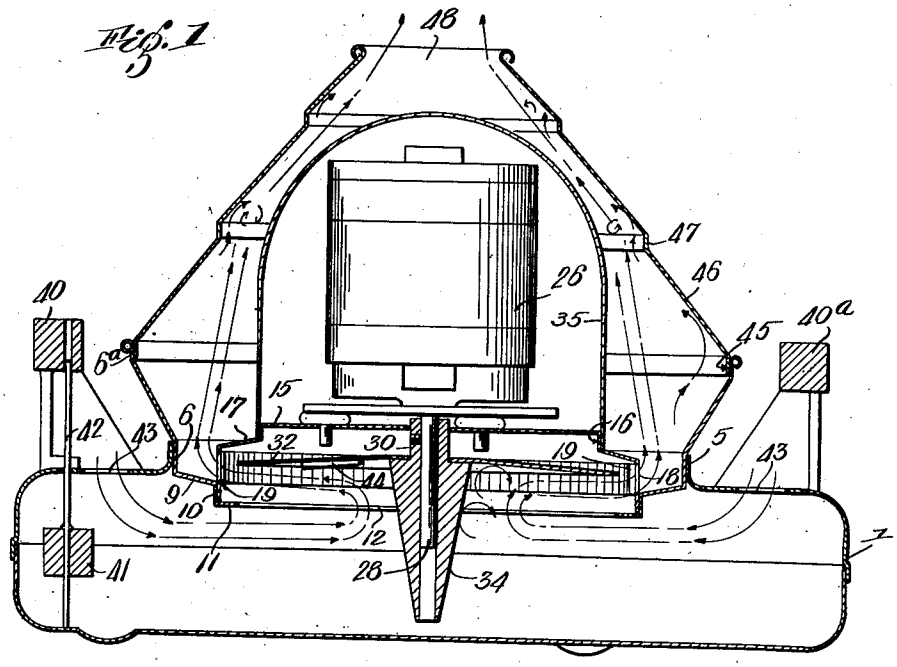
July 28, 1931. B. M. MILLS 1,815,951

AIR MOISTENER

Filed Sept. 6, 1929

Fig. 1



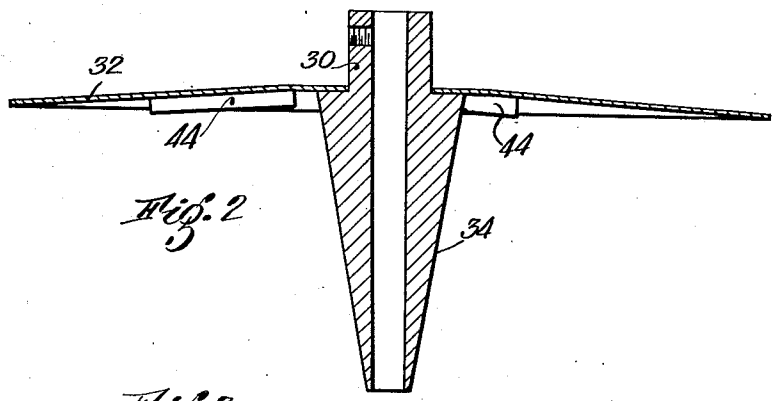
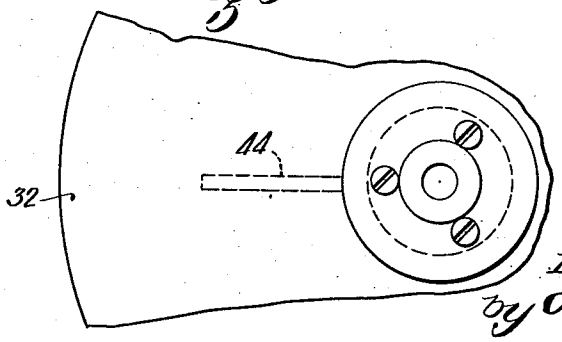


Fig. 2

Fig. 3



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UNITED STATES PATENT OFFICE

BERTRAM M. MILLS, OF PAWTUCKET, RHODE ISLAND

AIR MOISTENER

Application filed September 6, 1929. Serial No. 390,711.

This invention pertains to air moisteners or humidifiers, such as are used for moistening the air in dwellings, offices, industrial establishments, or other enclosures, and relates more particularly to improved means for bringing water and air into intimate contact in such a way as efficiently and rapidly to load an air current substantially to the saturation point with finely divided water but without spattering or wetting down the surroundings. Additional features of utility and novelty, particularly applicable to a device of portable type, will be pointed out at length in the appended detailed description and by reference to the acccompanying drawings, wherein one preferred embodiment of the invention is illustrated by way of example.

In the drawings:

Fig. 1 is a diametrical vertical section showing the invention as embodied in a portable humidifier;

Fig. 2 is a vertical section to larger scale, showing details of the water lifting element and atomizing disc; and Fig. 3 is a fragmentary plan view of the parts shown in Fig. 2.

The present invention is illustrated as embodied in a humidifier of the general type described in the patents to Mills, No. 1,439,319, December 19, 1922; No. 1,537,650, May 12, 1925; and No. 1,604,295, October 26, 1929, to which reference may be had for a more detailed disclosure of certain of the structural features.

As in the arrangement illustrated in Patent No. 1,604,295, the present apparatus may conveniently comprise a pan, dish or other receptacle 1 of suitable shape (here shown as substantially flat-bottomed) and usually made from sheet metal, although any other desirable substance, for example glass or ceramic material, may be used. The upper wall of the receptacle preferably comprises a substantially vertical flange 5 which defines a top opening of large diameter within which a retaining ring 6 fits snugly. This ring 6 is held in place detachably, if desired, in any suitable manner, as illustrated for example in my patent just referred to. Preferably the ring 6 is furnished with an inwardly and downwardly inclined flange 9 having a vertical flange 10 at its inner edge which terminates in a substantially radial, annular, supporting flange 11 defining a large central opening 12. The upper part of ring 6 preferably flares outwardly and upwardly, and as here illustrated terminates in a substantially vertical rim 6^a having a rolled edge.

A cover member 15 is arranged concentrically with relation to the ring 6, said cover comprising a substantially flat top having a depending marginal flange 16 terminating in an outwardly and downwardly inclined flange 17 which is provided at its edge with a vertical rim 18. This rim 18 is slitted vertically and the metal intervened between the slits is bent angularly to provide the atomizing vanes 19. The lower ends of these vanes (or the lower edge of rim 18 if the slits do not extend to the bottom of the latter) rest upon the flange 12, fitting snugly within the flange 10 so that the cover 15 is supported in concentric relation to the flange 6. The cover is provided with a central opening for the vertical shaft 28 of a motor 26 supported upon the cover (preferably with capability for self-centering, as disclosed in my aforesaid Patent No. 1,604,295). This shaft carries the rotating atomizing device (Figs. 1, 2, and 3) preferably comprising a hub 30 secured to the shaft in any desired manner, and carrying the dispersing or atomizing disc 32. This disc is preferably of a diameter closely approximating that of the vaned ring 18, and may, if desired, be horizontal, although preferably as shown the disc inclines downwardly from its center toward its periphery. The disc may be of sheet material, suitably secured to the hub 32, or may be in-

tegral with the hub, as desired, and its outer edge as here shown is disposed in a plane intermediate the upper and lower ends of the vanes 19. An elongate tapering water elevating member 34, preferably integral with the hub 32, projects downwardly below the disc and depends nearly to the bottom of receptacle 1. If desired, this member 34 may be provided with an external helical groove, as illustrated in my Patent No. 1,537,650.

The motor 26 is preferably enclosed and protected from moisture by a hollow shell 35 whose lower edge rests upon the inclined flange 17 of the cover and fits snugly against the vertical flange 16.

To facilitate lifting the apparatus, I prefer to provide handles 40 and 40ª attached to the top wall of the receptacle 1 at opposite sides of the latter, and for convenience in determining the quantity of fluid within the receptacle I may provide a float 41 having a stem 42 which is guided to slide vertically in aligned openings in the handle 40. While in my prior patented devices I have made ample provision for the discharge of the moisture laden air, and in certain cases for determining the direction of delivery of such air, and while my prior devices are highly satisfactory for the intended purpose, I find that even greater efficiency may be attained by providing for the admission of air to the apparatus in a slightly different way. With this in view, I provide one or more openings 43 in the top wall of the receptacle 1 preferably arranging the openings so that they are concealed or partially concealed by the handles 40 and 40ª. As thus arranged, fresh air is freely admitted to the interior of the receptacle at a point outwardly beyond the vanes 19, and this air flows downwardly and then inwardly (being guided to some extent at least by flanges 8, 10 and 11) over the surface of the fluid in the receptacle toward the axis of the atomizing disc. The tendency of the disc 32, when rapidly rotated, is to entrain air and expel it radially outwardly through the vanes 19, and this outwardly moving air thus travels in a direction opposite to the air which is admitted through the openings 43. The result of this action is apparently to set up violent swirls or eddies in contact with the lower surface of the atomizing disc, while the free entrance of air at the points 43 provides a large volume to be expelled at the edge of the disc 32, which assists in tearing off the thin film of water at the edge of the disc and bringing it into violent contact with the vanes 19. The air is thus caused in an efficient way to take up moisture by the contact of the eddying currents with the thin film on the lower surface of the disc, as well as to take up and rapidly carry away the fine particles dispersed by the vanes.

To increase the strength of this outwardly flowing air current, I preferably provide the under side of the disc with ribs or plates 44 which may be radially or otherwise disposed and which act after the manner of fan blades to produce a strong outward draft in contact with the lower surface of the disc.

By reason of the powerful outward flow of moisture laden air, I find it desirable to provide means external to the vanes for further mixing the air and water and for separating any large particles of entrained water from the air, and to this end I provide an outer casing which may be of sheet metal or other suitable material, and which preferably comprises a flange 45 fitting snugly within the flange 6ª of the ring 6. This outer casing also comprises an upwardly tapering portion, preferably consisting of one or more truncated conical sections 46 succeeded by vertically narrow cylindrical sections 47, thus forming a series of abrupt ribs upon the surface of the casing. As thus arranged, the moisture laden air, escaping between the vanes 19, rises in the annular guide passage between the curved shell 35 and the outer casing, and flowing toward the outlet opening 48 of the latter encounters successive narrowing zones followed by abruptly wider zones; this produces eddies and swirls in the air current tending to produce a thorough mixture of the moisture particles and air, and to break up large particles or to cause the deposit of the heavier portions upon the inner surface of the outer casing, down which the collected moisture runs into the receptacle 1. The outlet 48, here shown as central, may be at any desired point (more than one outlet being provided if desired), it being known, as disclosed for example in my Patent No. 1,439,319, to provide outlets for the moisture laden air adapted to deliver it in any desired direction. While I have shown but a few sections 46 as comprised in the outer casing, I contemplate that a greater or lesser number of such sections may be employed and that the formation of eddies and separation of large water particles may be accomplished by other and equivalent means if desired.

As herein illustrated, the invention is shown as embodied in a humidifier of portable type, and it may be noted that the apparatus as thus constructed is of very simple form, may be light in weight, and is of a pleasing external shape and appearance. If desired, the outer surface may be ornamented in any manner appropriate to the material employed, and since the air which is admitted enters through the top wall of the receptacle, it is permissible to set the apparatus upon a flat surface, such as a table top or the like, without interfering with the proper flow of air, as might be the case if the air were admitted through an opening in the bottom of the device. Although as here illustrated, the

device is of portable character, I contemplate that the principle herein disclosed may find ready embodiment in a humidifier of industrial type, such as employed in mills and like establishments. In the latter event, the receptacle may be supplied with water from a service main or the like under control of an automatic valve, if desired, it being noted, however, that whatever the specific embodiment the essential characteristics of the invention as here disclosed will be adhered to.

Moreover it is to be understood that various changes and modifications in arrangements of parts, as well as substitutions of equivalents for the elements here disclosed, may be made without departing from the spirit of the invention.

I claim:

1. A portable humidifying apparatus comprising a water receptacle, a motor supported by the receptacle, an atomizing disc driven by the motor, a series of vanes concentric with the disc, and handles secured to the receptacle, the receptacle having air inlet openings between the motor and the handles and so arranged as to be concealed partially at least by the handles and to permit inspection of the water level from a point above the handles.

2. A humidifying apparatus comprising a fluid receptacle, a motor, an atomizing disc driven by the motor, a series of vanes concentric with the disc, a protecting shell for the motor, and an outer casing spaced from the shell, said shell and casing defining a guide passage for moisture laden air, the outer casing having spaced inlet and discharge openings.

3. A humidifying apparatus comprising a receptacle for fluid, a rotating atomizing disc, vanes for impingement by particles centrifugally expelled by the disc, and means for directing a current of air across the surface of the contained fluid and against the surface of the disc in such manner as to create a swirl in such air by frictional engagement with the disc.

4. A humidifying apparatus comprising a receptacle for fluid, atomizing means and guide means for moisture laden air leaving the receptacle, said guide means comprising a converging casing consisting of a plurality of similarly disposed, longitudinally spaced and substantially axially aligned frusto-conical portions having diameters decreasing successively in the direction of flow, the smaller end of one of these frusto-conical portions substantially registering with the adjacent larger end of the next adjacent frusto-conical portion, and cylindrical portions interposed between these frusto-conical portions and connecting the smaller end of one of the frusto-conical portions with the adjacent larger end of the next adjacent frusto-conical portion.

5. A humidifying apparatus comprising a fluid receptacle, a motor supported by the receptacle, an atomizing disc driven by the motor, a series of vanes concentric with the disc, a protecting shell for the motor, an outer casing supported by the receptacle, said outer casing tapering upwardly and cooperating with the shell to define a guide passage for moisture laden air, the outer casing comprising a series of alternating frusto-conical and cylindrical portions.

6. A humidifying apparatus comprising a shallow receptacle for fluid, said receptacle having an annular upper wall defining a central opening, atomizing means comprising a rotating disc and a series of vanes concentric therewith for atomizing water and delivering it from the receptacle in finely divided condition, the upper wall of the receptacle having an opening for admitting air to the space below the disc, and an outer guide casing into which the atomizing fluid is delivered, said casing comprising means for creating eddies in the moisture laden air.

7. Humidifying apparatus comprising a receptacle for fluid, an atomizing disc arranged to turn about a substantially vertical axis, said disc having a downwardly tapering water elevating member depending into the receptacle and arranged to convey fluid to the lower surface of the disc, and a plurality of substantially radial blades projecting from the lower surface of the disc.

8. A humidifying apparatus comprising a fluid receptacle, an atomizing disc arranged to turn about a substantially vertical shaft, means for driving the disc, means for elevating fluid to the lower surface of the disc, and a plurality of blades projecting downwardly from the lower surface of the disc and adapted to deliver air outwardly toward the vanes.

9. A portable humidifying apparatus comprising a receptacle for water, said receptacle having an annular upper wall defining a central opening, supporting means disposed within the opening, a motor carried by said supporting means, an atomizing disc driven by the motor, said disc having water elevating means depending into the receptacle, and a series of vanes concentric with the disc, the receptacle having openings for admitting air to the space beneath the disc.

10. A portable humidifying apparatus comprising a fluid receptacle, a motor supported by the receptacle, an atomizing disc driven by the motor, a series of vanes concentric with the disc, handles secured to the receptacle, and a float member within the receptacle, said float having a stem projecting upwardly from the receptacle, one of the handles having guides for the stem of the float.

11. A humidifying apparatus comprising a receptacle for fluid, said receptacle having

bottom and side walls and an annular upper wall extending inwardly from the side wall and transversely above the contained fluid, means disposed within the receptacle above the contained fluid and substantially within the annular upper wall for atomizing water, the upper wall of the receptacle having an opening adjacent the side wall for the admission of air, and means extending upwardly from said wall for guiding moisture laden air delivered by the atomizing means.

Signed by me at Pawtucket, Rhode Island, this 3rd day of September, 1929.

BERTRAM M. MILLS.