

July 6, 1965

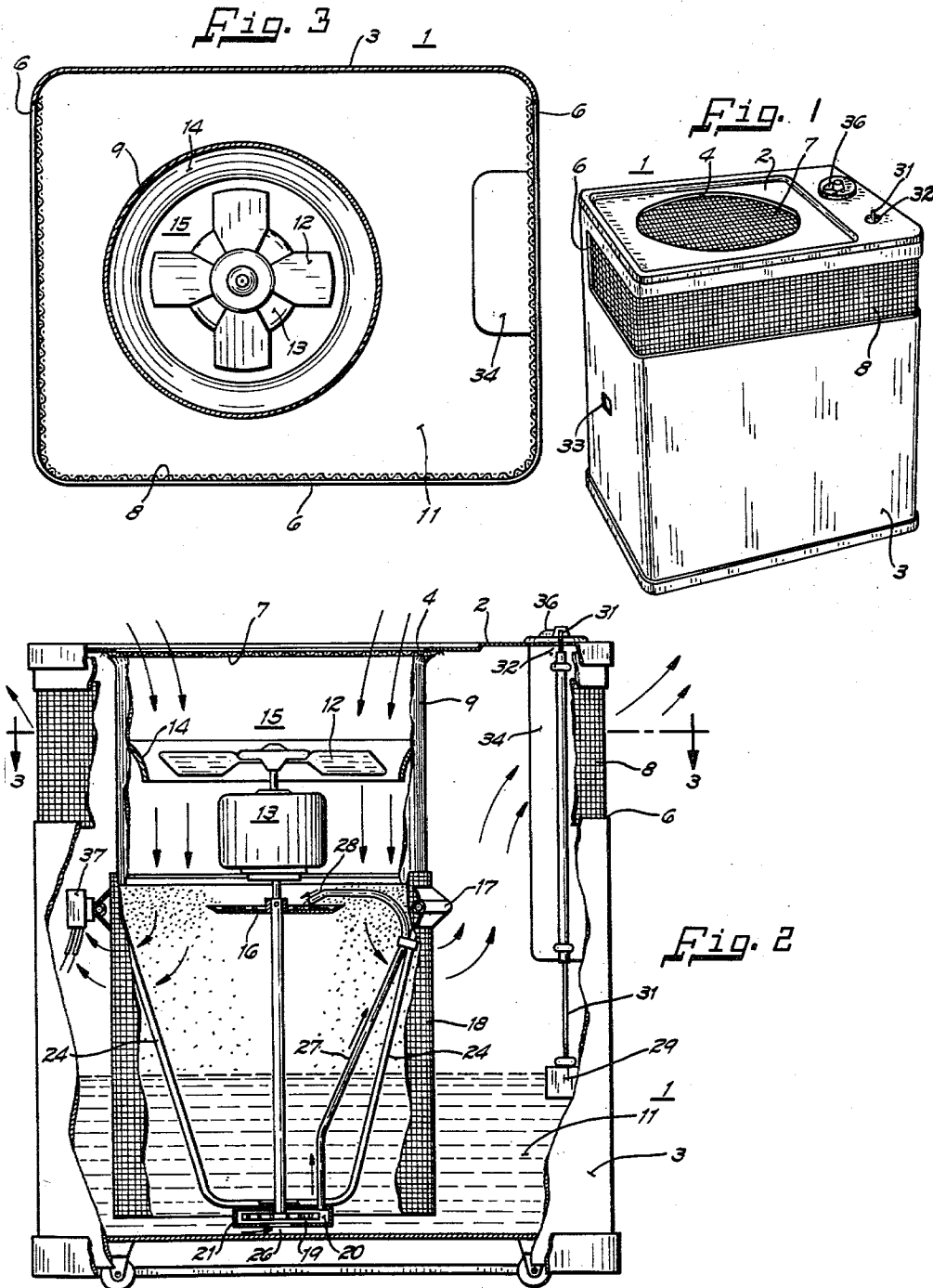
C. W. NESBITT

3,193,261

HUMIDIFIER

Filed Dec. 1, 1960

2 Sheets-Sheet 1



July 6, 1965

C. W. NESBITT
HUMIDIFIER

3,193,261

Filed Dec. 1, 1960

2 Sheets-Sheet 2

Fig. 4

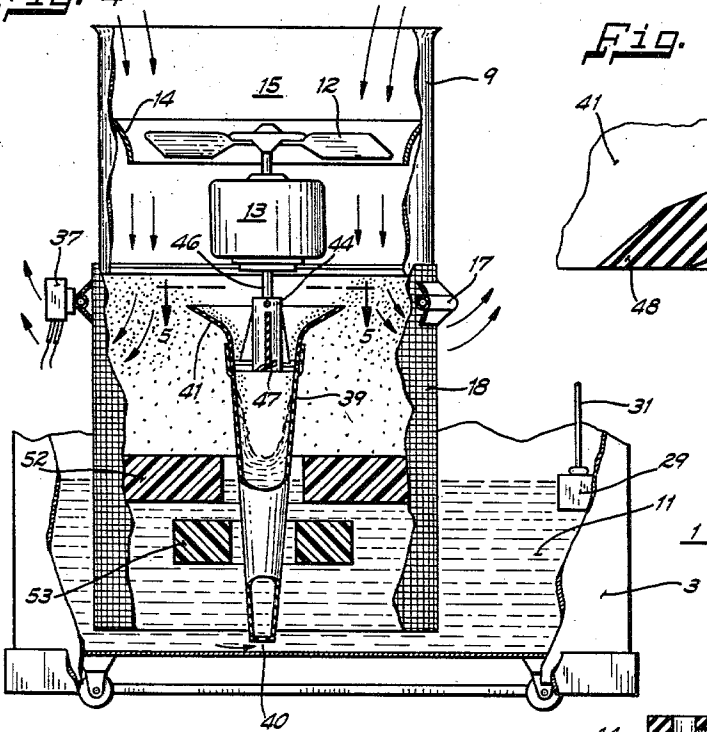


Fig. 7

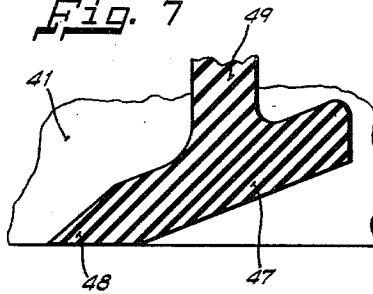


Fig. 6

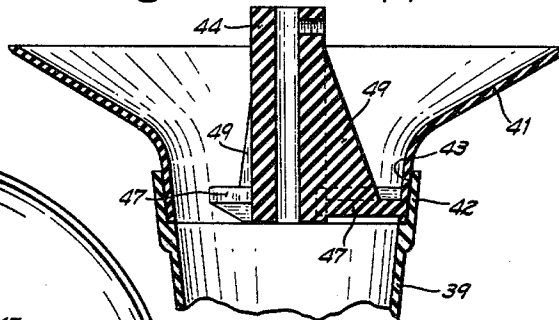
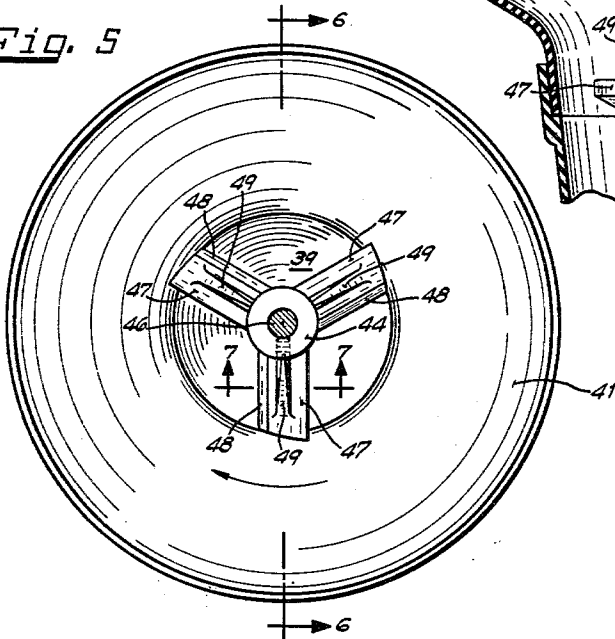


Fig. 5



1

3,193,261

HUMIDIFIER

Clifford W. Nesbitt, deceased, late of Albion, Mich., by
Lena L. M. Nesbitt, administratrix, Albion, Mich.,
assignor to McGraw-Edison Company, Milwaukee,
Wis., a corporation of Delaware
Filed Dec. 1, 1960, Ser. No. 73,143
2 Claims. (Cl. 261-142)

The invention relates to an improved humidifier, and more specifically to a humidifier designed to deliver air which is cleansed of air borne particles, free of large water droplets and contains a maximum amount of moisture.

In accordance with the invention, a humidifier housing is provided with relatively spaced air inlet and outlet openings that are separated by a baffle member which obstructs the direct flow of air from the air inlet opening to the air outlet opening. In passing through the humidifier the circulated air, because of the baffle member and the relative positioning of the air inlet and outlet openings, is made to undergo a marked change in direction prior to being discharged from the humidifier. Atomizing means is also provided within the humidifier and is so positioned in the air stream as to generate a water vapor cloud upstream of the point at which the circulated air must undergo the marked change in direction. An air flow pattern is thus defined whereby air is drawn in through the air inlet opening, directed through the water vapor cloud to pick up moisture, undergoes a marked change in direction and then passes through the outlet opening. The larger water droplets and air borne particles, being relatively heavy, resist the change in direction and are separated from the main air stream, so that the air, which is discharged from the outlet opening, contains moisture in only the most finely divide form and is cleansed of substantially all foreign particles. To insure the addition of a maximum amount of moisture to the air, the atomizing means also includes a heating element. The heating element, in addition to contributing to the formation of the water vapor cloud, increases the temperature of the air to be treated and correspondingly increases its moisture carrying capacity.

Accordingly, an object of the invention is to provide a humidifier which delivers air cleansed of air borne particles and carrying water in only the most finely divided form.

Another object of the invention is to provide atomizing means for a humidifier which, in addition to atomizing the water, heats the air circulated through the humidifier to increase its moisture carrying capacity.

A still further object of the invention is to provide a simple, compact, reliable and portable humidifier.

A more complete understanding of the invention and these and other objects and advantages thereof will be had from a reading of the following description in connection with the drawings, in which:

FIG. 1 is a perspective view of a humidifier embodying the invention;

FIG. 2 is a front elevation of the humidifier with a portion of its housing cut away;

FIG. 3 is a partial cross sectional view taken along lines 3-3 of FIG. 2;

FIG. 4 is a partial front elevation of an alternative embodiment of the invention;

FIG. 5 is taken along lines 5-5 of FIG. 4;

FIG. 6 is a cross sectional view taken along lines 6-6 of FIG. 5; and

FIG. 7 is a cross sectional view taken along lines 7-7 of FIG. 5.

A humidifier 1 is provided with a housing having a

2

top portion 2 and a sidewall portion 3. The housing is preferably rectangular in shape, but can be given other shapes without departing from the scope of the invention. An air inlet opening 4 and an air outlet opening 6 are provided in the top and side wall portions respectively. The air inlet opening 4 is circular in shape and the outlet opening 6 extends around three sides of the sidewall portion 3.

A perforated screen-like plate 7 is spot welded to the inner surface of the top portion 2 and covers the inlet opening 4 to prevent the extension of fingers or hands into the humidifier and to prevent entrance of other articles which might damage the humidifier. A second perforated screen-like plate 8 is spot welded to the inner surface of the sidewall portion 3 to cover the air outlet opening 6 and is similar in construction and function to the plate 7.

Contained within the humidifier 1 is a baffle 9 and a water reservoir 11. The baffle 9 is disposed adjacent the inlet opening 4 and extends from the top portion 2 to a point above the level of water within the water reservoir 11 to define an open-ended air passage 15 adjacent the air inlet opening 4. The baffle 9 is in the form of a hollow right cylinder.

Means, in the form of a fan 12 driven by an electric motor 13, is provided for circulating air through the humidifier. The fan 12 is preferably positioned within the passage 15 formed by the baffle 9. This positioning of the fan serves a twofold purpose, first, it contributes to the overall compactness of the humidifier 1, and secondly, it insures a positive force for drawing air into the humidifier. To substantially increase the amount of air which the fan 12 can move through the humidifier 1 the fan is positioned within a venturi-like section 14.

As illustrated by the arrows in FIG. 2, a predetermined air flow pattern through the humidifier 1 is defined by the relative positioning of the air inlet opening 4, the air outlet opening 6 and the baffle 9. Air is drawn in through the inlet opening 4, passes through the air passage 15, and then through the opening between the baffle 9 and the water in the reservoir 11 where it must undergo a marked change in direction to reach the outlet opening 6 for discharge from the humidifier. The outlet opening 6 is preferably disposed above the termination of the baffle 9 so that the circulated air, upon leaving the open-ended air passage 15, must make substantially a 180° turn to reach the outlet opening.

Atomizing means for generating a water vapor cloud from which the circulated air will take on moisture is provided and is so positioned relative to the air inlet opening, the air outlet opening and the baffle 9 that the circulated air undergoes the marked change in direction subsequent to passing through the water vapor cloud and prior to being discharged through the air outlet opening. The atomizing means is disposed on the outlet side of the baffle 9 so that the water vapor cloud will be formed at a point which is upstream of the point at which the change in direction of the circulated air occurs. More specifically, the atomizing means is disposed at the open end of the air passage 15 defined by the baffle 9, so that the water vapor cloud will be created at the open end of the air passage 15. The atomizing means preferably includes a rotatable spreader member 16 attached to and driven by the motor 13. Water is delivered to the spreader member 16 in a manner described hereinafter. Under the influence of centrifugal force, the water is spun or sprayed in a generally horizontal pattern from the lip of the spreader 16. Water spun from the spreader breaks up into small water droplets and forms the water vapor cloud. Spaced from the spreader member 16 and disposed substantially in horizontal alignment therewith is an electrical heating element 17. The electrical heating

3

element 17 is disposed in the path of the circulated air and heats the air as it passes. The moisture carrying capacity of air varies directly with the temperature of the air so that increasing the temperature of the air to be treated increases its moisture carrying capacity and a maximum amount of moisture can then be added to the air. Further, the electrical heating element 17 aids in the formation of the water cloud in that any large water droplets which are spun off of the spreader 16 will be sprayed against and vaporize upon contact with the electrical heating element.

Preferably disposed between the spreader 16 and the electrical heating element 17 is a screen-like member 18 which contributes to the formation of the water vapor cloud. The screen-like member will reduce some of the larger water droplets to a size that is readily absorbed by the circulated air. Further, the larger droplets are reduced to a size which, if not small enough to be readily absorbed by the air, are more readily vaporized upon contact with the heating element 17. The screen-like member 18, being generally cylindrical in shape, is connected to the baffle 9 around the open end thereof and extends into the water reservoir 11. This provides the added advantage that any water which condenses and/or collects around the open end of the baffle 9 does not drip back into the water reservoir, with the attendant disturbing dripping noise, but trickles back along the screen 18.

Therefore, water is sprayed from the spreader 16 by centrifugal force and breaks up into tiny water droplets which can be absorbed by the air circulated through the humidifier. In the event that not all of the water which leaves the spreader 16 is broken down into droplets fine enough to be picked up by the circulated air, the larger water droplets continue in a substantially horizontal path and contact, first, the screen-like member 18 where they are broken down into smaller droplets and, secondly, the electrical heating element 17 where they are vaporized upon contact. In this manner a water vapor cloud is produced adjacent the termination of the baffle 9.

Because of its simplicity and reliability a centrifugal pump is used in the preferred embodiment of the invention. The pump includes an impeller 19 disposed in a chamber 20 of a housing 21 located in the water reservoir 11. The housing 21 is supported by a mounting bracket 24 suitably attached to the housing 21 and the baffle 9. The lower portion of the of the housing 21 includes an aperture 26 located centrally with respect to the impeller 19 and the impeller 19 is driven by the motor 13. The centrifugal pump is operatively connected to the spreader 16 by means of an elongated specially formed tube 27 which has its lower end communicating with the impeller chamber 20 and has its upper end disposed adjacent the spreader 16. Rotation of the impeller 19 causes water to be drawn in through the aperture 26. The impeller 19 increases the water pressure within the housing 21 so that a pressure differential exists between the lower and upper ends of the tube 27 and causes water to flow up through the tube 27 to the atomizing means. More particularly the water is expelled from the end 28 of the tube 27 on to the spreader 16.

Since the atomizing means is continually generating a water vapor cloud and since the air which is being circulated through the humidifier is constantly absorbing and carrying away water vapor, the level of water within the reservoir 11 will recede during operation. Means is provided in the humidifier 1 for giving a visual indication exteriorly of the humidifier of the level of water within the reservoir 11 so that the humidifier can be refilled when necessary. The indicating means is sensitive to and controlled by variations in the level of the water within the reservoir 11 and includes a member disposed exteriorly of the humidifier housing which indicates the level of water within the reservoir.

A typical water level indicator is illustrated in FIG. 2. A float 29 is disposed in the water reservoir 11. An

4

elongated rod 31 is slidably supported within the humidifier housing and has one end attached to the float 29 and its opposite end extending through an aperture 32 provided in the top portion 2 of the humidifier. The position of the rod 31 is controlled by the float 29 and as the level of water within the reservoir 11 recedes the exposed end of the rod will be drawn back into the humidifier. The rod 31 is of a predetermined length so that a portion thereof extends exteriorly of the housing when the reservoir is full and so that it will be out of sight when the water level has fallen to a point where the reservoir should be refilled.

The float and rod will also provide visual indication when the humidifier is being filled, however, it may be desirable to provide more positive indication in the form of an aperture 33 in the side wall portions 3. The aperture 33 is positioned at a point corresponding to the desired initial water level within the reservoir 11 and gives a positive indication when the water reaches that desired point. Filling of the humidifier 1 is accomplished by pouring water directly through the air inlet opening 4 and the motor 13 is completely sealed to protect against seepage of water into the motor.

A humidistat 34 is suitably connected to and controls the electrical motor 13 (the connection not being shown for convenience). The humidistat 34 is of conventional design, well known to those skilled in the art and therefore is neither specifically illustrated nor described. The humidistat 34 is suitably supported from the side wall portion 3 and is disposed directly behind a portion of the outlet opening 6 so that it is exposed to the air adjacent the humidifier 1. The humidistat 34 senses the air outside of the humidifier and controls the motor 13 in accordance with the moisture content of that air so that the amount of air drawn into the humidifier and the generation of the water vapor cloud are varied accordingly. A control knob 36 is provided for the humidistat and can be provided with a plurality of settings varying from simple on-off settings to a plurality of positions corresponding to high, medium or low humidification.

To protect the electrical heating element 17 from overheating a limit switch 37 is used to establish the connection between the heating element 17 and a suitable source of electrical energy (not shown). Should the water reservoir 11 be substantially emptied, so that sufficient water is not supplied to the atomizing means, the element 17 tends to overheat. When overheating occurs the limit switch 37 trips and opens the circuit to the power source.

In operation the humidifier 1 is filled with water to a desired level, turned on and, if desired, set for automatic operation by proper adjustment of the humidistat 34. The electric motor 13 drives the pump to raise water from the water reservoir to the rotating spreader 16 of the atomizing means where it is spun off in the form of tiny water droplets. Any larger water droplets are further broken down by the screen 18 and finally vaporize upon contact with the heating element 17. The fan 12 draws air through the inlet opening 4, directs it through the water vapor cloud and then discharges the moisture containing air from the outlet opening 6. The circulated air passes through the water vapor cloud, is warmed by the electrical heating element 17 to thereby increase its moisture carrying capacity, and, subsequent to passage through the water vapor cloud and prior to being discharged from the outlet opening 6, is caused to undergo a marked change in direction. During the change of direction the larger water droplets and air borne particles, being heavier than the finely divided moisture, resist the change of direction and are separated from the main air stream. The air carrying moisture in the form of tiny water droplets is directed upwardly and through the outlet opening 6. The delivered air is then free of large water droplets, foreign particles and carries a maximum amount of moisture.

The separation from the delivered air of the larger water droplets and the discharge of air containing only

5

moisture in the finely divided water droplet form is particularly advantageous where the humidifier 1 is to be used in the area where it might be positioned adjacent furniture and the like. It has been found that, where the humidifier discharges air containing large water droplets, the water droplets deposit on furniture and destroy its finish.

An additional embodiment of the invention is illustrated in FIGS. 4-7. Only a portion of this embodiment has been illustrated and parts corresponding to like parts of the embodiment of FIGS. 1-3 are identified by the same reference numerals. The remainder of the humidifier is identical to that which is illustrated in FIGS. 1-3.

In this embodiment the pump means takes the form of an inverted cone-shaped member or spinner 39 which is rotatably driven by the electrical motor 13. The spinner 39 has one end disposed in the water reservoir 11 and is provided at its opposite end with a rotatable spreader member 41. Upon rotation of the spinner 39, water is drawn into the spinner through an aperture 40. The water, due to centrifugal force and the slope of the cone, travels up the inside of the cone to the spreader in a generally helical path.

The spinner 39 and the spreader 41 may be in one-piece, but, for ease of molding, it has been found that a two-piece arrangement is much more desirable. Referring to FIG. 6, the upper portion of the spinner 39 includes a collar 42 forming a recess 43 which provides a seat for the lower portion of the spreader 41. By providing the recess 43 a smooth juncture is established between the spreader 41 and the spinner 39 so that the flow of water up the inner surface of the spinner 39 to the spreader 41 is not interrupted. The spreader 41 is pressed into the recess 43 and a suitable bonding agent may be used to insure a secure connection therebetween.

Means for connecting the assembly consisting of the spinner 39 and the spreader 41 to the electrical motor 13 is provided and comprises a hub member 44 which receives a shaft 45 from the electric motor 13. The hub is connected to the spreader 41 by means of three equiangularly spaced vanes 47. Referring to FIG. 7, the vanes 47 are provided with a generally pointed leading edge 48 and are each positioned relative to the spreader at an angle to the horizontal and substantially in alignment with the helical path followed by the water which is raised along the inside of the spinner 39. The vanes 47 are then so configured and positioned as to present a minimum of resistance to water flow from the reservoir 11 to the spreader member 41. To strengthen the connection of the vane 47 to the hub 44 web portions 49 are provided which extend outwardly and downwardly from the upper portion of the hub 44 to each of the vanes 47 and act as reinforcing ribs. It should also be noted that the web 49 terminates short of the inner surface of the spreader 41 so that it will not interfere with water flow.

As the spinner 39 is rotatably driven by the electric motor 13, water is drawn into its lower end through the aperture 40. The water rises upwardly in a generally helical path along the inner surface of the cone 39 to the spreader 41. The spreader 41 at its upper most portion flares upwardly and outwardly at an angle which is greater than the slope of the cone 39 and the water is sprayed, in a generally horizontal pattern, from the lip of the spreader 41 where it is broken down into minute water droplets. In this embodiment the atomizing means, of which the spreader 41 is a part, also includes an electric heating element 17, and a screen-like member 18 disposed intermediate the spreader member 41 and the electric heating element 17. The atomizing means is again positioned to generate a water vapor cloud adjacent the end of a baffle 9 so that the air circulated through the humidifier undergoes a marked change in direction subsequent to passing through the water vapor cloud and prior to discharge from the outlet opening 6.

The pump means of this embodiment is particularly

6

advantageous because of its simplicity, containing no relatively moving parts, and its quietness of operation.

Where a humidifier is to be used for residential purposes the noise created within the humidifier becomes a consideration of major importance. Since the cone-shaped spinner 39 will have a tendency to create eddy currents in the water and since some water will attempt to rise on the outside of the spinner 39, some splashing noise may occur. To counteract the creation of eddy currents and to cushion any water which might be thrown from the outside of the pump 39, silencing means is provided. This silencing means includes first and second annular rings 52 and 53. These rings can be made of any porous mat-like material that floats, for example Styrofoam. The first annular ring 52 surrounds a portion of the spinner 39 and is fixed in position, the connection (not shown) of the annular ring may be by any suitable means such as by stapling to the screen 18. The second annular ring 53 surrounds another portion of the pump 39 and is free to float in the water reservoir 11. The annular rings break up the eddy currents which form around the outer surface of the pump 39 as it rotates and catch any water which is thrown off the outside of the pump 39. By providing the ring 53 which is free to float within the water reservoir, there will always be a silencing ring disposed adjacent the pump member 39 regardless of the water level within the reservoir 11.

The discussion of the invention with reference to particular embodiments thereof has been for illustrative purposes only and it is intended in the appended claims to cover all modifications and embodiments as fall within the true spirit and scope of my invention.

What is claimed:

1. A portable self-contained humidifier comprising, in combination, a housing including top and sidewall portions, a water filled reservoir within said housing, said top portion provided with an air inlet opening, a generally tubular baffle member surrounding said air inlet opening and extending from said top portion and terminating above the level of water in said reservoir to define an open-ended air passage, said sidewall portion having an air outlet opening disposed above said termination of said baffle member, a rotatable spreader member disposed at open end of said air passage, a centrifugal pump including a housed impeller disposed in said water and a tube extending from said housed impeller to said spreader member for delivering water from said reservoir to said spreader member, motor means in said air passage for rotatably driving said spreader member and said impeller, an electric heating element extending circumferentially around and supported in spaced substantially horizontal alignment with said spreader member, a single cylindrical screen disposed intermediate said spreader member and said electric heating element and extending into said water reservoir, whereby water is raised from said reservoir to said spreader member and is sprayed from said spreader member to form a water vapor cloud at the open end of said air passage, means within said air passage driven by said motor means for circulating air from said air inlet opening through said water vapor cloud to said air outlet opening, said circulated air undergoing a change of direction subsequent to passage through said water vapor cloud and prior to discharge from said air outlet opening, and means including a float in said water and sensitive to variations in the level of said water for indicating exteriorly of said housing the level of water in said reservoir.

2. A portable humidifier comprising, in combination, a housing including top and sidewall portions, a water filled reservoir within said housing, said top portion provided with an air inlet opening, a baffle member surrounding said air inlet opening and extending from said top portion and terminating above the level of water in said reservoir to define an open-ended air passage, said sidewall portion having an air outlet opening disposed above

7

said termination of said baffle member, a rotatable spreader member disposed at the open end of said air passage, a centrifugal pump including a housed impeller disposed in said water and a tube extending from said impeller to said spreader member for delivering water from said reservoir to said spreader member, motor means for rotatably driving said spreader member and said impeller, an electric heating element extending circumferentially around and supported in spaced substantially horizontal alignment with said spreader member, a screen disposed intermediate said spreader portion and said heating element, whereby water is pumped from said reservoir to said spreader member and is sprayed from said spreader member to form an atomized water cloud at the open end of said air passage, means driven by said motor means for circulating air from said air inlet opening through said atomized water cloud to said air outlet opening, said circulated air undergoing a change of direction subsequent to passage through said atomized water cloud and prior to discharge from said air outlet

8

opening, and means sensitive to variations in the level of water within said reservoir for providing a visual indication of the level of water in said reservoir exteriorly of said housing.

References Cited by the Examiner

UNITED STATES PATENTS

1,060,669	5/13	Darnall	261—34
1,952,269	3/34	Lundquist	261—91
1,955,518	4/34	Sherwood	261—91
2,143,628	1/39	Lea.	
2,153,932	4/39	Lea.	
2,379,932	7/45	Shoepflin et al.	
2,776,553	1/57	Williamson	261—139 X
2,860,228	11/58	Boyle et al.	261—139 X
3,028,150	4/62	King	261—24

HARRY B. THORNTON, *Primary Examiner.*20 WALTER BERLOWITZ, *Examiner.*