

July 22, 1969

W. W. MARTIN ET AL

3,456,927

PURGING SYSTEM FOR HUMIDIFIER

Filed July 10, 1968

2 Sheets-Sheet 1

FIG-1

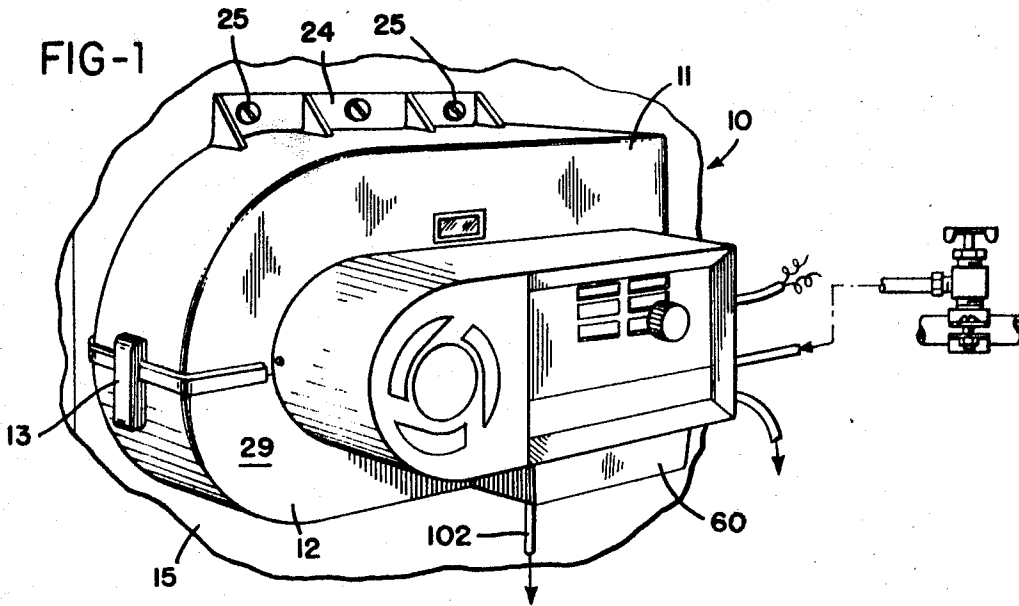


FIG-2

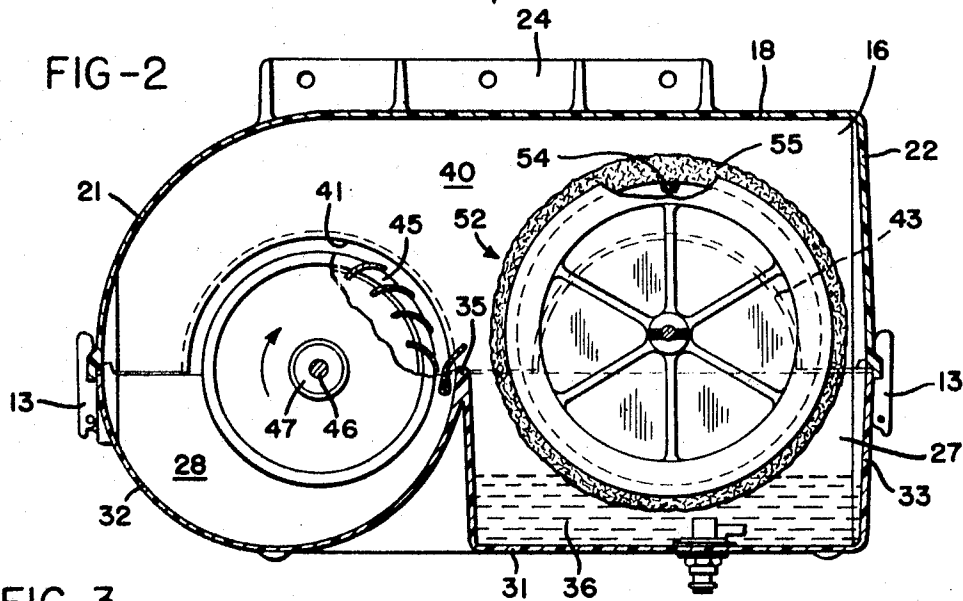
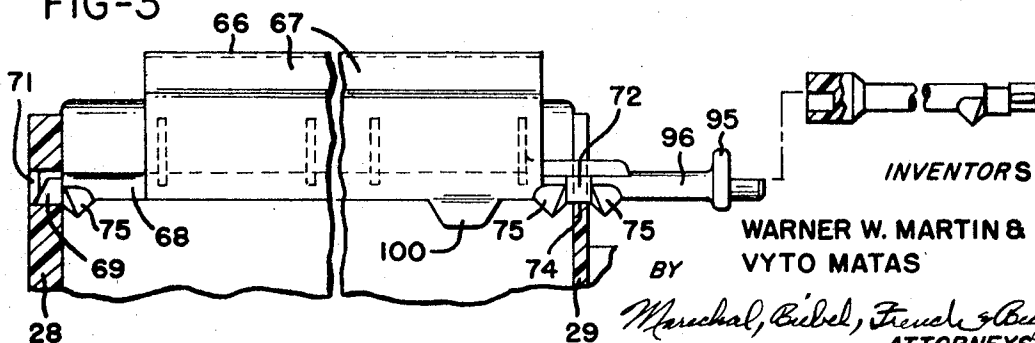


FIG-3



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FIG-4

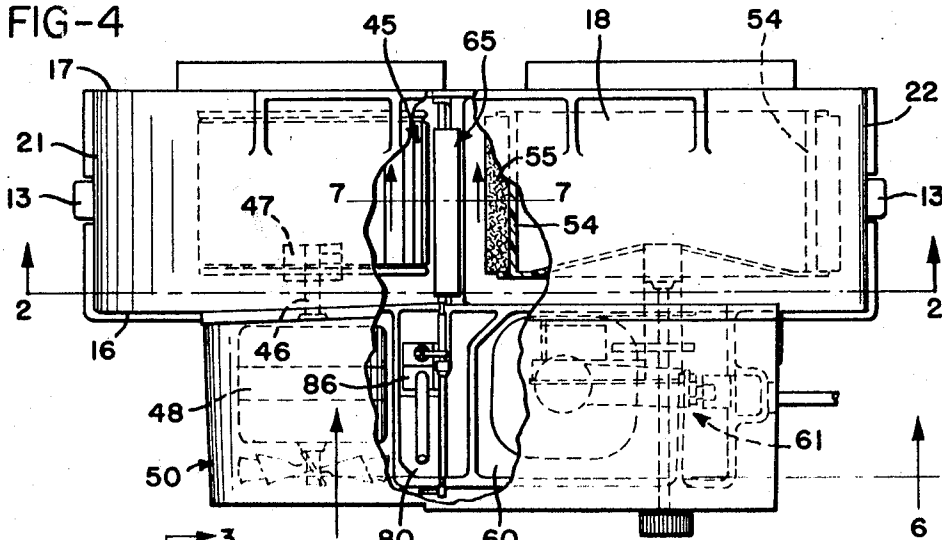


FIG-5

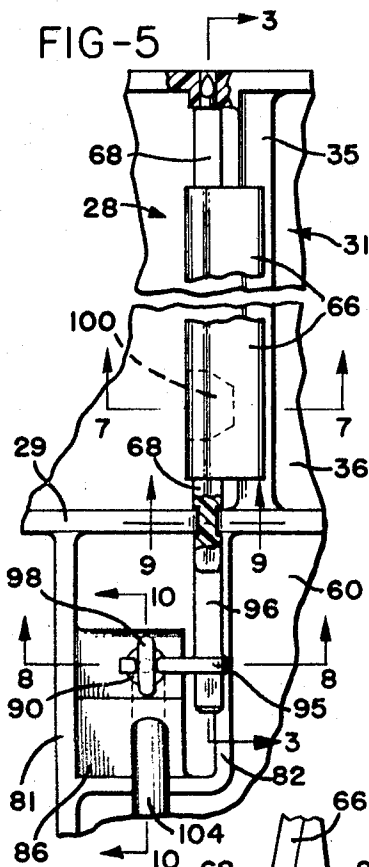


FIG-6

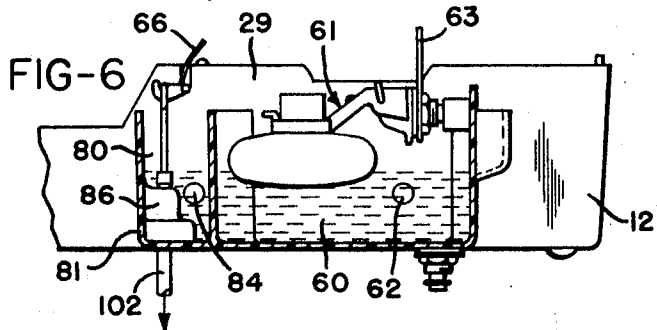


FIG-8

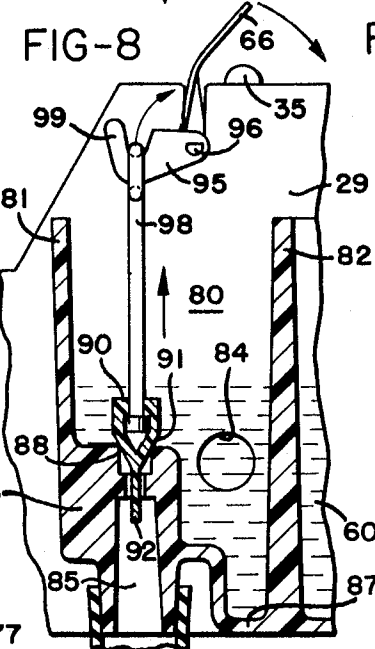


FIG-7

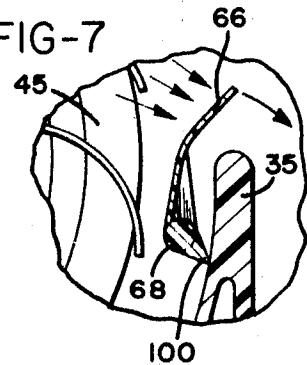


FIG-10

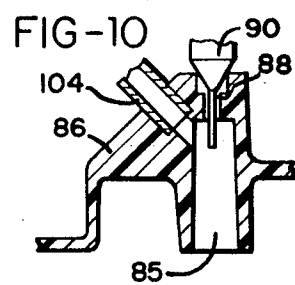
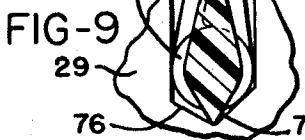


FIG-9



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3,456,927

PURGING SYSTEM FOR HUMIDIFIER

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Filed July 10, 1968, Ser. No. 743,816

Int. Cl. B01d 47/18

U.S. Cl. 261—2

12 Claims

ABSTRACT OF THE DISCLOSURE

A water purging system for a power humidifier including a drain valve opened in response to air flow through the humidifier to remove water from the reservoir at a preset rate. As air flows through the humidifier it impinges upon a sail which pivots to open the valve for draining water from the reservoir thereby substantially reducing precipitation of solids in the humidifier.

Background of the invention

One of the most pressing problems in the design of domestic humidifiers for adding moisture to the air of a home is the disposal of the mineral deposits which occur when tap water is evaporated. The minerals precipitate on the evaporation material and in the reservoir when the level of minerals in solution reaches and exceeds the saturation point.

One answer to this problem is to continually remove a portion of the water from the reservoir during the time that the humidifier is operating. This causes the float assembly to refill the reservoir with fresh water thereby diluting the concentration of minerals in solution. Two such concepts for washing water in this manner are shown in U.S. Patents No. Re. 26,243 and No. 3,315,948, both assigned to the assignee of the invention.

Summary of the invention

An improved humidifier purging system operable only in response to the flow of air through the humidifier which occurs only during operation of the humidifier. No electric or other power is supplied to the valve system. In the preferred embodiment, a pivotally mounted sail is interposed between the fan means of the humidifier and the evaporation media to be pivoted by the flow of air thereby rotating a lever arm which raises a valve from its seat to allow water to be slowly drained from the reservoir of the humidifier.

Brief description of the drawings

FIG. 1 is a perspective view of a typical humidifier which can utilize the invention;

FIG. 2 is a sectional view taken horizontally through the humidifier showing the operating components thereof and taken along the line 2—2 of FIG. 4;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 5;

FIG. 4 is a plan view of the humidifier partially broken away to show the operating components of the invention;

FIG. 5 is an enlarged plan view of the exposed area in FIG. 4;

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 4;

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 4;

FIG. 8 is another sectional view taken along the line 8—8 of FIG. 5;

FIG. 9 is a sectional view taken along the line 9—9 of FIG. 5; and

FIG. 10 is another sectional view taken along the line 10—10 of FIG. 5.

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Detailed description of the preferred embodiments

FIG. 1 illustrates the self-contained humidifier 10 which includes the upper and lower housings 11 and 12 clamped together by the clasps 13, and secured to the outside vertical wall 15 of a hot air furnace plenum or duct. The present invention is adapted to use with practically any hot air power operated evaporation type humidifier, whether mounted on a heating device or air duct, and consequently the furnace or air duct is not described in detail. The humidifier illustrated is of the type shown in the U.S. Patent of Martin, No. 3,274,992, assigned to the assignee of the invention, and is described in detail only to illustrate the operation of the purging system.

The upper housing 11 is generally rectangular and has the back and front walls 16 and 17 (FIG. 4) with the top wall 18 formed integrally therebetween. The left-hand end of the top wall 18 curves gently downwardly to form the end wall 21 whereas the right-hand end wall 22 is substantially perpendicular to the adjacent walls 16—18. A reinforced mounting flange 24 is formed integrally on the top wall 18, and the screws 25 can be inserted through suitable openings therein to secure the entire humidifier 10 to the furnace or duct wall 15, as seen in FIG. 1.

The lower housing 12 is also generally rectangular with back and front walls 27 and 28 (FIGS. 1 and 2) having the bottom wall 31 formed integrally therebetween. This bottom wall is connected integrally with the curved vertical end wall 32 on the left-hand end of the lower housing and the perpendicular end wall 33 on the opposite or right end thereof. The bottom wall 31 extends upwardly at an intermediate point to form a partition 35 which defines one side of the reservoir 36.

The upper and lower housings 11 and 12 are coextensive in length and width so that they fit snugly together, as shown in FIGS. 1 and 2, to define an air flow chamber 40, which has a circular inlet opening 41. A semi-circular outlet 43 is formed in a similar manner in the back wall 16 of the upper housing 11, and no mating cutout is provided in the lower housing 11 since the back wall 27 forms one side wall of the reservoir 36.

A blower wheel 45 (FIG. 4) is mounted on the shaft 46 by securing the hub 47 thereto, and the inlet to this blower wheel is aligned axially with and spaced close to the inlet 41 of the air flow chamber 40 for drawing air into this chamber. The drive shaft 46 is connected to the electric motor 48 enclosed by the front cover 50 secured to the front wall 16 of the upper housing 11. The evaporator drum 52 is mounted in parallel spaced relationship with the blower wheel 45 on the front wall 16 of the upper housing 11 and a suitable motor is mounted within the cover 50 to slowly rotate the media wheel 52. The media wheel 52 includes the spaced and radially extending fingers 54 which support an endless sleeve 55 of evaporator material, as shown in FIG. 2, so that rotation of the wheel 52 affects movement of the material along a predetermined path through the reservoir 36.

The evaporator material 55 is preferably open cell polyurethane foam which has numerous irregularly spaced pores or passages therethrough. This characteristic provides relatively large effective surface area to become wetted when the sleeve is submerged in water. Another advantage of this material is that the total space consumed by the sleeve is much less than that of other materials capable of providing the amount of surface area, and the particular porosity is dependent upon the thickness, length, and width of the material, as well as the rate of air flow therethrough. It is important that the material not be absorbent since it is not desired to completely saturate the material but only wet the surface area thereof.

A float chamber 60 is formed integrally with the lower housing 12 and extends outwardly from the front wall

28 thereof, as shown in FIGS. 4 and 6, to receive the float assembly 61 which is rigidly mounted on the upper housing 11. An opening 62 is provided in the front wall 28 so that water within the float chamber 60 passes readily into the reservoir 36 to maintain a preset water level therein. The float assembly 61 is supported in place by the bracket 63 (FIG. 6) to maintain a preset level of water in the chamber and the reservoir 36.

The sail valve assembly 65 utilized to drain water from the reservoir 36 is mounted entirely in the lower housing 12 and includes a sail member 66 having the relatively smooth surface 67 which projects upwardly from the integral pivotal shaft 68. The inner end 69 (FIG. 3) of this pivotal shaft is received in an opening 71 thereof in the back wall 28 of the lower housing while the outer end 72 thereof is received in a slot 74 in the wall 29 of the housing. Round projections 75 are formed on the shaft 68 adjacent the opening 71 and on either side of the slot 74 to hold the shaft 68 in place against axial movement, as shown in FIG. 5. The slot 74 has a V-shaped bottom portion 76 to accommodate the V-shaped portion 77 of the pivot shaft 68 to provide for rotation of the shaft about a point to reduce the frictional drag on this shaft as the sail member 66 rotates as the air which is being propelled by the blower wheel 45 impinges upon the sail member 66 and rotates it in a clockwise direction, as shown in FIG. 2. The sail member 66 and shaft 68 are preferably made of a rigid plastic material which can be easily molded as a unit.

A drain compartment 80 is provided in the lower housing 12 defined by the wall 81 which extends around the compartment and cooperates with the adjacent wall 82 of the float chamber 60 and the front wall 29, as shown in FIGS. 6 and 8. A suitable opening 84 is provided through the wall 29 to the reservoir 30 so that the same level of water is maintained in the compartment 80 as in the float chamber 60 and reservoir 36. A drain passage or orifice 85 is provided on the raised portion 86 of the bottom wall 87 and includes the valve seat 88 at the upper end of the passage 85.

The valve 90 having the conical surface 91 is adapted to engage the valve seat 88, and the axial guide pin 92 on the end thereof maintains alignment of the valve 90 with the seat 88, as well as cleans the orifice 85. The operator for the valve 90 includes a pivot arm 95 rigidly secured to the extension 96 of the pivot shaft 68 and the sail member 66. This arm 95 has a rod 98 secured in the hooked end portion 99 thereof which rod extends downwardly to a rigid connection to the valve 90. Thus, rotation of the sail member 66 in a clockwise direction, as viewed in FIG. 8, opens valve 90, whereas the normal weight of the arm 95, the actuator rod 98, and the valve 90 closes the valve 95 when no air flow impinges on the said member 66. A stop 100 may be formed integrally on the shaft 68, as shown in FIG. 7, to engage the partition 35 of the housing 12 to limit rotation of the sail 66 in a counter-clockwise direction.

A suitable hose 102 is provided to receive flow from the drain passage 85 for conducting the water to drain, and the syphon break tube 104 is provided in connection with the drain passage 85 and has its upper end disposed above the level of water in the compartment 80 to permit water to drain from the hose when the valve 90 is closed thereby eliminating any syphoning action.

In operation of the invention, the humidifier 10 is first properly mounted for cooperation with a furnace or heating duct and connected to a source of water under pressure and to electric current. Usually the humidifier is wired to operate with the blower of the furnace and a humidistat is provided in the return air duct of the furnace to terminate operation of the humidifier when a preset level of humidity is reached. When the humidifier is operating, the blower wheel 45 rotates and draws air through the inlet 41 and forces it through the air flow chamber 40, and through the outer surface of the evapora-

tion material 55 on the evaporation drum 52, after which it is returned to the furnace through the outlet 43.

The evaporation material 55 is moved through the water in the reservoir 36 by slow rotation of the drum 52 to continually wet the surfaces of this material so that water is evaporated as the air passes through the material 55 to increase the humidity of the air. As the water level in the reservoir 36 drops due to evaporation, a float valve assembly 61 senses this and opens the valve to reestablish the water level in the flow chamber and thus in the reservoir.

As the water is evaporated from the material 55 the concentration of minerals in solution in the reservoir increases since the minerals in solution are washed from the material as it reenters the reservoir 36. If this saturation were allowed to continue, precipitation would occur producing an undesirable buildup of solids in the reservoir 36 and on the evaporation drum 52. However, the water flows into the drain compartment 80 through the opening 84 from the reservoir 36.

When the blower wheel 45 is moving air through the chamber 40, the air impinges upon the surface 67 of the sail member 66 causing it to rotate in a clockwise direction, as viewed in FIG. 2, to pivot the shaft 68 thereby raising the arm 95 (FIG. 8) and the rod 98 to unseat the valve 90 from its seat 88. This action allows water to slowly drain from the compartment 80 thereby draining the saturated water solution from the reservoir 36. The reduction in water level is sensed by the float assembly 61 causing fresh water to be supplied to the float chamber 60 and thus the reservoir 36. The amount of water drained through the passage 85 is regulated so that the fresh water dilutes the solution in the reservoir and maintains the saturation below the level at which precipitation of the minerals will occur. As a result, the humidifier is substantially free from deposits of minerals.

When the humidifier operation is terminated and the blower wheel ceases to rotate, the combined weight of the arm 95, the rod 98 and the valve 90 causes the sail member 66 to rotate in the counterclockwise direction and seat the valve 90 to terminate flow of water from the compartment 80. The water level in the compartment 80 is above the surface of the valve 90 and thus aids in holding the valve 90 closed. The syphon break tube 104 allows the water to be drained from the passage 85 and the tube 102 once the valve 90 is seated thereby eliminating the possibility of a syphoning action to draw water around the valve 90 into the passage 85. However, the primary use of syphon break 104 is to create a controlled head of water above the orifice 85 so it develops a controlled flow rate through this calibrated orifice 85.

As a result, the water is drained from the reservoir 36 only during the operation of the humidifier thereby conserving water. For example, during the spring months when the furnace may not operate for an entire day, so that no water is drained from the reservoir 36 and there was no buildup in the concentration of minerals in solution in the reservoir. On the other hand, when the humidifier is cycling frequently, sufficient water is drained to prohibit the precipitation of the minerals.

While the invention has been described for use with a humidifier having an individual blower wheel mounted therein, it is possible to utilize the sail valve assembly with bypass humidifiers wherein the furnace fan or other means is utilized to move the air through the humidifier. In such case, the surface area 67 of the sail 66 may have to be increased since the air flow is frequently at a slower velocity. The important feature is that the drain valve is opened only during the time that air is flowing through the humidifier and thus only when the humidifier is operating. Opening of the drain valve occurs without the direct use of an electric motor or other separate power source and thus can be inexpensively provided in the humidifier. Because of its simplicity, its operation is very

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reliable and thus it is capable of operating over a substantial period of years without breakdown.

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 assembly comprising, a housing defining an air flow chamber, spaced inlet and outlet openings in said housing, drive means mounted in said housing having a drive shaft which extends into said air flow chamber, an evaporator drum assembly in said air flow chamber between said inlet and said outlet, said evaporator drum assembly including highly porous material secured on a support frame which is secured to said drive shaft, means defining a reservoir in said housing below said drum assembly for wetting said material as said drum assembly is rotated, air moving means associated with said air flow chamber for moving air through said outlet opening to increase the moisture content of the air, and sail means responsive to a preset flow of air through said air flow chamber and connected to drain valve means to drain water from said reservoir at a preset rate.

2. A humidifier assembly as defined in claim 1 wherein fan means are provided in said air flow chamber for drawing air from said inlet and forcing the same through said drum assembly and said outlet, said sail means being disposed between said fan means and said drum assembly.

3. A humidifier assembly as defined in claim 1 wherein said sail means responsive to air flow includes a sail mounted in said air flow chamber and adapted to move from a first position to a second position when air flows through said air flow chamber at said preset rate, and said valve means is operated by said sail means when said sail means is in said second position to drain water slowly from said reservoir.

4. A humidifier assembly as defined in claim 3 wherein said sail means includes a pivot shaft on which said sail is mounted, and said sail has sufficient surface area so that when said preset air flow contacts said sail said pivot is rotated.

5. A humidifier assembly as defined in claim 4 wherein said pivot shaft has an actuator arm on the end thereof adapted to move said valve means, said actuator arm and said valve means having sufficient weight to move said sail to said first position and close said valve means when said air flow is below said preset rate.

6. A humidifier assembly comprising, a housing defining an air flow chamber, spaced inlet and outlet openings in said housing, drive means mounted in said housing having a drive shaft, an evaporator assembly on said drive shaft in said air flow chamber between said inlet and said outlet, said evaporator assembly including highly porous material, means defining a reservoir in said housing below said evaporator assembly for wetting said

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material as said assembly moves said material along a preset path through said reservoir, air moving means associated with said air flow chamber for moving air between said inlet and outlet and through said porous material to increase the moisture content of the air, and sail means responsive to the flow of air through said air flow chamber and connected to drain valve means to drain water from said reservoir when a preset rate of air flows through said air flow chamber.

7. A humidifier assembly as defined in claim 6 wherein said sail and valve means includes a separate compartment having a valve seat which is connected to a drain passage, a valve member adapted to cooperate with said seat, and a sail in said air flow chamber to separate said valve from said seat when said preset rate of air flows through said air flow chamber.

8. A humidifier assembly as defined in claim 7 wherein said drain passage includes an orifice of precise size for controlling the flow rate, and a syphon break connected to said drain passage below said valve seat so that a controlled head of pressure acts on said valve member.

9. A humidifier assembly as defined in claim 7 wherein said valve seat has an orifice leading to said drain passage, said valve member having an elongated guide pin on the end thereof adapted to be received by said orifice to center said valve member on said seat and to maintain said orifice free of solids.

10. A humidifier assembly as defined in claim 7 wherein a separate float chamber is provided having a connection to said reservoir to supply fresh water to said reservoir when the level therein falls below a set level, said compartment being connected to said reservoir at a point remote from said connection between said reservoir and said float chamber for flow of fresh water directly from said float chamber to said reservoir and flow of saturated water directly from said reservoir to said compartment.

11. A humidifier assembly as defined in claim 10 wherein said air moving means is a blower wheel mounted in said housing, said sail being disposed between said blower wheel and said evaporator assembly.

12. A humidifier assembly as defined in claim 11 wherein said sail is mounted on a pivot shaft which operates said valve member, said sail extending across the width of said air flow chamber.

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TIM R. MILES, Primary Examiner

U.S. Cl. X.R.

126—113; 261—30, 92