United States Patent [19]

Bentley

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[45] **July 3, 1973**

[54] **AIR TREATMENT APPARATUS**

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[52] **U.S. Cl.** ..... **236/44 R**, 126/113, 261/18 R, 261/92

[51] **Int. Cl.** **G05d 22/00**

[58] **Field of Search**.....261/92 X, 18 B, 261/18 R, 66; 236/44 R, 44 A, 44 B; 126/113; 21/74

[56] **References Cited**

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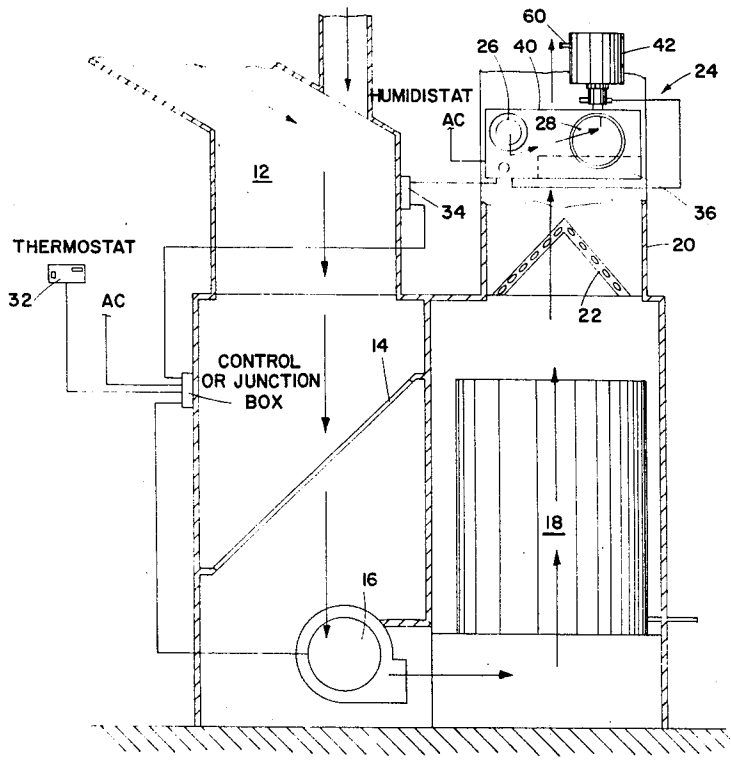
Primary Examiner—William E. Wayner
Attorney—Sidney W. Millard et al.

[57] **ABSTRACT**

A humidifier includes a ducting system associated with an apparatus housing, a moisture pad which rotates to pick up liquid from a pool in the bottom of the housing and a blower for drawing air into the housing and subsequently forcing it out. The blower is actuated, usually by some humidity-sensing device, to blow a stream of air over and through the moist pad, which air exits in a more humid state than when it entered. A container of deodorizing liquid or the like is mounted on the housing above the moisture pad for dispensing said liquid to the pad. The liquid may be for deodorizing, disinfecting and/or medication, such as some prescription drug needed by the occupant of the enclosure serviced by the humidifier. Control equipment is included to regulate the feed of the liquid to the pad.

8 Claims, 6 Drawing Figures



3 Sheets-Sheet 1

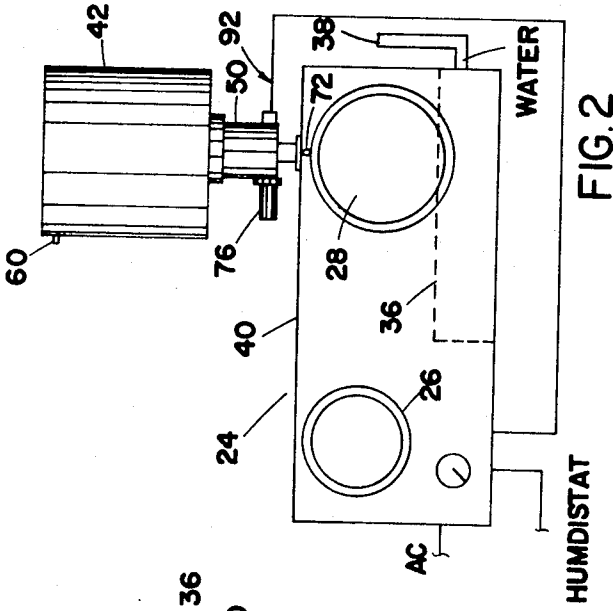


FIG. 2

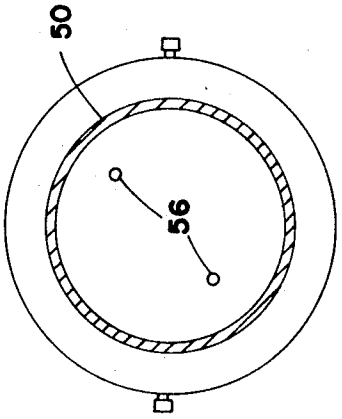


FIG. 6

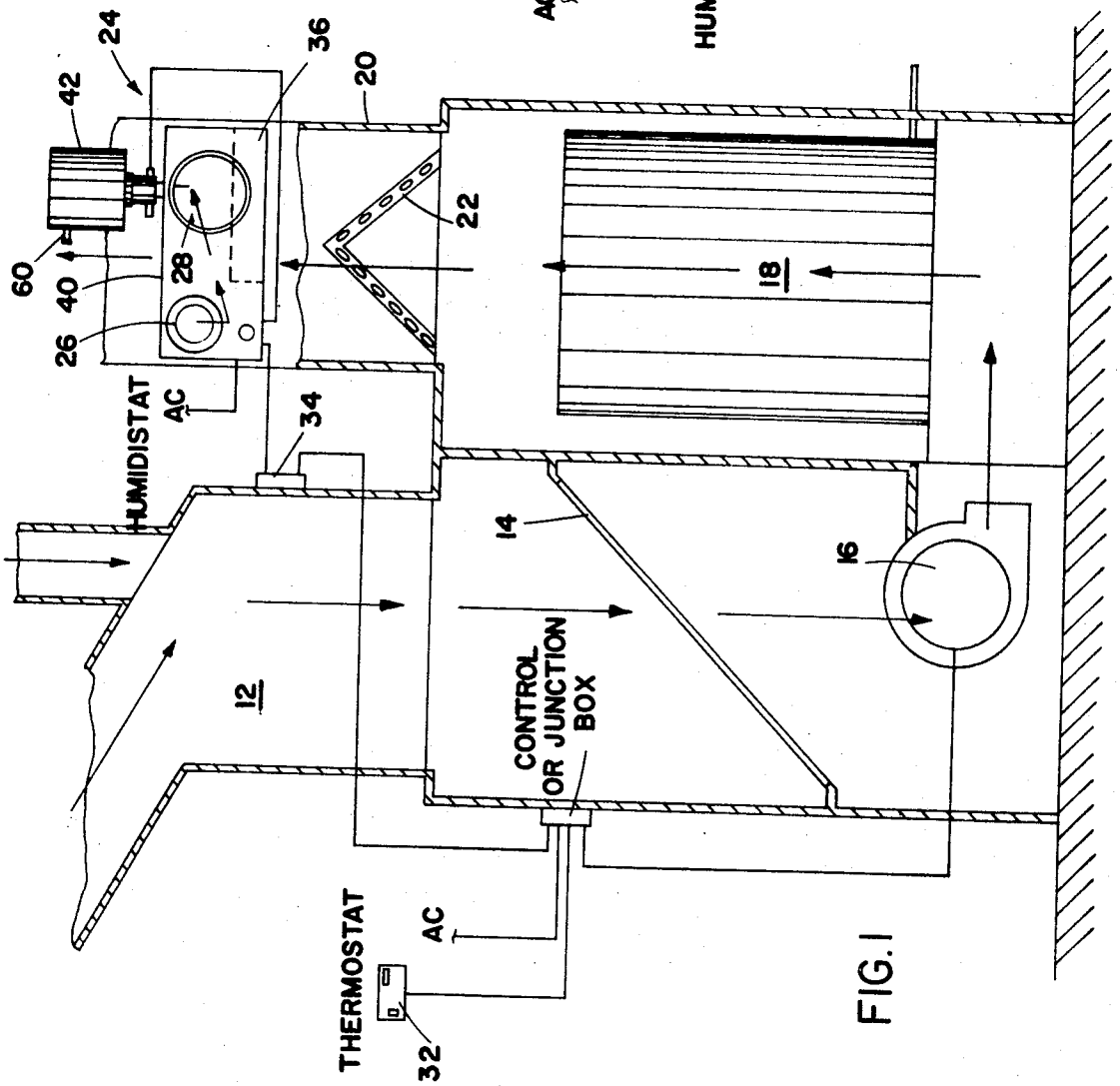
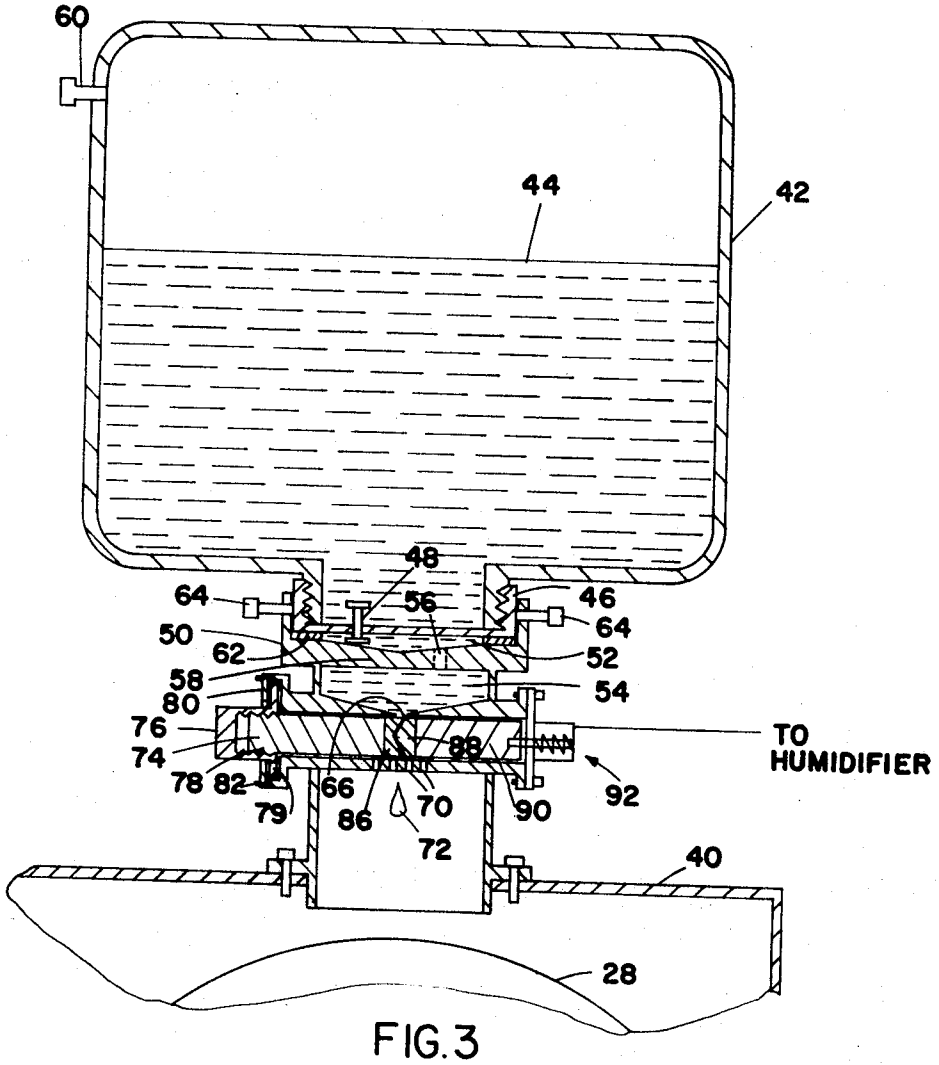


FIG. 1


60
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42
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46
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52
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76
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78
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79
66
86
70
72
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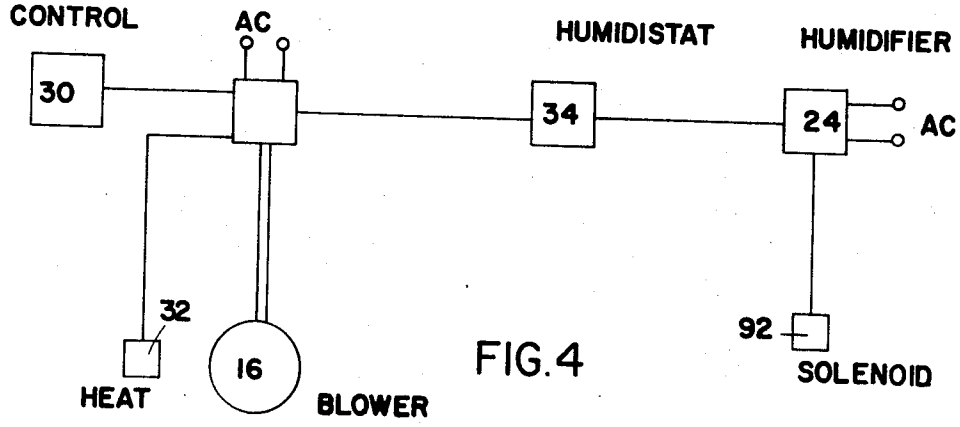
90
92
TO HUMIDIFIER
40
28

FIG. 3


CONTROL
AC
HUMIDISTAT
HUMIDIFIER
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34
24
AC
32
HEAT
16
BLOWER
92
SOLENOID

FIG. 4

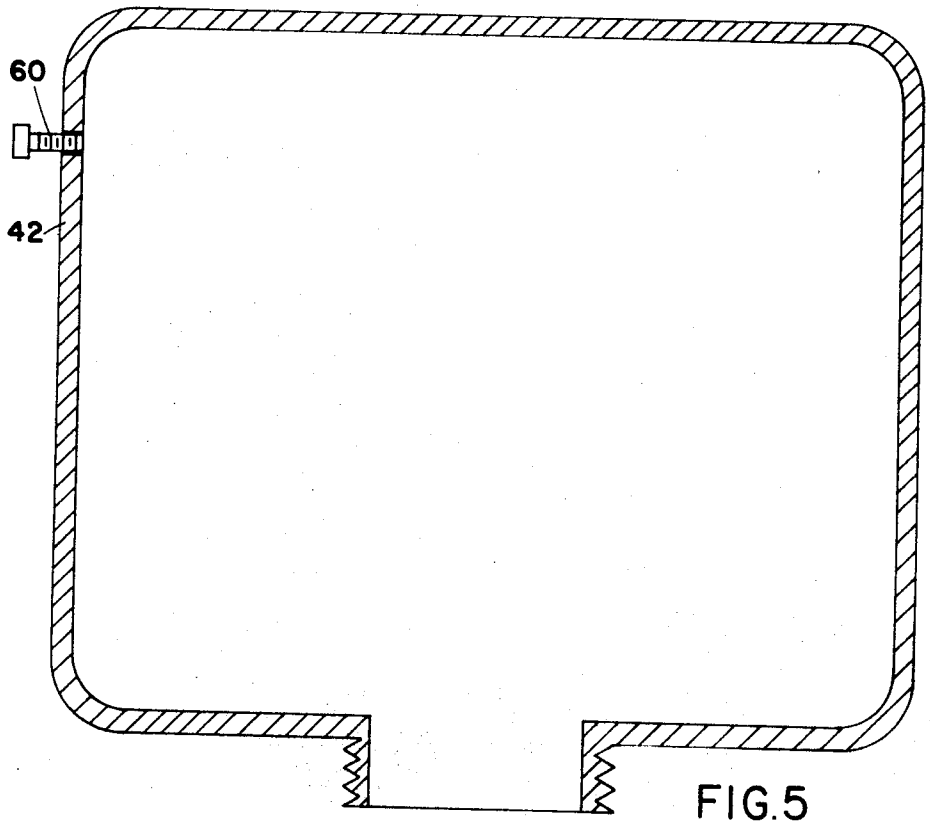
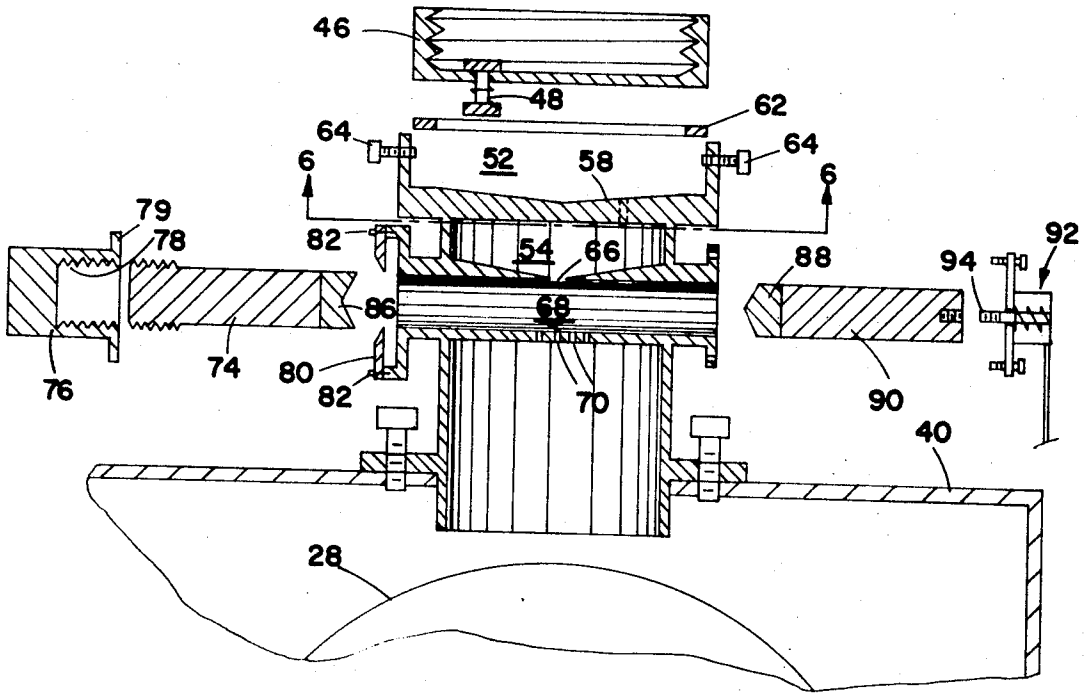

60
42

FIG.5


46
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AIR TREATMENT APPARATUS

BACKGROUND OF THE INVENTION

Within the past few years, the consumer market has found a need, or at least a desire, for sprayed materials which serve to (1) deodorize the air within a house, (2) disinfect the air in hospitals and/or homes, and (3) medicate the air for victims of respiratory ailments.

These various airborne vapors are most often dispensed from aerosol cans of the liquid; however, the need for periodic spray applications is an inconvenience to most people and it would be desirable to have an automatic system for dispensing the desired vapor. The instant invention provides such apparatus which may be installed in combination with a conventional humidifying system. It may be installed in an existing duct system or even on a portable humidifier as found in many homes having electrical heat, etc.

One problem with individual aerosol cans per se, is that they are so limited in volume, and if they are hand-dispensed, the spray can must be actuated in each separate room involved to achieve the desired effect; for example, in the kitchen for kitchen odors, in the bathroom for bathroom odors and in every room in the house where pets are free to roam. While it is conceivable that a plurality of aerosol cans (one for each room) could be automatically actuated by some timed device, it would be quite inconvenient to perform the number of can replacements necessary in the period of time involved. Thus, the need is for a large quantity of the desired vaporable liquid material which is automatically dispensed and this invention provides apparatus to accomplish that result.

BRIEF DESCRIPTION OF THE INVENTION

The apparatus includes a humidifier having a blower and a rotating foraminous pad mounted as a unit within a housing where the blower is actuated by some exterior source, either manual or automatic, and directs air against the pad. The pad, in turn, rotates and passes through a pool of water in the bottom of the housing where the pad picks up water and moves it into the blower path. As a result the blown air departs from the housing in more humid condition than when it entered.

It will be understood from the subsequent description that the aforementioned humidifying unit can be of the conventional portable type of humidifier filled with water manually at periodic times, or it can have some sort of automatic water feed system involving a float valve or other control. Further, the humidifying unit itself can also be mounted in combination with a built-in heating and cooling system and the usual duct work in a commercial establishment, a single dwelling house or even a motor vehicle.

A container of the desired liquid (deodorizing, disinfacint, and/or medicating) is mounted on top of the humidifier housing and dispenses the liquid through an outlet from the container, in drop-wise fashion directly onto the rotating porous pad without ever encountering the pool of water prior to its encounter with the pad. The amount of liquid dispensed onto the pad is controlled by a valve in the flow path from the container into the housing. It includes a cylinder having two openings through its sidewall. Two coaxially mounted pistons are adapted to reciprocate within the cylinder for opening and closing the two openings. The inner end of each of the pistons includes structure for sealingly engaging the other piston, to thereby seal the passage between the two openings in the cylinder sidewall. One of the pistons is axially adjustable along the cylinder axis by means of a micrometer type of dial gauge which is calibrated in drops per minute of the liquid being dispensed. The other piston is normally biased into sealing engagement with the adjustable piston. Upon a predetermined signal or by manual adjustment, the second piston is retracted to a predetermined stop and such retraction allows fluid to flow into the cylinder from above and out the other side, between the separated ends of the two pistons.

One mechanism which has been found to be desirable is a solenoid actuated retraction of the biased piston. The solenoid itself is actuated by a humidistat which is connected to the humidifier and across the leads of the blower to thereby operate or stop both simultaneously (although a timed delay could be incorporated with either one). The humidistat in such an instance is usually located on the wall of the enclosure whose air is to be treated or in a return duct which exhausts air from the room whose air is being treated.

It has been found that gallon containers of the liquid air-treating material is preferable because it will provide a supply which is adequate for about 45 to 60 days of normal use in a single-family dwelling of 2,000 to 2,500 square feet of living space. Obviously, larger or smaller containers of said liquid can be used as desired, should circumstances dictate otherwise. For example, the prescription life of some medications might be of 2 or 3 weeks duration, in which case a quart container of the liquid would be all that would be needed or acceptable.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagrammatic view of the ducting system, the heating and cooling apparatus, and the control mechanisms into which the humidifying and air treatment apparatus of this invention is incorporated.

FIG. 2 is an enlarged diagrammatic view of the humidifying and air treatment apparatus of FIG. 1.

FIG. 3 is an enlarged sectional view of the liquid dispensing apparatus of this invention.

FIG. 4 is a diagrammatic view of the control elements and one circuit usable in this invention.

FIG. 5 is a sectional exploded view of the elements of FIG. 3.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5.

PREFERRED EMBODIMENT

FIG. 1 illustrates diagrammatically many of the pieces of apparatus found in a conventional home air heating and cooling system. It includes a return air duct 12 for directing air through a filter 14 and a blower 16 which forces air through a furnace or air heating area 18 and out through ducting 20 leading to the room or larger enclosure to be heated.

During the summer months, the furnace or heating area 18 is not in operation but cooling coils 22, mounted in the outlet area above the heating chamber 18, serve to cool the air which is in turn moved through the same ducting system 20.

As illustrated in FIG. 1, a humidifier 24 is often incorporated in the ducting 20 above the cooling coils 22. It is mounted to draw air from the duct 20 by a second blower 26, force it through a moisture pad 28 and

back into the duct **20** for further passage to the aforementioned enclosure.

A control or junction box **30** is connected by a plurality of electrical connections to a thermostat **32** and a humidistat **34**, which operate in the conventional manner. In the embodiment illustrated, the humidistat samples the air from the return duct **12**, but it is obvious that the humidistat could be located in the enclosure whose air is to be treated. No particular discussion need be made in relation to the control box and other electrical apparatus, as the operations of these are well known to those having ordinary skill in the art. One operable circuit diagram is illustrated in FIG. **4** but many others fall within the scope of this invention.

Turning now to FIG. **2**, the porous pad **28** is connected electrically to rotate when the blower **26** is in operation. At its lower extent, it passes through a pool of water **36**, illustrated schematically by broken lines in FIGS. **1** and **2**. A water inlet line **38** is illustrated here only by way of example. It will be appreciated that water may be fed to the pool **36** manually or by some automatic filling device which may for example be controlled by a float valve (not shown). The blower **26** withdraws air from the duct **20** and forces it over and through the moisture pad **28**. The result is that the air which exits from the humidifier housing **40** back into the ducting **20** is more humid than when it entered.

The aforementioned apparatus is conventional. This invention is concerned with further treating the air which passes through the humidifier. Said treatment is with a vaporable liquid stored in container **42**. It is preferred that the container **42** be of clear plastic material so that the liquid level **44** can easily be observed and thereby allow the home owner or workman to know when replacement or filling of the container should be considered. The liquid itself may vary from household to household, its exact composition is relatively immaterial. The chemistry of the treatment liquid is not part of the invention beyond the broad concepts herein defined.

As is illustrated, it is preferred that the container be mounted in inverted position with a cap **46** threaded to its top. The threaded cap includes a valve **48** of any conventional design which will serve the purpose, to be outlined. Valve **48** is designed to normally prevent the exit of fluid from the container **42** until such time as it is depressed, as illustrated in FIG. **3**. With the cap **46** affixed to the container **42** and inverted to seat in the receiving body **50**, the valve **48** will be depressed and allow fluid to flow out of the container and into the cavity **52**. Flow from the cavity **52** into reservoir **54** will be by gravity through two apertures **56** in dividing wall **58**. The apertures **56** through wall **58** are best illustrated in FIG. **6**. It will be appreciated that different shapes or sizes of apertures **56** may be used if desired.

To allow free flow of the fluid from the container **42** through valve **48**, a valve **60** is provided at its upper inverted end. It will also be understood that with a valve such as illustrated at **60**, liquid would tend to flow out through valve **48** into cavity **52** and overflow the receiving body **50** without some means for sealing and blocking such flow. To remedy this a sealing ring or gasket **62** is provided around the inside of the cavity **52** to seal against the cap **46**. Initially the weight of the fluid in the container **42** will help the gasket seal the edges of the cavity **52** but thumbscrews **64** which are designed to thread through apertures in the sidewall of the receptacle **50** will hold the cap and container in position regardless of the liquid level. This contributes to the sealing effect of the gasket **62** and, in addition, prevents accidental tipping of the container.

An aperture **66** leads from the reservoir **54** into a cylinder **68** which contains two coaxially mounted pistons for sealing and periodically opening the aperture **66**. The operations of the pistons will be described subsequently; however, for purposes of description it will be assumed that the pistons are retracted enough to allow fluid to flow through aperture **66** in the top sidewall of the cylinder and out through the plurality of lower apertures **70** in the bottom sidewall of the cylinder.

As illustrated in FIG. **3**, the fluid will exit from apertures **70** in droplets **72** which will fall by gravity onto the surface of the rotating moisture pad **28**. Air from blower **26** will vaporize some of the droplets **72** in their gravitational drop toward the mousture pad; subsequently, the droplets **72** will evaporate with the water from the pad and be conveyed onto the ducting **20** as previously explained.

Obviously, not all of the droplets **72** will be vaporized immediately. Some will be carried by the moisture pad **28** into the water pool **36** and subsequently will be vaporized in aqueous combination. This fact is obvious but not particularly significant, as it will be clear to those in the industry that the deodorizing, medicating and/or disinfecting liquid could be fed directly into the pool of water **36** without dropping onto the moisture pad **28**. However, the apparatus described and the direct gravitational application of the droplets **72** to the moisture pad has been found to be most efficient. Volatile mixtures of appropriate ingredients tend to get the deodorizing liquid into the moving airstream more quickly than applications directly to the pool **36**. Some mixtures of deodorizing liquid are more volatile than water; as a result, if such fluids are fed directly to the pool **36**, they might tend to be overpowering in their fragrance rather than merely deodorizing as is intended, especially in the first gush of air after blower **26** was activated. Additionally, there is no easy way to control the amount of deodorizing liquid vaporized when it is applied directly to the pool of water; however, the illustrated valving system which meters the deodorizing liquid directly onto the moisture pad allows one to more accurately control the quantities believed to be needed.

Returning again to FIGS. **3** and **5**, the piston **74** illustrated on the left-hand side, is axially adjustable within the cylinder **68** by means of a vernier-like dial gauge **76** threaded on its outer end. By way of illustration, it is preferred that the mating threads **78** be machined at 64 threads per inch. The dial **76** can be calibrated in drops per minute or some other convenient quantity designation which will control the amount of liquid from container **42** which passes between the ends of the two pistons when the valve is opened. By way of illustration only, the dial **76** is shown with a radial flange **79** which is connected to one end of the cylinder wall by a plate **80** penetrated by bolts **82**. The plate **80** traps flange **79** and prevents its axial movement while allowing it to rotate and adjust the adjustable piston **74**.

A cone-shaped soft sealing cavity **86** on the inner end of piston **74** is adapted to sealingly engage a cone-shaped male member **88** on the inner end of the other piston **90**. Piston **90** is normally biased toward piston **74** and together the ends **86** and **88** seal the cylinder

and prevent fluid flow from aperture **66** to apertures **70**. The spring biasing in question is accomplished by a conventional solenoid illustrated schematically at **92**. The solenoid is connected to the piston **90** by a conventional screw or rod **94** which includes appropriate stop means for limiting the withdrawal of the piston **90** when it is actuated. No particular discussion of this operation appears necessary as it is well known to those having ordinary skill in the art.

Having thus explained the basic concepts of the invention, it will be obvious that the container and associated parts and apparatus may easily be adapted to and mounted on conventional and existing humidifying apparatus. As illustrated herein, an aperture is cut in the top of the housing **40** of the humidifier and the receptacle-conduit-valving combination is simply bolted in place over the aperture. This concept may be employed with built-in humidifiers, portable humidifiers having no such elaborate duct work as is illustrated or even in the heating system of motor vehicles.

Having thus basically explained the apparatus, itself, the expected and conventional operation of the total system will be outlined. First, the thermostat **32** will signal through the control box **30** that heat is needed. The furnace and heating box **18** will be actuated and when it reaches a certain temperature, the blower **16** will switch on to draw air from duct **12** through filter **14** along with some fresh air, not illustrated. Such propelled air will flow through the burner box **18** and out through the ducting **20**. While this is going on, the humidistat **34** will sense the moisture content of the air in duct **12** and at such time as it gets below a certain preselected amount, the humidifier blower **26** will be activated through controls **30** and simultaneously the moisture pad **28** will begin to rotate. Following a short delay from the actuation of the blower **26**, the solenoid **92** will be energized, withdrawing the piston **90** and separating sealing surfaces **86** and **88**. Deodorizing or other fluid will flow from aperture **66** through the cylinder **68** and drop through apertures **70** onto the rotating moisture pad **28** where it will be vaporized and carried into the ducting system **20** to the indicated enclosure.

While the invention has been described with respect to a heating system, it is understood that the invention is equally operable under the cooling or summer conditions. In the summer months, it is desirable that the level of water be relatively low, the humidity is normally higher in those months and a pad **28** which is only slightly moist will serve adequately.

Obvious modifications will appear to those having ordinary skill in the art and it is not intended that the language used to describe the invention, nor the drawings illustrating the same be limiting on the invention, rather, it is intended that the invention be limited only by the wording of the appended claims.

I claim:

1. In the combination of a ducting system, a blower, a moisture pad, power means for operating the blower and the pad, and means for dispensing and vaporizing a deodorizing or disinfecting liquid into the air in the ducting system,

the ducting system being structured to conduct the treated air to an enclosure and return air from the enclosure,

the blower being positioned to force air into a path leading to the pad and subsequently into the ducting system leading to the enclosure,

the pad being located in a housing having an opening leading into the portion of the ducting system which leads to the enclosure, the pad being foraminous and being mounted for rotation in a path with the lower extent passing through a pool of water, whereby air from the blower passing through the moisture pad will evaporate water and other vaporable material it carries,

the improvement comprising:

a container of said liquid being connected to means for dispensing said liquid into said housing, said liquid being (1) partially vaporized substantially immediately and moving out of the housing with the air into the duct system and (2) partially mixed with the water in the pad and in the pool where it will continue to vaporize in combination with the water in the pad,

the means for dispensing includes a valve connected to an outlet from said container which valve is opened and closed by apparatus actuated by humidistat means for sensing the humidity of the air in the return ducting.

2. The combination of claim **1** wherein the container is mounted on the top of the housing and the liquid is dispensed by gravity directly onto the moisture pad.

3. The combination of claim **2** wherein the valve comprises two openings through the sidewall of a cylinder, one opening being connected to the container outlet and the other being in fluid communication with the interior of the housing,

two pistons mounted within said cylinder, the inner ends of said pistons being adapted to abut in sealing relationship to prevent fluid flow from one cylinder opening to the other,

one of said pistons being manually adjustable along the cylinder axis and the other being biased toward the adjustable one.

4. The combination of claim **3** wherein the biased piston is retracted from the adjustable one by a solenoid actuated by apparatus which is actuated by the humidistat means, the retraction allowing liquid to flow from the container,

the axial retraction of the biased piston in the cylinder being limited by stop means and the axial distance traveled being controlled by the prior adjustment of the adjustable piston.

5. The combination of claim **1** wherein the valve comprises two openings through the sidewall of a cylinder, one opening being connected to the container outlet and the other being in fluid communication with the interior of the housing,

two pistons mounted within said cylinder, the inner ends of said pistons being adapted to abut in sealing relationship to prevent fluid flow from one cylinder opening to the other,

one of said pistons being manually adjustable along the cylinder axis and the other being biased toward the adjustable one.

6. The combination of claim **5** wherein the biased piston is retracted from the adjustable one by a solenoid actuated by apparatus which is actuated by the humidistat means, the retraction allowing liquid to flow from the container,

the axial retraction of the biased piston in the cylinder being limited by stop means and the axial distance traveled being controlled by the prior adjustment of the adjustable piston.

7. In the combination of a humidifier and a means for dispensing and vaporizing a deodorizing or disinfecting liquid into the humidifier,

the humidifier including a housing holding a blower for directing a stream of air against a rotating porous moist pad, whereby the air passes through the pad, evaporates water and other vaporable material carried by the pad, and exits from the housing in a more humid state than when it entered, said housing including a pool of water through which the pad passes in its rotating path,

the improvement comprising:

the dispensing and vaporizing means including a container mounted on top of the housing, an outlet from the container controlled by a valve means, the valve means being in fluid communication with the container and including means for opening and closing an outlet leading into said housing where the liquid is dispensed and vaporized with the water on the moisture pad,

said valve means comprising two pistons within a cylinder adapted to abut and stop flow of the liquid,

one piston being manually adjustable along the cylinder axis, the other being biased toward the adjustable one.

8. The combination of claim 7 wherein the liquid passing through said valve is dispensed directly onto said pad without first contacting the pool of water.

* * * * *