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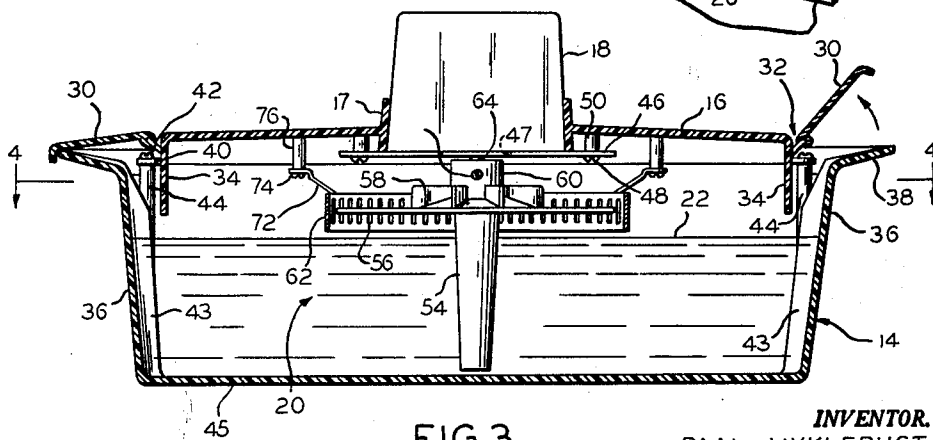
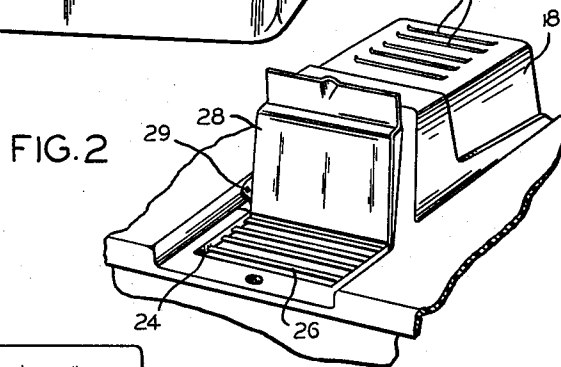
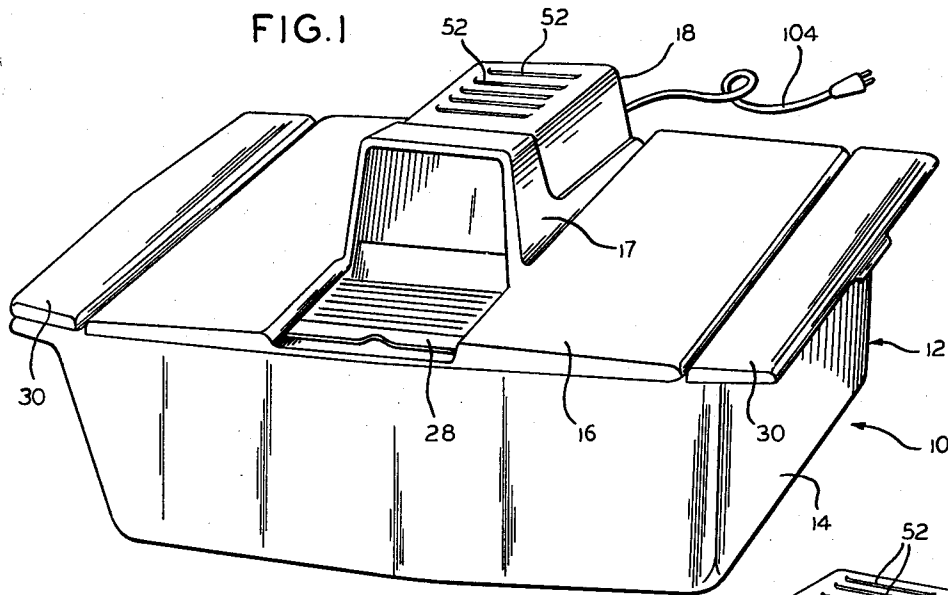


FIG.3

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Nov. 12, 1963

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HUMIDIFIER

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2 Sheets-Sheet 2

FIG. 4

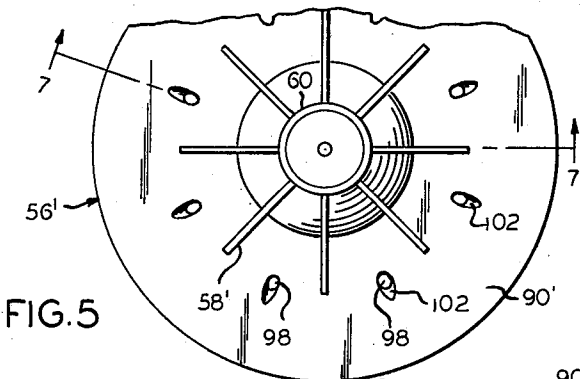
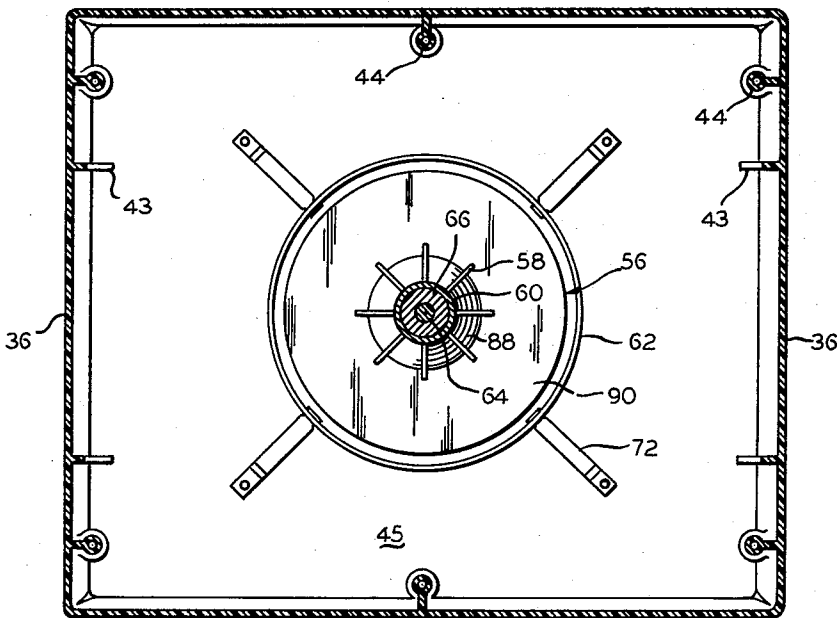


FIG. 5

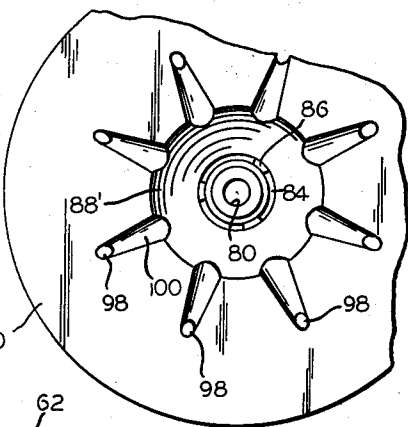


FIG. 6

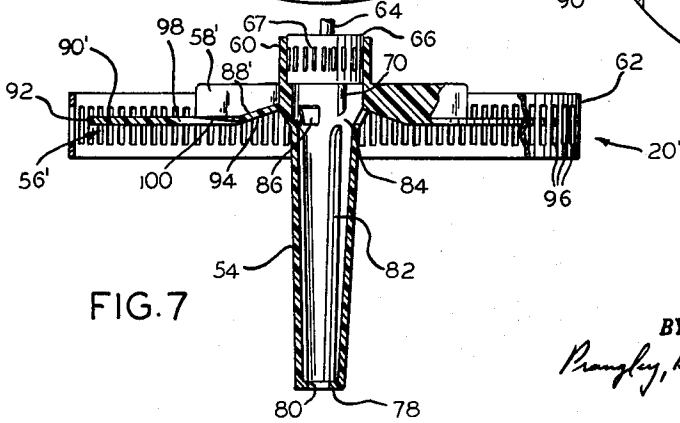


FIG. 7

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1 Claim. (Cl. 261—29)

The present invention relates to humidifiers, and more particularly to a highly improved humidifier of a heatless type which operates by atomizing water in air and disbursing the humid air in the surrounding area.

Most previously known humidifiers of the kind heretofore used for adding moisture to the air in homes and offices and the like, have relied upon heat for vaporizing water. Although these humidifiers have been known in a great variety of forms and constructions, they have invariably had the disadvantage that they discharged heat into the room and increased the room temperature. Portable humidifiers of the heat type, furthermore, have involved a certain element of danger in their use inasmuch as they have almost always relied upon the boiling of water to produce the desired water vapor. The presence of the water boiling device in a room occupied by a small child, for example, involves a certain amount of risk that the child may tamper with the device and be burned. Accordingly, it has usually been necessary when using heat type humidifiers of the portable kind to take precaution that accidents will be avoided.

Heatless type humidifiers for the most part have not heretofore found wide acceptance in homes, and the like, and this is particularly true with respect to small heatless humidifiers of the portable category, for such humidifiers have in most cases produced undesirable noises when in operation and their operating efficiency has been quite low. The amount of water discharged into the atmosphere during a given period with the use of the heatless type humidifiers of earlier construction has been substantially less than the amount of water discharged in the atmosphere during a like period of time by heat-type vaporizers of comparable size. Another objection usually found in prior humidifiers of the heatless type is that an undesirable amount of the moisture discharged therefrom has fallen out of the atmosphere in the form of droplets in the closely surrounding area.

An important object of the present invention is to provide a heatless humidifier that is readily constructed in portable form and which avoids all of the disadvantages mentioned above with respect to both the heat-type and the previously known heatless type humidifier. Although the present humidifier is electrically driven, it employs no heat in connection with its humidifier action. As a consequence, there is no danger of burning involved in its use. Furthermore, objectionable noises during its operation are avoided, and its efficiency is substantially greater than heatless type humidifiers of previously known constructions.

Additional objects of the present invention are to provide a simple, compact, inexpensive and substantially foolproof portable humidifier that is particularly well suited for use in the home, office, or the like.

A further object is to provide a humidifier which is economically operated, and which has a long useful and trouble-free life.

These and other objects, advantages and functions of the invention will be apparent on reference to the specification and to the attached drawings illustrating preferred embodiments of the invention, in which like parts are identified by like reference symbols in each of the views, and in which:

FIGURE 1 is a front perspective view of one embodiment of the humidifier;

2

FIG. 2 is a fragmentary perspective view of a portion of FIG. 1 illustrating a cover flap in its open position for filling the humidifier with water;

FIG. 3 is a vertical sectional view taken from side to side of the humidifier;

FIG. 4 is a horizontal sectional view of the humidifier showing parts in top plan view, taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged fragmentary top plan view of another embodiment of the atomizing and mixing apparatus of the humidifier;

FIG. 6 is a bottom plan view of the apparatus of FIG. 5; and

FIG. 7 is a vertical sectional view of the apparatus taken substantially along the line 7—7 of FIG. 5, with a screen shown in association with the apparatus.

The humidifier apparatus of the present invention includes a rotatable disc, pump means for discharging water onto the disc centrally thereof, the disc being adapted when rotated to spray the water from its outer or peripheral edge, a screen surrounding the disc and adapted to break up the spray into a fine mist, and fan means for mixing air with the mist and moving the resulting humidified air.

The complete unit includes a water reservoir, a cover therefor, and reservoir air inlet and outlet means. The atomizing and mixing apparatus is disposed within the reservoir for pumping water, atomizing the water, and mixing it with air therein, following which the humidified air is moved from the reservoir into the surrounding atmosphere to increase its humidity.

The drawings illustrate, with certain variations, a preferred embodiment of the new humidifier in a unitary portable form indicated generally by the numeral 10. The humidifier, which may be constructed largely of any suitable plastic material such as high impact polystyrene or polyethylene or the like, is comprised of a housing 12 which includes a water reservoir or vessel 14, a cover 16 therefor, a motor mounting frame 17 integral with the cover 16, and a motor casing 18 within which a suitable electric motor, not shown, is mounted in the frame 17. In the preferred form of the humidifier all of the parts just mentioned, except the motor and the motor casing 18 are constructed of plastic. Atomizing and mixing apparatus, generally indicated by the numeral 20 and also preferably formed largely of plastic, is mounted in the reservoir with a portion of the apparatus extending below the water level 22 therein, as best seen in FIG. 3.

The cover 16 of the reservoir is provided with a filling opening 24 having a grate 26 mounted therein, and the opening is closed by a manually operable flap 28 pivotally mounted on the cover above the opening by ears 29 provided on the flap. The reservoir 14 is initially filled with water to the level 22, and the water is replenished when the level reaches the lower end of the atomizing apparatus 20. The opposite ends of the cover 16 are constructed as vent plates 30, each of which is pivotally mounted in any suitable manner about a horizontal axis on the main body of the cover, as indicated at 32. Baffles 34 are formed integrally with the main body of the cover at this location, and they depend vertically into the flow paths from the humidifier. Each baffle is spaced inwardly from the adjacent end wall 36 of the reservoir 14, to form a flow path therebetween. The end walls terminate in upwardly and outwardly inclined flanges or rims 38 which cooperate with the adjustable vent plates 30 to regulate the quantity and direction of the flow of humid air from the humidifier 10. The flanges 38 also serve as handles for carrying the unit.

The atomizing and mixing apparatus is supported en-

tirely by the cover 16 which has a plurality of laterally extending ears 40 formed integrally upon the baffles 34 thereof. These ears 40 rest upon the tops of upstanding posts 44 that are formed integrally with the end walls 36 of the reservoir 14 and extend upwardly therefrom. The ears 40 are secured to the tops of the posts 44 by screws 42 which are accessible when the vent plates 30 are lifted to open position. Thus, the entire cover 16 may easily be removed to give access to the interior of the humidifier merely by removal of the screws 42. If desired, vertically extending reinforcing ribs 43 may be formed integrally with the inner surfaces of the end walls 36 of the reservoir and with the base or floor 45 thereof, and these ribs may merge at their upper ends with the posts 44.

The motor is supported by a mounting plate 46 secured by screws 48 to bosses 50 depending from the cover 16. The motor casing 18 is also supported by the mounting plate 46, and the casing includes louvers 52 on the top surface thereof which permit air to enter the casing, cool the motor, and then pass downwardly through an oversize motor shaft opening 47 in the plate 46 and into the reservoir 14 for humidification therein and ultimate discharge therefrom along the previously mentioned flow paths that are provided when the vent plates 30 are lifted.

The atomizing and mixing apparatus 20 is comprised of two main units, namely: a unit which includes a pump 54, a disc 56, fan blades 58, and a hollow or tubular central hub or head 60, all integrally formed in one piece; and a surrounding screen or grid 62 spaced outwardly from the periphery or outer edge of the disc. The unit first mentioned is axially mounted upon the depending motor shaft 64 which extends downwardly through the opening 47 in the plate 46. To this end, the hollow hub 60 of the unit is provided with a bushing 66 (FIG. 7) that is force-fitted into the hub and, if desired, provided with splines 67 to provide tight permanent seating within the hub. The bushing may seat upon or abut stops 70 that extend inwardly from the inner wall of the hub 60, and the bushing is provided with an axial opening that receives the motor shaft 64, the bushing being secured to the shaft by a set screw 68 (FIG. 3) or by any other suitable means. The screen 62, on the other hand, is supported by hangers 72 secured by screws 74 to bosses 76 which are formed on and depend from the underside of the cover 16.

The construction and arrangement of the components of the atomizing and mixing apparatus 20 constitute important features of the invention. The embodiment of FIGS. 5-7 is similar to that of FIGS. 3 and 4, with the former having additional features of construction which serve to increase the capacity of the unit. For convenience, the corresponding parts of the elements of FIGS. 5-7 which are modified will be identified by the reference numerals employed in FIGS. 3 and 4, with the addition of prime symbols.

The unit comprised of the pump, disc, fan blades and hub is advantageously constructed in one piece of high impact polystyrene. The pump 54 thereof constitutes a rotatable tubular impeller connected to and depending from the hub 60 and driven by the motor through the motor shaft 64. The pump is vertically arranged in the reservoir 14, as illustrated in FIG. 3, so that its lower portion extends below the liquid level 22 to a point just above the bottom 45 of the reservoir. The pump preferably widens conically upwardly, as illustrated, to function as a centrifugal pump. The bottom end is partly closed by an inwardly extending annular flange 78 (FIG. 7) which defines an axial water inlet opening 80. The flange assists in pumping water upwardly through the pump 54, by partly closing the end to the flow of water outwardly of the opening 80. The centrifugal pumping action is augmented by a plurality of vertical ribs or impeller blades 82 which extend inwardly from the inner wall of the pump 54 and are spaced equidistantly around the wall. When the pump is rotated at a substantial speed, the

centrifugal force causes the water within the pump to climb the interior wall thereof, in what may be termed an internal vortex action, and thereupon to be discharged through openings 86 in the upper wall portion 84 of the pump onto the lower side of the disc 56, the supply of water within the pump being continuously replenished through the lower opening 80. In the particular embodiment shown, the upper wall portion 84 of the pump in which the discharge openings 86 are located slopes outwardly so that the cores used in forming the openings during the molding of the pump may easily be withdrawn without interference with the underside of the disc 56.

The rotatable disc 56, or 56' is integral with the pump 54 and the hub 60 at the juncture thereof, and it extends outwardly therefrom horizontally above the liquid level 22. The disc includes a central frusto-conical portion 88 and an outer annular portion 90 joined integrally thereto and terminating in a circular outer rim or periphery 92. The frusto-conical portion defines a corresponding concavity 94 on the lower side or undersurface of the disc, and the pump discharge openings 86, it will be observed, are located substantially entirely within the concavity. By this construction, the water discharge from the pump 54 impinges on the undersurface of the concave portion, and a substantial portion of the water clings to the undersurface of the disc 56 rather than merely being thrown out below the disc.

When the pump unit is rotated, the water discharged upon the lower surface of the concave portion of the disc which clings or adheres to the disc, is conveyed by centrifugal force outwardly onto the flat lower surface of the outer annular portion 90 of the disc in a thin film which tends to decrease in thickness as the circumference becomes larger. As seen in the drawings, the maximum diameter of the frusto-conical concave portion 88 is substantially less than the diameter of the disc, and the planar outer annular portion 90 of the disc has an area several times the area of that portion of the disc occupied by the concave portion, with the result that the film of water becomes very very thin before it reaches the periphery 92 of the disc. When the film reaches the outer edge of the lower surface of the disc at the periphery 92 thereof, the water is sprayed outwardly, following which it impinges upon the screen 62. Because the film is very thin as it is sprayed outwardly upon the screen 62, much of the film is very efficiently broken up into a fine mist by the screen.

The screen 62, in the preferred embodiment illustrated, is a circular metal band which is arranged vertically in spaced relation to the disc 56, with the disc located approximately at the center of the height or width of the band. The screen is provided with a plurality of elongated narrow vertically arranged slots 96 extending therearound. The water spray from the disc is broken up by the screen into a fine mist which leaves outwardly therefrom, and larger droplets fall by gravity into the liquid in the reservoir.

In the embodiment of the pump and disc unit illustrated in FIGS. 5-7, flow channels 98 are provided which extend from the lower side to the upper side of the disc 56'. On the lower side, the channels terminate in radial inwardly widening grooves 100 (FIGS. 6 and 7) which extend from their intersections with the frusto-conical portion 88' to approximately the radial center of the disc, in the outer annular portion 90'. The channels terminate in radially outwardly extending grooves 102 (FIG. 5) on the upper side of the disc 56'. By this construction, the water discharged on the underside of the central disc portion 88' is in part conveyed through the channels 98 to the flat upper surface of the disc and to the outer edge thereof at the periphery 92 by centrifugal force. Water is thus sprayed outwardly both from the lower and from the upper outer edges of the disc at the periphery thereof. This construction substantially increases the output of the humidifier.

The construction so far described serves to produce a

5

substantial quantity of atomized water in the form of a fine mist and as water vapor within the humidifier. In order to draw air for humidification into the reservoir 14 through the louvers 52, to mix the air with the water particles, and to move the humidified air therefrom and through the openings provided by the vents 30 into the surrounding atmosphere, fan means are provided which comprise vertically arranged fan blades 53, or 53'. These blades are integral with the hub 60 or 60' and the upper side of the disc 56 or 56', and extend radially outwardly from the hub. When the unit is turned by the motor through the shaft 64, the fan blades rotate together with the pump and the disc. Air is thus moved outwardly from the center, in part passing through the slots 96 in the screen and in part flowing over the screen, the fan blades extending vertically upwardly somewhat above the screen. In the embodiment shown in FIGS. 5-7, the fan blades 53' are somewhat longer than in the embodiment of FIGS. 3 and 4, extending about to the radial center of the disc 56', to provide increased air flow corresponding to the increased atomization of this embodiment. It will be noted that the fan blades 53' terminate at about the radial distance of the channels 98 and are spaced medially thereof on the upper side of the disc, to permit unobstructed travel of the film of water on the surface.

In a preferred construction, the humidifier holds about two gallons of water. After filling the humidifier 10 with water up to the liquid level 22, just below the screen 62, operation is commenced simply by connecting an electrical cord 104 (FIG. 1) to a suitable electrical outlet, which energizes the motor. The centrifugal pump 54 draws water in at the base thereof through the inlet opening 80 and discharges the water through the opening 86, onto the undersurface of the frusto-conical portion 88, from whence the water is conveyed by centrifugal force to the outer periphery 92 of the disc. The spray from the disc is broken up by the slotted screen 62 into a fine mist and mixed with the air current produced by the fan blades 53. Larger droplets of water are separated from the moist air by the side walls of the vessel 14 and the end baffles 34, and a stream of air containing atomized water particles and water vapor leaves the humidifier through either or both of the flow channels provided between the baffles 34 and the end walls 36, and then through the openings formed by raising the vents 30 above the rim 38 of the vessel. The vents are raised or lowered to increase or decrease the output and to control the direction of flow of the moist air streams. The care and cleaning of the humidifier is very simple. It may be filled with ordinary tap water, and refilled when about empty. It is preferable to rinse the internal areas from time to time and between periods of use, but rinsing is not necessary when immediately refilled and used. The cover 16 and assembly thereon may be removed, as stated above, simply by removing the fastening screws 42. There is very little problem with deposits, and there will be only occasional need for cleaning the openings in the atomizing and mixing apparatus 20.

6

In this manner, the invention provides a very useful and reliable humidifier which is easy to use, economical, has a large capacity, and is lightweight and portable. Effective humidification takes place with no objectionable increase in room temperature and without settling of water particles on surrounding areas.

It will be apparent that various changes and modifications may be made in the construction and arrangement of the apparatus within the spirit and scope of the invention. It is intended that such changes and modifications be included within the scope of the appended claim.

I claim:

Apparatus adapted for use in a humidifier comprising, a vertically arranged rotatable tubular-walled impeller adapted on rotation thereof about its axis to pump water upwardly therethrough by internal vortex action, a horizontally arranged disc on said impeller and rotatable therewith about said axis, a central frusto-conical concave portion on the underside of said disc at the junction of said disc with said impeller, the maximum diameter of said frusto-conical concave portion being substantially less than the diameter of said disc, and the underside of said disc outwardly of said frusto-conical concave portion being substantially flat and planar and having an area several times the area of that portion of said disc occupied by said frusto-conical concave portion, means forming openings in the wall of said impeller immediately below its junction with said concave portion of said disc for discharging water from said openings in the impeller wall radially outwardly onto said frusto-conical concave portion, said openings being located substantially entirely within the concavity provided by said frusto-conical concave portion so that the water discharged from said openings impinges upon said frusto-conical concave portion, said disc being adapted when rotated to spray from the outer periphery of said underside thereof such of the water discharged onto said concave portion as adheres to said underside of said disc and travels outwardly therealong from said concave portion to said periphery during the rotation of said disc and said impeller, and fan blades on the upper side of said disc for mixing air with the spray and moving the resulting humidified air.

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