

July 2, 1929.

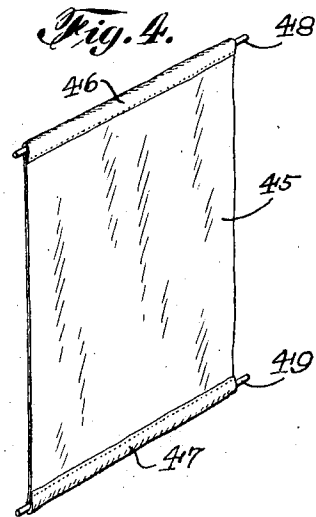
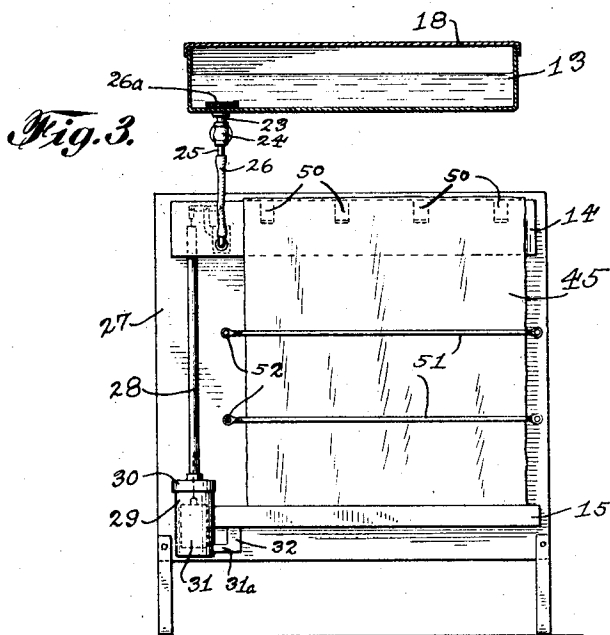
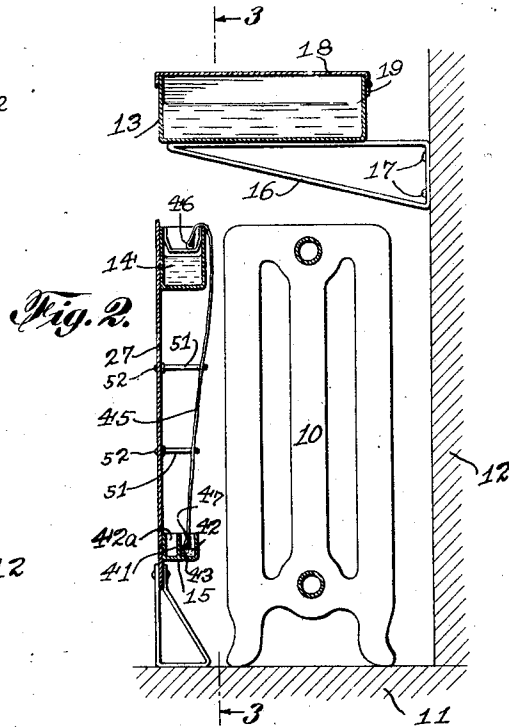
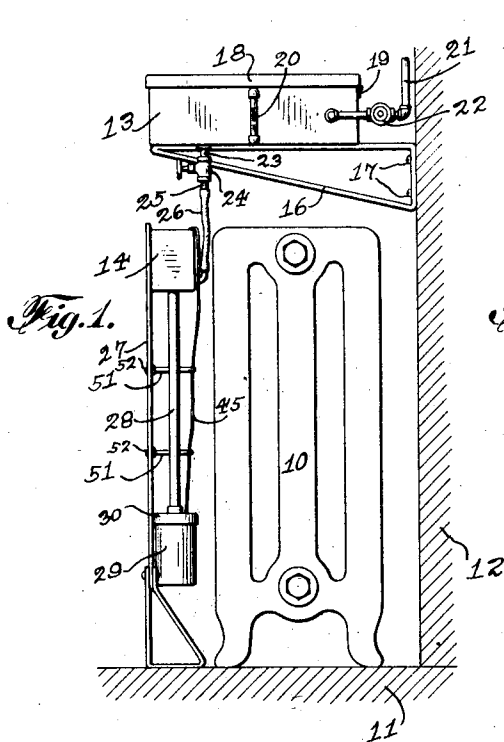
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1,719,569

HUMIDIFIER

Filed April 20, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet. 2

*Fig. 5.*

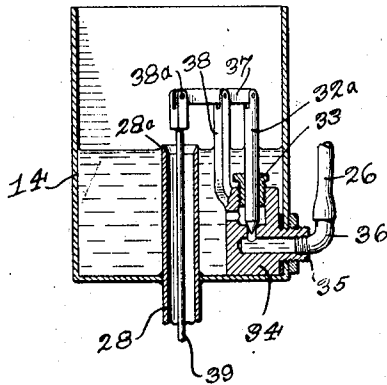


*Fig. 7.*

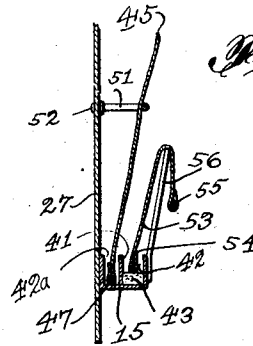


*Fig. 6.*

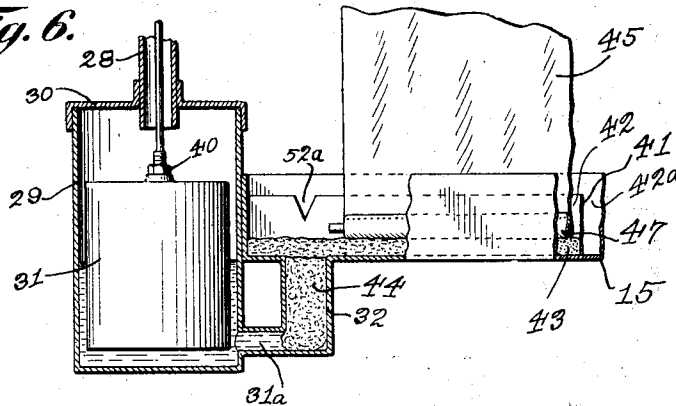


*Fig. 8.*

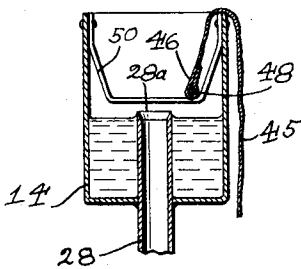


*Fig. 9.*

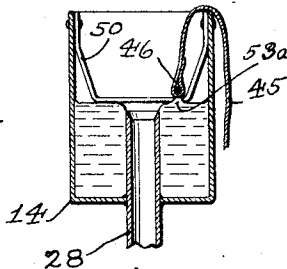
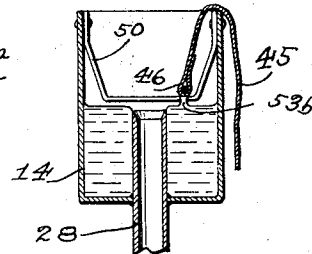


*Fig. 10.*



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## UNITED STATES PATENT OFFICE.

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## HUMIDIFIER.

Application filed April 20, 1927. Serial No. 185,107.

This invention relates to a humidifier adapted to be arranged adjacent a source of heat for moistening the air heated thereby.

One object of this invention is to provide a humidifier including a moistened absorbent sheet for rapidly delivering a large quantity of moisture to the heated air and in which the rate of humidification will be automatically regulated according to the relative humidity of the air in the room.

A further object is to provide a humidifier of the above nature in which the moistened sheet will be maintained in a downwardly extending position adjacent the source of heat and having means responsive to the rate of evaporation for automatically controlling the amount of moisture supplied to said sheet.

A further object is to provide a humidifier of the above nature in which the ends of the moistened absorbent sheet are adapted to simultaneously absorb water from a pair of water tanks, the supply of water to said tanks being regulated by the rate of evaporation from one end of said sheet.

A further object is to provide a device of this nature which will be simple in construction, inexpensive to manufacture, easy to install and manipulate, compact, and very efficient and durable in use.

With these and other objects in view there have been illustrated on the accompanying drawings two forms in which the invention may be conveniently embodied in practice.

Fig. 1 represents a side view of a radiator and improved humidifier as they appear when assembled in operating position.

Fig. 2 is a sectional view of the same.

Fig. 3 is a sectional view of the apparatus taken along the line 3—3 of Fig. 2 looking in the direction of the arrows.

Fig. 4 is a perspective view of the absorbent humidifying sheet.

Fig. 5 is a sectional view of the receiving tank showing the inlet valve mechanism for automatically controlling the supply of water thereto.

Fig. 6 is a sectional view of the drain trough and float chamber showing the float for controlling the inlet valve mechanism of the receiving tank.

Fig. 7 is a sectional view of a modified form of drain tank having a small auxiliary absorbent sheet.

Figs. 8, 9, and 10 are sectional views of the receiving tank under three different operating conditions.

The present invention provides a humidifier having a moistened absorbent evaporating sheet which may be arranged vertically adjacent a radiator or other source of heat together with mechanism for automatically supplying the proper amount of moisture to said sheet in accordance with the humidification requirements. By means of this construction, the upwardly moving warm air passing between the moistened sheet and the source of heat produces a very efficient evaporative action and results in a substantial humidification of the air in the room.

Referring now to the drawings in which like reference numerals denote corresponding parts throughout the several views, the numeral 10 indicates a radiator resting upon a floor 11 adjacent a wall 12 of a room. The humidifying apparatus consists essentially of three vertically disposed tanks 13, 14, and 15, hereinafter designated as the main supply tank, the receiving tank, and the drip tank, respectively.

The main supply tank 13 is supported above the radiator 10 in any suitable manner as by means of a triangular bracket 16, said bracket being secured to the wall 12 in any suitable manner, as by screws 17. It will be understood, that if desired, however, the tank 13 may be supported directly upon the top of the radiator, within the spirit and scope of the invention. The supply tank 13 is preferably provided with a cover 18, preferably hinged as at 19, so as to permit access to said tank for cleaning and filling. A gauge glass 20 is preferably provided on the outside of the tank 13 for indicating the level of the water therein, and said tank is preferably connected to the water supply line 21 by means of a shut-off valve 22. If desired, a float actuated valve, not shown, may be provided within the tank 13 to automatically maintain a constant level of water therein.

Depending from the tank 13 is an outlet pipe 23 connected to which is a manually-operated shut-off valve 24, from which the water flows through a short pipe 25 to a flexible hose connection 26 leading to the receiving tank 14.

In order to prevent dirt and other materials from passing into the tank 14, a fine mesh

strainer 26<sup>a</sup> is provided on the bottom of the tank 13 for covering the outlet to the pipe 23. The receiving tank 14 is secured in any suitable manner to the rear surface of a vertical panel 27, which if desired, may comprise the front part of a radiator cabinet or enclosure not shown. Moreover, a suitable cover, not shown, may be employed for keeping dust out of the receiving tank 14.

It is also within the scope of this invention to support the panel 27 or radiator enclosure either from the wall of the room or from the radiator itself. Moreover, the humidifier and radiator may be sold separately or as a unit enclosed within a suitable cabinet.

The drip tank 15 is secured to the rear of the panel 27 near the bottom thereof and is adapted to lie directly below the tank 14 in approximate vertical alinement therewith. The liquid in the receiving tank 14 is maintained at a substantially constant level by means of a vertical overflow pipe 28 which passes down through the bottom of said tank 14 and is joined thereto, as by solder. The lower end of the pipe 28 projects into a cylindrical float chamber 29 having a cover 30 and containing a float 31, said chamber 29 being connected by a horizontal passage 31<sup>a</sup> to a vertical passage 32 leading to the drip tank 15.

In order to diminish the capillary wall that builds up around the top of the overflow pipe 28 just before the water overflows into the lower tank 29, the top of the pipe 28 is, preferably but not necessarily, given a sharp edge 28<sup>a</sup>. This construction reduces the amount of water which will pass into the overflow pipe each time the float valve 30 functions.

The supply of water in the receiving tank 14 is maintained by an intermittently-operated needle valve 32<sup>a</sup>, and as clearly shown in Fig. 5 said needle valve is vertically slidable in a collar 33 threaded into the top of a valve housing 34. The valve housing 34 has a lower inlet neck 35 into which is screwed an elbow pipe 36 connected with the hose 26 leading from the supply tank 13.

The top of the needle valve 32<sup>a</sup> is pivotally connected to a lever 37, the latter being fulcrumed on a supporting bar 38 and having its other end pivoted at 38<sup>a</sup> to a depending rod 39. The lower end of the rod 39 is threaded, and adjustably connected to a collar on the top of the float 31, as by a lock nut 40.

As will be clear from Fig. 6, the clearance between the float 31 and its surrounding chamber 29 is so small that only a slight addition to the quantity of water in the chamber 29, coming either from the overflow pipe 28 or the sheet 45, will be sufficient to cause the float 31 to rise and close the needle valve 32<sup>a</sup>. Similarly, a slight decrease in the amount of water in the chamber 39 caused by the evaporation of the water from the ab-

sorbent sheet 45, to be hereinafter more fully described, will cause the float 31 to drop and open the needle valve 32<sup>a</sup>.

The drip tank 15 is preferably divided by a vertical partition 41 into a rear wick compartment 42 and a front reserve compartment 42<sup>a</sup>, but it is to be understood that the apparatus will function successfully when the partition 41 is omitted. The compartment 42 is provided with an elongated wick 43, said wick having a depending portion 44 extending into the vertical passage 32 leading to the float chamber 29. The wick 43 preferably extends throughout the length of the wick compartment 42 and is made of any suitable absorbent material, such as felt.

In order to produce a rapid humidifying action, provision is made of a moistened absorbent sheet 45, preferably constructed of terry cloth toweling, although any other suitable absorbent material may be employed. The sheet 45 is preferably rectangular in shape having its upper and lower ends provided with hems 46 and 47 through which brass rods 48 and 49 are adapted to pass. The rods 48 and 49 serve as weights to maintain the sheet 45 in proper position at all times. The lower hem 47 of the sheet 45 is adapted to rest on the top of the wick 43 in absorbent contact therewith, while the upper hem 46 of the sheet 45 is dropped down over the inner edge of the receiving tank 14 and rests upon a plurality of U-shaped brackets 50, four in this instance, as clearly shown in Figs. 8 to 10.

By means of this construction, it will be seen that the absorbent sheet 45 may be readily removed from the apparatus for cleaning or renewal, merely by lifting its weighted ends from the tanks 14 and 15. The sheet 45 is prevented from coming in contact with the radiator 10 by means of a plurality of horizontal U-shaped cross-rods 51, two in this instance, which are secured at their ends to the panel 27 as by rivets 52.

The brackets 50 serve to maintain the upper hem 46 of the absorbent sheet 45 at a predetermined level in the receiving tank 14 with respect to the top of the overflow pipe 28. If desired, the overflow pipe may be provided with an upper screw collar, not shown, so as to permit adjustment of the height of said pipe and thereby alter the level at which the water will overflow into the float tank 29.

The partition 42 separating the compartments of the drip tank 15 is provided with a V-shaped overflow groove 52<sup>a</sup>, whereby water will be permitted to overflow from the wick compartment 42 whenever the level rises above the bottom of said groove 52<sup>a</sup>.

In operation, the main supply tank 13 will be kept filled with clean water either manually by periodical fillings or automatically by the use of a float control valve, not shown, located within said supply tank and connect-

ed to the water shut-off valve 22. At the start, the float 31 will rest upon the bottom of the float chamber 29 thereby holding the needle valve 32<sup>a</sup> in open position. Water will then be permitted to flow from the supply tank 13 through the valve housing 34 into the receiving tank 14 where it will rise until it passes down through the overflow pipe 28 into the float chamber 29 causing the float 31 to rise and close the needle valve 32<sup>a</sup>. Water will thus be supplied to the absorbent sheet 45 from both ends and it will rapidly become completely moistened by capillary action. As the water evaporates from the lower end of the sheet 45, it will be drawn up from the wick 43 until the water in said wick eventually becomes so exhausted that the float 29 will fall and open the needle valve 32<sup>a</sup>. The tanks 14 and 15 will thus be given a fresh supply of water and the operation just described will be repeated. The apparatus will continue to function in this manner intermittently, the frequency of the valve openings being responsive to the speed of evaporation of the water from the sheet 45 which speed is roughly inversely proportional to the relative humidity of the air in the room.

Normally, before passing down into the overflow pipe, the water will build up to a level somewhat above the top edge 28<sup>a</sup> thereof. This phenomenon is caused by the surface tension of the water. The brackets 50 are preferably so positioned within the receiving tank 14 that the upper hem 46 of the sheet 45 will lie approximately  $\frac{1}{4}$  of an inch above the top of the overflow pipe 28, which is just equal to the height to which the water in the receiving tank will build up by surface tension when it overflows into the pipe 28. The surface of the water will thus just come into contact with the upper hem 46 as shown in Fig. 9. Water will thus be absorbed by the sheet 45 (see Figs. 9 and 10), and will then pass over the edge of the tank 14 and down in front of the radiator. By locating the brackets as above described, water will be absorbed by the top portion of the sheet 45 only when the water overflows into the pipe 28.

Fig. 8 shows the appearance of the receiving tank 14 when the water level is below the top of the overflow pipe 28 and out of contact with the upper hem 46.

Fig. 9 shows the appearance of the receiving tank 14 after the level of the water has risen sufficiently to wet the brackets 50 and be absorbed by the sheet 45, but before any water has overflowed through the pipe 28. Water will then be drawn up by capillary action through the neck 53<sup>a</sup>.

After the water has overflowed into the pipe 28 the needle valve 32<sup>a</sup> will close shutting off the supply of water to the tanks 14 and 15. Water will then be drawn up through the hem 46 into the top of the sheet 45. The

neck 53<sup>a</sup> gradually becomes smaller and smaller until it finally breaks away, as shown at 53<sup>b</sup> in Fig. 10. The supply of moisture to the top of the sheet 45 will then cease and the conditions will again become as illustrated in Fig. 8.

One advantage of this construction is that only a very small amount of water will be supplied to the top of the sheet 45 with each functioning of the float valve. This results in more frequent downward impulses of water into the top of the sheet 45 and produces a more even moistening thereof. The above-mentioned action thus introduces a very desirable time element into the moistening action, inasmuch as this action approaches a continuous automatic supply of moisture.

It has been found by experiment that the speed at which the water will be absorbed by the top of the humidifying sheet 45 varies inversely with the height of the top of the tank 14 above the water level, and this height is so regulated by the size of the brackets 50 that under normal conditions only enough water will be drawn up from the receiving tank as can be easily evaporated from the upper part of the absorbent sheet 45. In this manner the excess of unevaporated water from the receiving tank 14 which flows down by gravity through the evaporating sheet into the drip tank 15 will be reduced to the minimum.

The float chamber 29 is so disposed vertically relative to the bottom of the drip tank 15 that the float 31 will rise and close the needle valve 32<sup>a</sup> when the water level in said chamber is slightly below the bottom of the drip tank. By means of this construction, any excess of water in the drip tank 15 not absorbed by the wicks 43 and 44 will gravitate readily through the passages 32 and 31<sup>a</sup> into the float chamber 29. It will be understood that even if all the water has been evaporated from the upper portion of the absorbent sheet 45, the lower portion of said sheet by virtue of its contact with the wick 43 will continue to absorb water from the tank 15 by capillary attraction to a height of about 9 inches. Evaporation will then continue in the lower end of the sheet 45 until sufficient water has been removed from the drip tank 15 to cause the float 29 to fall and again open the needle valve 32<sup>a</sup>. It will thus be seen that the rate of evaporation from the lower part of the absorbent sheet 45 constitutes the most important element affecting the time between successive openings of the needle valve 32<sup>a</sup>. The rate of absorption by the wicks 43 and 44 thus largely determines the length of time the valve remains open.

After several successive valve openings and the resultant impulses of water, the evaporating sheet 45 should become thoroughly moistened and evaporation

should proceed at a satisfactory rate. If, however, the rate of evaporation is low, due perhaps to a high existing relative humidity in the room, the excess of water flowing down into the drip tank 15 from the absorbent sheet 45 will delay the next opening of the valve until said excess of water has been evaporated. Under these conditions the float valve will function less frequently and the amount of water supplied to the evaporating sheet 45 will be automatically regulated in inverse proportion to the amount of moisture in the room. If too great an excess of water accumulates in the wick compartment 42 of the drip pan 15, it will overflow through the notch 52<sup>a</sup> into the reserve compartment 42<sup>a</sup> where it will subsequently evaporate slowly independently of the sheet 45.

In the modified form of the invention shown in Fig. 7, the bottom hem 47 of the sheet 45 is adapted to rest in the bottom of the front compartment 42<sup>a</sup> of the drip tank 15, and an auxiliary absorbent sheet 53 is employed to evaporate the moisture absorbed from the float chamber. The sheet 53 has its lower weighted hem 54 in contact with the wick 43, while the upper weighted hem 55 hangs down over the edge of an open wire support 56 so that said sheet 53 will lie in proximity to the front of the radiator. The auxiliary wick 53 will thus serve to evaporate the water from the float chamber 29 and also any excess of water overflowing from the compartment 42<sup>a</sup>. The evaporative action of the auxiliary sheet 53 will be independent of that of the sheet 45, and any possible excess of water which may flow down into the compartment 42<sup>a</sup> from the sheet 45 will not retard the valve action unless it builds up an excess sufficiently to overflow into the forward compartment 42.

While there have been disclosed in this specification two forms in which the invention may be embodied, it is to be understood that these forms are shown for the purpose of illustration only, and that the invention is not to be limited to the specific disclosures but may be modified and embodied in various other forms without departing from its spirit. In short, the invention includes all the modifications and embodiments coming within the scope of the following claims.

Having thus fully described the invention, what is claimed as new, and for which it is desired to secure Letters Patent, is:

1. In a humidifier, an upwardly extending moistened absorbent evaporating sheet, a water tank, a drip tank below said sheet, one edge of said sheet being bent over into said water tank and positioned just above the normal level of the water therein, the other edge being in contact with the liquid in the drip tank, and means controlled by the dropping of the level in said drip tank for intermittently raising the level of the water in

said water tank into momentary contact with said edge for permitting moisture to be absorbed thereby by capillary action, thereby cutting down the supply of water at each operation of the valve and regulating the amount of water absorbed.

2. In a humidifier, a moistened absorbent evaporating sheet, one edge of said sheet being supported just above the normal level of a body of water, and means for intermittently raising the level of said body of water into momentary contact with said edge whereby the water will be drawn up above said surface into said sheet by capillary attraction.

3. In a humidifier, a source of water supply, a receiving tank connected with said source, a moistened absorbent evaporating sheet, the upper end of said sheet being bent downwardly into said tank for receiving an intermittent supply of water therefrom by absorption, a drip tank below said sheet and arranged for receiving the excess water which drains therefrom, said receiving tank having an overflow pipe for moistening the lower part of said sheet, a float chamber communicating with said drip tank, a float in said chamber, the overflow from said receiving tank being delivered to said float chamber through said overflow pipe, and means operated by the motion of said float for opening and closing the connection between said receiving tank and said source of water supply.

4. In a humidifier, a panel member, said panel member having a receiving tank and a drip tank mounted at its upper and lower ends respectively, an overflow pipe for carrying excess water from said receiving tank into said drip tank, a moistened sheet having its upper and lower edges extending into said tanks, means for intermittently supplying water to said receiving tank, and means controlled by the amount of water in said drip tank for controlling the amount of water supplied to both of said tanks.

5. In a humidifier, a downwardly extending moistened evaporating sheet, an upper tank for supplying water to the upper end of said sheet, a drip tank at the lower end of said sheet for catching the excess water which drains therefrom, an overflow connection for delivering excess water from said upper tank to said drip tank, said drip tank having a reserve compartment to receive water from said drip tank when the latter overflows, a float chamber communicating with said drip tank, a wick in the passage between drip tank and said float chamber, and a float in said float chamber for controlling the supply of water to both ends of said sheet.

6. In a humidifier, a moistened absorbent evaporating sheet weighted at its ends and extending downwardly, a pair of water tanks arranged one above the other, a pipe depending from said upper tank for carrying the

overflow therefrom into said lower tank, the upper end of said sheet being bent over into said upper tank for receiving a supply of water therefrom, the lower end of said sheet  
5 resting in said lower tank for receiving a supply of water therefrom and to allow excess water from said upper tank to drain therein, and means for automatically and intermittently supplying water to said upper  
10 tank.

7. In a humidifier, a moistened absorbent evaporating sheet, a water supply tank, a plurality of U-shaped brackets mounted in the top of said tank, the upper end of said sheet  
15 being bent downwardly into said tank and supported on said brackets just above the normal level of the water in said tank, and means for intermittently raising the level of water in said tank into momentary contact with said  
20 upper end whereby water will be absorbed thereby by capillary attraction.

8. In a humidifier, a pair of vertically spaced tanks, a moistened absorbent evaporating sheet having its ends in said tanks, means  
25 for supplying water to the upper of said tanks for capillary absorption by the upper end of said sheet, and an overflow pipe connecting said tanks whereby excess water from said upper tank will be supplied directly to the  
30 lower of said tanks for capillary absorption by the lower end of said sheet, the excess of water supplied to the upper end of said sheet being indirectly delivered to said lower tank

through said sheet, and a float in said lower tank for controlling the supply of water to  
35 both ends of said sheet.

9. In a humidifier, an upwardly extending moistened absorbent evaporating sheet, a water tank, a drip tank, one edge of said sheet being bent over into said water tank and positioned just above the normal level of the water  
40 therein, the other edge of said sheet being in contact with the liquid in said drip tank, and means including an overflow pipe defining said normal level and delivering to said drip  
45 tank, and a water supply valve controlled by the level of water in said drip tank for intermittently raising the level of water in said water tank into momentary contact with the upper edge of said sheet for permitting mois-  
50 ture to be absorbed thereby.

10. In a humidifier, an upwardly extending absorbent evaporating sheet, a water supply tank, one edge of said sheet being positioned just above the normal level of water in  
55 said supply tank, said tank having an overflow pipe for determining said normal level, and means for intermittently causing the water to overflow and thus to rise momentarily above said normal level and come into  
60 contact with said edge for permitting water to be absorbed thereby.

In testimony whereof, I have affixed my signature to this specification.

MAURICE G. STEELE.