May 26, 1964 R. M. ANDERSON 3,134,657

AIR HUMIDIFYING APPARATUS

Filed July 25, 1960 2 Sheets-Sheet 1

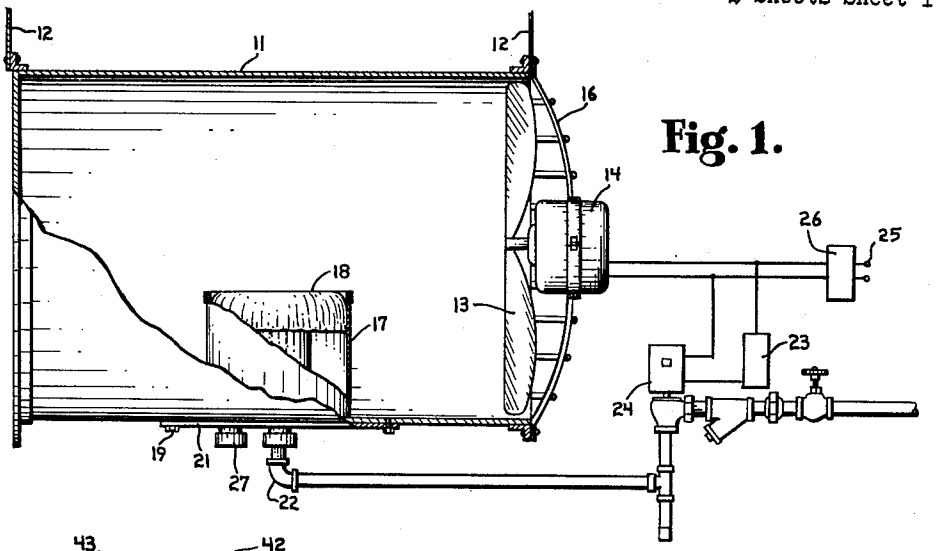


Fig. 1.

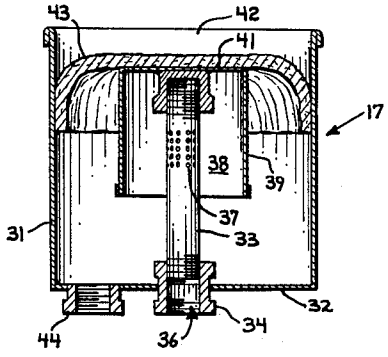


Fig. 2.

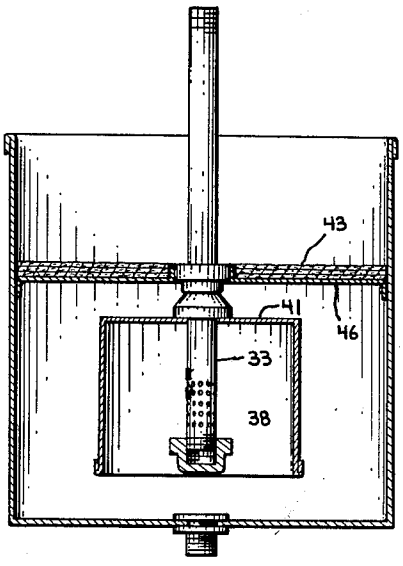


Fig. 3.

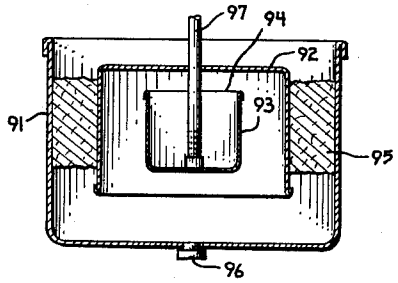


Fig. 7.

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AIR HUMIDIFYING APPARATUS

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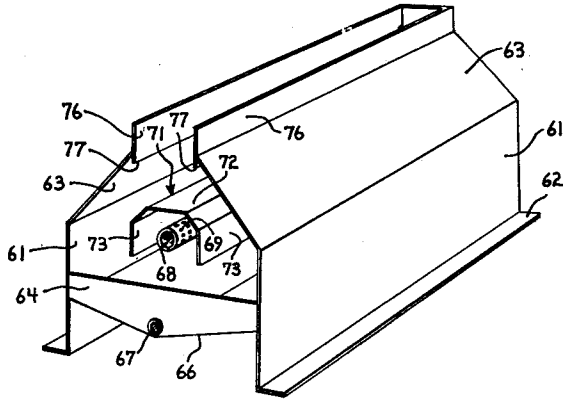


Fig. 5.

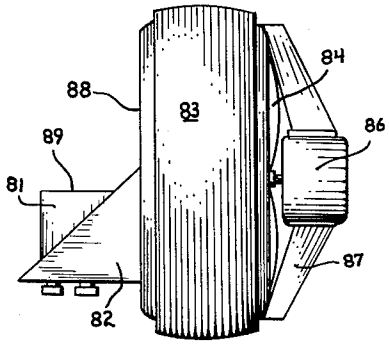


Fig. 6.

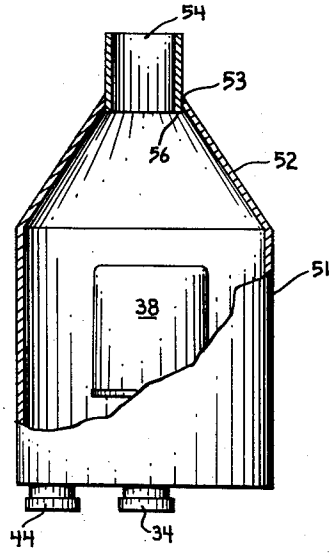


Fig. 4.

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AIR HUMIDIFYING APPARATUS

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6 Claims. (Cl. 55—263)

This invention is related to the humidification of air.

It is well known that there are many and various occasions when the humidification of air is necessary. A frequent employment of humidification is in connection with air conditioning where air is reheated after a cooling phase in which gaseous moisture was removed. Upon reheating of the air to a suitable temperature the humidity is usually too low so that some water must be added and this is usually accomplished by a humidifier. Humidification of air is frequently necessary, not only for purposes of comfort, but also to meet certain requirements of manufacturing processes.

Humidification is not always necessarily on a large scale but frequently is employed for only a room or a small space, such as a test chamber. An effective and versatile humidifier adaptable to a variety of sizes and capacities is obviously desirable in this type of application. It is also necessary that a humidifier be capable of humidifying air without producing droplets of water or condensate in the air and without an accumulation of condensate in the region around the humidifier itself. It is also desirable that a humidifier be capable of relatively noiseless operation.

It is, therefore, a general object of this invention to provide a novel humidifier adapted to a variety of uses and installations.

It is a further object of this invention to provide a humidifier with the foregoing characteristics and capable of silent operation.

It is a still further object of this invention to provide a humidifier having the foregoing characteristics and capable of humidifying air without the production of condensate in the air around the humidifying apparatus itself, or elsewhere in a system.

This invention includes in its scope a humidifier having a diffuser portion with an outlet disposed in the air stream. The diffuser outlet is at its uppermost margin and there is a humidifying fluid discharge conduit inside the diffuser. A deflector having a substantially closed top and side portion, but open at its underside, is disposed around the conduit so that when the humidifying fluid is discharged from the conduit, any condensate will be collected by the deflector and only the gaseous form of the humidifying fluid is able to escape from the bottom of the deflector toward the diffuser outlet and into the air stream. The collected condensate falls from the deflector to the bottom of the diffuser where it can pass to a drain outlet.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

FIG. 1 shows a humidifying apparatus according to a typical embodiment of this invention.

FIG. 2 shows the novel diffuser of the apparatus of FIG. 1.

FIG. 3 illustrates a diffuser similar to FIG. 2, but with a top feed rather than the bottom feed as shown in FIG. 2.

FIG. 4 shows a diffuser similar to that of FIG. 2, but with a nozzle type outlet and a condensate arrester lip at the outlet instead of a filter or diffusing pad such as shown in FIG. 2.

FIG. 5 shows a diffuser according to this invention and typical of those adapted to higher capacities.

FIG. 6 shows a diffuser such as that of FIG. 1, but in a unit heater type of application.

FIG. 7 shows a modification of the diffuser of FIG. 2.

Referring to FIG. 1, there is shown a preferred embodiment of a humidifier apparatus in accordance with the present invention which includes a duct **11** which may be supported from a building structure, for example, by hangers **12**. A fan **13** is driven by a motor **14** which is fastened to one end of the duct by means of brackets **16**. The fan produces an air flow through the duct **11**. A diffuser **17** having an outlet at **18** produces the vapor by which the air flow produced by the fan **13** is humdified. In a typical embodiment a hole is provided in the bottom of the duct **11** so that the diffuser **17** may be inserted through the hole up into the air stream and fastened to the duct by means of a set of fasteners **19** holding a supporting plate **21** to the bottom side of the duct.

Usually steam is supplied to the diffuser through an inlet **22** in its bottom side. The steam supply comes from a conventional system and is controlled by a humidistat **23** which operates the motorized valve **24**. A source of electrical supply at terminals **25** provides the power for both the fan motor **14** and the motorized valve **24**. There is a switch **26** in the supply to the motor and this also controls the humidistat **23** in the motorized valve **24** so that if the supply to the motor should fail, the valve **24** will be closed and no more steam will be supplied to the interior of the diffuser **17** of the humidifier. The diffuser **17** has an outlet **27** in its bottom side by which condensate can pass to a drain.

In FIG. 2, the diffuser **17** has a container with a wall portion **31** and a bottom portion **32** adapted to collect condensate. There is a conduit **33** fastened to the bottom portion **32** by means of a coupling **34**. The conduit is capped so that humidifying fluid (usually steam) entering the coupling **34** at the inlet **36** can escape only through a plurality of perforations **37** in the walls of the conduit. The escaping steam is deflected downwardly by a deflector cup **38** having the wall portion **39** and the top portion **41**. The deflected steam then finds its way upwardly through the space between the wall of the deflector and the wall of the diffuser toward the outlet **42** at the top or uppermost margin of the diffuser. There is a filter or diffusion pad **43** disposed across the diffuser, and this pad is capable of collecting any condensate which may have escaped from the deflector and passed upwardly toward the outlet from the diffuser. The diffusion pad may be made typically of an aluminum mesh filtering material. Condensate is collected by the deflector **38** and by the diffusion pad **43** and drops to the bottom of the diffuser and is discharged to a drain through the outlet coupling **44** in the bottom portion **32** of the diffuser.

FIG. 3 shows structure similar to that of FIG. 2, but in which the humidifying fluid is fed to the conduit **33** through the top **41** of the deflector **38** and the diffuser pad **43** is supported by a bracket **46**.

FIG. 4 shows a diffuser **51** having a deflector **38** therein similar to that of FIG. 2. The upper part **52** of the diffuser is of a conical shape and converges upwardly, being terminated by an opening **53**. A tubular portion **54** is fastened to the conical portion **52** at the opening **53** and extends downwardly a short distance below the opening **53**. This portion **56** extending below the opening **53** is capable of collecting condensate which was not collected by the deflector **38** and, therefore, passes toward the outlet from the diffuser. Because of this condensate col-

lecting ability, the downwardly extending portion 56 is called an arresting lip. Because of this feature, the diffuser pad, which is shown in FIGS. 2 and 3, is not required in this embodiment.

FIG. 5 shows an embodiment of this invention which is adapted to large capacities. The diffuser has upright walls 61 which have flanges 62 at their lower edges for fastening to a conduit, for example. Inclined walls 63 join the upright walls 61 adjacent their upper edges. The inclined walls 63 converge generally upwardly and provide a rectangular opening at their top edge adjacent the uppermost margin of the apparatus.

A pair of end walls 64 closing the ends of the apparatus in combination with the bottom portion 66 adjoining the end walls and the upright walls form a diffuser. An outlet 67 in the end wall 64 permits discharge of condensate from the diffuser to a drain.

The humidifying fluid supply conduit 68 for the embodiment of FIG. 5, is in the form of a tube extending the length of the diffuser and having a plurality of perforations 69 in its upper side. A continuous deflector 71, having a top portion 72 and side portions 73, extends the length of the diffuser and around the top and sides of the conduit 69. The deflector 71 performs the same function as the deflectors in the previous embodiments described.

A pair of plates 76 are fastened to the inclined walls 63 at their upper edges and have downwardly projecting arresting lips 77. These plates with the arresting lips perform the same function as those of FIG. 4, and obviate any need for the diffusion pad or filter.

FIG. 6 shows a diffuser 81, such as those illustrated in previous figures, mounted on a bracket 82 fastened to an assembly 83 which represents an apparatus such as a unit heater or a self-contained furnace. Air flow through the apparatus 83 is provided by a fan 84 driven by a motor 86 fastened to the apparatus by means of the brackets 87. An air flow out of the apparatus 83 at the outlet 888 passes over the diffuser outlet 89 and is accordingly humidified.

FIG. 7 shows a diffuser having a container 91 with a deflector cup 92 therein similar to the diffuser of FIG. 2. However, in this embodiment an additional deflector cup 93, having an outlet at its top 94, is provided which provides for exceptional condensate collection characteristics. A diffusion pad 95 is disposed in the annular space between the deflector 92 and the container 91. A drain outlet 96 is provided in the bottom of the container 91 whereby condensate may be discharged to a drain. As illustrated in this figure, the humidifying fluid is fed from the top of the diffuser to the conduit 97, but could just as well be fed from the bottom of the diffuser.

While an aluminum mesh has been mentioned as suitable material for the diffusion pad, other materials would serve equally well and certain other materials of more of a filtering nature than aluminum mesh are particularly adapted to noise suppression as well as condensate collection.

While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as modifications may readily suggest themselves to persons skilled in this art and within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. A steam humidifying apparatus, comprising in combination: a duct; blower means coupled to said duct for causing a positive flow of air therethrough

a container mounted within said duct and having imperforate side and bottom walls for collecting condensate, and having a steam discharge opening at the top thereof and in the path of airflow within said duct;

a steam discharge conduit connected with the interior of said container and having apertures for the discharge of steam into the interior of said container;

deflector means located within said container covering and extending below said steam discharge apertures to intercept flow of steam from said apertures and prevent a direct flow of steam from said conduit through said steam discharge opening;

a filter comprising a pad of meshed fibers providing a plurality of randomly spaced tortuous flow paths and a plurality of surfaces from which condensate will drip into the interior of said container, said filter closing said steam discharge opening of said container;

whereby condensate carried in the steam to the interior of said container is drained to the bottom of said container;

and means for withdrawing condensate from the bottom of said container.

2. A steam humidifying apparatus as defined by claim 1 in which said container and deflector means each comprise cup-shaped members, said deflector being mounted within said container in inverted position with respect to said container.

3. Steam humidifying apparatus as defined by claim 2 in which said steam conduit is connected to the bottom of said container.

4. Apparatus as defined by claim 2 in which said steam conduit is connected to the bottom of said deflector member.

5. A humidifying apparatus comprising: a duct; blower means coupled to said duct for causing a positive flow of air therethrough; a container mounted in said duct and having imperforate side walls and bottom for collection of condensate; an imperforate deflector member in said container of substantially inverted cup-shaped form, said deflector being mounted with its open end spaced above the bottom of said container; a steam discharge conduit disposed within said container and deflector and having a plurality of perforations therein located within the walls of said deflector for the discharge of steam into the interior of said deflector; an outlet from said container into said duct; a filter closing the flow path between said conduit and said outlet for collecting condensate and discharging it to the bottom of said container, said filter comprising a pad of material forming a plurality of extended randomly-spaced, tortuous flow paths and a plurality of surfaces disposed at a multiplicity of angles to the path of steam flow and from which condensate will drip into the interior of said container; and means for the connection of said conduit to a controlled pressure source of steam whereby the water vapor content of air flowing through said duct is increased without the addition of condensate to the air flow.

6. A humidifying apparatus comprising: a duct; blower means coupled to said duct for causing a positive flow of air therethrough; a container mounted in said duct and having imperforate side walls and bottom for collection of condensate; an imperforate deflector member in said container of substantially inverted cup-shaped form, said deflector being mounted with its open bottom spaced above the bottom of said container; a steam discharge conduit disposed within said container and deflector and having a plurality of perforations therein for the discharge of steam into the interior of said deflector; an outlet from said container into said duct; a filter disposed in a flow path between said conduit and said outlet for collecting condensate and dischargeing it to the bottom of said container, said filter comprising a mass of material arranged to provide a plurality of randomly-spaced, tortuous flow paths and a plurality of surfaces from which condensate will drip into the interior of said container; means for the connection of said conduit to a controlled source of steam whereby the water vapor content of air flowing through said duct is increased without the addition of condensate to the air flow; a motorized valve in

said steam conduit; a humidistat connected to said valve for opening said valve in response to predetermined humidity and for closing said valve in response to predetermined humidity; and means for closing said valve in response to the failure of current to said blower means.

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