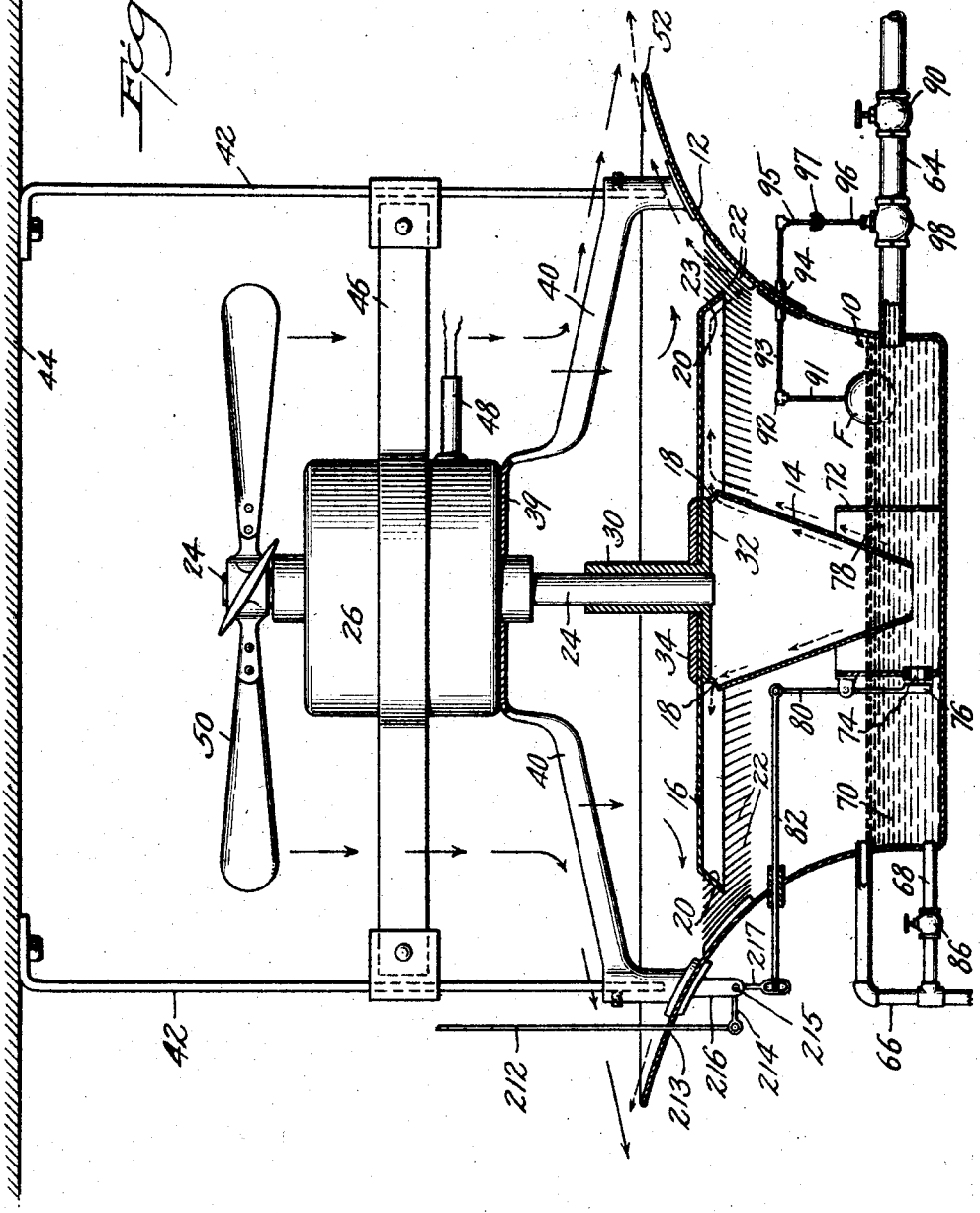
May 3, 1927. 1,626,667

S. W. CRAMER ET AL

HUMIDIFIER

Original Filed Dec. 17, 1924 2 Sheets-Sheet 1

Fig. 1.



WITNESS

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Fig. 2.

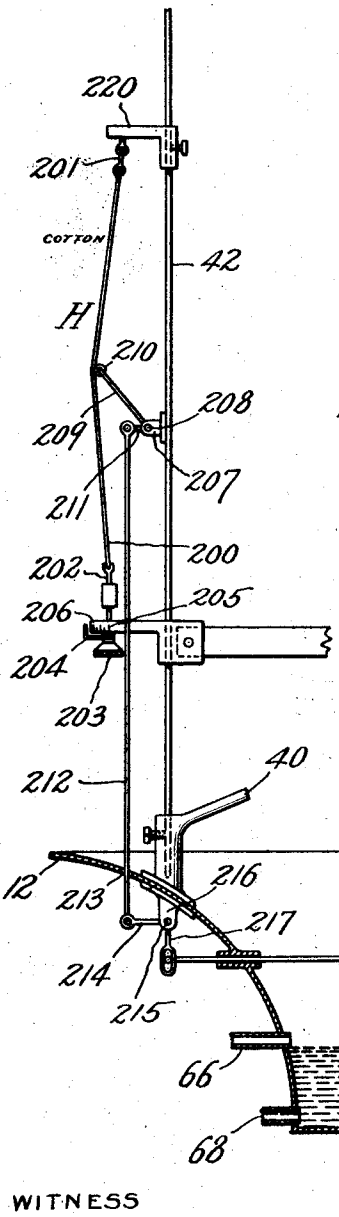


Fig. 2a.

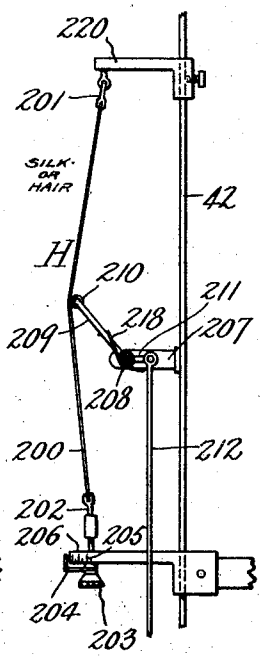


Fig. 3.

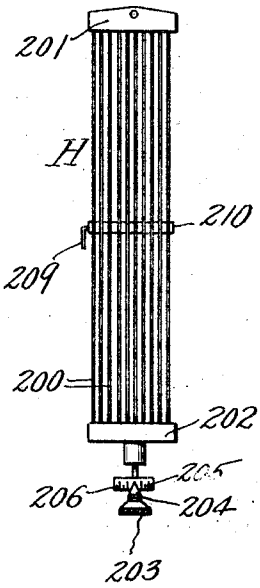
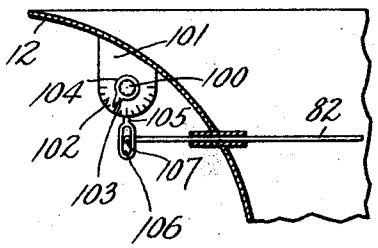


Fig. 4.



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UNITED STATES PATENT OFFICE.

STUART W. CRAMER, OF CRAMERTON, AND WILLIAM B. HODGE, OF CHARLOTTE, NORTH CAROLINA, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO WM. B. HODGE COMPANY, OF CHARLOTTE, NORTH CAROLINA, A CORPORATION OF NORTH CAROLINA.

HUMIDIFIER.

Original application filed December 17, 1924, Serial No. 756,421. Divided and this application filed October 27, 1925. Serial No. 65,102.

This invention relates to a humidifier and, more particularly, to a humidifier of the large capacity, centrifugal, type for creating and distributing a mist of water and thus increasing the content of water vapor, in the atmosphere about the humidifier.

This application is a division of our application Serial No. 756,421 filed December 17th, 1924.

One of the objects of our present invention is to provide a simple and effective humidifying apparatus in which the tendency of the water particles or droplets in the mist to fall or settle out of the draught of air in which they are carried or suspended is resisted or opposed, and in which a rapid and wide distribution of the mist is obtained.

Other objects of the invention is to provide a humidifier in which particles of water of too large a size to be carried in the draught of air are eliminated or prevented from being carried into the atmosphere, and at the same time to insure the suspension and rapid distribution of the particles to enable them to be completely evaporated while in suspension.

A still further object of the invention is to provide a humidifier of the type outlined above in which the elements for forming water into mist, removing the larger particles and suspending and distributing the mist of smaller particles, are of a compact construction and of a minimum of parts.

With these and other objects in view, the invention comprises the apparatus described and set forth in the following specification and claims.

The various features of the invention are illustrated in the accompanying drawings, in which:

Fig. 1 is an elevation, partly in section, of a humidifier embodying our invention.

Fig. 2 is a side elevation of the hygrostat and co-operating elements for opening and closing the valve.

Fig. 2ª is a fragmentary detail of a form of hygrostat.

Fig. 3 is an elevation of the hygrostat element.

Fig. 4 is a fragmentary view showing the mechanism for manual valve adjustment.

In our present invention, a draught of air is created to move downwardly in a substantially vertical direction and is then deflected and spread radially outwardly in a substantially flat, spreading stream. A mist of water particles small enough to readily float in the spreading draught of air until completely evaporated, is formed in a relatively quiescent body of air, and then centrifugally thrown into the draught of air above mentioned, and this mist is thus diffused throughout the surrounding atmosphere. To form this mist, a stream or film of water is drawn by centrifugal force from a supply container and led upwardly on both surfaces of the rapidly rotating collecting element, which dips into said supply container, to the under surface of a rotating plate which rotates at the same speed as the collecting element. This stream or film of water is thrown outwardly along the surface of the disc by centrifugal action and projected first against the inner surface of a peripheral bevel in the disc, which results in the breaking up of the larger particles of water thus forming a fine mist. The water is then thrown from the edge of the disc or plate as a fine mist against a stationary receiving surface on which the larger particles are retained or are broken up into smaller particles, the smaller particles being thrown into suspension in the adjacent, relatively quiescent air, from which the larger particles readily settle or drop downwardly. The larger particles thus settle out and are caught on the retaining surface, which is preferably corrugated and are then received on a surface which converges downwardly and leads into the supply container. To more effectively break up the stream of water as above described as it is projected or thrown from the rotating plate, the edge of the said plate is preferably sharply bent downwardly towards the corrugated drop receiving surface.

The air that is blown downwardly from the fan and is deflected radially outwardly carries the fine spray of mist, which has been thrown by centrifugal force to meet it, outward into the surrounding atmosphere and is thus evaporated and the atmosphere humidified. At the same time the heavy draught downwardly tends to drive many of the heavy particles of water against the pan

so that they return into the supply tank but the mist is carried readily away into the surrounding atmosphere thus humidifying the same.

Referring more particularly to the accompanying drawings, a supply of water to be broken into a mist and distributed throughout an atmosphere to be humidified is contained in a supply container 10 having an upwardly and outwardly flaring side wall 12. A stream of water is drawn by centrifugal action upwardly from the central portion of the container 10 by means of a rotating inverted, frusto-conical member 14 depending from a horizontal rotatable plate or disc 16 and dipping into the body of water in the container 10. As the plate 16 is rapidly rotated, the stream of water is drawn upwardly over its inner and outer surface, as indicated by the broken line arrows, to the under surface of the plate 16 and is then thrown outwardly along the under surface of the plate. Openings 18 are provided in the upper edge or base of the member 14 to permit the water on the inner surface of the member to reach the under surface of the plate. As the outwardly moving sheet or stream of water reaches the outer portion of the plate 16, it is deflected sharply downwardly by a downwardly turned rim or edge portion 20 and thrown against a corrugated surface 22 on the inner surface of the outwardly flaring wall 12 of the container 10. The downturned edge 20 not only serves to give the water a downward velocity at right angles to the plate 22, but as the water reaches the edge portion 20 it is flattened to a thin sheet or spread out in a thin film by the component of the centrifugal pressure acting normal to the surface of this portion. As the water strikes the downwardly turned rim or edge portion 20 and is thus deflected and thrown from the edge of the disc, it is broken up into small particles and then it is projected against the corrugated surface 22. As a result of this centrifugal action and the consequent breaking up of the sheet or stream of water, a mist of fine particles or droplets is formed in the atmosphere in the space 23 about or above the corrugated surface 22. Any larger particles thrown against this surface which are too heavy to remain in suspension for a sufficient time to entirely evaporate, readily settle out of the mist onto the surface 12 and flow back into the container 10. The remaining mist, however, which is actually being thrown centrifugally outward, is taken up and carried in suspension by the outwardly spreading draught of air 19 which has been created by the propeller 15 and this mist is thus permitted to evaporate in the surrounding atmosphere to effect the desired result of humidifying the same.

The plate 16 and member 14 may be supported and rotated in any suitable manner. As shown in the drawings, the plate 16 is supported on the lower end of the shaft 24 which extends from a driving motor 26 placed above the container 10. The shaft 24 is provided at its lower end with a collar 30 having a supporting flange 32 and a holding washer 34 for mounting the plate 16 therebetween. The driving motor 26 is supported by a spider 39 having radially and downwardly extending arms 40 secured to the inner upper surface of the wall 12, the shaft 24 extending downwardly from the motor to a position to support the plate 16, as above described. The entire apparatus is suspended from hangers 42 depending from a ceiling 44 and the motor may be further guided and supported by means of horizontal bars 46 extending between the hangers 42, the hangers being secured respectively to the ceiling and to the arms 40 of the spiders by bolts and set screws, as shown. The motor is driven by any suitable electric current supplied through the mains 48, the motor thus serving to drive a fan 50 for creating the forceful and distributing draught of air by means of which the suspended particles of mist in the atmosphere are carried outwardly by suspension into the surrounding atmosphere and distributed in such a manner as to come into intimate contact with the relatively dry atmosphere and thus readily evaporate.

The fan 50 being mounted above the motor 26 directs the draft of air downwardly towards the top of the plate 16 which is exposed to the draught. This draught of air as it strikes the flat revolving disc backs up somewhat and part of the draught of air is deflected radially, the main course of the air being indicated by the full arrows. The draught of air which is deflected towards the outside edge of the apparatus carries the spray, produced at the periphery of the disc, along with it outwardly into the surrounding atmosphere.

The arms 40 of the spider 39 are made wide or flat in a vertical direction so as to oppose the circulating or swirling motion that might be given to the air above the disc and thus avoid the lifting or carrying action that might be given to the mist thereby.

Water may be supplied to the container 10 in any suitable manner. As illustrated, a supply of water is directed through a pipe 64 provided with a hand operated by-pass valve 90. A circulation of the water and a constant level in the container are obtained by permitting the excess of water not formed into a mist by the plate 16 to overflow through an overflow pipe 66. In the compartment 70 of the container 10 a float valve structure is provided consisting of a ball F from which projects a rod 91

connected by a suitable joint 92 to a rod 93, which passes through a flexible joint 94 in the wall 12. The rod 93 is connected to a valve 98 by rods 95 and 96 connected together by a universal joint 97. The float will thus rise and fall with the water in the compartment 70 to close and open the valve 98 at a predetermined water level. A valved by-pass pipe 68 may be provided between the lower part of the container 10 and the overflow pipe 66 for the purpose of draining the container. The water supplied through the pipe 64 is received in an outer annular compartment 70 formed in the container 10 by means of a circular wall 72 and from this compartment is admitted through an opening 74 in the wall controlled by means of a plug valve 76 to an inner compartment 78 into which the lower end of the member 14 dips. The position of the plug valve 76 relative to the opening may be controlled to regulate the flow of water into the compartment 78 by means of a lever 80 on the lower end of which the plug valve 76 is mounted and which is in turn controlled by means of an operating rod 82 which is moved either manually, by the construction shown in Fig. 4, or automatically by means of a hygrostat to which it is suitably connected, as by the construction shown in Figs. 2 and 3.

Referring to Fig. 4, the manual adjustment is obtained by mounting the handle 100 on a supporting part 101 secured to the side wall 12, the part 101 being provided with a scale 102, the handle being provided with a pointer 103. Depending from the pivot 104 of the handle is a rod 105 provided with an elongated slot 106, which engages a projecting portion 107 extending from the rod 82. By means of this construction, when the handle 100 is turned, the pointer runs over the scale 102 and the rod 82 can thus be drawn back and forth and the valve 76 opened to any predetermined and set extent.

Referring to Figs. 2, 2[a] and 3, the automatic control is governed by a hygrostat H which consists preferably of a band of fibers 200, such as cotton (Fig. 2) or silk or hair (Fig. 2[a]), which are secured to bridges 201 and 202. The bridge 201 is pivotally secured to the bracket 220, which is supported upon the hanger 42. The fibers are adjusted into position by means of a thumb screw 203 mounted in the standing part 206 and connected with the lower bridge 202. A pointer 204 on the thumb screw 203 runs over a scale 205 on the standing part 206. There is also secured to the hanger 42 a projection 207 upon which is pivoted at 208 a bell crank lever 209, having a weight 210 secured at the upper free end, which weight bears with some tension against the fibers 200 of the hygrostat H. The shorter arm 211 of the bell crank lever 209 is pivoted to a rod 212 which passes through the wall 12 at 213 and is secured to an arm of a bell crank lever 214 pivoted at 215 upon a projection 216 extending from the underside of the wall 12, the lower arm 217 of this bell crank lever being pivoted to the operating rod 82 which controls the movements of the valve 76.

As the moisture in the air surrounding the hygrostat increases, the fibers of the element when of cotton (Fig. 2) will shorten, or when of silk or hair (Fig. 2[a]) will lengthen, thus in each case operating to raise the rod 212 which in turn draws the rod 82 outwardly to close the valve 76. When the moisture decreases the valve 76 in each case is similarly opened. In the construction shown in Fig. 2[a] it is desirable to place a spring 218 in the pivot 208 to assist in keeping the weight 210 of the bell crank lever 209 always in contact with the fibers of the hygrostat.

The adjustment of the automatic control by means of the construction above described is effected by turning the head of the screw in one direction or the other so that the initial setting of the valve 76 can be secured.

By providing two adjacent communicating tanks of water, into one of which the supply of water initially flows, and from the other of which the water is drawn to form a mist, the operator is enabled by the valve construction thus described to provide sufficient water to meet the necessities of the case. That is to say, when the surrounding air is laden with moisture it is obvious that the supply of water for forming the mist need only be at its minimum whereas when the air is dry, the supply of water should be at its maximum. This condition is attained by means of the operation of the valve governing the flow of water from one tank to the other. Without such a construction, the supply tank must be kept always at its maximum which would frequently supply more water than is needed to effectively form the required mist.

By means of the above invention, therefore, water from a regulated and controlled supply is drawn upwardly by the member 14 and thrown centrifugally outwardly against the corrugated surface 22 and broken up into a fine mist which is entrained in and carried in suspension outwardly by a forceful or powerful draught of air created by the propeller 50 into the surrounding atmosphere to evaporate and thus humidify the said atmosphere. The larger particles of water falling onto the wall 12 run back into the container 10, the form of the container providing a very simple, compact apparatus for this purpose.

As changes of construction could be made within the scope of our invention, it is in-

tended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. Apparatus of the type described which comprises a water container having a side wall flaring outwardly at its upper end, a rotatable horizontal plate mounted within the upper periphery of said flaring wall, rotatable means for drawing water from said container to the under surface of said plate and projecting it therefrom to the inner surface of said flaring wall, and means for directing a draft of air downwardly towards the upper surface of said plate and outwardly over the edge of said container in a path independent of that of said projected water, permitting only finely divided particles thrown from said projected water to reach said draft of air, the courses of said remaining water and said draft of air diverging after leaving the edge of said disk.

2. Apparatus of the type described which comprises, a water container having a side wall flaring outwardly at its upper end, and having corrugations on its inner surface, a horizontal plate rotatably mounted and having an edge sharply bent towards said corrugated surface, rotatable means for drawing water from said container to the under surface of said plate, and means for directing a draught of air downwardly towards said plate.

3. Apparatus of the type described which comprises, a water container having a side wall flaring outwardly at its upper end and having corrugations on its inner surface, a horizontal plate rotatably mounted in the upper portion of said flaring wall, an inverted frustro-conical member depending from the under surface of said plate into said container and rotatable with said plate to draw water to the under surface of said plate, said plate having an edge bent sharply towards said corrugated surface, and means for directing a draft of air downwardly towards said plate.

4. Apparatus of the type described which comprises a water container having a side wall flaring outwardly at its upper end and having corrugations on its inner surface, a horizontal plate rotatably mounted within the periphery of the upper flaring portion of said container, the outer edge of said horizontal plate being bent downwardly towards said corrugations, means for supplying water to the under surface of said plate, a motor mounted above said plate, a shaft depending from said motor for supporting said plate, and means for directing a draft of air downwardly towards said plate, the side wall of said container at the flaring corrugated portion serving to deflect said draft of air outwardly out of direct contact with the liquid thrown from said rotating plate.

5. Apparatus of the type described which comprises, a water container having a side wall flaring outwardly at its upper end and having corrugations on its inner surface, a horizontal plate rotatably mounted within the periphery of said upper, flaring wall, means for supplying water to the under surface of said plate, a motor having a depending shaft for supporting said plate, said plate having an edge portion sharply bent towards said corrugations, and a fan driven by said motor to direct a draught of air downwardly against the upper surface of said plate.

6. Apparatus of the type described which comprises, a water container having a side wall flaring outwardly at its upper end, a horizontal plate rotatably mounted within the periphery of said upper, flaring wall and having an edge portion bent towards the inner surface of said flaring wall, means for supplying water to the under surface of said plate, a motor above said plate and having a shaft depending downwardly on which said plate is mounted, a fan driven by said motor to direct a draught of air downwardly towards said plate, and a supporting spider for said motor having arms providing a resistance against a rotary movement of air above said plate.

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