

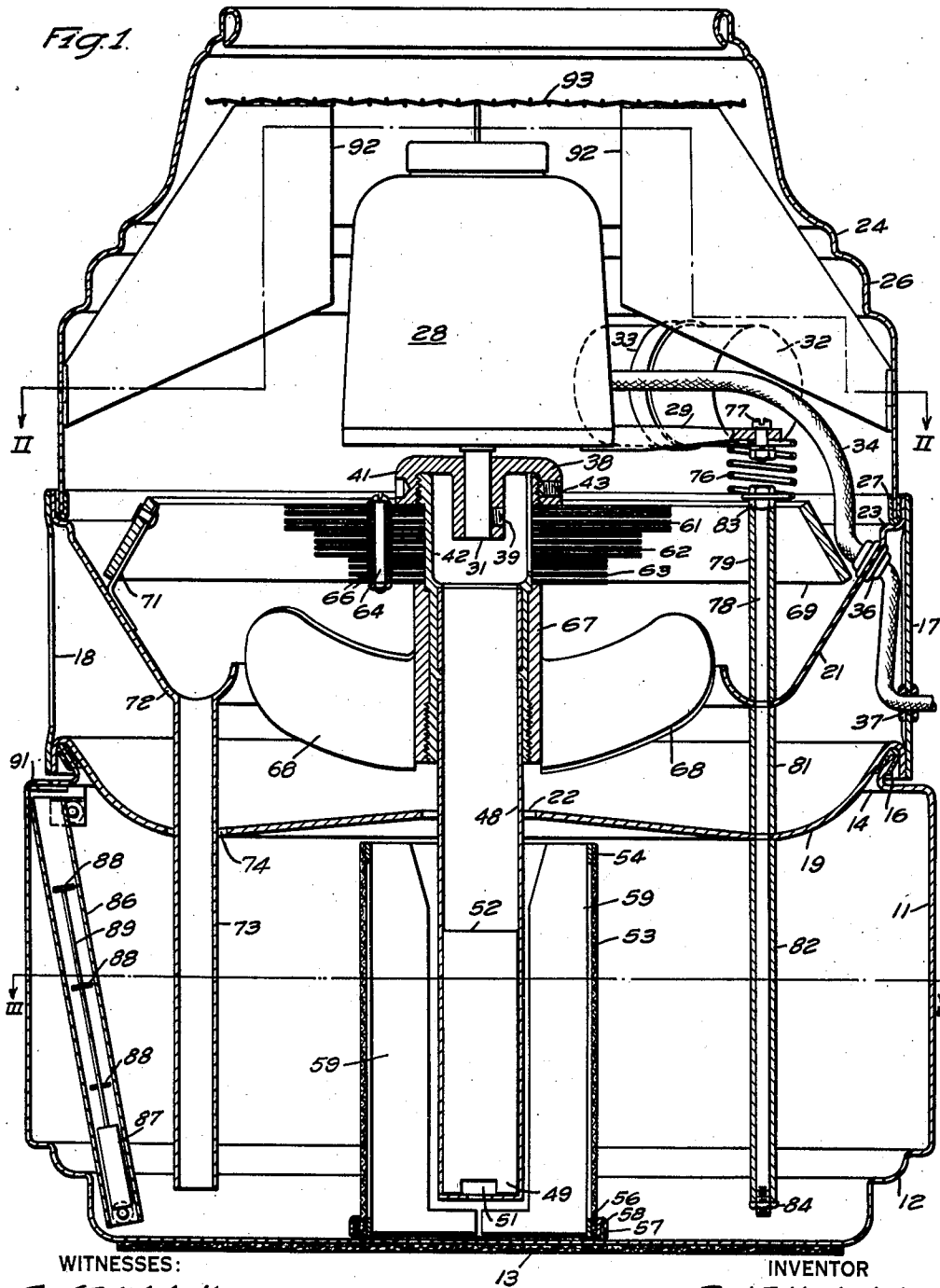
March 19, 1935.

P. E. HOCHSTETTER  
MOTOR DRIVEN HUMIDIFIER

1,994,912

Filed May 3, 1933

4 Sheets-Sheet 1



WITNESSES:

*E. A. M. Lockey*  
*N. M. Bichel*

INVENTOR

*Paul E. Hochstetter*

BY *W. R. Coley*  
ATTORNEY

March 19, 1935.

P. E. HOCHSTETTER

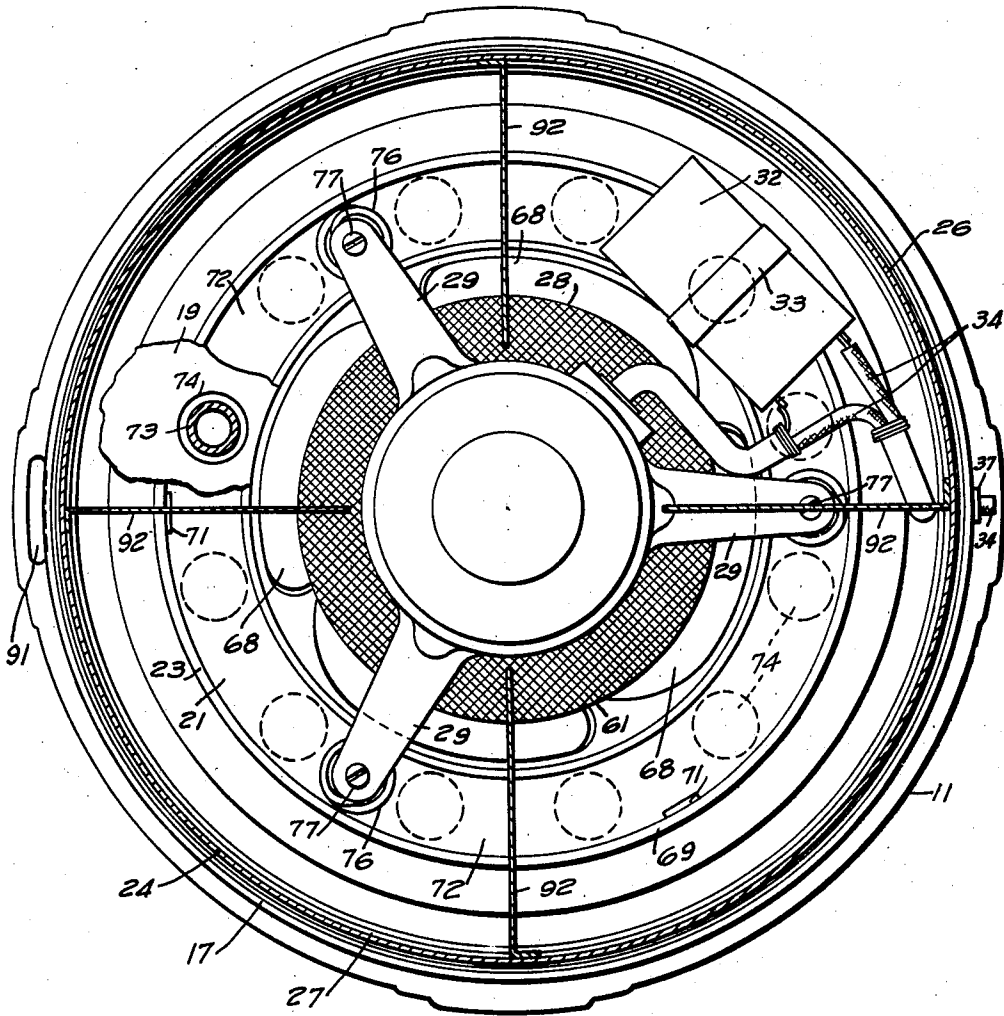
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MOTOR DRIVEN HUMIDIFIER

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4 Sheets-Sheet 2

FIG. 2.



WITNESSES:

*E. A. McLaughlin*  
*J. M. Riebel*

INVENTOR

*Paul E. Hochstetter*

BY *W. R. Coley*  
ATTORNEY

March 19, 1935.

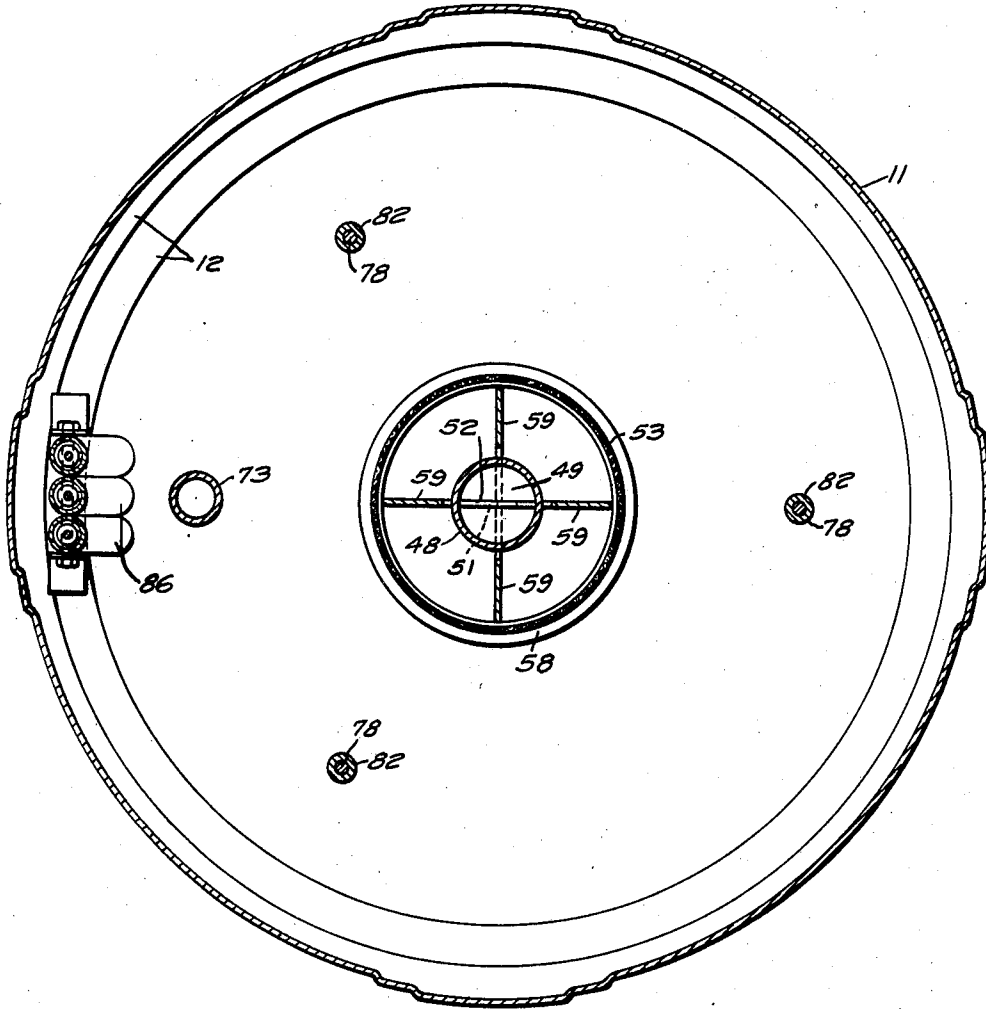
P. E. HOCHSTETTER  
MOTOR DRIVEN HUMIDIFIER

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4 Sheets-Sheet 3

Fig. 3.



WITNESSES:

*E. A. McLeskey*  
*H. M. Biebel*

INVENTOR

*Paul E. Hochstetter.*

BY

*W. R. Coley*  
ATTORNEY

March 19, 1935.

P. E. HOCHSTETTER  
MOTOR DRIVEN HUMIDIFIER

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4 Sheets-Sheet 4

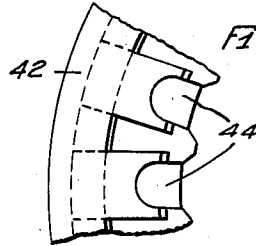
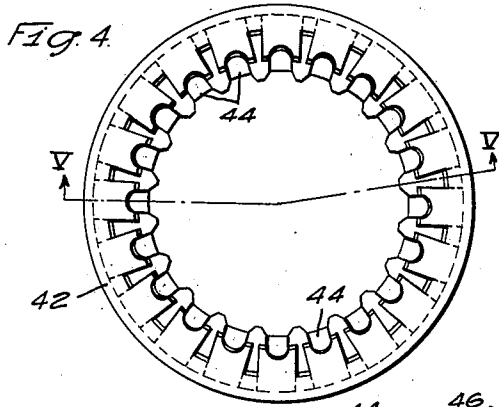


Fig. 7.

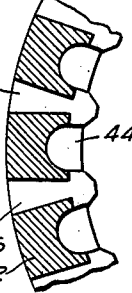


Fig. 8.

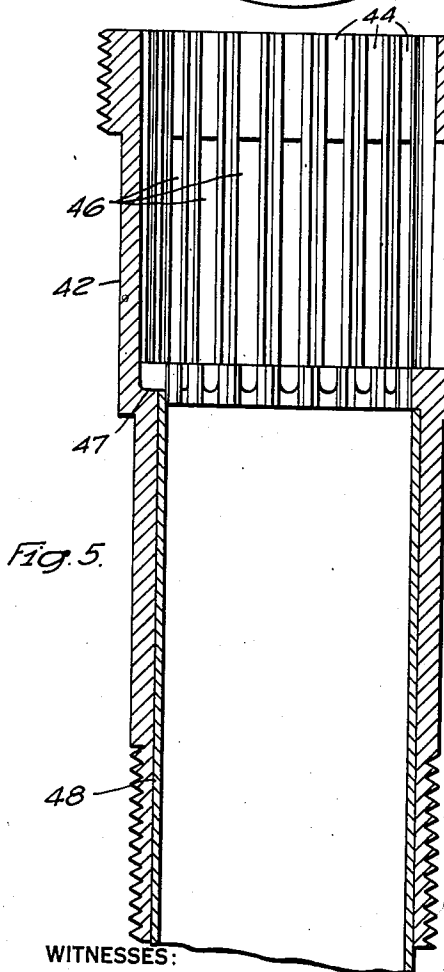
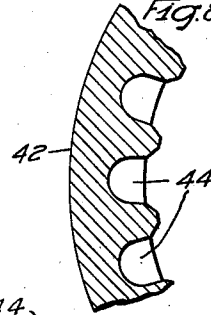
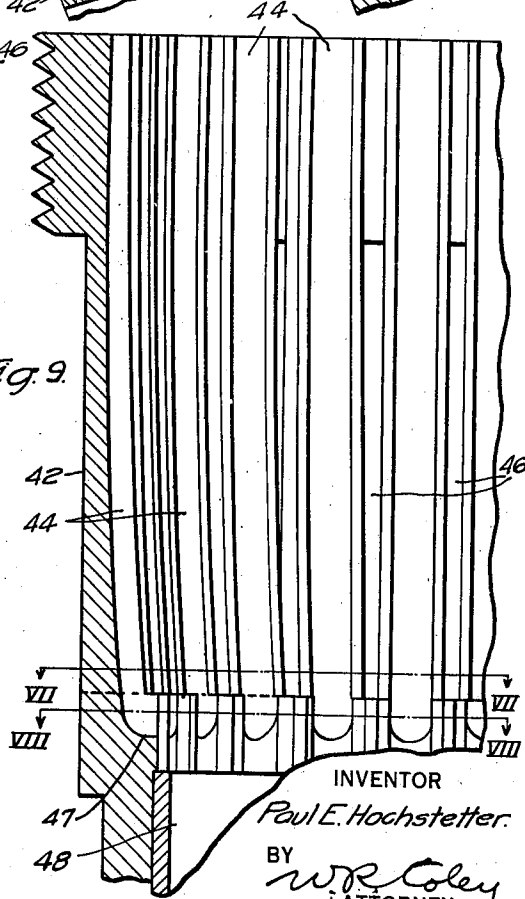


Fig. 5.

Fig. 9.



WITNESSES:

*E. A. McLaughlin*

*A. M. Biebel*

INVENTOR

*Paul E. Hochstetter*

BY

*W. R. Coley*  
ATTORNEY

# UNITED STATES PATENT OFFICE

1,994,912

## MOTOR DRIVEN HUMIDIFIER

Paul E. Hochstetter, East Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 3, 1933, Serial No. 669,179

8 Claims. (Cl. 261—91)

My invention relates to air conditioning devices and particularly to motor driven humidifiers.

An object of my invention is to provide a relatively simple, compact, and easily assembled and disassembled portable motor driven humidifier.

Another object of my invention is to provide a humidifier that shall be effective to provide humidified air containing only invisible moisture.

Other objects will be either self-evident from or will be pointed out specifically in the course of the description of a preferred form of device embodying my invention, which provides a bottom tank for water, a fan chamber resting thereon and nested therewith, and an open-top hood resting on and nested with the fan chamber. The fan chamber has a perforated peripheral wall to serve as air inlets, the top and bottom walls of the fan chamber serving as guiding means for the entering air.

A vertical motor driven shaft has associated therewith a water pump, a fan, a water spraying device, a spray-receiving ring, and an electric motor at the top of the assembly, all of these elements being supported from a part of the fan chamber by a plurality of resilient members freely movable in all directions.

The pump has associated therewith a strainer and means for preventing swirling of the water entering the pump. A triple-element water-level indicator is provided in the water tank. Peripherally spaced vertical baffles are located in the hood to prevent swirling of the leaving air.

In the drawings:

Figure 1 is a view in vertical section through a device embodying my invention;

Fig. 2 is a view in horizontal section through a device embodying my invention and taken on the line II—II of Fig. 1;

Fig. 3 is another view in horizontal section taken on the line III—III of Fig. 1;

Fig. 4 is a top plan view of the water nozzle constituting a part of the device embodying my invention;

Fig. 5 is a view in vertical section therethrough taken on the line V—V of Fig. 4, the view showing also a part of the suction pipe associated therewith;

Fig. 6 is a fragmentary top plan view of a portion of the nozzle shown on an enlarged scale;

Fig. 7 is a view similar to that shown in Fig. 6, taken on the line VII—VII of Fig. 9;

Fig. 8 is a view in horizontal section of the

nozzle, taken on the line VIII—VIII of Fig. 9; and

Fig. 9 is a view similar to Fig. 5 of the drawings but shown on an enlarged scale.

Referring to Fig. 1 of the drawings, I have there illustrated an open-top tank 11 which may be substantially circular in horizontal contour and which may be provided with a plurality of stepped or shoulder portions 12 at the bottom end in order to present a pleasing appearance. A pad 13 of felt or other similar material may be suitably secured against the bottom wall of the tank 11 in order that the entire humidifier may be located on a highly polished table surface without scratching the same.

The top edge of the water tank 11 is of slightly less diameter than the main portion of the tank, and the upper edge 14 thereof is bent outwardly and has associated therewith a gasket 16 which may be made of any suitable resilient material, such as rubber, in order to provide not only a resilient interfit between the upper edge of tank 11 with another portion of the humidifier resting thereon, but to provide also a sound-deadening means.

A fan chamber rests directly upon the upper edge 14, or, more particularly, on the gasket 16, the fan chamber including a peripheral wall 17 provided with a plurality of relatively large openings, one of which is indicated by the reference character 18 in the left-hand side of Fig. 1 of the drawings, to serve as air inlets. The fan chamber includes also a lower pan 19 and an upper pan 21. The outer edge of lower pan 19 is bent downwardly, as shown in Fig. 1 of the drawings, in order that it may extend substantially parallel to and fit tightly within the wall 17 at the bottom edge thereof, to which it may be secured by any suitable or desired means, such as welding, soldering, brazing, or riveting. The lower pan 19 has a relatively small central opening 22 therein for a purpose to be hereinafter set forth.

The upper pan 21 is relatively deeper than the lower pan 19, and is of substantially cup or centrally-depressed shape, as shown in Fig. 1 of the drawings, the outer peripheral portion thereof being provided with a shoulder seat 23 to serve as a support for another part of the casing. The extreme outer peripheral edge of member 21 is made to extend substantially parallel to the upper edge of wall 17, and to fit closely therewithin so that suitable securing means may be provided therebetween, either in the shape of rivets,

or by brazing, welding, or soldering the two portions together.

The extreme upper portion of the casing of the humidifier is constituted by a hood 24 which, as shown in the drawings, has its largest diameter at the lower portion thereof, and is provided with a plurality of stepped portions 26 at substantially the intermediate portion of its height in order to provide a pleasing appearance. A gasket 27, which may extend entirely around the lower edge of member 24, fits closely on the shoulder portion 23 of member 21, and tightly within the extreme upper edge thereof not only to provide a substantially air-tight, or at least closely fitting connection, but also to serve as sound-deadening means.

A motor driven assembly having a vertical axis is located within the triple-part housing or casing hereinbefore described, and includes a vertical shaft motor 28 which may be of any suitable or desired construction, and which includes a substantially stationary stator housing, at the lower end of which there are provided a plurality of radially extending arms 29, which are utilized in a manner to be hereinafter described, to support the motor and a plurality of other parts operated or driven by the motor.

The motor is further provided with a rotor (not shown specifically in the drawings) and a rotor shaft 31 shown as extending below the motor 28 in Fig. 1 of the drawings. While any type of electric motor may be utilized, that is, either a direct-current motor or an alternating-current motor, I have thus far provided devices of this kind with what is usually termed a "capacitor motor", and I have illustrated a condenser 32 as being suitably supported by a clamping means 33 from any suitable or desired stationary part of the humidifier assembly. I have further illustrated conductors 34 as connected both to the stator winding (not shown specifically in the drawings) and to the condenser, and extending through a bushing 36 in the upper pan 21 and then outwardly through a bushing 37 in the peripheral wall 17, so that an electrical connection can be effected between the driving motor and a suitable source of supply of electric energy in a manner well known in the art.

A cap 38 is suitably secured on the lower end of rotor shaft 31 as by means of a short headless set screw 39, the cap being provided with a central opening so that it may fit on the shaft 31, and with an annular flange 41, which is provided with internal screw threads for receiving and holding a tubular water nozzle 42. The upper end of the outer periphery of member 42 is suitably screw threaded so that it may interfit with the inner surface of cap 38 and, more particularly, the flange 41, a headless set screw 43 being provided in flange 41 to lock the two members together.

Reference may be had to Figs. 4 to 9 of the drawings, in which the nozzle is shown in various portions and sections, and it may be noted that the upper portion of nozzle 42 is provided with inner vertically extending recesses 44, through which water pumped or forced upwardly by means to be hereinafter described may flow, the water then flowing radially outwardly through other slots 46. The vertically extending grooves 44 extend downwardly through a certain distance and are then limited as by a shoulder portion 47, which is shown more particularly in Figs. 5 and 9 of the drawings.

I have shown the depth of certain parts of the

water paths in Fig. 9 of the drawings on an enlarged scale, and it may be noted that the radial thickness of a plurality of parts of the member 42 above the shoulder portion 47 varies with the height thereof above the shoulder 47. Thus it will be noted that the thickness of the wall on the line indicated by the numerals VII—VII is greater than the thickness of the wall towards the top of member 42. I consider this an important element in my invention, as it cooperates with a water-spraying device, to be hereinafter described, to ensure that the amount of water provided at successive vertical planes of the radial openings 46 in member 42 will be substantially uniform, that is, that the same amount of water is available at the top of the radial slots 46 as there is at the bottom of the radial slots 46. This, in combination with other elements to be hereinafter detailed, insures that a plurality of superposed sprays of finely divided particles of water will be available, all of these sprays containing substantially the same amount of finely divided water.

A pump tube 48 is fitted into the lower end of tubular nozzle 42 and extends downwardly into tank 11, the lower end of pump tube 48 being located a small distance above the bottom of tank 11, and being closed by a disc 49, which has a small central opening 51 therein, in order to permit the entrance of water from tank 11. A pump or other water-raising means includes tube 48 and a strip of sheet metal 52 therein, which extends diametrically across the lower end of tube 48. It is obvious that when the pump tube 48 and member 52 are rotated at a relatively high speed water will be drawn into the bottom of the tube through opening 51, and will be forced upwardly by centrifugal action thereon so that it will ultimately reach the upper end of nozzle 42 and be drawn radially or substantially radially therefrom through the plurality of openings 46 hereinbefore described.

In order to ensure that no solid particles, which may be located in or fall into the water in tank 11, shall reach the nozzle 42, I provide a substantially cylindrical strainer 53, which surrounds the pump tube 48 and which may be made in any suitable or desired manner, and may include an upper stiffening ring 54 and a lower stiffening ring 56. A member 57 of substantially flat cup shape may be suitably secured against the upper surface of the bottom wall of tank 11, and has a resilient gasket 58 associated with its upper edge, and in which the lower end of strainer 53 may fit. In order to prevent swirling of water drawn in through the wall of strainer 53, I provide a plurality of baffle plates 59 which, as shown in Fig. 1 of the drawings, may be of substantially L-shape so as to closely surround the pump tube 48 at its bottom portion.

A spraying means is mounted on the upper end of nozzle 42 and includes a plurality of discs 61, 62 and 63, which are of different external diameters, the diameter of discs 61 being the largest, the diameter of discs 62 being intermediate in dimension, and the diameter of discs 63 being the smallest.

While I do not desire to be limited thereto, I have found that wire mesh or screen may be utilized to advantage in the construction of this plural-disc spraying element, the two considerations which obtain in a device of this kind being that the water shall be permitted to move radially outwardly in a substantially free and unobstructed path, and that the outer pe-

riphery of each disc shall be serrated or be provided with a plurality of relatively fine sharp points. Means for holding the plurality of discs together may include a plurality of machine bolts 5 64 extending therethrough and a suitable number of spacers 66, which may be in the form of small washers, located between adjacent discs. Each of the bolts 64 may be provided with cooperating nuts in the usual manner.

10 A fan 67 is mounted on, and at the lower end of, nozzle 42, for which purpose the outer periphery of the lower end of nozzle 42 is provided with screw threads, the lower end of the tubular part of fan 67 being provided with internal co- 15 operating screw threads so that the fan may be screwed on the nozzle 42. The upper end of the tubular part of the fan may engage the inner periphery of the discs 63 and press them upwardly against the face of the flange portion 41. The 20 fan 67 is provided with a plurality of fan blades 68 which are located within the upturned central part of upper pan 21, there being a slight clearance only between the outer edge of each fan blade 68 and the inner annular edge of mem- 25 ber 21.

The plurality of sprayer discs 61, 62, and 63 will be effective to throw radially outwardly a relatively large amount of atomized water, all of which may not be absorbed or taken up other- 30 wise by air which is forced upwardly by the fan blades 68 during operation of the device, and I therefore, provide a spray ring 69 axially aligned with the sprayer discs. The spray ring is in the form of an annulus of a relatively soft material, 35 which may be in the form of a strip of soft metal such as lead, bent to the frusto-conical shape shown in Fig. 1 of the drawings, and which may be supported from upper pan 21 by a plurality of peripherally spaced brackets 71. As the spray 40 ring 69 has a smaller diameter at its upper edge than at its lower edge any water striking it will be arrested and deflected downwardly against the upper pan 21 and will be entrained in the annular trough or recess indicated generally at 45 72 in Fig. 1 of the drawings, from which place it may return to tank 11 by a drain tube 73. A plurality of openings 74 is provided in a lower pan 19 through one of which the drain tube 73 may extend, while the others permit of water 50 poured into the hood to overflow the inner rim of pan 21 and then flow through these openings into the water tank.

It is very difficult to construct a motor operating at relatively high speed in which the rotat- 55 ing parts are so balanced that no vibration whatever will occur either during the starting or the stopping of the device or during its operation. It has been found possible to make the design such that the rotating parts will have a so-called "critical speed" which is well below the operating 60 speed. This means, of course, that the device will operate properly at normal speed but that vibration of the rotating parts will occur not only during the time of coming up to speed but 65 also during deceleration of the device to standstill. It is further well known that it is highly desirable to make this critical speed occur at a value much below the normal operating speed in order that any vibration of the rotating parts 70 will occur at relatively low speed. Thus, in a case of a four-pole alternating-current motor operating on a 60-cycle source of supply, it is desirable to make the critical speed occur at, say 75 200 or 300 R. P. M., which is, of course, well be-

low the normal operating speed of approximately 1700 R. P. M.

I obtain this relatively low critical speed by resiliently supporting the motor and the assembly driven thereby on a plurality of helical 5 springs 76, the upper ends of which are respectively secured to the outer end of the arms 29, as by clamping bolts 77, while the lower ends of the respective springs 76 are similarly secured to the upper end of supporting rods 78. In order 10 to support the rod 78, of which I may use three for each motor, I provide a plurality of tubular spacing members 79, 81 and 82 thereon, tubular spacer 79 extending between a nut 83 used to secure the spring 76 to rod 78 and the upper face 15 of the upper pan 21. Spacer 81 extends below the upper and lower pans, while spacer 82 extends below the lower pan 19 and a small distance below the bottom end of pump tube 48. A nut 84 is provided in the bottom of rod 78 20 in order to clamp all of the tubular spacers on the rod 78, and also to maintain them in proper operative position relative to the upper and lower pans of the fan chamber. It will be noted that this provides a relatively rigid assembly of the 25 fan chamber, and, as the lower ends of rods 78 extend below pump tube 48, it is possible to remove the motor assembly while located within the fan chamber and the upper hood 24 and rest it on a suitable horizontal surface, such as a 30 table top, when it is necessary to add more water in the tank 11 or when it becomes desirable to remove any sediment therefrom which has been deposited therein from water located for some 35 time in the tank.

It is, of course, desirable to have a continuous indication of the amount of water in the tank 11, and I provide a triple-element water level indicator for this purpose, each element includ- 40 ing a substantially vertically-extending tube 86 and a float 87 in each tube. Indicating discs 88 are located also in each of the tubes 86, and rods 89 are located between the respective floats and indicating discs, the rods 89 being of different 45 lengths in the different tubes 86, as may be seen by reference to Fig. 1 of the drawings. It will, therefore, be evident that if an amount of water is located in tank 11, whose height is equal to substantially the distance between the uppermost 50 disc 88 (that is, as shown in Fig. 1 of the drawings) and a transparent cover plate 91 located immediately above the tubes 86, that indicator disc 88 having the longest rod 89 extending between it and a float 87 will engage plate 91. If 55 the height of the water in tank 11 is greater, disc 88 having the intermediate length of rod 89 between it and its float will also be in engagement with plate 91, while if the tank 11 is substantially filled with water, disc 88 in the third 60 tube will also engage plate 91, thereby indicating that the tank is completely filled.

The rotation of the fan blades 68 will, of course, tend to impart some rotating or swirling move- 65 ment to the air which is forced upwardly thereby through the water sprayed radially or substantially radially outward from spraying discs 61, 62, and 63, and in order to counteract this tendency, I provide a plurality of peripherally spaced 70 baffle plates 92 in the hood 24 which are suitably secured at their radially outer end portions to the hood 24 by any suitable means. A protective grating 93 may be provided to rest on the upper edges of baffles 92 in order to prevent articles 75 dropping into the device, and particularly the

hood, and to prevent also the unintentional in-  
section of the hand of a child.

The device embodying my invention thus pro-  
vides a relatively simple, light-weight and easily  
5 manufactured and assembled vertical-shaft mo-  
tor-driven humidifier, and tests which have been  
made with the device indicate that the air forced  
vertically upwardly as little or no peripheral or  
swirling movement, and that little or no "fog  
10 effect" is to be noted in the leaving air; that is,  
instead of the moisture in the air being visible,  
it is invisible.

The cooperating shapes of the lower and the  
upper pans of the fan chamber provide air paths  
15 for the air drawn in through the openings 18  
which make for highly efficient and silent opera-  
tion of the fan, and the shape of the spray ring  
69 aids also in confining the upwardly moving  
column of air to the central portion of the hood  
20 24, and the spray ring being made of a relative-  
ly soft material, such as lead, is substantially  
silent in its operation of arresting the outward  
movement of excess water. The interfitting por-  
tions of the casing with the gaskets therebetween  
25 also tend toward providing easily assemblable  
and disassemblable interfitting portions having  
little or no tendency towards relative movement  
and, therefore, noise.

Various modifications may be made in the de-  
vice embodying my invention without departing  
30 from the spirit and scope thereof, and I desire,  
therefore, that only such limitations shall be  
placed thereon as are imposed by the prior art or  
are set forth in the appended claims.

I claim as my invention:

1. A motor driven humidifier including a water  
tank, a fan chamber thereon having a lower pan  
resting on the tank and an upper pan spaced  
40 from the lower pan and cooperating therewith to  
provide inlet air paths, a fan located within the  
fan chamber, a vertical-shaft motor driving the  
fan and supported by the lower pan, and a hood  
supported directly by the upper pan.

2. A motor driven humidifier including a water  
45 supply, a rotatable vertical-axis shaft, a fan on  
the shaft, a water sprayer on the shaft above the  
fan, and a lead annulus, of frusto-conical shape,  
surrounding the water sprayer to arrest outward  
movement of any water not taken up by air moved  
50 upwardly by the fan, and to deflect radially in-  
wardly the air moved by the fan.

3. A motor driven humidifier comprising a wa-  
ter tank, a fan chamber thereabove having a lower  
pan and an upper pan defining air inlet paths  
55 therebetween, a vertical motor driven shaft, a

fan on the shaft, a sprayer on the shaft above the  
fan, a spray ring having its spray-receiving sur-  
face inclined to cause excess water striking it  
into the upper pan and a drain pipe to return  
said excess water to the tank.

4. A motor driven humidifier including a rotat-  
able vertical shaft, a multi-disc water sprayer  
thereon, a tubular nozzle within the sprayer hav-  
ing radial slots in its wall communicating with  
the sprayer discs, and having also longitudinal  
10 grooves, of axially-varying depth, in the inner  
surface of the wall connecting with the axial  
slots and effective to ensure the delivery of sub-  
stantially equal amounts of water to the indi-  
vidual discs of the sprayer.

5. A motor driven humidifier including a verti-  
cal shaft motor, a tubular nozzle secured to and  
depending from the motor, a plural-layer sprayer  
on the nozzle adjacent to its upper end, a fan  
assembly on the nozzle having a tubular member  
20 engaging the sprayer to hold it on the nozzle and  
means on the tubular member to secure it on the  
nozzle.

6. A motor driven humidifier including a verti-  
cal shaft motor, a cap member of inverted cup-  
25 shape secured to the lower end of the motor shaft,  
a tubular nozzle having radial openings therein  
adjacent to the top end and fitting into the cap,  
a plural-layer sprayer on the nozzle axially alined  
with the radial openings, a fan assembly on the  
30 nozzle having a tubular member surrounding the  
nozzle and clamping the sprayer against the cap.

7. A motor driven humidifier including a verti-  
cal rotatable tubular nozzle having a plurality  
of radial openings therein near its upper end, a  
35 sprayer thereon including a plurality of sets of  
spaced-apart layers of wire mesh, the diameters  
of the respective sets being different and means  
below the nozzle and secured thereto to elevate  
water thereinto when said means and the nozzle  
40 are rotated.

8. A motor driven humidifier including an open  
top water tank, a spraying and air-moving as-  
sembly including a fan chamber having a lower  
pan resting on the upper edge of the tank and  
45 an upper pan spaced from the lower pan and co-  
operating therewith to provide air inlet paths, a  
fan located within the fan chamber, a vertical  
shaft motor driving the fan and a plurality of  
rods extending above and below the lower pan  
50 and supporting the motor at their upper ends and  
adapted to support the fan chamber, the fan and  
the motor when removed from the water tank.

PAUL E. HOCHSTETTER.