June 4, 1963 O. WALTHER 3,092,708

AIR MOISTENING APPARATUS

Filed April 11, 1960

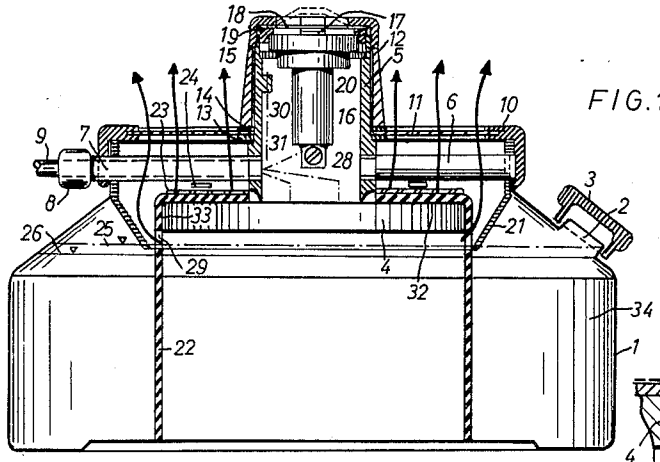


FIG. 1

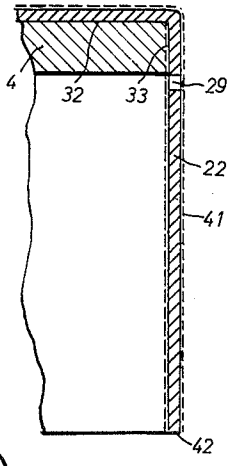


FIG. 4

FIG. 2.

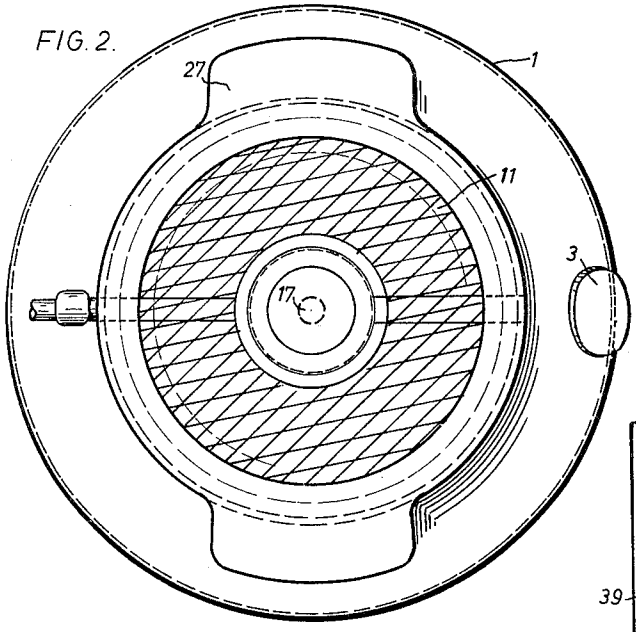
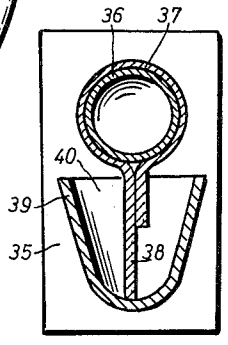


FIG. 3



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AIR MOISTENING APPARATUS

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This invention relates to air-moistening apparatus.

Air-moistening apparatus are known which comprise a wick dipping into a compartment of a container designed to accommodate the water to be evaporated. Such apparatus is generally suspended on central heating units, the water and the filter-like wick being mainly heated by the heat radiated by the radiator. However, there is produced in this way, only a comparatively slight vaporisation of water which is effected partly by evaporation at the water surface and partly through the wick. The wick or filter consists of unsized paper which would not withstand any relatively great heat. The action of such apparatus is not satisfactory as regards humidifying air in accordance with hygienic standards. Consequently, the need exists for air humidifiers which have a greater capacity. Such humidifiers are however only known in the form of apparatus with liquid atomisation, the atomised water being introduced into the room air by means of an air stream produced by a fan. However, this arrangement frequently results in condensation of the atomised water or to deposition of drops of water because of insufficient atomisation. The expense for the provision of the atomiser, the fan and the means for driving these two devices make the complete apparatus considerably more expensive. In addition, the noise which is set up, particularly by the fan, is not always desired.

The present invention seeks to obviate the disadvantages of the known apparatus and has for an object to increase the output of the apparatus initially referred to in such a way that the apparatus satisfies the standards required of an air humidifier, especially for living-rooms or offices, business premises and the like without water atomisation. An air-moistening apparatus according to the invention is characterised by the fact that it is provided with a heatable surface which is arranged externally of the said water chamber and on which the wick is adapted to bear.

It has been shown by experiments carried out with this apparatus that the air-moistening capacity can be increased within wide limits by accelerating the vaporisation in the wick, which automatically increases the supply of water by the wick to the vaporisation zone, since a wick of suitable design always supplies as much water to the vaporisation zone as is consumed at the said zone. As a wick which has a particularly good capacity, there is recommended a wick made of highly capillary, incombustible material, more especially of glass microfibre paper, such as available commercially under this name and consisting of borosilicate glass. This material is manufactured in a manner similar to paper, using the said microfibres, which have a diameter from 0.05 to 2.5/μ, most of the fibres having a diameter of 0.75 to 1.5/μ. The absorption capacity of this material is so considerable that even an artificial acceleration of the evaporation is possible at the evaporation zone by the passage of a strong air current passed the latter, without the water supply to the said zone being inadequate. The apparatus is consequently suitable as an air humidifier for air conditioning plants, in which the air humidifier is installed in an air supply duct and the air to be moistened flows past it on all sides.

Two embodiments of the invention are shown by way of example in the accompanying drawings of which:

FIGURE 1 is a vertical mean longitudinal section of one embodiment,

FIGURE 2 is a plan view thereof,

FIGURE 3 is a vertical section showing a second embodiment, and

FIGURE 4 shows a modification of the wick in the same view as in FIGURE 1.

The apparatus shown in FIGS. 1 and 2 comprises a container **1** which is of circular cross-section, but tapers conically at the upper part and then terminates in a cylindrical rim.

In the conical part is a short filling tube **2**, which is closed by a cap **3**. The lower part of the container **1** is intended to serve as a water chamber **34**. It extends up to the level **25** shown in chain-dotted lines, which is at the height of the lowest point of the opening of the filling tube **2**. The normal water level is preferably located at the level **26** which lies at the height of the lowermost point of the tube **2**.

A cylindrical heater element **4** is located above the water chamber **34** co-axial with the vertical axis of the container. The heater element **4** is connected to a central hollow cylindrical attachment **5**, for example by welding, which attachment has at the lower end portion two diametrically opposed radial supporting rods **6** and **7**, which are supported at the outer ends on the rim of the container **1** in a manner to be more fully explained. The rod **6** is solid and is provided at the inner end with a threaded pin **28**, which is screwed as a tight fit into a corresponding radial threaded bore of the attachment **5**. The other supporting rod **7** is made tubular and is provided at the inner end with a screw thread and is screwed as a tight fit into a threaded bore of the attachment **5**. It extends outwardly through the container rim and is provided at the end with a clamping sleeve **8** for securing a current supply cable **9** which is led through the tube. The connection ends **30** of the cable are introduced into the hollow attachment **5** and some are connected to the multi-stage electrical heating element arranged in a manner not shown in the heater unit **4**. The heating element can for example have three stages, in a manner similar to an electrically heated pad, a suitable switch being arranged in the cable **9** which permits, the heating element to be switched off, or to be switched on at one or two third power or at full power as required. Another connecting end **31** is introduced inside the hollow attachment **5** into a thermal cut-out **16**, and in fact to the switch thereof, which is located in a central position at its upper end and can be actuated by a switch button **17** projecting upwardly. The cutout **16** is secured inside the hollow attachment **5**, which comprises for this purpose an inwardly projecting shoulder on which is disposed a supporting disc or washer **20**. The cut-out has a collar the upper end of which rests on the disc or washer. The collar is embraced on the upper side by a clamping ring **19** on which rests a diaphragm **18**, against which bears the underside of the switch button **17**. The diaphragm **18** is clamped by a locking nut **15** on the rim, simultaneously clamping the clamping ring **19** and the cutout collar and the supporting disc **20** relatively to the shoulder on the extension **5**.

The container **1** is closed by a detachable perforated cover, which is a disc **11** preferably consisting of expanded metal and an annular rib **10** co-operating with the container rim by means of a bayonet connection (not shown). The rods **6**, **7** preferably serve as latching means for the bayonet connection, the rim portion of the container comprising two diametrically opposed slots which open upwardly and which have a peripheral branch in the lower part. The rods **6** and **7** can then be fixed to the annular rim **10** of the cover. The annular disc **11** can

be directly cast in the annular rim 10, which is preferably made of plastic. The inside of the annular disc 11 rests on a supporting washer 13, which bears on an outwardly projecting shoulder of the extension 5. Located above the ring 11 in a rubber ring 14 which is under the influence of a clamping sleeve 12, which is pressed downwardly by the locking nut 15 and causes a tight clamping of the annular cover disc 11 between the supporting washer 13 and the rubber ring 14. The disc 11 is consequently clamped like a wheel disc in the hub-like attachment 5.

Arranged centrally in the container 1 is a cap-shaped wick 22, the upwardly disposed base portion of which fits tightly on the upper end face 32 and the wall portion of which fits tightly on the cylindrical peripheral surface 33 of the heater unit 4. The wick 22 is of the glass microfibre paper hereinbefore referred and can for example be made of a strip of this paper of a length which corresponds to the cap circumference. The upper rim portion of this strip is serrated so that when this rim portion is folded inwardly by 90°, the serrations form the base of the cap, the separate serrations abutting radially one against the other. The cap base is pressed against the upper end face 32 of the heater unit 4 by means of a perforated clamping disc 23 preferably of expanded metal. The clamping disc 23 is under the influence of compression springs 24 acting at the other end on the supporting rods 6, 7. These springs are preferably of hair-pin form.

The container 1 is provided above the water chamber 34 with a frusto-conical baffle ring 21 which is situated on the inside of the container rim portion and tapers progressively downwards to the wall portion of the wick 22. The wall portion of the wick 22 is provided above the water chamber 34 with venting apertures 29. The baffle ring 21 is so arranged that it terminates immediately below the apertures 29 in the immediate vicinity of the wall portion of the wick 22. A baffle ring 21 prevents any splashing of water as the apparatus is being carried so that the water cannot reach that part of the container which is above the ring 21. The container is provided with two diametrically opposed handles 27 to facilitate transport.

In the normal operating position, the diaphragm 18 has the flat form shown in full lines in FIGURE 1. By this means, the switch is closed. Therefore, when the current is switched on, the heater unit 4 is heated according to the stage switched on. Consequently, the water absorbed by the wick 22 is evaporated in the region of the heating surfaces 32, 33 acting thereon. The water vapour being formed rises in accordance with the arrows which are shown through the clamping disc 33 and the cover disc 11 and enters the space to be humidified. The evaporated water is immediately replaced by the suction effect of the wick 22. Consequently, always only as much water as is supplied by the wick 22 to the heating surfaces 32, 33 is heated. By switching on a higher heating stage, the vaporising effect can be correspondingly increased, since corresponding to the increased evaporating capacity, more water is supplied by the wick 22 to the vaporisation zone.

The cut-out 16 is so set and is of such dimensions that the current remains switched on in normal operation. However, as soon as overheating occurs, for example due to lack of water in the container 1, this is made apparent by a corresponding rise in temperature inside the hollow attachment 5, so that when a predetermined maximum temperature is reached, the cut-out 16 is released, this being effected in the usual way by bimetallic strips. As a result, the switch button 17 which is under the action of a spring (not shown) is projected upwardly by the spring pressure, opening the switch, whereby the diaphragm 18 assumes the upwardly bulged position shown in broken lines in FIGURE 1. After the heating action has ceased and the heater unit 4 has cooled down, the current can be switched on again by pressing down the bulged portion of the diaphragm 18. As a result, the diaphragm 18 again assumes the former flat form. If the water chamber 34 has meanwhile been filled again, normal operation is recommenced.

The supporting rods 6 and 7 and also the annular cover ring 10 and the cover clamping sleeve 12 are preferably of plastic for thermal insulation reasons, in order as far as possible to prevent the heat of the heater unit 4 being transmitted by conduction to the container 1.

The FIG. 3 construction is particularly suitable for an air humidifier of an air conditioning plant and comprises a container 39 which has a space 40 for receiving the water to be evaporated. This space or chamber 40 can be practically the full height of the container 39 which is open at the top. The apparatus has a heatable surface which is arranged above the chamber 40 and the container 39, this surface in the present case being formed by the cylindrical wall surface 37 of a tubular heating element 36. This element has a horizontal axis and is fixed at both ends to a holder 35. By means of this holder, to which the container 39 can also be secured at its ends, the apparatus can be placed on a horizontal support. One or more electrical heater elements can be arranged inside the heating unit 36 in known manner, and these elements can be actuated by manual switches, as mentioned in connection with the first embodiment, and again can be under the influence of a thermal cut-out.

A wick 22 formed as a foil wrapped around the heater unit 36 rests on practically the entire periphery of the heatable surface 37, one free downwardly directed end portion 38 of the wick dipping into the water chamber 40. There is no objection to the other end portion also being allowed to dip in the water, as thereby a symmetrical supply of water to the heating surface 37 and an increase in the absorption action can be produced. With apparatus of relatively small capacity, it is also sufficient for the foil forming the wick to be simply hung with the middle portion thereof over the heater unit 36, so that the wick only contacts the latter on a portion amounting to half its circumference.

The action is in principle the same as with the first construction in that the wick takes up the water from the chamber 40 and brings it into the region of the heating surface 37 by which vaporisation is effected. In order to increase the vaporisation effect, an upwardly directed artificial air stream can be produced near the heating unit 36.

It has been found that particularly preferred wicks, such as the wicks of glass microfibre paper, have a tendency to change in structure during use, a flaky decomposition or crumbling and partial dissolving in the water of the container gradually taking place. This causes a more or less great reduction in the effective value and life of the wick. It has now been found that this disadvantage can be obviated by the wick consisting of a highly capillary material being covered on at least one side by a sheath of water-pervious and water-resistant, incombustible material. Because of its water permeability, the sheath does not in any way obstruct the absorption of the water from the container and the evaporation of the absorbed water in the region of the heating surface, provided the sheath is of suitable design.

As is apparent from FIGURE 4 which illustrates this feature and in which there is shown only the cylindrical heater unit 4 of the air moistening apparatus, with the upper portion of the wick 22 of angular cross-section bearing on the heating surfaces 32 and 33 of the said heater unit, the wick 22 is completely covered on its outside and also on the vertical portion of its inside and at the bottom end by a sheath 41 of water-permeable and water-resistant incombustible material. The wick is again of highly capillary material, especially glass microfibre paper, whereas the sheath 41 is of a pliable fabric, especially an asbestos fibre fabric. The sheath 41 is folded over in the manner of the covers of a book, clamp-

ing the wick 22 therebetween, the closed spine 42 of the sheath being at the bottom end of the wick. Apertures 29 are again formed in the wick beneath the heater unit 4, and these openings also extend through the sheath 41. They are again above the highest permissible level of the water to be evaporated in the container. In this connection, reference is made to FIGURE 1.

The sheath 41 can if desired only extend as far as the heater unit 4 on the inside, so that it can be omitted along the heating surface 33. Conversely, it can however extend over the entire inner surface of the wick 22, i.e. also over the heating surface 32.

The sheath or covering does not have to be entirely of water-permeable material or fabric. For example, it can be omitted on the entire inside and a wall section of light metal or the like can instead be provided at this position, which wall section ensures the dimensional stability of the wick, for example by suitable reinforcement, or serves as a carrier for the wick. The sheath or covering must of course be resistant to water at all places which are exposed to the water.

The fixing of the sheath or covering of for example asbestos fibre fabric to a wick of for example glass microfibre paper can be effected by pressing them one against the other, since the covering and wick are sufficiently anchored together by engaging mutually one in the other, so as to satisfy the conditions which arise as regards cohesion.

What I claim is:

1. An electrically heated humidifier comprising a container having a water chamber therein and an upper rim portion, a detachable perforated cover for the container mounted on the upper rim portion and having a clamping sleeve mounted thereon, a central hollow cylindrical member extending into the clamping sleeve and projecting into the container, a pair of diametrically opposed radial supporting rods extending from the rim portion to the cylindrical member to support the latter, an electric heating element secured to the cylindrical member, and a wick secured to the heating element and suspended therefrom down into the water in the chamber.

2. An electrically heated humidifier according to claim 1, in which one of the rods is hollow to accommodate wires connected to the heating element.

3. An electrically heated humidifier according to claim 1 in which a frusto-conical baffle ring is secured to the rim and extends toward the wick.

4. An electricially heated humidifier according to claim 1 in which a thermal cut-off is secured in the clamping sleeve and which is electrically connected to the heating element.

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