

June 30, 1931.

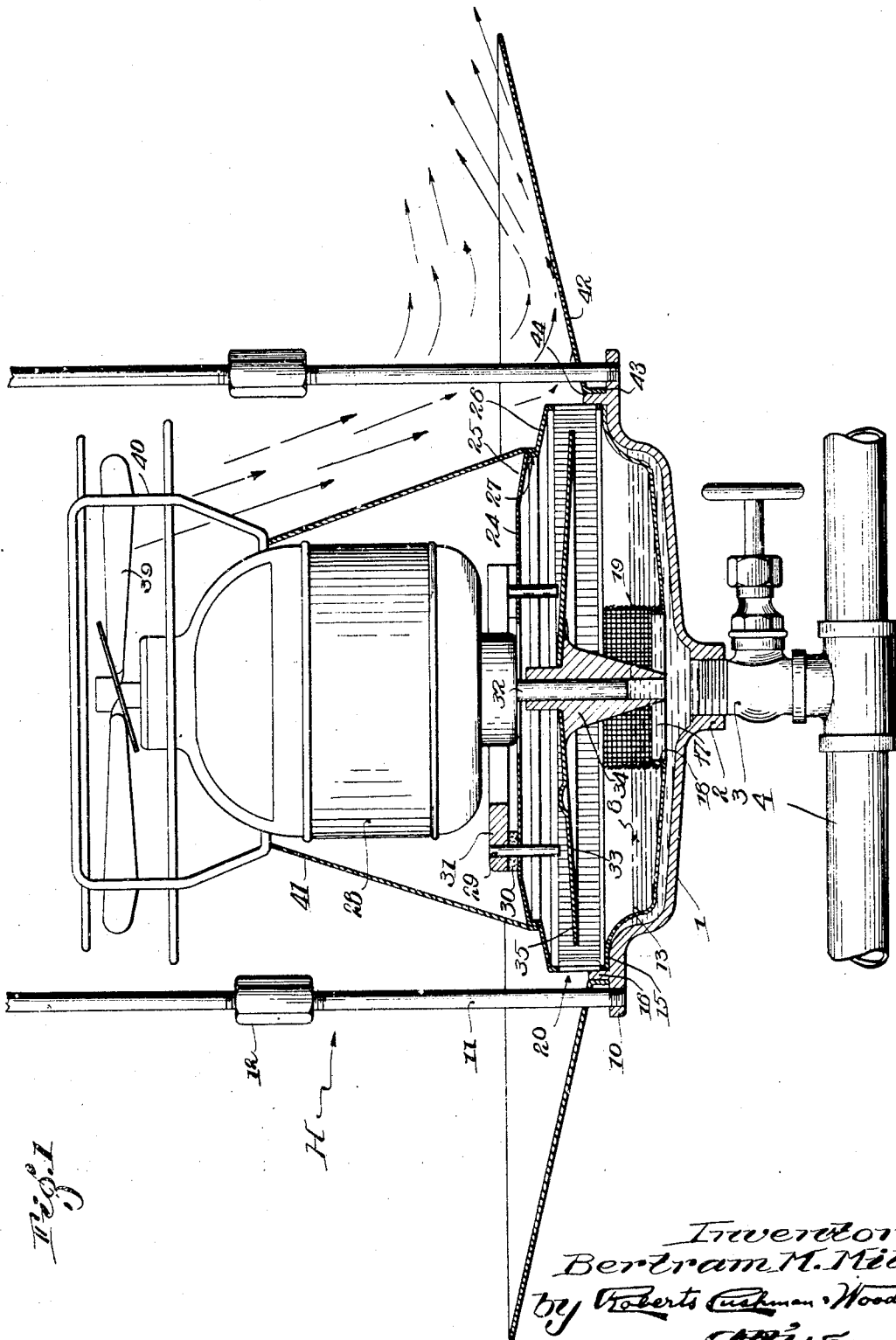
B. M. MILLS

1,812,356

HUMIDIFIER

Filed Nov. 5, 1927

3 Sheets-Sheet 1



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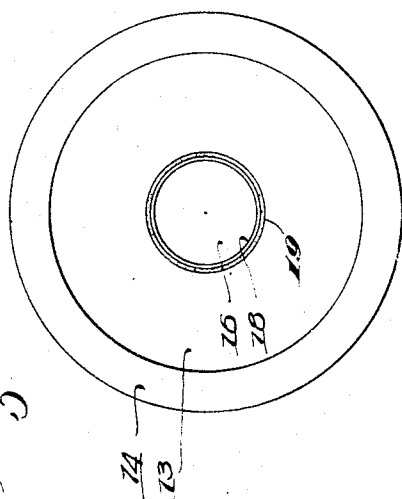
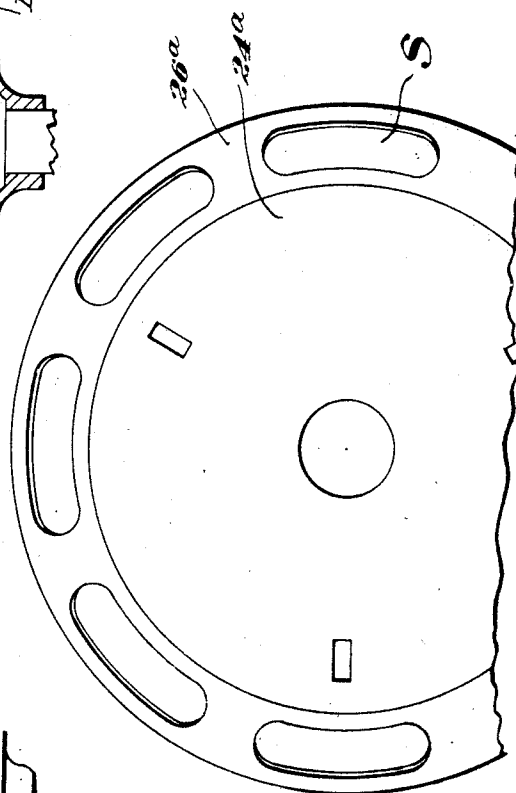
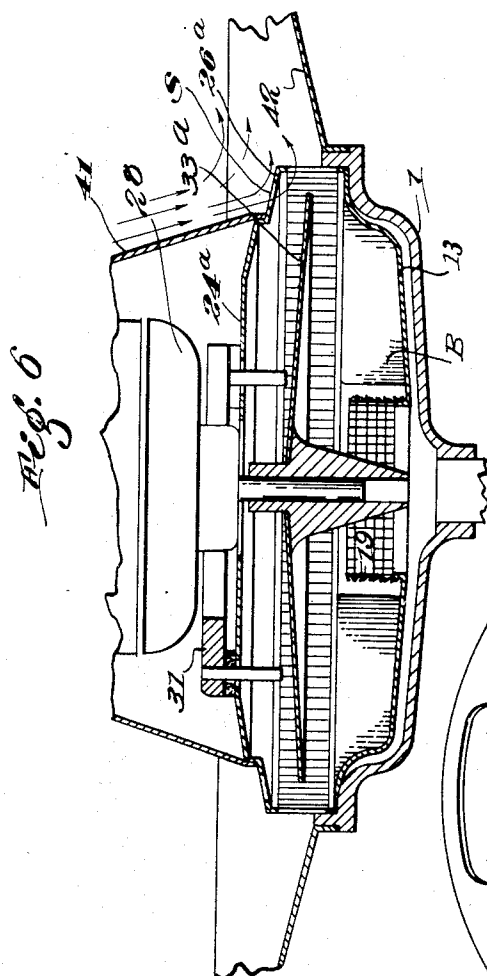
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3 Sheets-Sheet 2



Inventor
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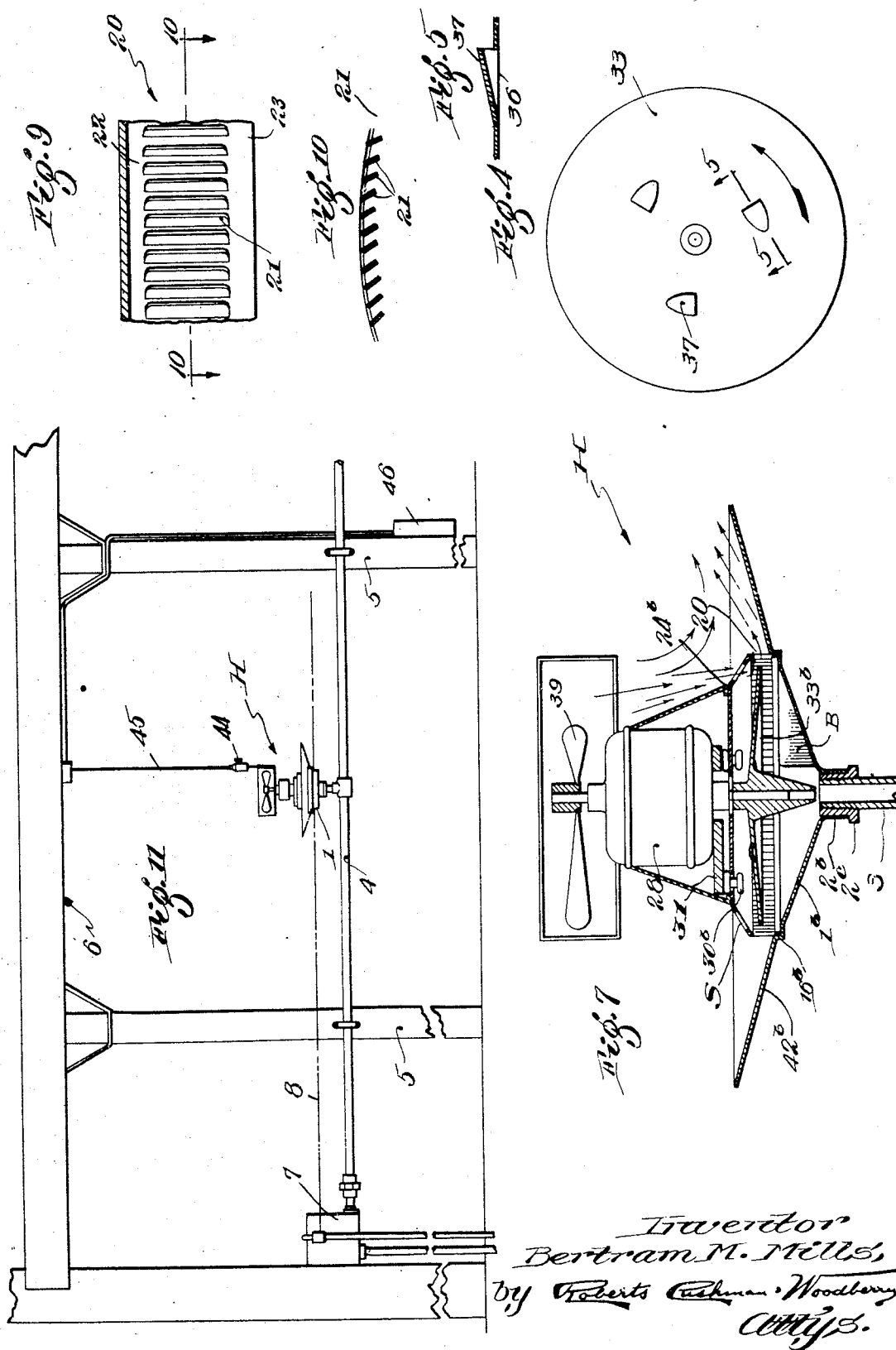
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HUMIDIFIER

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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HUMIDIFIER

Application filed November 5, 1927. Serial No. 231,265.

This invention pertains to air moisteners or humidifiers of that general type in which water or other liquid is atomized or reduced to the form of a vapor by mechanical or equivalent means for use in moistening the air in mill-rooms, etc. Among the objects of the invention are to provide a humidifier of high capacity but of small dimensions, light weight, and simple and inexpensive construction which may be so installed as to deliver atomized fluid or vapor directly into a work room or other apartment without danger of spattering or "wetting-down"; which is readily installed without requiring special brackets, hangers or other supports; which constitutes an independent unit which may be operated without affecting similar units; whose moving parts are readily removable for repairs or replacement and which may be cleaned readily and quickly; and to provide a novel method of commingling the atomized water or vapor with the air to be moistened so as to obtain maximum efficiency of operation.

While in the accompanying drawings I have chosen by way of example to illustrate an embodiment of the invention especially designed for permanent installation in mills and similar locations I wish it to be understood that certain points of novelty herein described and claimed are equally useful in humidifiers of portable and other type and that the drawings, while representing certain useful applications of my invention are not to be regarded as limiting it to the specific arrangements of elements shown.

In the drawings:

Fig. 1 is a vertical section showing my improved humidifier complete and mounted upon a water supply main;

Fig. 2 is a plan view of a removable lining or catch basin adapted to be placed within the water receptacle of the humidifier;

Fig. 3 is a side elevation of the device shown in Fig. 2;

Fig. 4 is a plan view, to smaller scale, of the atomizing disk which forms an element of the structure of Fig. 1;

Fig. 5 is a fragmentary section on the line 5-5 of Fig. 4;

Fig. 6 is a vertical section to smaller scale, similar to Fig. 1, but showing a slightly modified construction;

Fig. 7 is a view similar to Fig. 6 but showing a further modification;

Fig. 8 is a plan view to larger scale, of the cover member or motor supporting element of the device shown in Fig. 6;

Fig. 9 is a fragmentary side elevation, partly in section, illustrating a desirable form of grid structure constituting one of the atomizing elements;

Fig. 10 is a fragmentary section on the line 10-10 of Fig. 9; and

Fig. 11 is a diagrammatic elevation illustrating one desirable arrangement of mounting the improved humidifier in a work room together with the means for supplying the humidifier with water.

Referring to the drawings the letter H designates the humidifier as a whole. As indicated in Fig. 1 this humidifier comprises a base 1 which may conveniently be made of brass or bronze, although other materials may be employed. This base member is preferably basin-like in shape and is adapted to hold a supply of water or other liquid which is to be vaporized. This basin or base member 1 is provided with an outwardly projecting hollow boss 2 preferably at its center, such boss being internally screw threaded and being adapted to receive the upper end of a water supply pipe 3. As shown in Fig. 1, this pipe 3 forms part of a controlling valve by means of which the water supply for the humidifier unit may be controlled, but this valve is not essential and may be dispensed with if desired. The pipe 3 forms a branch of a supply main 4 which, as indicated in Fig. 11, may be supported in any suitable manner as, for example, by the columns 5 which support the ceiling 6 of the mill-room. The main 4 may be arranged at any suitable height, preferably near the ceiling, and as shown in Fig. 11 constitutes the sole support for the humidifier unit. Preferably the main 4 receives water from a tank 7 which may be provided with a valve operated by a ball-float or other device adapted to maintain a constant level therein. This level is indicated (Figs. 1 and 11)

11) at 8 and is common to all humidifier units mounted upon the main 4. Preferably this level is so adjusted as to lie about midway of the depth of the base 1 of the humidifier.

5 While as above noted the humidifier unit is preferably supported wholly by the water supply main 4, it may be desirable, in order to prevent undue vibration of the parts, to furnish the base 1 with a plurality of out-
10 standing ears 10 adapted to receive the lower ends of brace rods 11 extending upwardly to the ceiling or to some other convenient fixed part of the surrounding structure. These
15 brace rods may be furnished with turn buckles 12, if desired, so as to permit accurate adjustment.

To facilitate cleaning the humidifier basin, I prefer to provide a shallow dish-like lining member 13 (Figs. 1, 2 and 3) which may be
20 made of sheet brass or other suitable material and which fits loosely within the basin or base member 1. This lining 13 is preferably provided with a marginal substantially horizontal rim 14 which rests upon a substan-
25 tially horizontal seat surface 15 near the upper edge of the base member 1. This seat surface 15 may be continuous, extending substantially around the edge of the casing 1, or may consist of a plurality of spaced lugs
30 projecting from the surface of the basin. The rim of the basin 1 is preferably provided with an upstanding flange 16 and the lining member 13 fits inside of this flange.

The lining member 13 has a central opening 17 in its bottom, preferably defined by an
35 upwardly directed flange 18 (Fig. 1). This flange provides centering means for a cylindrical wall member 19 having its lower edge engaging the bottom of the member 13 and
40 projecting up substantially to the level of the rim 14 of the lining member. This wall 19 is perforated or preferably made of wire netting or other stiff foraminous material and defines a central well in which the water level
45 rises and wherein the water is kept free of lint and other dirt by the surrounding wall 19 which constitutes a strainer. If lint or other dirt collects in the annular space surrounding the strainer 19, the lining member
50 13 may readily be lifted out of the basin (after the removal of superimposed parts) and may be replaced by a clean lining in a few minutes time so that the operation of the humidifier need not be interrupted for
55 an extended period for cleaning.

An annular grid member 20 fits inside of the flange 16 of the basin 1. If the lining 13 is employed the lower edge of the grid member may seat upon the rim 14 of this lining,
60 but if the latter is not used the edge of the grid may rest directly upon the seat surface 15. The grid 20 is preferably cylindrical and may be made of sheet material, for example sheet brass. Referring to Figs. 9 and
65 10, this grid comprises a series of substan-

tially vertical spaced bars, vanes, or louvres 21 projecting inwardly and which are inclined with respect to radial planes. Preferably these bars or vanes are integral with the sheet material forming the body of the grid and
70 merge at their upper and lower ends into continuous ring-like portions 22 and 23 of the grid structure. The grid thus devised may be constructed cheaply from sheet metal by a stamping or similar operation and as the
75 vanes are securely anchored at both top and bottom, the grid structure is very rigid and the predetermined angle of the vanes is accurately maintained.

The grid 20 supports a cover member 24 (Fig. 1) which is preferably integral with or at least permanently united to the upper part 22 of the grid. Preferably this cover
80 comprises downwardly and outwardly projecting annular faces 25 and 26 united by a substantially vertical shoulder 27. The cover, as shown in Fig. 1, is substantially imperforate except for such openings as are necessary for the passage of certain parts hereinafter described, and the space between the
85 cover and the bottom of the basin 1 is substantially closed except for the openings provided between the vanes 21. The cover 24 constitutes a support for the motor and other moving parts of the apparatus.
90

As shown in Fig. 1 the electric motor 28 has a base 31 provided with a plurality, usually three, of pins 29 projecting downwardly therefrom and through corresponding openings
95 in the cover 24. The pins fit loosely in these openings and are encircled by resilient washers 30 interposed between the base 31 and the cover. This arrangement allows the motor to nutate freely so that its shaft and the parts carried thereby are free to move
100 and to assume a position, for any given speed, at which all the forces acting at an angle to the axis of rotation are substantially balanced. The motor and other rotating parts may thus be run at high speed without producing excessive vibration or noise.
105

The motor shaft 32 projects downwardly through the base 1 and the cover 24, and at its lower end carries an atomizing disk 33.
110 This disk may be of any suitable material capable of rotating at high speed, although I prefer to employ sheet metal, for example bronze, for the purpose. This disk is furnished with a downwardly directed conical member 34 which is preferably solid, although under some circumstances it may be replaced by a conical annulus of sheet material. This conical hub-member 34 projects
115 down into the well defined by the screen 19 and, as the disk is rotated, picks up water by centrifugal action and draws it upwardly to the under surface of disk 33. Preferably the disk 33 is so placed on the shaft that its outer edge is in a plane substantially midway be-
120
125
130

tween the upper and lower edges of the grid 20.

that it is unconfined circumferentially and free to mingle with the air in the room.

I also preferably provide an annular deflector 42 having an inner marginal flange 43 fitting against the flange 16 of the basin 1, to which it may be secured in any desired manner. The deflector 42 preferably flares outwardly and upwardly and its inner edge 44 is adjacent to, although slightly spaced from, the outer surface of the grid 20 and is disposed in a plane slightly below the plane of the atomizer disk.

The unit thus constructed is mounted upon a water supply main as above described, and the terminals of the motor 28 may be connected by means of a suitable plug to an ordinary lamp socket 44 connected by a conductor 45 to a control box 46 conveniently located and which may receive the conductors for all of the atomizing units employed. The basin 1 is supplied with water from the tank 7 through the main 4. When the motor 28 is started, the disk 33 is rotated and water from the well within the strainer 19 is drawn upwardly to the under surface of the disk and delivered with great force against the vanes 21 where it is broken up into exceedingly small particles which are practically invisible and which escape into the space immediately surrounding the grid 20. The outwardly flowing air current produced by the action of the blades 37 assists in carrying the minute particles of water outwardly through the grid bars. The air current which flows down along the deflector shell 41 is suddenly turned outwardly and upwardly when it engages the upper surface of the deflector 42, and at the point where the air current suddenly changes its direction there is produced a violent swirl and probably a pronounced decrease in pressure. Both of these conditions are favorable to the complete absorption of the vapor particles by the air current, which carries away these particles very rapidly and distributes them in a highly efficient manner through the workroom without any tendency to cause spattering or wetting down of adjacent material.

The upwardly and outwardly flaring deflector 42 is preferable since it serves as a collector for any droplets of water (such as might possibly be ejected if the humidifier were operated in a substantially saturated atmosphere) and returns such collected water to the basin 1. However, it is not essential, so far as the broadest aspects of the invention are concerned, that the deflector 41 be turned upwardly as disclosed since it is possible that useful results might be secured if the deflector 42 were substantially horizontal or even downwardly directed. Furthermore I contemplate that some of the advantages of the invention might be obtained were the fan placed below the basin 1 and the air current directed upwardly along the surface of

The disk 33 may be plain, if desired, but for certain purposes and in order to obtain a maximum capacity, that is to say, to atomize or reduce to vapor as large an amount of water as possible within a given time, I may, as indicated in Figs. 1, 4 and 5, provide the disk 33 with a plurality of openings 36 having scoop-like air propelling blades 37 directly above them. These openings and blades may be prepared by a stamping operation, the blades being integral with the material of the disk and each having its free edge pointing in the direction of rotation of the disk. When these blades are employed they scoop up air from the space above the disk and deliver it into the space below the disk, thus building up substantial pressure below the disk and causing a rapid flow of air outwardly. This outwardly flowing air apparently increases the normal outward speed of the water along the under surface of the disk, thus causing a large amount of water to impinge upon the vanes 21 while at the same time the current of air issuing between the vanes tends to hurry the departure of the vapor from the point where it is evolved, thus assisting in the vaporizing action. In order to insure desired balance of the parts it is preferable to arrange the blades 37 symmetrically about the axis of the disk, but while I have shown three blades herein, I wish it to be understood that the invention is not limited to this particular number or arrangement and further, so far as the broad principle of operation is concerned, I contemplate that other means of supplying air beneath the disk 33 may be employed as within the scope of my present invention.

A fan 39 is also carried by the motor shaft 32. As here shown this fan is mounted above the motor 38 and is so designed as to direct a current of air downwardly. Preferably this fan is enclosed within a wire guard 40, of usual type, to prevent accidental contact of the fan blades with outside objects.

As the motor 28 is coaxial with the fan 39 and in the path of the air current, the latter is constrained to assume the form of a hollow, preferably annular stream and for guiding this stream in the desired manner I prefer to provide a deflector shell 41 extending from a point near the upper part of the motor casing downwardly to the cover 24 and preferably fitting snugly against the shoulder 27 of the latter. This shell 41 may be of sheet brass or other sheet material and preferably increases or flares in diameter from its upper toward its lower end so that the annular air stream gradually increases in diameter as it descends. While this air stream is thus directed in a downwardly and outwardly diverging path, it should be noted

an appropriate guide or deflector and then caused abruptly to change its direction.

In Fig. 6 I have shown a humidifier generally similar to that shown in Fig. 1 but having a disk 33^a which is plain, that is to say, it is not provided with openings or blades such as the openings 36 and blades 37 shown in Fig. 1. In order to obtain substantially the same results as with the disk of Fig. 1, I provide the cover 24^a with openings through which a portion of the unconfined air current from the fan may enter the space above the disk. Conveniently these openings take the form of elongate slots S spaced circumferentially along the annular face 26^a of the cover. A portion of the downwardly moving air current produced by the fan enters the opening S and impinges upon the rapidly moving upper surface of the disk 33^a. The frictional contact of the disk with this air tends to impart a rotary motion to the air, and as this rapidly moving air impinges upon the vanes of the grid and escapes from between them it forms swirls or eddies which have a strong tendency to pick up the atomized moisture and carry it rapidly away into the main body of the air current. The removal of the vaporized moisture from the vicinity of the grid is thus hastened and the efficiency of operation increased.

In Fig. 7 a construction is shown which is generally similar to that of Figs. 1 and 6 but in this instance the base 1^b is of sheet material, having the central downwardly directed sleeve 2^b secured by means of solder or otherwise to an internally screw-threaded bushing 2^c which receives the supporting pipe 3. In this instance the flange 42^b is integral with the basin 1^b, there being a shoulder 16^b at the junction of the basin proper and the flange to accommodate the lower edge of the grid 20.

In this arrangement the motor 28 has the base 31 which is provided with pins (not shown) similar to the pins 29 above described, but in this embodiment the flat washers 30 are replaced by spool-shaped cushions 30^b which fit into slots in the cover 24^b. In this arrangement also the cover 24^b is furnished with openings S which permit air from the fan 39 to pass directly down into the space above the disk 33^b, the latter being of the same type as that shown in Fig. 1, although a disk such as shown in Fig. 6 may be substituted, if desired. As shown in Figs. 6 and 7, I may provide baffle plates B in the lining member 13 or directly in the base receptacle to prevent swirling of the water, and in these figures the brace rods are omitted. Obviously, the brace rods and baffles may or may not be employed, as desired.

In all the arrangements shown the motor and other elements constituting the atomizing means may be removed as a unit from the basin 1 for replacement of parts or repairs or to facilitate the exchange of the lining

member 13, without otherwise dismantling the apparatus. It is thus possible, by keeping one or spare units on hand, to maintain the humidifier in substantially continuous operation since upon failure of any part to operate, the entire atomizing unit may be replaced by a spare one without stopping the operation for a long period. It is also possible, as above described, to clean the basin in a few minutes time merely by exchanging the lining member for a spare clean one, whereas with the usual structures a long shut down of the apparatus is necessary at frequent intervals for cleaning. The mounting of the motor permits extremely high speed without excessive noise or vibration so that an unusually small atomizing disk may be employed without an undue reduction in capacity.

While I have stated that I prefer to mount the humidifier directly upon the supply main which constitutes the only necessary support, I contemplate, so far as certain aspects of the invention are concerned, that the humidifier may be otherwise supported and supplied with water or other liquid in any convenient way. Further, I do not necessarily confine myself to the employment of an electric motor since the invention is independent of the type of motor means employed.

I have herein shown desirable embodiments of my invention but contemplate that various changes in size and proportion of parts as well as substitution of equivalents and changes in relative arrangement of parts may be made without departing from the invention.

I claim:

1. A humidifier having a basin-like base provided with a screw-threaded hollow boss for engagement with a supporting water supply pipe, a cylindrical grid seated on edge in said base, a cover member mounted on the grid, said cover having a series of circumferentially spaced marginal openings, a motor above the cover, the motor having a normally vertical shaft extending down through the cover, an atomizing disk on the shaft below the cover, the edge of the disk being in a plane intermediate the top and bottom of the grid, an annular deflector having its inner edge adjacent to the outer surface of the grid, and a fan on the motor shaft above the cover arranged to deliver air through the openings in said cover and also against the deflector.

2. A humidifier comprising a substantially vertical shaft, a fan secured to the shaft, the fan being constructed to deliver air downwardly, a motor below the fan, a deflecting shell concentric with the shaft and substantially enclosing the motor, said shell causing the air from the fan to flow in an annular unconfined stream, a disk on the shaft below the motor, a cover member between the disk and motor, said cover having a series of open-

ings therethrough adjacent to the lower edge of the deflecting shell to permit air from the fan to impinge upon the disk, means for supplying water to the disk, means cooperating with the disk to evolve water vapor at a point adjacent to the lower end of said shell, and an annular upwardly flaring deflector concentric with the shaft and in the path of the air stream, said deflector having its inner edge disposed adjacent to the point at which the water vapor is evolved.

3. A humidifier comprising a rotary atomizing disk having openings therethrough at a plurality of points symmetrically spaced about its axis, means for rotating the disk, means for supplying liquid to the lower side of the disk, and means for causing air to pass through the openings in the rotating disk.

4. A humidifier comprising a rotary atomizing disk having an opening therethrough and an air impelling blade adjacent to the opening, means for rotating the disk, and means for supplying water to the lower side of the disk.

5. A humidifier comprising a receptacle for fluid, an annular grid supported by the receptacle, a cover mounted on the upper part of the grid, an atomizer disk below the cover, the edge of the disk being intermediate the top and bottom of the grid, the disk having openings therethrough, and blades carried by said disk above and adjacent said openings for causing air to flow downwardly through the openings in the disk and outwardly through the grid.

6. A humidifier comprising a rotary atomizing disk having an eccentrically disposed opening, a cover-like shield above the disk, means for rotating the disk, means including a substantially solid conical hub depending from said disk for supplying liquid to the lower side of said disk, and means for causing air to pass through the opening in the rotating disk to contact with and assist in vaporizing the liquid film on the lower side of said disk.

7. Humidifying apparatus comprising means for producing an unconfined current of air, means for diverting a portion of said current to form an auxiliary stream, a rotary atomizing disk in the path of said auxiliary stream, said disk imparting a swirling motion to the air of said auxiliary stream, means cooperating with the disk to evolve finely divided liquid and to deliver such divided liquid into the swirling air, and means for causing an abrupt change in the direction of the main portion of the unconfined air current, the swirling moisture-laden auxiliary stream uniting with the main current adjacent to the point at which the direction of the latter changes.

8. Humidifying apparatus comprising means for producing an annular unconfined air current flowing in a generally vertical di-

rection, means for diverting a portion of the air from said stream, means for setting up swirls and eddies in the diverted portion of the air and for delivering atomized water into said swirling air, the moisture-laden swirling air uniting with the main stream, and means abruptly deflecting the air current laterally adjacent to the point at which the moisture-laden air unites with the main stream.

9. A humidifier comprising a motor having a substantially vertical shaft, a propeller fan on the shaft above the motor arranged to deliver an unconfined current of air downwardly, an atomizing disk mounted on the shaft below the motor, means for supplying water to the disk, a cover member above the disk, means below the cover member cooperating with the disk to form water vapor, and an annular outwardly flaring deflector concentric with the shaft and having its inner edge adjacent to the edge of the disk.

10. A humidifier comprising a substantially vertical shaft, a fan secured to the shaft, the fan being constructed to deliver air downwardly, a motor below the fan, a deflecting shell concentric with the shaft and substantially enclosing the motor, said shell causing the air from the fan to flow in an annular unconfined stream, a disk on the shaft below the motor, a cover member between the disk and motor, means for supplying water to the disk, means cooperating with the disk to evolve water vapor at a point adjacent to the lower end of said shell, and an annular upwardly flaring deflector concentric with the shaft and in the path of the air stream, said deflector having its inner edge disposed adjacent to the point at which the water vapor is evolved.

11. A humidifier having a hollow supporting base provided with means for mounting it upon a water supply pipe, said base constituting a reservoir for water, an annular grid arranged within the base, a cover above the grid, a motor above the cover, the motor having a normally vertical shaft projecting downwardly through the cover, an atomizing disk on the shaft below the cover, a fan mounted on the shaft above the cover, said fan generating a downwardly directed air current, and an annular upwardly and outwardly flaring conical deflector in the direct path of said downwardly directed air current concentric with the shaft and having its inner edge adjacent to the grid.

12. A humidifier comprising a fan, a deflecting shell at the discharge side of the fan for causing the air from the fan to flow in a hollow unconfined stream, rotary means for discharging atomized liquid into said unconfined air stream adjacent to said shell, and a deflector adjacent said shell and in the path of the hollow unconfined air stream for deflecting the stream laterally and causing a

swirling of the air stream and atomized fluid.

13. A humidifier comprising a fan, an outwardly flaring shell at the discharge side of the fan for causing the air from the fan to flow in a hollow unconfined stream, rotary means for discharging atomized liquid into said unconfined air stream adjacent said shell, an upwardly flaring deflector adjacent said shell and in the path of the hollow unconfined air stream for deflecting the stream laterally and causing a swirling of the air stream and atomized fluid.

14. A humidifier comprising a water receptacle, a removable lining for the receptacle, said lining comprising an annular wall defining a well, and atomizing means within the receptacle arranged to draw water from the well.

15. A humidifier comprising a basin-like receptacle, a removable lining for the receptacle, said lining comprising a centrally disposed perforate wall defining a well, and a rotary atomizing disk within the receptacle, said disk having water lifting means disposed within said well.

16. A humidifier comprising a basin-like receptacle, an atomizing unit removably mounted in the receptacle, and means for removing lint and other foreign matter from the receptacle comprising a dish-like removable lining fitting within the receptacle, said lining having an opening at its center, and a perforate wall extending upwardly from the edge of said opening.

17. In combination, a water supply pipe and a humidifier supported thereby, the humidifier comprising a basin-like base having means for attaching it to the pipe, atomizing means in the basin-like base, said means including a rotary atomizing disk and a motor for driving it, means controlling the water in the supply pipe whereby automatically to maintain a predetermined water level in the base of the humidifier, and a removable lining for the basin-like base, said lining constituting a dirt collector.

18. A humidifier having a base of basin-like form provided with a seat surface, a removable lining supported by said seat surface, a removable vertically disposed annular grid having its edge seated within the basin-like base, motor supporting means carried by the grid, a motor on the supporting means, the motor having a normally vertical shaft, a disk mounted on the shaft, the edge of the disk being in a plane intermediate the top and bottom of the grid, an annular deflector concentric with the grid, and an air propelling fan on the shaft.

Signed by me at Pawtucket, Rhode Island, this 31st day of October, 1927.

BERTRAM M. MILLS.