

June 16, 1925.

1,542,136

W. B. HODGE

HUMIDIFIER

Original Filed Dec. 17, 1920.

Fig.1.

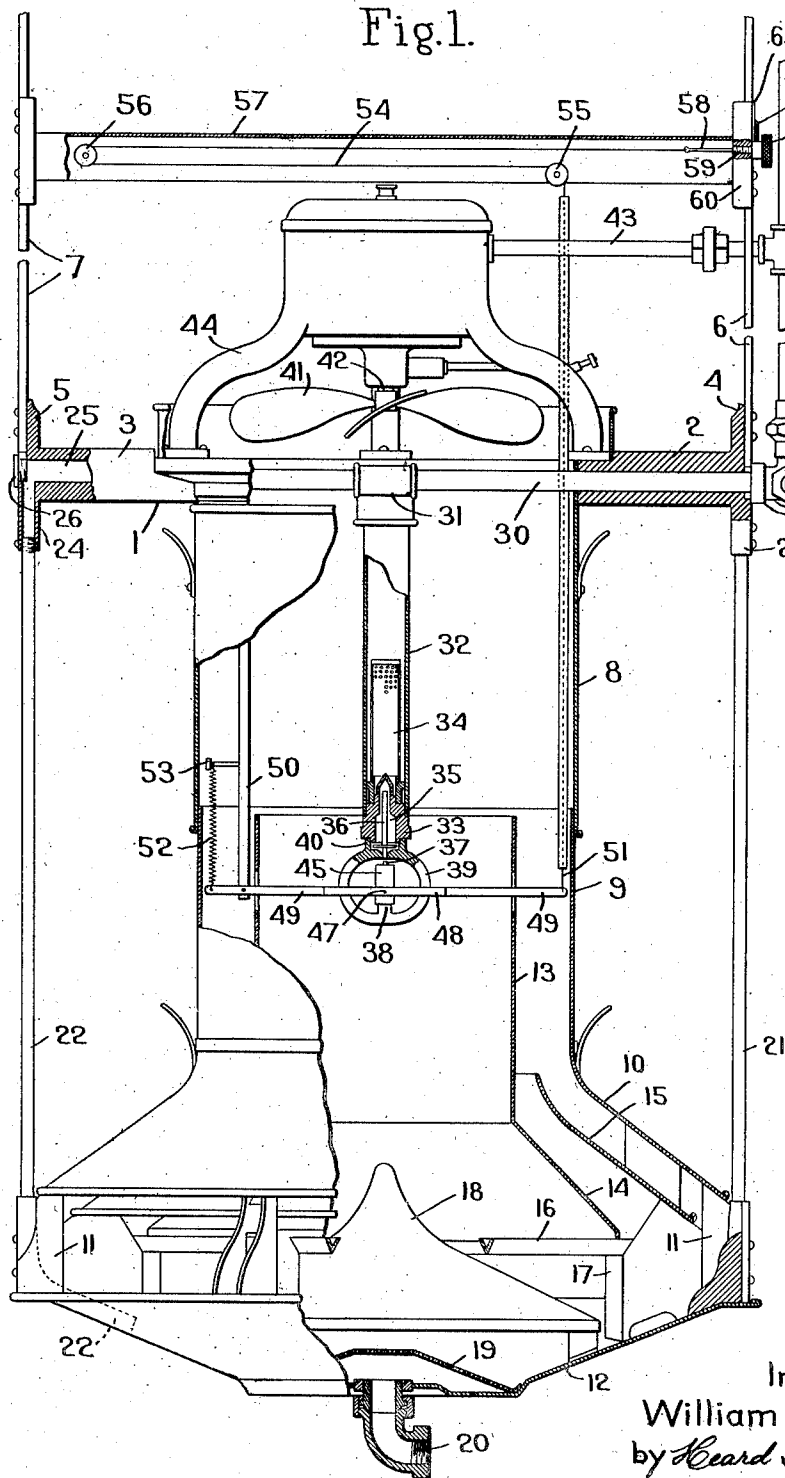


Fig.2.

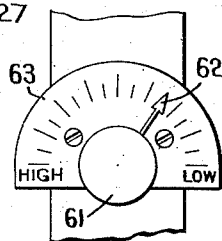


Fig.3.

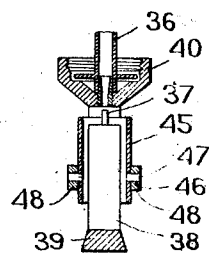
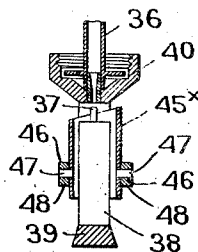


Fig.4.



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Attys.

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1,542,136

UNITED STATES PATENT OFFICE.

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HUMIDIFIER.

Original application filed December 17, 1920, Serial No. 431,521. Divided and this application filed May 17, 1923. Serial No. 639,633.

To all whom it may concern:

Be it known that I, WILLIAM B. HODGE, a citizen of the United States, and a resident of Charlotte, county of Mecklenburg, State of North Carolina, have invented an Improvement in Humidifiers, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to improvements in humidifiers of the type in which a current of air is projected through a cloud of spray produced in any suitable manner, the current of air, after absorbing moisture from the spray, being delivered into the enclosure to be humidified, while the water which is not vaporized or atomized is collected and preferably recirculated through the spraying device.

The usual type of apparatus commercially used is exemplified in Patent No. 996,217 granted June 27, 1911, to Stuart W. Cramer and myself which discloses a humidifier, comprising a casing, suspended from the ceiling of the enclosure, having a downwardly directed nozzle for producing a spray, with a fan superposed above the same to project a current of air through the spray, with means below the casing for diverting the moisture-laden air laterally into the enclosure and a pan located beneath the casing to collect the water which is not vaporized or atomized.

The present application is a division of my prior application Serial No. 431,521 filed December 17, 1920, for improvements in humidifiers.

One of the objects of the present invention is to provide a humidifier of the above type, of simplified construction, in which the initial cost of production and installation will be decreased and which will be more economically and efficiently operated to maintain a desired condition of humidity than humidifiers heretofore produced.

The principal object of the invention is to provide a humidifier of the character described with automatically operable means for restricting the amount of spray in correlation to the amount of moisture in the air supplied to the humidifier.

A further object of the invention is to provide regulating means operable to vary

the quantity of spray produced and thereby to control the amount of moisture delivered by the humidifier.

A further object of the invention is to provide regulating means of the character described which will control the amount of moisture delivered from the humidifier without varying the air current or the amount of fluid delivered by the spray-producing means.

A further object of the invention is to provide a novel spray-controlling means operable selectively, partially or fully, to divert the jet of spray and thereby regulate the amount of moisture delivered to the humidifier without varying the amount of fluid delivered by the jet.

A further object of the invention is to provide means for controlling the regulating means including a member which is sensitive to moisture, preferably of hygroscopic material, so positioned as to be influenced by the moisture content of the air entering the humidifier, thus enabling the amount of moisture delivered by the humidifier to be correlated to the moisture condition of the air of the enclosure so that the atmosphere of the air of the enclosure may be maintained at a predetermined substantially constant condition of humidity.

A further feature of the invention consists in providing a humidifier regulating means of the character described with a member or members sensitive to moisture which are of the same material as that which is being operated upon within the enclosure, thereby enabling a substantially constant content of moisture to be maintained in the material being treated.

Other objects and features of the invention will more fully appear from the following description and the accompanying drawing and will be particularly pointed out in the following claims.

In the drawings:

Fig. 1 is a side elevation of the humidifier embodying the invention, certain portions being broken away and others illustrated in cross section;

Fig. 2 is a detail view of the dial mechanism which indicates the adjustment of the regulating device;

Fig. 3 is a detail vertical sectional view of a portion of the spray-producing mecha-

nism showing one means of controlling the amount of spray delivered in the path of the current of air passing through the humidifier casing; and,

5 Fig. 4 is a similar view of a modified form of regulating means which is adapted to be so adjusted as to divert a part or the whole of the jet of spray which is normally presented in the path of the current of air in the humidifier casing.

10 A preferred embodiment of the invention is disclosed herein as applied to a humidifier which is suspended vertically from the ceiling of an enclosure to be humidified, but it will be understood that whereas the following description is specifically addressed to this particular embodiment of the invention it is not restrictive and that the various novel features of the invention may be employed also in humidifiers having other arrangements and also in other types of humidifiers to which the invention may be adapted.

15 As illustrated herein the humidifier comprises a supporting frame which desirably is in the form of a ring 1 formed of cast iron or other metal, provided with a pair of oppositely extending hollow arms 2, 3 having flanges 4, 5 by which they are secured to the lower ends of hangers 6, 7 which may be supported from the ceiling of the enclosure or from any other suitable support.

20 The humidifier comprises as outer, preferably cylindrical, casing which desirably is constructed in two telescoping sections 8, 9, the upper section 8 of which is secured within the ring 1, while the lower section 9 is provided with an outwardly-flanged lower end 10 which is connected by suitable brackets 11 to a pan 12 which receives and collects the excess of water supplied to the humidifier.

25 The humidifier also comprises an inner casing 13 of smaller diameter and concentric with the lower section of the outer casing, said inner casing also having a divergent lower portion 14 which is supported above the pan 12. A deflector 15 is also provided intermediate of the lower portions 10 and 14 of the outer and inner casings. The lower end of the inner casing 14 is located above a gutter 16 which is supported upon a hollow brackets 17 providing a passage for water and leading to the pan 12. A suitable conical deflector 18 is located axially of the inner casing and serves to deflect the blast of air through the humidifier outwardly in a substantially horizontal direction through the space between the lower ends of the casing members and the pan.

30 The pan 12 may be and is provided with the usual strainer 19 and outlet pipe 20 which may lead to a pump to provide for the recirculation of the water to the humidifier

nozzle, and water motor which will hereinafter be described.

35 The pan 12 and the casing members carried thereby are supported by members 21, 22 which are connected at their lower ends to the brackets 11 and at their upper ends to downwardly projecting bosses 23, 24 upon the arms 2 and 3 of the supporting frame 1 of the humidifier. The boss 23 desirably may be in the form of a socket to receive the upper end of the rod 21, suitable set screws being provided for securing the rod therein. The boss 24 desirably is hollow and communicates with a conduit 25 in the arm 3 to provide a passageway for the waste water from the motor as will hereinafter be described. The end of the conduit 25 may be provided with a suitable plug 26 to close the opening therein, the opposite end of the conduit 25 being closed in any suitable manner.

40 The member 22 desirably is a pipe having at its upper end screw threaded connection with the boss 24 and at its lower end suitably secured to the bracket 11 and extending beyond the same along the wall of the pan so that the waste water from the motor will be conducted through said supporting member to the pan of the humidifier.

45 In this type of humidifier means are provided for producing a conoidal jet or spray of water within the casing and a fan, located in the upper part of the casing or above the casing, serves to force a current of air through the spray thus produced and to distribute the same through the opening at the lower end of the casing just above the pan.

50 In the preferred construction illustrated herein water under high pressure, as for example 150 pounds per square inch, is supplied to a pipe 27 having a connection 28 provided with a suitable valve 29 leading to a pipe 30 which extends through the hollow arm 2. The pipe 30 is connected at its opposite end to a suitable elbow, or for convenience in construction to a plugged T 31 the vertical arm of which is connected to the upper end of a pipe 32 which supports at its lower end a nozzle for producing a conoidal jet of spray.

55 The form of nozzle, which is illustrated herein, is so constructed that stoppage, due to the accumulation of particles of dirt and other foreign matter, will be prevented. It comprises a body portion 33 which supports at its upper end a cylindrical screen 34 which extends upwardly within the pipe 32. The body portion 33 is provided with passages which serve to cause the water passing downwardly through the screen to flow through a sinuous course to a chamber 35 in said body, thereby causing a slow circulation of the water under pressure which permits the particles of dirt and other debris to settle in said chamber, thereby preventing

ing stoppage of the nozzle. The water passes from the chamber 35 into the upper end of a stand pipe 36, the upper end of which projects above the chamber 35, (see Figs. 3 and 4), and the water is delivered from the lower end of this stand pipe through a restricted nozzle in the form of a small jet which is directed against the flat upper end of a pin 37 located closely adjacent to the nozzle in such a manner as to produce a conoidal film-like jet which breaks into a finely divided spray upon reaching the wall of the inner casing.

In the preferred construction illustrated the pin 37 projects upwardly from a vertical standard 38 which is formed integral with and extends diametrically across a supporting ring 39 having an upwardly extending boss 40 which is suitably secured, as by a screw threaded connection, to the body portion 33 of the nozzle.

Any suitable means may be provided for projecting the air to be moistened through the conoidal film-like jet. In the preferred construction illustrated herein a fan 41 is mounted upon a shaft 42 which is located axially of the casing and is driven by a suitable motor to cause a strong blast of air to be projected downwardly through the casing.

Preferably a water motor of the type more fully described in my prior application, of which this is a division, is employed as such a motor can be operated by water under pressure which also is supplied to the humidifier jet. While a full description of the motor is unnecessary, it may be stated that the water motor may be actuated by water under pressure passing through a pipe 43 which is connected to the pipe 27 and the waste water from the motor conducted through a hollow arm 44 of the motor stand to the conduit 25 in the arm 3 of the supporting frame and thence to the waste pipe 22.

The principal object of the invention, as above described is to provide novel means for regulating the amount of spray which is presented in the path of the current of air which passes through the humidifier. Regulating devices for humidifiers of this type heretofore employed have been so constructed as either to shut off or turn on the jet of spray or to stop and start the fan which produces the current of air through the humidifier or to perform both of these operations. The present invention contemplates the provision of regulating means by which a portion or all of the jet of spray may be diverted or intercepted without the necessity of varying the amount of water discharged through the nozzle or varying the current of air produced by the fan.

The preferred mechanism for accomplishing this purpose comprises a shield, preferably in the form of a cylinder 45, which sur-

rounds the post 38 and is of sufficiently large diameter to permit the stream of water, when the jet of spray is intercepted or diverted, to flow through the space between the shield and the post.

Suitable means are provided for adjusting the shield relatively to the nozzle in such a manner as to divert a portion or the whole of the spray produced by the nozzle from the path of the air current.

As illustrated in Fig. 3 the shield 45 is shown as being of cylindrical form with a flat upper end and axially disposed with reference to the nozzle. By moving the shield vertically in such a manner as to cause it to enclose the jet issuing from the nozzle, the film of spray, which otherwise would be produced by the jet as it impinges upon the upper end of the pin 37, will be intercepted by the walls of the cylindrical shield and caused to run downwardly into the drip pan. Thus the humidifier will be rendered practically inoperative without modifying the volume of water delivered from the spray nozzle and without varying the current of air which is caused to pass through the humidifier.

By providing different forms of shields any desired graduated production of humidity may be obtained. In Fig. 4 a cylindrical shield 45* is shown, the upper end of which is beveled obliquely relatively to the axis of the shield so that when the shield is raised toward the nozzle the higher portion will first intercept a portion of the jet and as it is raised further will progressively intercept more of the jet of spray until finally the entire jet is intercepted and caused to pass downwardly into the drip pan. Thus any desired humidification can be obtained from the maximum which is produced when the air from the fan is projected through the full conoidal jet to a minimum when the water is caused to flow in a substantially vertical stream axially of the casing without presenting any substantial surface to the current of air from the fan.

Any suitable means may be provided for adjusting the spray-diverting member or shield 45. In the preferred construction illustrated herein the shield is provided with laterally extending bosses 46 which receive the ends of studs 47 carried by branches 48 of a lever 49 which is pivotally mounted at one end upon a bracket or support 50 extending downwardly from the arm 3 of the frame, the other end of the lever 49 being connected by a wire 51, or other suitable means, to a suitable regulating device which is sensitive to the moisture condition of the air in the enclosure and preferably so positioned as to be subject to the influence of the air entering the humidifier casing.

In the preferred construction the lever 49 extends beyond the support 50 and is at-

tached to the lower end of a tension spring 52, the upper end of which is secured to a stud 53 upon the bracket or support 50 so that the spring 52 tends to force the shield below the path of the conoidal film of spray formed by the nozzle.

In the preferred construction the movement of the lever 49 is controlled by automatic regulating means which are subject to the air of the enclosure, before it enters the humidifier, and which operates when the moisture of the air of the enclosure exceeds a predetermined amount to raise the free end of the lever 49 and thereby elevate the shield gradually into the path of the jet so that a portion or the whole of the jet is diverted from the path of the current of air passing through the humidifier as above described.

Any suitable regulating means which is sensitive to the moisture condition of the air of the enclosure may be employed for controlling the movement of the lever 49 and the sleeve 45. In the illustrative embodiment of the invention shown in the accompanying drawing the wire 51, the lower end of which is connected to the lever 49, is connected at its upper end to one end of a hygroscopic member 54, such as a thread or threads of fibrous material, which passes over suitable guide rollers 55 and 56 preferably mounted in a channel-shaped frame 57 which extends between the supporting members 6 and 7 of the humidifier. This channel-shaped supporting frame serves to prevent lint and dust from settling on the hygroscopic members and also to protect them from injury while permitting free access of the air of the enclosure to them.

Suitable means may be provided for adjusting the position of the hygroscopic member for the purpose of setting the humidifier to supply a desired amount of humidity to the enclosure. As illustrated herein the opposite end of the hygroscopic member 54, from that which is connected to the wire 51, is secured to an extension 58 of an adjusting screw 59, the threads of which engage complementary threads in the plate 60 at the end of the frame 57. The screw 59 desirably is provided with a milled head 61 and also with an index 62 positioned over a suitable dial 63 which is provided with graduations to indicate the degree of humidity at which the hygroscopic member is set to operate, or in other words, to set the device for the initial wet bulb depression.

By providing different hygroscopic materials different conditions of humidity can be maintained in the enclosure as certain materials have greater absorptive properties than others. Where the humidifier is installed in mills for treating textile materials it is usually desirable that the hygroscopic member shall be of a material which corresponds in

absorptive properties to that of the material being treated in the particular enclosure in which the humidifier is located. For example, in cotton mills the hygroscopic member may be made of cotton fibre; in woolen mills or worsted mills the hygroscopic member is preferably of woolen or worsted material; in silk mills of silk, etc. Thus changes in the humidity of the room, which would affect the working of the product itself, affect in the same way and to the same extent the hygroscopic member of the regulator and the expansion or contraction of the hygroscopic member will thereby be caused to maintain a desired condition of humidity in the product being treated.

In the operation of the device water is supplied through the pipe 27 to the water motor and also to the nozzle. That which is supplied to the water motor rotates the fan at a high speed and projects a strong current of air through the humidifier. The water from the pipe 27, which is admitted through the valve 28 to the spray nozzle, issues from said nozzle in the form of a stream which impinges upon the top of the pin 37 and produces a conoidal film or spray. Desirably the flat end of the pin 37 is so positioned that the film will break into a spray about the time it strikes the wall of the inner casing. The current of air from the fan, passing through the spray of water thus produced, becomes charged with moisture and issues through the aperture between the lower ends of the inner and outer casings and the pan 12.

In the preferred construction a portion of the current of air produced by the fan passes through the space between the inner and outer casings and is caused by the deflector 15 to beat down any drops of water which otherwise would be blown out of the humidifier by that portion of the current which passes through the inner casing.

Upon starting the humidifier a current of super-saturated air, carrying also some unevaporated spray, is delivered from the humidifier, but this unevaporated spray is quickly evaporated by the air of the enclosure. As the moisture content of the enclosure reaches the desired amount, the action of the hygroscopic member will raise the lever 49 and through it the sleeve 45 or 45^x so that the conical jet of spray will be gradually intercepted until the amount thereof is reduced sufficiently to produce the desired output of moisture from the humidifier, whereupon the amount of spray will remain substantially constant until a condition in the enclosure occurs which causes the moisture content of the air of the enclosure to change. The hygroscopic member will at once respond to such change and cause the humidifier to supply more or less

moisture to the enclosure as may be required to maintain the substantially uniform condition of humidity. In case of unusual humid weather which causes the enclosure to reach a condition of humidity exceeding that which is desired, the regulating mechanism will entirely intercept the production of spray until the moisture content of the air of the enclosure falls below the predetermined desired amount. Thus by varying the amount of spray delivered into the path of the current of air in the humidifier a predetermined moisture content of the air of the room may be maintained without varying the speed of rotation of the fan or the amount of water delivered from the nozzle of the humidifier.

By reason of this invention a very compact and relatively inexpensive humidifier is produced which can be readily installed in any usual plant and which will operate effectively and economically to maintain a desired condition of humidity in the enclosure in which it is installed.

It will be understood that the embodiment of the invention particularly disclosed herein is not restrictive and that various modifications may be made in form, construction and arrangement of parts. For example, while it is generally desirable to suspend humidifiers of this type from the ceiling of the enclosure in which they are used, under certain conditions, as in low posted rooms, it is desirable to arrange them upon horizontal axes. It is obvious that the entire construction may be readily adapted for horizontal use by merely rearranging the supporting members and omitting the drip pan, the water in such case being collected from the bottom of the main horizontal casing from which it may be delivered by a suitable waste pipe. By providing a suitable conduit moistened air from the humidifier may be delivered to any desirable portion of the enclosure or to another enclosure or enclosures located at a distance from the humidifier, such arrangements merely requiring the application of the skill of those familiar with the humidifying art.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. A humidifier comprising a casing, means within said casing for producing a jet of spray, means for projecting a current of air through the spray and adjustable regulating means operable to intercept a portion of spray produced and thereby to regulate the amount of moisture delivered by the humidifier without varying the air current or the amount of liquid delivered to said spray producing means.

2. A humidifier comprising a casing, spray-producing means within said casing, means for projecting a current of air

through the spray and adjustable regulating means operable to intercept a portion of the spray presented in the path of said current of air and thereby regulate the amount of moisture delivered from the humidifier without varying the air current or the amount of fluid delivered to said spray producing means.

3. A humidifier comprising a casing, means for producing a conoidal jet of spray within said casing, means for projecting a current of air through said spray and adjustable regulating means operable selectively to partially or fully divert into a stream the liquid which forms the jet of spray and thereby regulate the amount of moisture delivered by the humidifier without varying the air current or the amount of fluid delivered to said spray producing means.

4. A humidifier comprising a cylindrical casing, means for producing a conoidal jet of spray within said casing, means for projecting a current of air through said spray and automatically operable regulating means for gradually varying the amount of spray delivered in the path of the current of air in correlation to the amount of moisture in the air supplied to the humidifier.

5. A humidifier comprising a cylindrical casing, means for producing a conoidal jet of spray within said casing, means for projecting a current of air through said spray and automatically operable regulating means for gradually varying the amount of spray in correlation to the amount of moisture in the air supplied to the humidifier including a member sensitive to moisture, so positioned as to be influenced by the moisture content of the air as it enters the humidifier.

6. A humidifier comprising a casing, means within said casing for producing a conoidal jet of spray, means for projecting a current of air through the spray, automatically operable regulating means operable gradually to divert into a stream a part or the whole of the liquid delivered to said spray producing means and means for controlling said regulating means including a member sensitive to moisture, so positioned as to be influenced by the moisture content of the air as it enters the humidifier.

7. A humidifier comprising a casing, a nozzle within said casing operable to produce a jet of spray, a sleeve adjustably mounted adjacent said nozzle and means for moving said sleeve to intercept and render ineffective a portion of the water delivered by said nozzle without substantially modifying the volume of water passing through said nozzle.

8. A humidifier comprising a casing, a nozzle within said casing operable to produce a jet of spray, a sleeve adjustably mounted adjacent said nozzle, automatic

means for moving said sleeve to restrict the effective action of said spray without substantially modifying the volume of water passing through said nozzle including a member sensitive to the moisture content of the air entering the humidifier.

9. A humidifier comprising a casing, a nozzle within said casing operable to produce a jet of spray, a sleeve adjustably mounted adjacent said nozzle and automatic regulating means for moving said sleeve to restrict the effective action of said spray including a hygroscopic member located adjacent the intake of said casing.

10. A humidifier comprising a casing, a nozzle within said casing operable to produce a jet of spray, a sleeve adjustably mounted adjacent said nozzle and automatic regulating means for moving said sleeve to restrict the effective action of said spray including a hygroscopic member located adjacent the intake of said casing and means for adjusting said regulating means operable to cause said humidifier to maintain the atmosphere of the enclosure at different predetermined degrees of humidity.

11. A humidifier comprising a casing, a nozzle within said casing operable to produce a conoidal jet of spray, a sleeve adjacent said nozzle arranged in axial relation thereto, means for moving said sleeve to restrict the effective action of said spray including a lever connected to said sleeve intermediate of its ends and pivotally mounted at one end, a hygroscopic member con-

nected at one end to the opposite end of said lever extending transversely across the humidifier adjacent the inlet thereof.

12. A humidifier comprising a casing, a nozzle within said casing operable to produce a conoidal jet of spray, a sleeve adjacent said nozzle arranged in axial relation thereto, means for moving said sleeve to restrict the effective action of said spray including a lever connected to said sleeve, a hygroscopic member connected at one end to said lever and extending transversely across the humidifier casing adjacent the inlet thereof and adjustable means connected to the other end of said hygroscopic member operable through said hygroscopic member and lever to position said sleeve relatively to said nozzle.

13. A humidifier for use in textile mills comprising a casing, a nozzle within said casing operable to produce a jet of spray, a sleeve adjustably mounted adjacent said nozzle and automatic regulating means for moving said sleeve to restrict the effective action of the spray including a hygroscopic member located adjacent the intake of said casing, said hygroscopic member having substantially the same moisture-absorptive property as that of the material being treated in the enclosure of the mill in which the humidifier is installed.

In testimony whereof, I have signed my name to this specification.

WILLIAM B. HODGE