunication between the float chamber 39 and the evaporating portion 14 of pan 13 avoids differences in pressure between chambers 39 and 11 such as might cause undesirable flow of liquid back from pan portion 14 to the float chamber, with resulting undesirable precipitation within chamber 39 of lime or other dissolved material. At the same time, baffle 44 cooperates with the cover edge 43 to shield the interior of chamber 39 from air currents which may circulate within chamber 11, thus preventing undesirable evaporation within chamber 39 without the necessity of forming chamber 39 in a separate container or otherwise sealing it from pan portion 14 and the interior of chamber 11.

Means are provided for supplying liquid at a controlled rate to chamber 39 for evaporation in the portion 14 of pan 13, and the float 40 controls this supply means in accordance with the liquid level within chamber 39. Referring to Figs. 5 to 7, a cap 50 is secured by means of bolts 51 to the cover 41 of float chamber 39, the cover 41 being open at 52 as shown in Figs. 6 and 7. The cap 50 may be made of any suitable material and is shown as formed of transparent molded resin. A valve body 55, which may also be formed of molded plastic shown, is secured by bolts 54 to the top of cap 50, and it includes a threaded inlet connection 56 for receiving a suitable fitting 57 and a hose or pipe 58 leading to a source of water for evaporation such as a cold water pipe in the building in which the heating system is installed.

The inlet connection 56 leads to a valve chamber 60 within valve body 55 into which is threaded an annular valve seat 61 having a valve orifice 62 therethrough leading into a chamber 63 between valve body 55 and cap 50. A rubber diaphragm 64 is clamped between cap 50 and valve body 55 in position to be moved inwardly of chamber 63 and into sealing relation with valve seat 61 and orifice 62. A duct 65 leads from chamber 63 to another valve chamber 66 into which is threaded an annular valve seat 67 having a valve orifice 68 therethrough leading into a chamber 69 similar to chamber 63. A diaphragm 70 is clamped similarly to diaphragm 64 between cap 50 and valve body 55 in position to be moved into sealing relation with valve seat 67 and orifice 68. A duct 71 leads from chamber 69 to outlet chamber 72 in valve body 55, from which a tube 73 leads into the float chamber 15, and a rubber gasket 74 is clamped between cap 50 and valve body 55 and around tube 73 to seal this part of the valve body. In operation, the valve seat 67 acts as a metering valve and valve seat 61 acts as a safety valve, and it will be noted that valve orifice 62 is of somewhat greater diameter than orifice 68, satisfactory results having been obtained with these orifices 0.040 and 0.030 inch in diameter, respectively.

The valve diaphragms 64 and 70 are controlled by a pair of pins 75 and 76, respectively, each mounted for reciprocating movement within the cap 50 and controlled by float 40. In order to minimize friction between each pin and its associated diaphragm when seating, which has a tendency to misalign the pin and cause leakage, a ball 77 of stainless steel or other suitable material is positioned between the upper end of each of pins 75 and 76 and its associated diaphragm. Thus when either pin rises in cap 50, it will raise its associated ball 77 and diaphragm and thus in turn raise the diaphragm into accurate sealing relation with its associated valve seat and close the valve orifice therethrough.

The operating connections between pins 75 and 76 and the float 40 are shown in detail in Figs. 6 and 7. The two pins are pivoted to opposite ends of an arm 80 which is pivotally connected substantially at its midpoint to the upper end of a link 81. The lower end of link 81 is pivoted to a lever 82 having one end pivoted to a vertically adjustable pivot pin 83. The other end of lever 82 is pivoted to a vertically arranged link 84 pivotally connected to an intermediate position on a link 85 which is in turn pivoted at one end to a fixed pivot pin 86 and at its other end to a post 87 on float 40. The fixed pivot pin 86 is threaded at its upper end and secured by a nut 88 in fixed relation to cap 50 as shown in Fig. 7. A stabilizing link 89 is pivotally connected to pivot pin 86 and post 87 to guide the float during its up and down movement as the liquid level changes within the float chamber 39.

In operation, the liquid for evaporation is supplied by pipe 58 to inlet 56 and flows through both valve seats 61 and 67 to the outlet chamber 72 and float chamber 39 and then through passage 46 to the evaporating portion 14 of pan 13. As the liquid accumulates in chamber 39, float 40 will rise and act through links 85 and 84 to raise lever 82 and its associated link 81. This will in turn tend to raise arm 80 and pins 75 and 76. However, since the safety valve orifice 62 is greater in diameter than the metering valve orifice 68, the pressure against diaphragm 64 is correspondingly greater than against diaphragm 70. As a result, pin 76 will rise ahead of pin 75, with accompanying pivoting movement of arm 80 with respect to link 81, and pin 76 will force its associated ball 77 and diaphragm 70 into sealing relation with the metering valve seat 67 and

orifice 68, thus shutting off the supply of liquid to chamber 39. However, if for any reason diaphragm 70 fails to close orifice 68 and instead permits liquid to continue to enter chamber 39, float 40 will continue to rise. This will in turn force arm 86 to pivot about its connection to pin 76 and thus raise pin 75 and its associated ball 77 to a position closing diaphragm 64 against the safety valve seat 61 and orifice 62, thus effectively limiting the maximum liquid level within chamber 39 without requiring an overflow outlet from pan 13.

The pivot post 83 is adjustable vertically to vary the height of the pivotal mounting of lever 82 and hence the level of liquid within chamber 39 at which float 40 closes each valve. Referring to Figs. 5 and 7, a compression spring 90 is mounted on pivot pin 83 between the inner surface of cap 50 and a collar 91 held on pin 83 by a pin 92, this spring thus tending to force the pivot pin 83 downwardly with respect to cap 50. The upper end of pivot pin 83 extends through cap 50, and a handle 95 is secured thereto. This handle has a cam surface 96 on its under side adapted to engage the top of a pin 97 fixed in cap 50.

With this construction and arrangement, when handle 95 is rotated in clockwise direction as viewed in Fig. 5, the cam surface 96 will ride up on pin 97 and will thus raise pivot pin 83 against spring 90. A cooperating scale 99 provided with suitable indicia is molded or otherwise formed on the upper surface of cap 50 as shown in Fig. 5, and it will be seen that when handle 95 is in its zero position, the pivot pin 83 will have been raised to a position such that lever 82 will be raised sufficiently to close the valves in valve body 55 irrespective of the level of the float 40, thus shutting off the supply of liquid to the float chamber. Conversely, as handle 95 is rotated in counterclockwise direction from its zero position, it will lower pivot pin 83 and thus correspondingly raise the predetermined level within chamber 39 at which float 40 will close each of the metering and safety valves. Thus with the handle 95 in the position shown in Fig. 5, the pivotal connection between lever 82 and pivot pin 83 will be at its lowest relative position within chamber 39, which is the position permitting the maximum level of liquid within pan 13 and hence the maximum rate of evaporation from pan portion 14 into hot air chamber 11.

It will accordingly be seen that this humidifier is of simple and easily assembled construction, with a single pan of suitable sheet metal providing both an evaporator and a float chamber for maintaining the liquid level within the evaporator, and this single pan serves to support all the working parts of the device. This humidifier will operate effectively and reliably to supply liquid at a controlled rate for evaporation in a hot air chamber of a hot air heating system, and it may be quickly and readily mounted in or on the wall of such a hot air chamber as shown in Figs. 1 and 2. This construction of the pan and its mounting means also provides for ready removal or addition of diffuser plates within the hot air chamber, as described in connection with Figs. 1 and 2, in accordance with the desired area of evaporating surface within the hot air chamber and hence the desired rate of evaporation.

In operation, the handle 95 is adjusted in accordance with the desired maintained level of liquid within the pan 13, and liquid from pipe or hose 58 will then enter the float chamber 39 and flow to the evaporating portion 14 of the pan until the level is reached at which the float acts as described to close the metering valve seat 67. Thereafter, as liquid is evaporated within chamber 11 and the level within the pan falls, the float will fall correspondingly and thus open the metering valve to admit sufficient liquid to restore the desired level. In practice, a substantially equilibrium condition will be established, with the float assuming a position such that liquid will be metered through the metering valve orifice 68 at the same rate as that at which the liquid is evaporated from the pan within chamber 11. However, if for any reason this metering valve fails to operate properly, and permits liquid to enter the pan at a faster rate than it evaporates, the resulting increase in liquid level will cause the float to rise sufficiently to close the safety valve, thus effectively limiting the maximum liquid level within the pan without the necessity for an overflow outlet.

This application is a division of my application Serial No. 776,968, filed September 30, 1947, and assigned to the same assignee, and which became Patent No. 2,585,764 on February 12, 1952.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves in said body for controlling communication from said inlet to said outlet, said valves including valve orifices arranged in series in the line of flow from said inlet to said outlet, diaphragm means mounted for movement in said valve body into closing relation with said respective orifices, means movable in response to change in the level of liquid in said chamber for moving said diaphragm means into closing relation with said orifice, and one of said valve orifices being larger than the other to establish greater pressure on said diaphragm means at said one valve than at the other said valve to cause said other valve to close when said liquid reaches a predetermined level and to cause said one valve to close only in response to increased pressure on said movable means resulting from rise of said liquid above said predetermined level.

2. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves in said body for controlling communication from said inlet to said outlet, said valves including valve orifices arranged in series in the line of flow from said inlet to said outlet, a float for sensing the liquid level within said chamber, means operated by upward movement of said float for closing the respective said valve orifices, one of said valves having a greater orifice than the other said valve to provide greater total pressure therethrough, and said valve closing means including flexible connections for transmitting said upward

movement of said flow alternatively to said valve closing means to cause said smaller valve orifice to be closed when said float reaches a predetermined level and to cause said larger valve orifice to be closed upon movement of said float to a higher level.

3. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves in said body for controlling communication from said inlet to said outlet, said valves including valve orifices arranged in series in the line of flow from said inlet to said outlet, a pair of valve operating members each mounted for reciprocating movement in said valve body with respect to one of said valve orifices to close the associated said orifice upon seating thereagainst, a float for sensing the liquid level within said chamber, an arm pivotally connected with both said operating members, means pivotally connecting said arm to said float to transmit rising movement of said float to said operating members, and one of said orifices being larger than the other to provide greater total pressure therethrough against the associated said operating member than the pressure on the other said operating member to cause said other operating member to close the smaller said valve orifice upon movement of said float to a predetermined level and to cause said larger valve orifice to be closed upon movement of said float to a higher level against said greater pressure.

4. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves arranged in series in said valve body to control communication from said inlet to said outlet, each of said valves including an annular valve seat having a valve orifice therethrough and a flexible diaphragm adapted to be moved into sealing relation with said valve seat, a pair of valve control members mounted for reciprocating movement with respect to said valve body to cause said diaphragms to move into sealing relation with their associated valve seats, a pair of balls each mounted adjacent one of said diaphragms and adapted to be moved with said diaphragm to a position of accurately seated relation with the valve orifice in its associated valve seat, a float for sensing the liquid level within said chamber, means operated by said float for moving said control members, and means establishing different pressure conditions on said diaphragms providing greater resistance to valve closing movement to one of said valve closing members than the other to cause said control members to close said valves at different predetermined liquid levels in said chamber.

5. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves arranged in series in said valve body to control communication from said inlet to said outlet, each of said valves including an annular valve seat having a valve orifice therethrough and a flexible diaphragm adapted to be moved into sealing relation with said valve seat, one of said valve orifices being of larger diameter than the other said orifice, a pair of pins each mounted for reciprocating movement with respect to said valve body to cause said diaphragms to move to positions of sealing relation with their associated valve seats, an arm pivotally connected to both said pins, a float for sensing the liquid level within said chamber, and means providing a pivotal connection between said float and said arm effective upon rising movement of said float to raise said arm and thus to move said pins first to a position of closing relation between said smaller valve orifice and its associated diaphragm and thereafter to a position of sealing relation between said larger valve orifice and its associated diaphragm.

6. Liquid level control means for use in a humidifier of the character described comprising a chamber for liquid, a valve body mounted on said chamber, means forming an inlet for liquid to said valve body, means forming an outlet from said valve body to said chamber, a pair of valves arranged in series in said valve body to control communication from said inlet to said outlet, each of said valves including an annular valve seat having a valve orifice therethrough and a flexible diaphragm adapted to be moved into sealing relation with said valve seat, one of said valve orifices being of larger diameter than the other said orifice, a pair of pins each mounted for reciprocating movement with respect to said valve body to cause said diaphragms to move to positions of sealing relation with their associated valve seats, an arm pivotally connected to both said pins, a lever pivotally mounted in said chamber and pivotally connected to said arm at a position intermediate said pins, a float for sensing the liquid level within said chamber, and means connecting said float and lever effective upon rising movement of said float to raise said lever and arm and thus to move said pins first to a position of closing relation between said smaller valve orifice and its associated diaphragm and thereafter to a position of sealing relation between said larger valve orifice and its associated diaphragm.

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