

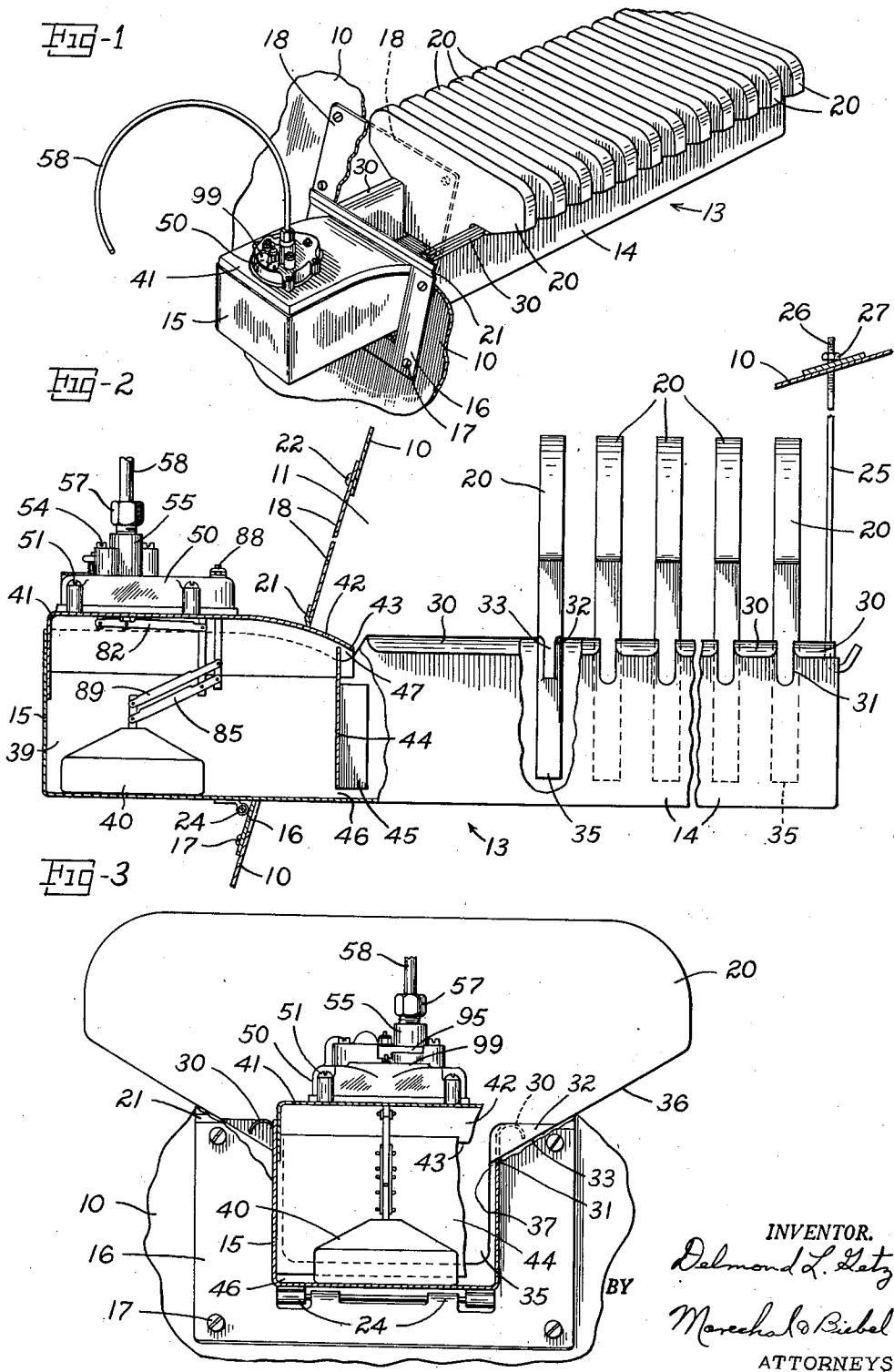
Feb. 12, 1952

D. L. GETZ
HUMIDIFIER FOR THE HOT-AIR CHAMBERS
OF AIR-HEATING SYSTEMS

2,585,764

Filed Sept. 30, 1947

2 SHEETS—SHEET 1



INVENTOR.
Dalmond L. Getz
BY *Marshall & Biebel*
ATTORNEYS

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2 SHEETS—SHEET 2

Fig-5

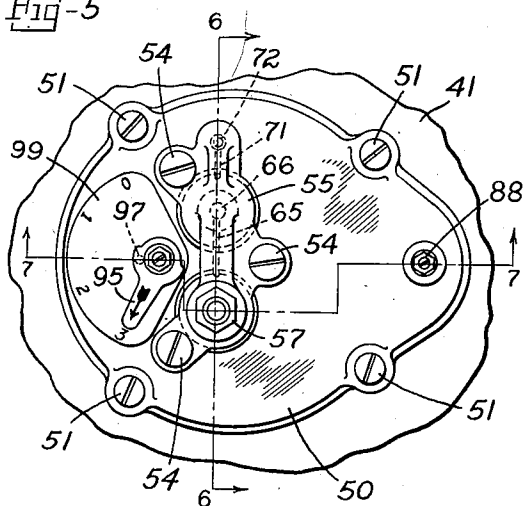


Fig-4

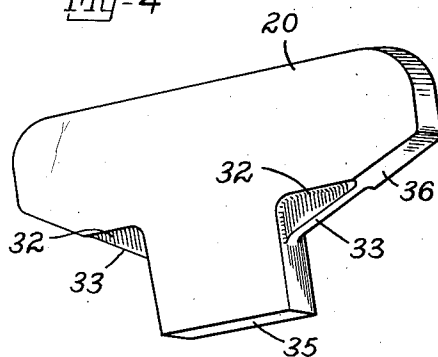


Fig-7

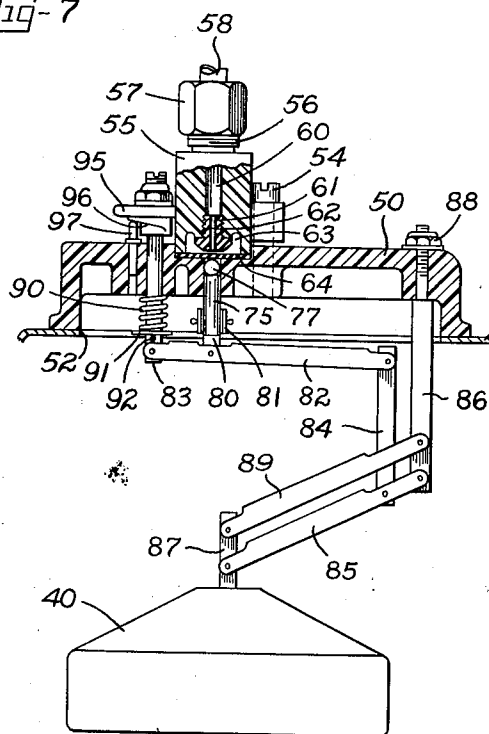
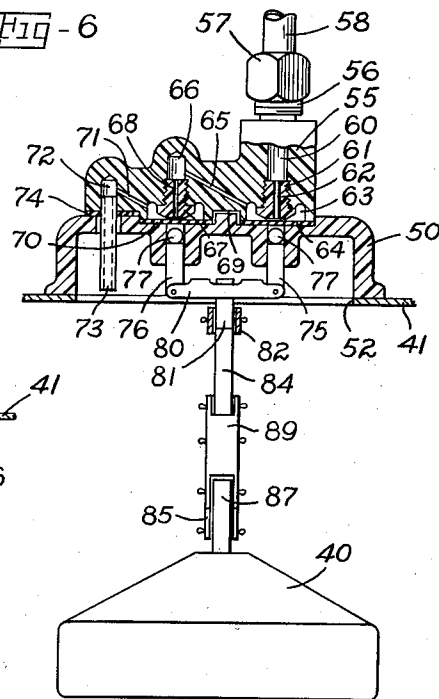


Fig-6



INVENTOR.

Diamond L. Getz

BY

Morehead & Biebel

ATTORNEYS

UNITED STATES PATENT OFFICE

2,585,764

HUMIDIFIER FOR THE HOT-AIR CHAMBERS
OF AIR-HEATING SYSTEMS

Delmond L. Getz, Springfield, Ohio, assignor to
The Steel Products Engineering Company,
Springfield, Ohio, a corporation of Ohio

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9 Claims. (Cl. 126-113)

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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.

Another object is to provide for simple and effective control of air currents and pressure adjacent the mechanism controlling the supply of liquid to a humidifier to prevent undesirable evaporation and precipitation of lime or the like adjacent the control mechanism without the necessity of enclosing the control mechanism in a sealed chamber.

An additional object is to provide a humidifier wherein the float or other liquid level control member and the diffuser plates or other evaporator members are mounted at different positions in the same pan or like container adapted for mounting in or on the wall of a hot air chamber with the evaporator members within the chamber and with the liquid control portion of the pan outside of the chamber.

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

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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 detailed 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 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 with-

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in 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 41 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. 2.

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

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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 a 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. 6. A stabilizing link 89 is pivotally connected to pivot pin 86 and post 87 to guide the float during its up and down move-

ment 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 68 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 80 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 85 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 provide 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.

Reference is made to application Serial No. 174,249 filed July 17, 1950, as a division of the present application and assigned to the same assignee as this application.

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. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said hot air chamber, a generally upright partition extending transversely within said pan to define a float chamber in said exterior pan portion, said partition having a passage in the lower part thereof for flow of liquid from said float chamber to said interior pan portion, a cover for said exterior pan portion adapted to extend within said hot air chamber in overhanging spaced relation with the upper edge of said partition to form therewith a passage providing open communication between said float chamber and said hot air chamber to prevent differences in pressure between said chambers while shielding said float chamber from air currents circulating within said hot air chamber, means mounted on said

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cover for connecting said exterior pan portion with a source of liquid for evaporation, and means sensitive to the level of liquid in said exterior pan portion and including a float in said float chamber for controlling the passage of liquid through said connecting means.

2. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, a cover for said exterior pan portion adapted to extend within said chamber, a baffle, means mounting said baffle between said exterior and interior pan portions and spaced vertically between said cover and the bottom of said pan to provide passages above and below said baffle for communication between said pan portions, means mounted on said cover for connecting said exterior pan portion with a source of liquid for evaporation, and means for controlling the passage of liquid through said connecting means to maintain a predetermined level of liquid in said pan.

3. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, a cover for said exterior pan portion adapted to extend within said chamber, the portion of said cover within said chamber extending downwardly with respect to the exterior portion of said cover, a baffle, means mounting said baffle between said exterior and interior portions of said pan at a position spaced externally of said downwardly extending cover portion, the lower edge of said baffle terminating above the bottom of said pan and the upper edge of said baffle terminating at a level below said cover but above the level of the lower edge of said downwardly extending cover portion to provide passages of limited extent above and below said baffle for communication between said exterior and interior pan portions, means for connecting said exterior pan portions with a source of liquid for evaporation, and means sensitive to the level of liquid in said exterior pan portion for controlling the passage of liquid through said connecting means to maintain a predetermined level of liquid in said pan.

4. A humidifier of the character described for use in conjunction with a hot air heating system including a hot air chamber having a wall, comprising a pan, means for mounting said pan with a portion extending through said wall of said hot air chamber and interiorly of said chamber and with another portion extending exteriorly of said hot air chamber, a generally upright partition extending transversely within said pan to define a float chamber in said exterior pan portion, said partition having a passage in the lower part thereof for flow of liquid from said float chamber to said interior pan portion, said mounting means including means for pivotally connecting said pan to said wall for movement in a vertical plane and vertically adjustable means spaced longitudinally of said pan from said pivot means for adjusting the level of said pan about said pivot means, evaporator members supported in said interior pan portion, a cover for said exterior pan

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portion adapted to extend within said hot air chamber in overhanging spaced relation with the upper edge of said partition to form therewith a passage providing open communication between said float chamber and said hot air chamber to prevent differences in pressure between said chambers while shielding said float chamber from air currents circulating within said hot air chamber, means mounted on said cover for connecting said exterior pan portion with a source of liquid for evaporation, and means including a float in said float chamber for controlling the passage of liquid through said connecting means to maintain a predetermined rate of evaporation from said pan.

5. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, said evaporator members having recessed portions on the sides thereof, means on the upper side edges of said pan for engagement in said recessed portions to support said members in spaced and substantially parallel alignment, the side edges of each of said evaporator members being inclined upwardly and outwardly to conduct back towards said pan liquid accumulating on said member, said recessed portions of said evaporator members and said supporting means being proportioned to support said inclined edges of said evaporator members above the edges of said pan to provide clearance for flow of said liquid along said inclined edges into the interior of said pan, means for connecting said exterior pan portion with a source of liquid for evaporation, and means for controlling the passage of liquid through said connecting means to maintain a predetermined level of liquid in said pan.

6. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, the upper side edges of said interior pan portion being flanged and having a plurality of spaced vertical slots therein, said evaporator members having recessed side portions adapted for engagement in said slots in said pan edges and cooperating with said flanged pan edges to support said evaporator members in spaced and substantially parallel alignment, each of said evaporator members having a web portion intermediate said recessed portions, said web portions and the adjacent side edges of each of said evaporator members being inclined upwardly and outwardly to conduct back toward said pan liquid accumulating on said member, said flanged pan edges being proportioned to support said evaporator members with said web portions thereon in vertically spaced relation with the bottoms of said slots to provide clearance for flow of said liquid along said web portions into the interior of said pan, means for connecting said exterior pan portion with a source of liquid for evaporation, and means for controlling the passage of liquid through said connecting means to maintain a predetermined level of liquid in said pan.

7. A humidifier of the character described for

use in conjunction with a hot air chamber of a hot air heating system, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, a cover for said exterior pan portion adapted to extend within said chamber, a baffle, means mounting said baffle between said exterior and interior pan portions and spaced vertically between said cover and the bottom of said pan to provide passages above and below said baffle for communication between said pan portions, means mounted on said cover for connecting said exterior pan portion with a source of liquid for evaporation, said connecting means including a valve for controlling the passage of liquid to said pan, and means sensitive to the level of liquid in said exterior pan portion for actuating said valve to maintain a predetermined level of liquid within said pan.

8. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system to provide a continuous supply of liquid at a desired rate for evaporation in the chamber without an overflow outlet, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, a cover for said exterior pan portion adapted to extend within said chamber, a valve body mounted on said cover, means forming an inlet for liquid to said valve body, means for connecting said inlet with a source of liquid for evaporation, means forming an outlet from said valve body into said pan, a pair of valves arranged in series in said valve body to control communication from said inlet to said outlet, one of said valves having a smaller passage therethrough than the other said valve, said other valve being located between said one valve and said inlet, means including a float responsive to change in the level of liquid within said exterior pan portion for controlling said one valve and effective to close said valve when said liquid reaches a predetermined level, and means connected with said float for closing the other of said valves in response to a rise in said liquid level above said predetermined level following failure of said first named valve to close when said liquid reaches said predetermined level to positively limit the accumulation of liquid above said predetermined level and prevent overflow from said pan.

9. A humidifier of the character described for use in conjunction with a hot air chamber of a hot air heating system to provide a continuous supply of liquid at a desired rate for evaporation in the chamber without an overflow outlet, comprising a pan, means for mounting said pan with a portion thereof extending interiorly of said hot air chamber and with another portion extending exteriorly of said chamber, evaporator members supported in said interior pan portion, a cover for said exterior pan portion adapted to extend within said chamber, a baffle, means mounting said baffle between said exterior and interior pan portions and spaced vertically between said cover and the bottom of said pan to provide passages above and below said baffle for communication between said pan portions, a valve body mounted on said cover, means forming an inlet for liquid to said valve body, means for connecting said inlet with a source of liquid for evaporation, means forming an outlet from said valve body into said pan, a pair of valves arranged in series in said valve body to control communication from said inlet to said outlet and including a valve orifice, one of said valve orifices being of larger diameter than the other said orifice, a pair of valve control members each mounted for reciprocating movement with respect to said valve body to control said valves, an arm operably associated with said valve control members for operating the same, a float for sensing the liquid level within said exterior pan portion, and means forming 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 control members first to a position closing said smaller valve orifice and thereafter to a position closing said larger valve orifice to assure the continuation of the flow of liquid to said pan when the liquid in said pan reaches a predetermined level and thus to prevent overflow from said pan.

DELMOND L. GETZ.

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