June 8, 1965 P. MYKLEBUST 3,188,007

HUMIDIFIER

Filed April 16, 1962 4 Sheets-Sheet 1

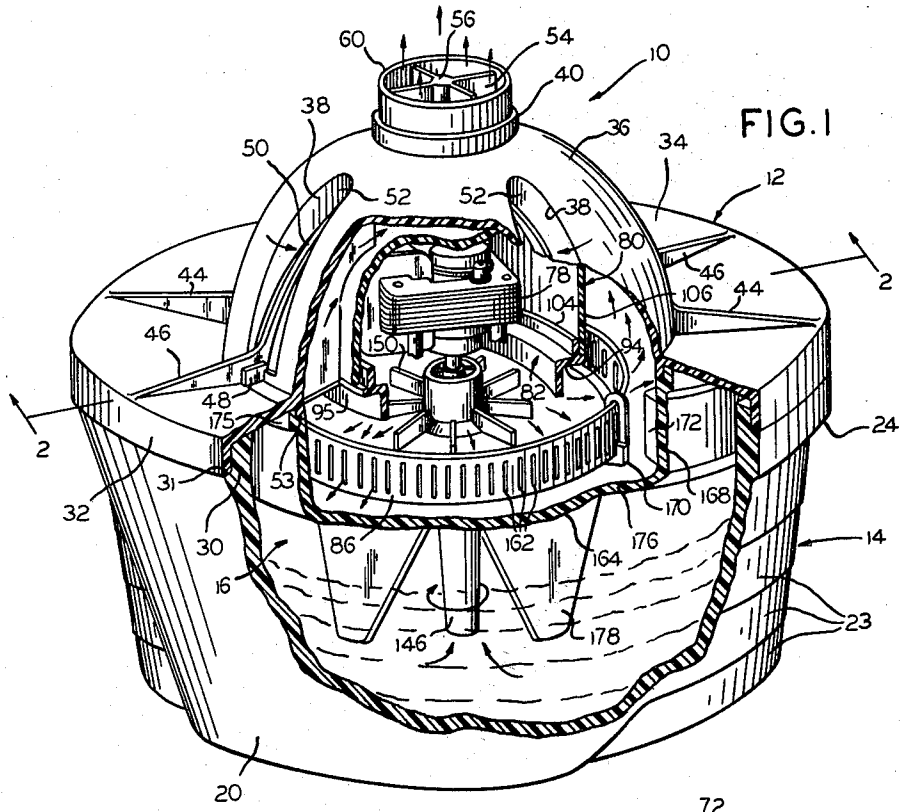


FIG. 1

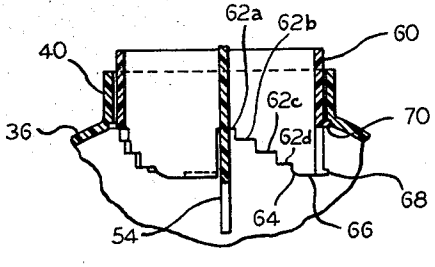


FIG. 11

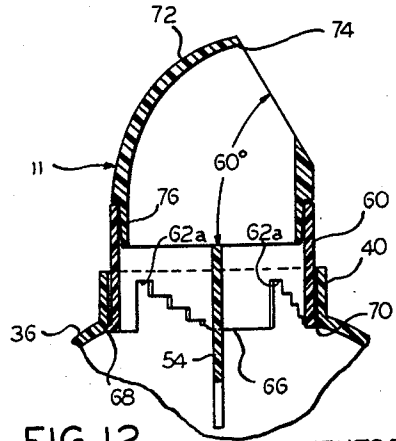


FIG. 12

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HUMIDIFIER

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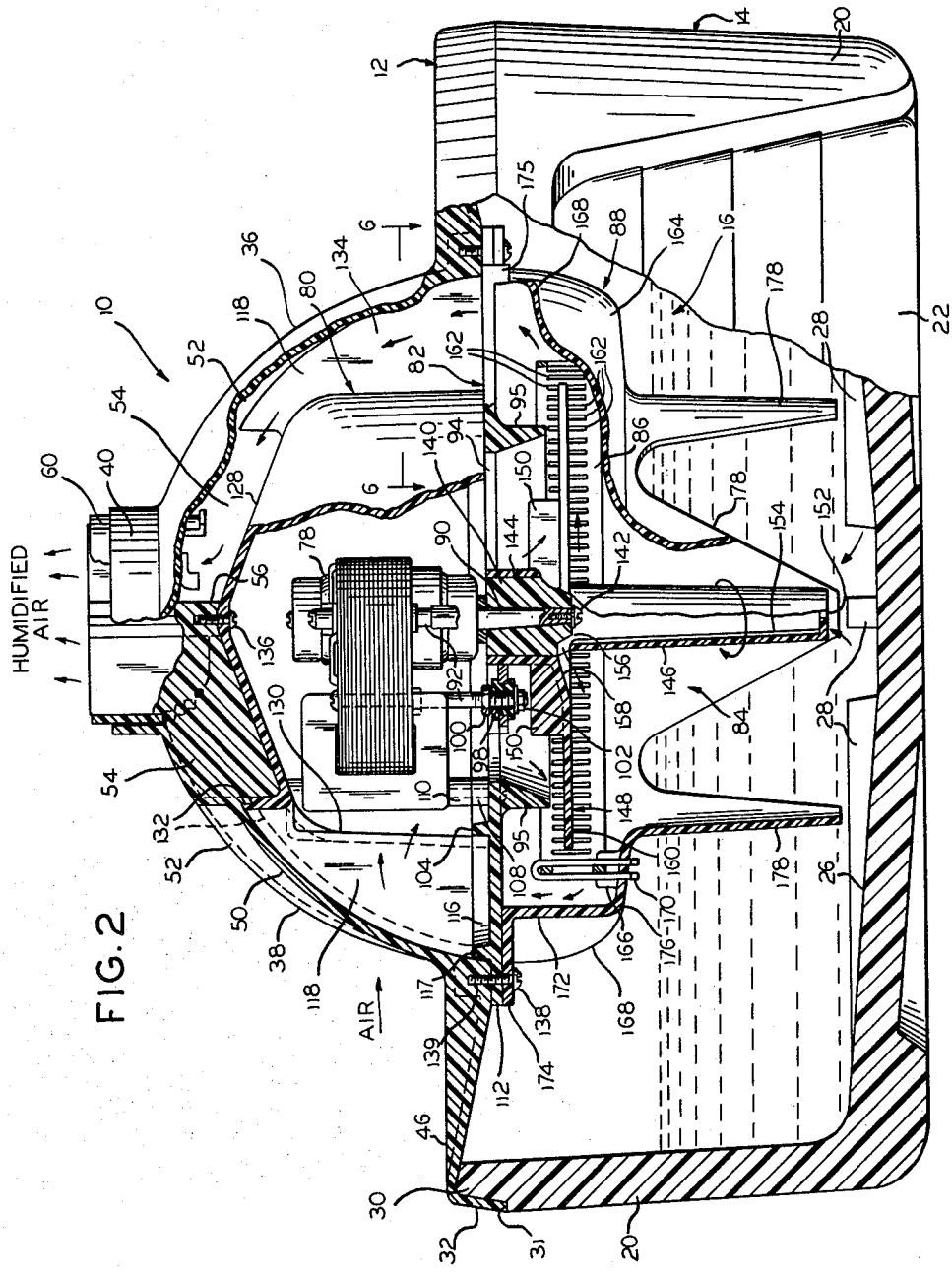


FIG. 2

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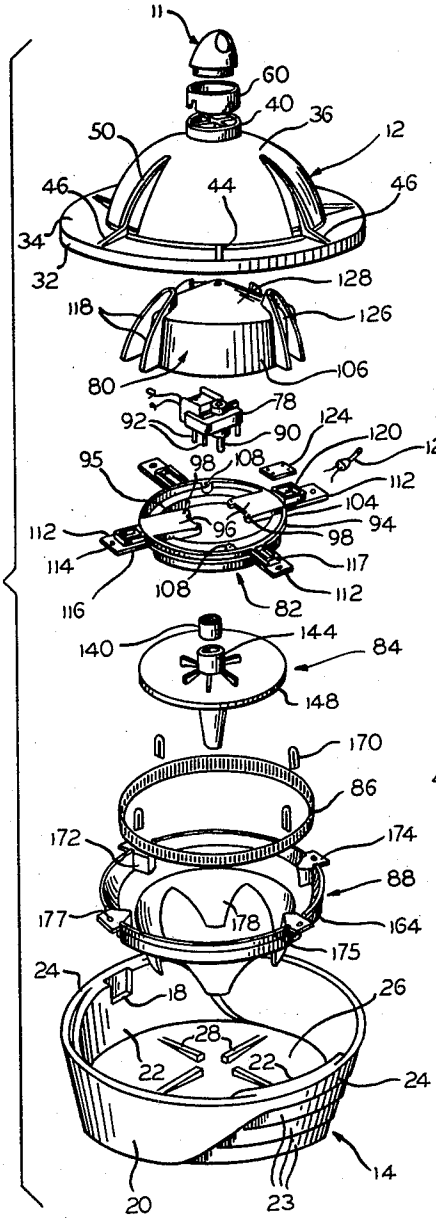
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HUMIDIFIER

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FIG.3



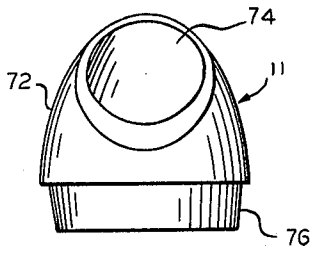


FIG.7

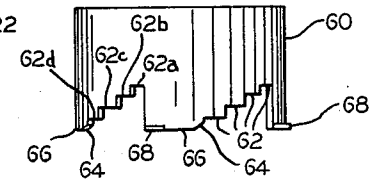


FIG.8

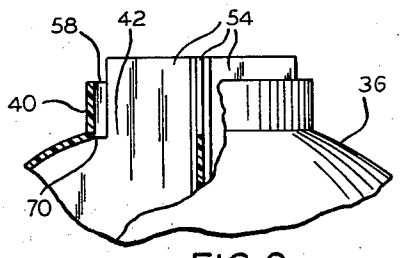


FIG.9

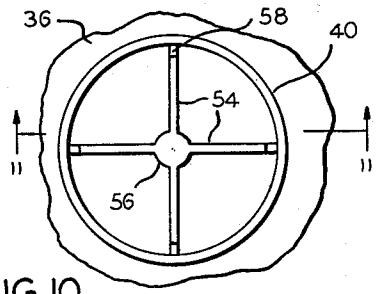


FIG.10

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HUMIDIFIER

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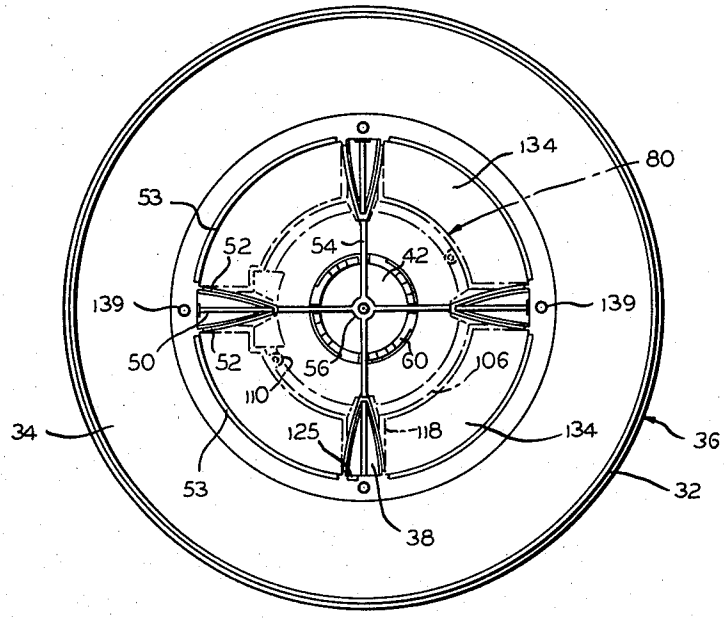


FIG. 4

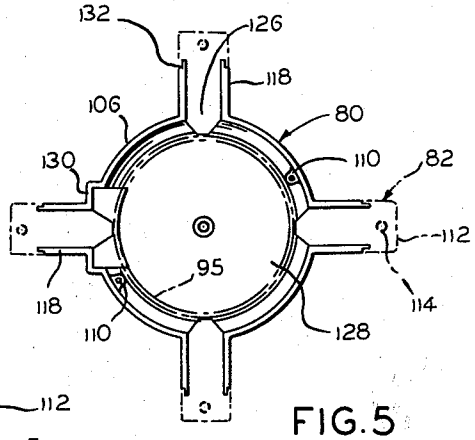


FIG. 5

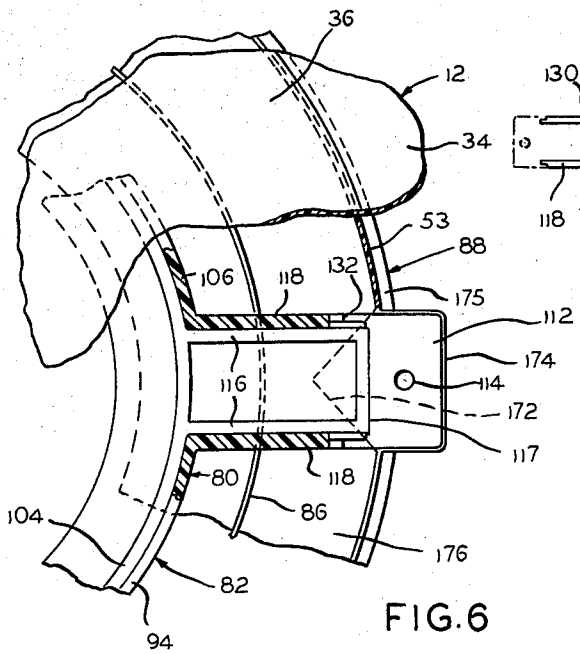


FIG. 6

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United States Patent Office

3,188,007
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3,188,007

HUMIDIFIER

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Filed Apr. 16, 1962, Ser. No. 187,695
8 Claims. (Cl. 239—215)

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.

The initial cost of both types of portable humidifiers has been relatively high. Additional disadvantages of the prior humidifiers include excessive weight and bulk, fragility, and inconvenience.

An important object of the present invention is to provide a heatless humidifier which avoids the prior disadvantages of the heat type and heatless type humidifiers. Although the humidifier of the present invention is electrically driven, it employs no heat in connection with its humidifying action. As a consequence, there is no danger of scalding involved in its use. Furthermore, objectionable operating noises are avoided, and its efficiency is substantially greater than the prior heatless type humidifiers.

Another important object is to provide a humidifier which supplies the large demand for a portable humidifier which is very economical, both in initial cost and in operation, and is light, shock-resistant, durable, convenient, usable in any desired location.

An additional object is to provide a portable room type

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humidifier which discharges fine mist-laden air into the surrounding atmosphere in quantities which may be varied from moderate to very substantial, and without fallout of water droplets.

A further object is to provide a portable humidifier which may be employed for humidification in the home, office, and the like, and which also finds important application as a vaporizer in the alleviation of respiratory conditions.

Another object is to provide a portable humidifier which, except for its motor, is constructed for the most part by molding plastic materials, and is thereby rendered safe, economical, lightweight, durable, sanitary and attractive. The humidifier includes a number of parts which perform several functions while being molded in one piece, thereby minimizing the number of parts required.

These and other objects, advantages and functions of the invention will be apparent on reference to the specification and to the attached drawings illustrating a preferred embodiment 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 side and top perspective view of the humidifier, with parts broken away and in section;

FIGURE 2 is a partly vertical sectional and partly elevational view with parts broken away, taken substantially on lines 2—2 of FIGURE 1;

FIGURE 3 is an exploded perspective view of the humidifier, on a reduced scale;

FIGURE 4 is a bottom plan view on a larger scale of the humidifier cover, and in phantom lines, a bottom plan view of the hood section of the motor housing as it is assembled with the cover;

FIGURE 5 is a bottom plan view of the hood section, and in phantom lines, a bottom plan view of the base section of the motor housing as it is assembled with the hood section;

FIGURE 6 is a fragmentary horizontal sectional view taken on line 6—6 of FIGURE 2;

FIGURE 7 is a side elevational view of a directional spout employed on the humidifier;

FIGURE 8 is a side elevational view of the regulator ring in the humidifier;

FIGURE 9 is a fragmentary elevational and sectional view of the top of the humidifier, illustrating the discharge nozzle and guide vanes thereat;

FIGURE 10 is a top plan view of the structure shown in FIGURE 9;

FIGURE 11 is a vertical sectional view taken on line 11—11 of FIGURE 10, and also illustrating the regulator ring shown in FIGURE 8 mounted in one of its positions in the nozzle; and

FIGURE 12 is a view like FIGURE 11, with the regulator ring in another position and with the addition of the spout of FIGURE 7, shown in section.

The invention provides a portable humidifier which includes a water reservoir, a cover having air outlet means, and humidifying apparatus preferably mounted on the cover. In the preferred construction, the humidifying apparatus includes a motor, and a motor housing defining with the cover a flow path therebetween which communicates with the air outlet means. The humidifying apparatus also includes a water pump driven by the motor, spray means in the form of a rotatable disc driven by the

motor, the pump being arranged to discharge water on the disc for spraying the water therefrom and thereby humidifying air in the humidifier, and means for moving the humidified air through the said flow path to the air outlet means. Adjustable means are provided on the humidifier for regulating the amount of humidified air discharged from the air outlet means. The invention further embodies several additional features of construction and arrangement of the parts of the humidifier, as will be apparent from the description which follows.

Referring to the drawings, and particularly FIGURES 1–3, a preferred embodiment of the portable room type humidifier is generally indicated by the number 10. The humidifier includes a circular reservoir or vessel 14, a cover 12 seated on the reservior to close it, and humidifying apparatus generally designated by the number 16, which is mounted on and suspended from the cover to extend into the reservoir. A directional spout 11 may be mounted on the humidifier and is detachable therefrom (see also FIGURES 7 and 12).

In the preferred construction, the reservoir 14 is a one-piece expanded plastic construction, produced by expanding polystyrene beads in a mold, for example. The resulting construction is exceptionally light in weight, and does not chip, crack, break or peel. A recess bordered by a lower ledge 18 (FIGURE 3) is formed on the inner upstanding side wall of the reservoir, and the ledge serves to indicate the proper level for filling the reservoir with water, as illustrated in FIGURES 1 and 2. A preferred large capacity, versatile and adaptable construction according to the invention has a capacity of one and one-half gallons of water.

The side wall of the reservoir 14 includes a pair of diametrically opposed outwardly protruding sections 20, and a pair of inwardly protruding sections 22 overlapping the former sections and disposed between them in diametrically opposed relation. The outer surfaces between the protruding sections 20 are stepped down to provide integral horizontal band sections 23 extending between the protruding sections. Two handle portions 24 extend outwardly along the top of the side wall on opposite sides thereof, and they extend between and are integral and flush with the outwardly protruding sections 20. The upper rim 30 of the reservoir is provided with an outer peripheral recess 31, which inclines inwardly. The reservoir has a base or bottom 26 which is slightly concave on its inner side, as will be seen especially in FIGURE 2. Four reinforcing ribs 28 extend upwardly from the inner side of the base and are disposed radially therearound at equal angles, terminating short of the center of the base. The reservoir as thus constructed is very strong and durable.

The cover 12 preferably is constructed in one piece of high impact plastic such as polystyrene or other equivalent plastic material. It includes a central semi-spherical dome section 36, a concave annular plate section 34, joined therearound, and a depending outwardly inclined peripheral band or flange 32 around the plate section. The band 32 is received in the recess 31 on the reservoir rim 30 when the humidifier is assembled. The cover then is supported on and fits snugly around the rim, so that air passage at the juncture is prevented.

The dome section is provided with four upwardly extending elongated air intake openings 38 which extend from points adjacent to the plate section 34 to points spaced from the top of the dome, and which are spaced equiangularly around the dome. A cylindrical tubular vertical air outlet nozzle 40 is integral with the dome section at the top thereof, around an air outlet or discharge opening 42 (FIGURES 4 and 9) in the dome section.

As seen in FIGURES 1 and 3, a plurality of upstanding reinforcing ribs are disposed radially and equiangularly around the upper surface of the cover 12. Four of the ribs, numbered 44, are integral with the plate section 34, and with the dome section 36. Four additional ribs, numbered 46, alternate with the ribs 44, and they extend to the centers of the air inlet openings 38. At this point, each rib is supported at its sides by integral enlargements 48. The ribs 46 are integral with louvers 50, which extend for the length of the inlet openings and bisect them.

The air inlet openings 38 are bordered by pairs of inwardly extending walls 52 (see also FIGURE 4) which provide internal guide vanes and also serve as conduit walls, as explained subsequently. Four arcuate mounting flanges 53 depend from the cover at the juncture of the dome and plate sections, and they terminate adjacent to the air inlet openings 38 and the walls 52. The walls for each opening converge at their upper extremities and integrally merge into internal upper guide vanes and spacers 54 at the top of the dome section 36. These vanes are four in number and intersect at right angles at the center of the air outlet opening 42, where they are integral with a cylindrical vertical hub 56. The vanes and the hub further extend upwardly in and through the nozzle 40, projecting thereabove. As seen especially in FIGURE 9, the vanes 54 are recessed or spaced inwardly from the inner wall of the nozzle 40, leaving a recess 58 between each vane and the nozzle.

A regulator ring or tube 60 (FIGURE 8) is mounted within the nozzle 40, being received within the recesses 58 and seated on the guide vanes 54, as shown particularly in FIGURES 2, 11 and 12. The ring is provided with four recesses 62 of varying depth in each of the four quadrants or sections around its lower end. The individual recesses are lettered *a–d*. A bevel 64 is provided adjacent the bottom edge 66 in each section. A slightly outwardly extending retaining flange 68 is formed at the bottom edge 66 in each section.

The regulator ring 60 may be placed in any one of five positions by manual turning of the upper or outer end thereof, which projects above the nozzle 40 in all positions. The innermost position of the ring is illustrated in FIGURE 11. In this position, the vanes 54 are received in the recesses 62*a* of the greatest depth, whereby the four recessed sections of the ring extend below the nozzle into the spaces between the vanes to a maximum extent and reduce the cross-sectional area of the flow paths therebetween to a minimum. The position of the ring is adjusted by lifting and turning the ring. Thus, the ring may be turned so that the vanes 64 are received successively within the recesses 62*b*, 62*c*, and 62*d*, and then so that the lower edge 66 is seated on the vanes. With each increment of turning, the ring 60 is moved upwardly and outwardly a distance equal to the reduction in depth of the adjoining recess, thus withdrawing the ring sections from between the vanes 54 a corresponding amount and increasing the effective areas of the flow paths therebetween. In moving the ring to its outermost position, illustrated in FIGURE 12, the bevels 64 move on the edges of the vanes 54 and wedge the ring in position with its edges 66 on the vanes. The ring is held by means of the retaining flanges 68 received in a recess 70 in the dome and encompassing the outlet opening 42. The minimum rate of flow from the humidifier occurs with the regulator ring in the position of FIGURE 11, and it is about one-half of the maximum rate of flow in the preferred embodiment, which takes place with the ring in the position of FIGURE 12.

The vanes 54 are arranged to provide unidirectional vertical flow therebetween and from the nozzle 40. The directional spout 11 is provided for the purpose of changing the direction of flow, and it may direct the flow at an angle of 30 degrees from the horizontal, for example. The spout includes a rounded body section 72 which terminates at its outer end in a discharge opening 74. A rim 76 of reduced external diameter is integral with the inner end of the body and is received within the regulator ring 60. The spout is seated on the upper ends of the vanes 54, and it is rotatable thereon for 360 degrees to direct the flow in any desired direction. In the illus-

trative embodiment, the spout 11 is designed for use with the regulator ring 60 in its outermost position shown in FIGURE 12. The outer surface of the spout rim 76 tapers inwardly from the body 72 to the outer edge, so that the spout is wedged within the ring 60 and held firmly in place.

Referring to FIGURES 1–3, the humidifying apparatus 16 includes an electric motor 78, and a plastic motor housing including a one-piece hood section 80 and a one-piece base section 82. A suitable plastic for constructing the housing is a phenol-aldehyde condensation resin. The apparatus also includes a one-piece plastic spraying and mixing assembly 84, which may be constructed of high impact polystyrene, for example. A grid or screen 86 encircles the assembly 84, and it is desirably constructed of metal but may be constructed of other materials. The apparatus further includes a one-piece reflector pan and leg assembly 88, which may be constructed of high impact polystyrene.

The motor 78 includes a depending drive shaft 90 and four depending mounting legs 92. The base 82 includes a circular ring portion 94, and an integral depending annular wall 95. Two mounting ledges 96 are integral with the ring and wall, and extend inwardly from opposite sides thereof. Each ledge is provided with a pair of openings 98 which receive threaded lower ends of the motor mounting legs 92, being secured by upper and lower nuts 100 and 102, as seen in FIGURE 2. An upstanding circular flange 104 is integral with the ring 94, and an upstanding wall 106 of the hood section 80 is received therearound (FIGURES 1 and 6). Apertured bosses 108 (FIGURES 2 and 3) are provided adjacent to the flange 104 on the base section 82. They register with internally threaded bosses 110 (FIGURES 2 and 5) on the hood section 80, for securing the base section and the hood section together by means of screws inserted from beneath the ring 94.

Four integral mounting arms 112 extend radially from the base ring 94 at angles of 90 degrees to each other, and each is provided with a mounting opening 114 (see FIGURE 6). Three of the arms are also provided with two parallel upstanding side flanges 116 which fit between the lower ends of one of four pairs of guide vanes 118 on the hood section 80. Each of the three arms also has a curved end flange 117 which nests within the dome section 36, as seen in FIGURE 2. The fourth arm 112 has an integral upstanding casing 120 (FIGURE 3) thereon which receives an electrical cord 122 for connection to a source of power, and is closed by a lid 124. The casing nests within a pair of guide vanes 118 and the hood section 80 similarly to the flanges 116 and 117. The cord 122 is inserted through an opening in a recessed wall portion 125 (FIGURE 4) at the base of the dome section.

The side wall 106 of the hood section 80 is substantially cylindrical, with four equidistantly spaced wedge-shaped openings 126 (FIGURES 3 and 5) therein extending from the lower edge to a shallow conical top wall 128. An enlarged section 130 is formed in the side wall 106 at one of the openings 126, and it extends into the top wall 128. The enlargement accommodates the particular motor 78 employed in the illustrative embodiment.

Each of the hood section openings 126 is bordered on opposite sides by one of the four pairs of upstanding guide vanes 118, which converge and unite above the top wall 128. The outer edges of the vanes are provided with grooves 132 (FIGURES 2, 5 and 6) which form rabbet joints with the corresponding construction along the inner edges of the inwardly extending walls 52 on the dome section 36. The two hood guide vanes 118 in each pair unite at their upper extremities, and they abut one of the dome guide vanes 54 where the dome walls 52 merge into the latter (see FIGURES 2 and 4). Each dome vane also extends down to the surface of the hood top wall 128. The advantages of the invention also may be achieved by other constructions and arrangements of the respective walls and guide vanes, which preferably are integral with one member of the hood and dome sections.

In this manner, the space between the hood section 80 and the dome section 36 is divided into four flow compartments 134 of substantially equal size, corresponding to the four quadrants of the dome. Each compartment is bordered on one side by a dome wall 52 and an abutting hood guide vane 118 of one pair of walls and a corresponding pair of vanes, and on the other side by a wall and vane of an adjacent pair of each, and on the respective sides by two corresponding dome vanes 54. The compartments extend convergingly from the base of the hood section 80 up to the air outlet opening 42, to provide four flow paths therebetween. The dome vanes 54 and the regulator ring 60 further define corresponding flow paths through the nozzle 40, between the outlet opening the outer end of the ring.

The hood section 80 is centered and held in the dome section 36 by a screw 136 (FIGURE 2) which extends through an opening at the top of the hood top wall 128 and is received in a suitable threaded opening in the base of the hub 56. As previously noted, the base section 82 of the housing is secured to the hood section 80, with the motor 78 mounted on the base and enclosed by the hood. The arms 112 of the base section are connected to the underside of the plate section 34 of the cover by means of screws 138 (FIGURE 2) which extend through the openings 114 in the arms and into corresponding threaded openings 139 formed at the base of each of the cover ribs 46. The arms are received between the ends of the mounting flanges 53 depending from the cover.

With the housing and dome section thus assembled, four air inlet conduits or passages are formed between the air inlet openings 38 in the dome section and the air inlet openings 126 in the hood section, by the pairs of inwardly projecting dome walls 52 and the adjoining outwardly projecting hood guide vanes 118. The air inflow is represented by arrows at the left in FIGURE 2. Air is supplied exclusively to the humidifier 10 through the four conduits, and the air cools the motor 78 continuously during operation. The air flow to the reservoir 14 is down through the center of the housing ring 94 and the depending wall 95, which define an air outlet opening in the housing.

As seen in FIGURE 2, a bushing 140 is secured to the motor shaft 90 by a screw and washer combination 142. The spraying and mixing assembly 84 is mounted on the bushing, by force fitting or other suitable means, so that the assembly is driven by and rotates with the shaft. The assembly includes a tubular hub 144 frictionally mounted on the bushing, an integral depending centrifugal water pump 146, an integral circular spray disc 148 extending horizontally where the hub and the pump join, and a plurality of upstanding radial fan blades 150 integral with the central top surface of the disc and the outer side of the hub where they join. The circular grid or screen 86 surrounds the disc 148 and is spaced therefrom, with the disc disposed medially of the vertical dimension of the grid. The pump and disc construction of the spraying and mixing apparatus is claimed in my co-pending application Serial No. 119,659, filed June 26, 1961, now Patent No. 3,110,748, issued November 12, 1963.

The water pump 146 is constructed as a frusto-conical tubular impeller having a central bottom opening 152 of reduced diameter and three longitudinal ribs 154 spaced equiangularly around the upwardly and outwardly inclined inner wall of the pump. Three discharge openings 156 are formed at the top of the pump, one between each pair of ribs 154, for discharging water on a concave frusto-conical under surface 158 of the disc 148. When the pump is driven by the motor, water enters the

inlet opening 152 and is conveyed by centrifugal force to the discharge openings 156. The water travels by centrifugal force from the sloping inner section 158 of the rotating disc to a horizontal flat outer annular section 160, in a stream or film of decreasing thickness on the disc. When the water reaches the outer periphery of the disc, it is sprayed therefrom against the grid 86. The grid is constructed as a circular band having a plurality of vertically elongated openings 162 in spaced apart relation therearound. When the water spray impinges on the grid, it is atomized into a fine mist. The directions of movement of the water and spray are represented by arrows in FIGURE 2.

When the assembly 84 is rotated by the motor 78, the rotating fan blades 150 draw air into the motor housing, and the air is directed by the depending housing wall 95 onto the blades and the central portion of the disc 148. The air is moved by the fan blades in the direction of the grid 86 and through the openings 162 thereof. The air mixes with the water mist and vapor, and is thereby humidified.

The spraying and mixing assembly 84 and the grid 86 are surrounded by the pan and leg assembly 88. The latter assembly includes an annular dish-shaped reflector pan or bowl 164 having a bottom wall 176 and a plurality of integral upstanding grooved mounting lugs 166 therearound. The grid 86 is mounted on the lugs in the grooves thereof, and is spaced inwardly from an outer upstanding side wall 168 and upwardly from the bottom wall 176 of the pan. The grid is secured in place by inverted U-shaped clips 170, which extend through openings in the bottom wall and are bent thereon to hold them in place.

Four V-shaped inward protrusions or deflectors 172 are formed in the side wall 168, at angles of 90 degrees to each other around the pan. Outwardly extending mounting flanges 174 are integral with the protrusions at their upper extremities. Four arcuate rim sections 175 surmount the side wall and are outwardly offset therefrom. They terminate at the mounting flanges.

The pan and leg assembly 88 is mounted on the cover 12 beneath the motor housing base 82. The protrusions 172 and the mounting flanges 174 on the assembly are aligned with the arms 112 of the motor housing base. The flanges are secured to the cover by the screws 138 extending through openings 177 in the flanges, which register with the arm openings 114 and the cover openings 139 (see FIGURES 2–6). The rim sections 175 receive the depending cover flanges 53 in close fitting relation within them, as seen in FIGURES 1 and 6.

The protrusions 172 and the walls 168 and 176 of the pan 164 together form four flow channels which are aligned or register with the flow compartments 134 between the hood section 80 and the dome compartment 36. By this construction, the humidified air is directed to the flow compartments 134, as illustrated by the arrows in FIGURE 2. The humidified air is moved upwardly in the compartments, and the construction provides curvilinear flow while minimizing turbulence. The humidified air flows in the compartments formed between the upwardly projecting portions of the dome vanes 54 and the regulator ring 60, and out of the nozzle 40 in substantially unidirectional streams which merge into a substantially vertical stream of fine mist-laden air.

Referring especially to FIGURES 1 and 2, the annular bottom 176 of the reflector pan 164 slopes downwardly and inwardly, and is integral with four spaced apart depending triangular legs 178. The sloping bottom serves to return to the reservoir 14 water droplets which collect in the pan, and the legs serve as return guides for the water. The legs extend downwardly for a slightly greater distance than does the pump 146, to provide a stand for the assembled humidifying apparatus 16 and cover 12 while protecting the pump from damage. With the humidifier assembled as shown, the pump and the legs are spaced slightly above the reservoir bottom ribs 28. The pump is capable of utilizing substantially all of the water in the reservoir for humidification, leaving only a small quantity in the center of the bottom 26.

As humidified air flows through the compartments 134 between the hood section 80 and the dome section 36, entrained water droplets may settle in the compartments. The hood section 80 and the base section 82 of the motor housing have outer surfaces contoured for the flow of water onto the upper surface of the outer annular section 160 of disc 148. Thus, water droplets flow down the housing top wall 128, down the side wall 106, under the ring 94, and down the depending base wall 95, from which they drop onto the disc. The return water is sprayed from the upper surface of the disc in the same manner as from the lower surface. This construction increases the operating efficiency of the humidifier.

In use, the reservoir 14 is supplied with water while the cover 12 is removed. Water is filled to the ledge 18, so that the liquid level is approximately as illustrated in FIGURES 1 and 2, a short distance below the bottom 176 of the reflector pan 164. The cover 12 and the humidifying apparatus 16 mounted thereon may be supported on the legs 178 while the reservoir is being filled. Thereafter, the cover is seated on the rim 30 of the reservoir, providing a tight closure. The humidifier may be carried by grasping the handles 24, and it is placed in a convenient location resting on the bottom 26. The electrical cord 122 is connected to a convenient source of electrical current, such as a wall outlet, whereupon the humidifier operates to produce and discharge humidified air.

The maximum quantity of humidified air is discharged with the regulator ring 60 in its uppermost position illustrated in FIGURE 12. This setting is recommended for initial operation when the air is very dry. The output subsequently may be adjusted to provide the desired relative humidity by turning the regulator ring so that the vanes 54 are received in one of the recesses 62*a–d*. Such adjustment moves the regulator ring increasingly into the several flow compartments 134 and successively reduces the cross-sectional areas of the flow paths therein adjacent the outlet 40. The discharge of humidified air is reduced to about one-half of the maximum when the regulator ring is in its lowermost position illustrated in FIGURE 11. If it be desired to change the direction of flow from the normally upward vertical flow, the spout 11 is inserted in the regulator ring 60 in the manner illustrated in FIGURE 12. The spout may be turned in any desired direction.

A small amount of water may remain in the reservoir 14 when humidification ceases. Preferably, the unit is rinsed out and wiped clean after use. It may continue to run when empty without damage to the unit, in which case it will continue to circulate air in the room.

The motor 78 is permanently lubricated and requires no special care. Tap water may be used in the humidifier with very little problem of deposits, there being only occasional need for cleaning the openings in the spraying and mixing assembly 84 and in the grid 86, the latter being to a large extent self-cleaning.

In this manner, the invention provides a very useful, reliable and economical humidifier which is easy to use, has a large capacity, runs quietly, and is lightweight and portable. Effective humidification takes place safely with no objectional 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 parts of the humidifier within the spirit and scope of the invention. It is intended that such changes and modifications be included within the scope of the appended claims.

I claim:

1. A portable humidifier comprising, in combination, a water reservoir; a cover therefor; an air outlet nozzle on said cover; humidifying apparatus mounted on said cover and including a motor, a motor housing defining with said cover a flow path therebetween communicating with said outlet nozzle, a water pump driven by said motor, a rotatable disc driven by said motor, said pump being arranged to supply water from said reservoir to said disc for spraying the water from the outer periphery of the disc when rotated and thereby humidifying air in the humidifier, and means for moving the humidified air through said flow path to said outlet nozzle; and a regulator tube mounted adjacent said outlet nozzle to extend into said flow path adjustably for external manual manipulation to vary the area of said flow path and thereby regulate the amount of humidified air discharged from the nozzle.

2. A portable humidifier comprising, in combination, a water reservoir; a cover therefor including a dome section; an air outlet nozzle on top of said dome section; humidifying apparatus mounted on said cover and including a motor, a motor housing mounted in said dome section and spaced therefrom to define flow paths between the housing and dome section disposed therearound and converging to said outlet nozzle, a water pump driven by said motor, a rotatable disc driven by said motor, said pump being arranged to supply water from said reservoir to said disc for spraying the water from the outer periphery of the disc when rotated and thereby humidifying air in the humidifier, and means for moving the humidified air through said flow paths to said outlet nozzle; guide vanes disposed between said motor housing and said dome section and defining said flow paths to discharge a substantially unidirectional stream of humidified air from said outlet nozzle; and a regulator tube mounted within said outlet nozzle and adjustably movable into said flow paths by external manipulation to vary the areas thereof and thereby regulate the amount of humidified air discharged from the nozzle.

3. A humidifier as defined in claim 2 and including a grid surrounding said disc for atomizing the water spray, a reflector pan around said grid and directing the flow of humidified air to said flow paths, and legs integral with said pan for supporting thereon said cover and humidifying apparatus when separated from said reservoir, and providing return guides to said reservoir for water that settles in said pan.

4. A portable humidifier comprising, in combination, a one-piece plastic reservoir; a one-piece plastic cover therefor including a dome section and having air inlet openings disposed around said dome section; a plastic air outlet nozzle on top of said dome section and integral therewith; humidifying apparatus mounted on said cover and including a motor, a plastic motor housing mounted in said dome section and including a one-piece hood section and a one-piece base section, said hood section being spaced from said dome section to define flow paths between the sections disposed therearound and converging to said outlet nozzle, and a one-piece plastic construction of a water pump, a rotatable disc thereon, and fan blades on said disc, driven together by said motor, said pump being arranged to supply water from said reservoir to said disc for spraying the water from the outer periphery of the disc when rotated; a grid surrounding said disc for atomizing the water spray; a one-piece plastic construction of a reflector pan around said grid, and legs for supporting thereon said cover and humidifying apparatus when separated from said reservoir, and providing return guides to said reservoir for water that settles in said pan; said fan blades mixing air with the water spray and moving the resulting humidified air through said flow paths to said outlet nozzle, said pan directing the flow of humidified air to said flow paths; said housing being adapted to convey to said disc water that settles on the housing during flow of humidified air through said flow paths; plastic guide vanes disposed between said hood section and said dome section and extending into said outlet nozzle, integral with one of said hood and dome sections, and defining said flow paths to discharge a substantially unidirectional stream of humidified air from said outlet nozzle, said guide vanes also providing conduits between said air inlet openings and the interior of said hood section for conducting the air input to the humidifier through said housing; and a plastic regulator tube mounted within said outlet nozzle and adjustably movable between said guide vanes by external manual manipulation to vary the areas of said flow paths and thereby regulate the amount of humidified air discharged from the nozzle.

5. In a portable humidifier including a cover having an air outlet opening and humidifying apparatus spaced from said cover to define flow paths therebetween and adapted for supplying humidified air for movement thereof through said flow paths to said outlet opening, guide vanes disposed between said cover and said humidifying apparatus and defining said flow paths, and a regulator tube mounted within said outlet opening and adjustably movable into said flow paths by external manual manipulation to vary the areas of said flow paths and thereby regulate the amount of humidified air discharged from the outlet opening.

6. In a portable humidifier including a cover having an air outlet opening and humidifying apparatus spaced from said cover to define flow paths therebetween and adapted for supplying humidified air for movement thereof through said flow paths to said outlet opening, an air outlet nozzle surrounding said outlet opening, converging guide vanes defining said flow paths disposed between said cover and said humidifying apparatus and intersecting at said outlet opening, and a regulator ring mounted within said outlet nozzle and seated on said guide vanes, said regulator ring having recesses of varying depth for adjustable seating on said guide vanes with ring portions of varying depth extending between the guide vanes, to vary the areas of said flow paths and thereby regulate the amount of humidified air discharged from said outlet nozzle.

7. In a portable humidifier including a cover having a dome section and an air outlet opening in the top of the dome section, and humidifying apparatus in said dome section and spaced therefrom to define flow paths therebetween, and adapted for supplying humidified air for movement thereof through said flow paths to said outlet opening, an air outlet nozzle surrounding said outlet opening and integral with said dome section, converging guide vanes defining said flow paths disposed between said dome section and said humidifying apparatus, integral with said dome section, intersecting at said outlet opening, and extending into said outlet nozzle, and a regulator ring mounted within said outlet nozzle and seated on said guide vanes, said regulator ring having recesses of varying depth for adjustable seating on said guide vanes with ring portions of varying depth extending between the guide vanes, to vary the areas of said flow paths and thereby regulate the amount of humidified air discharged from said outlet nozzle.

8. A portable humidifier comprising, in combination, a water reservoir; a cover for said reservoir having an air inlet opening therein; an air outlet nozzle on said cover; humidifying apparatus including a motor, a motor housing covering said motor and defining with said cover flow paths therebetween communicating with said outlet nozzle, said housing having an air inlet opening and an air outlet opening therein for conducting air therethrough in direct heat exchange relationship with said motor, a water pump driven by said motor, centrifugal spray means driven by said motor, said pump being arranged to supply water from said reservoir to said spray means for spraying the water therefrom and thereby humidifying air in the humidifier, and means communicating with said

housing outlet opening for moving the humidified air through said flow paths to said outlet nozzle; and guide vanes disposed between said housing and said cover and defining said flow paths, said guide vanes also providing a conduit between said cover inlet opening and said housing inlet opening for conducting the air input to the humidifier through said housing to cool said motor.

References Cited by the Examiner

UNITED STATES PATENTS

1,190,386	7/16	Dickerson	239—215
2,047,025	7/36	Gilbert	261—91
2,176,174	10/39	Gelakoski	239—215
2,226,128	12/40	Harmon	55—230
2,554,867	5/51	Mills	261—91
2,874,797	2/59	Flury	239—215
2,891,731	6/59	Huber	239—215
2,974,580	3/61	Zimmerman et al.	239—579

FOREIGN PATENTS

523,157	3/56	Canada.
469,854	8/37	Great Britain.

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