

[54] **HUMIDIFIER-DEHUMIDIFIER DEVICE**

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[56]

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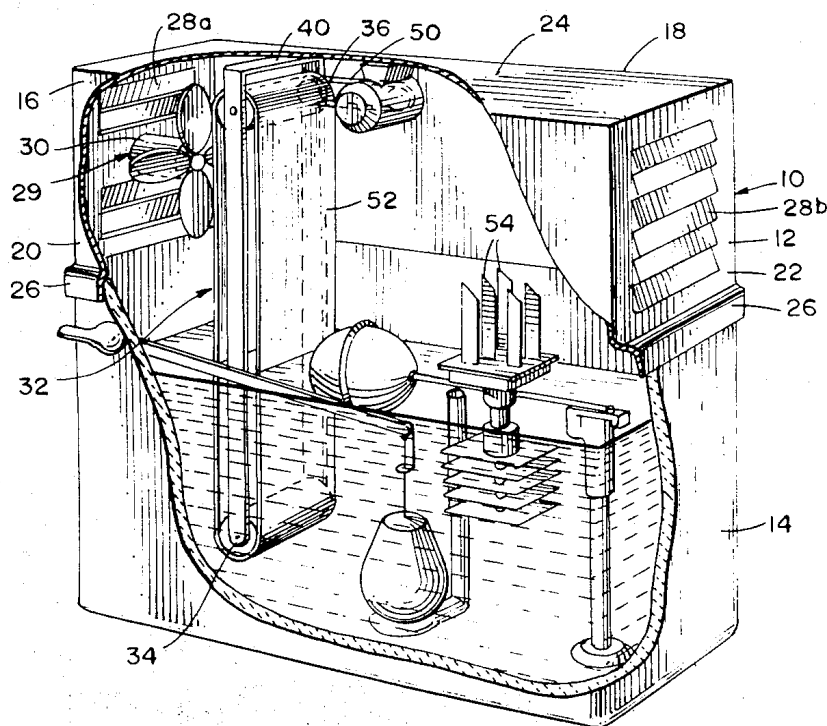
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ABSTRACT

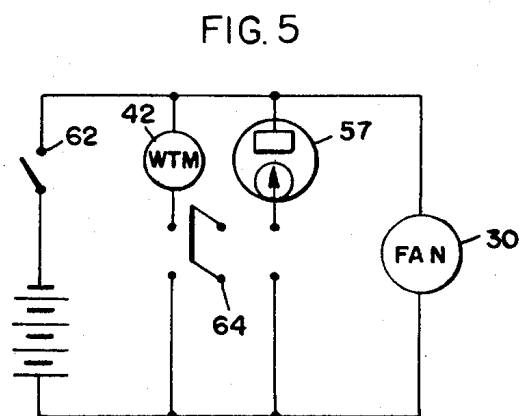
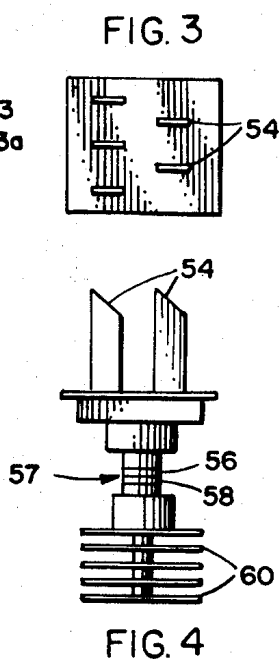
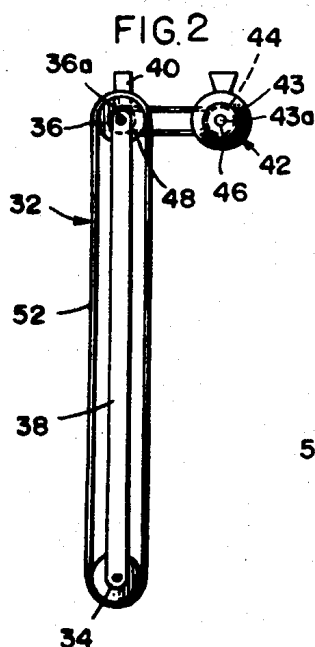
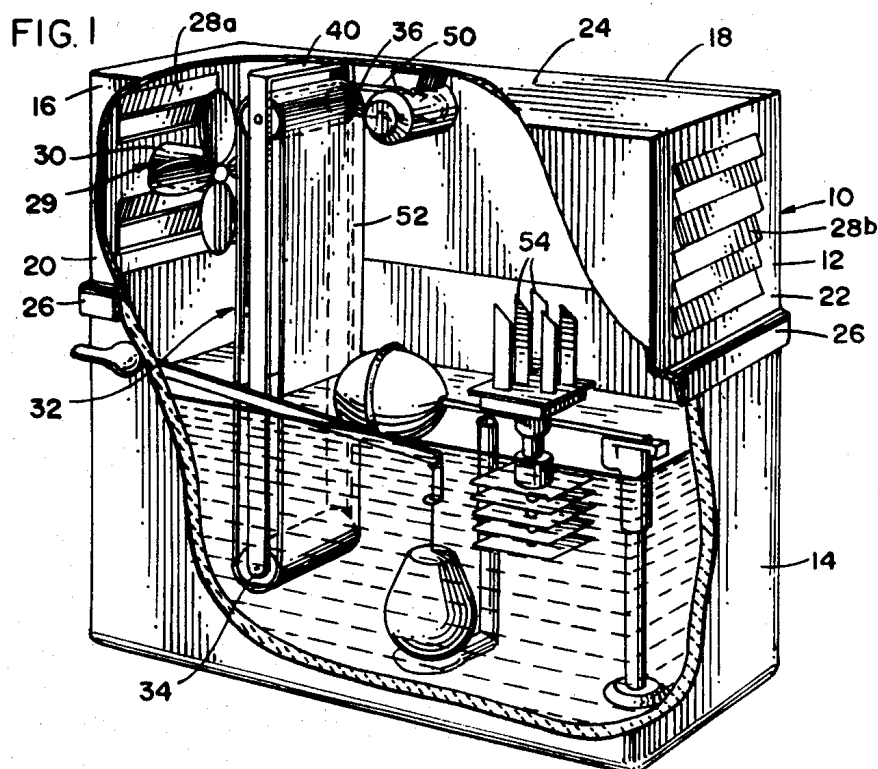
A humidifier-dehumidifier device operates in combination with a water closet. The device includes a housing with a fan mounted therein. The fan blows air through water transfer means and cooling fins positioned within the housing. Control means alternatively energize the water transfer means to humidify the air, or the cooling fins to dehumidify the air. The water closet acts as a cycling water reservoir in the humidifying mode of operation and as a catch basin in the dehumidifying mode of operation.

8 Claims, 5 Drawing Figures



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HUMIDIFIER-DEHUMIDIFIER DEVICE

BACKGROUND OF THE INVENTION

The invention relates generally to an air treatment device and more particularly to a combination humidifier-dehumidifier device which utilizes a water closet as one of its components.

Humidifiers and dehumidifiers are well-known in the art. Typically, a humidifier includes a housing having a fan to create an air flow, a water reservoir within the housing, and means to transfer water from the reservoir into the air flow where it is evaporated and expelled into the surrounding atmosphere. Dehumidifiers generally include a housing having a fan to create an air flow, a water reservoir within the housing and means for cooling the flow of air to condense the moisture in the air flow for collection of moisture in the water reservoir. Any combination of a humidifier-dehumidifier would combine certain common elements. These would include the housing, the water reservoir, and air flow means.

One problem, however, with independent humidifiers and dehumidifiers (as opposed to those incorporated in a furnace) is the constant attention required of the water reservoir. Typically, a humidifier used in household applications has water supplied from an external source. Water is hand carried from the external source to the humidifier, or alternatively, a water supply hose may run to the reservoir.

In a dehumidifier the opposite problem exists. As moisture is condensed from the air flow it accumulates in the reservoir. The reservoir must periodically be emptied to prevent its overflowing. Alternatively, an overflow hose may be provided to direct the excess moisture to a drain. In either case, the use of such a device requires constant attention or unsightly hoses to fill or drain the reservoir.

A further problem with a humidifier involves the water transfer means. When the water transfer means places water which is to be evaporated in the flow of air, the water transfer means simultaneously transfers dust and dirt particles into the water reservoir. The dust and dirt accumulates in the reservoir, thus necessitating periodic cleaning.

The present invention serves to alleviate problems through the use of a simple, economical, maintenance-free, self-contained unit which can be utilized in every household having a water closet.

SUMMARY OF THE INVENTION

A humidifier-dehumidifier device which cooperatively operates with a cycling water reservoir. The water reservoir has water inlets and outlets and means to introduce and cycle water therethrough. A housing, having an air inlet and outlet and air flow means, water transfer means, and heat exchange means, is located adjacent to the water reservoir. Control means energize the air flow means and alternatively the water transfer means or heat exchange means to humidify or dehumidify respectively the flow of air.

In a preferred embodiment, the present invention utilizes a water closet as the water reservoir. A housing containing air flow means, water transfer means and cooling fin means is adapted to fit on top of the water closet. This construction is advantageous because all the plumbing is already present to fill and drain the reservoir. Also, the water is continuously cycled by the

flushing action of the water closet. This removes any dirt from the water closet which accumulated when the device is used as a humidifier. Also, overflow means are currently found on water closets, so the necessity of draining the water reservoir when the device is used as a dehumidifier is eliminated.

One object of the present invention then, is to provide a combination humidifier-dehumidifier device.

A further object is to provide an economical combination humidifier-dehumidifier which cooperatively operates with a preexisting cycling water reservoir.

Still another object of the present invention is to provide a device with removable components which can be used alternatively as a humidifier, or as a dehumidifier.

These and other objects, advantages and features of the present invention will be set forth in greater detail in the description which follows.

BRIEF DESCRIPTION OF THE DRAWING

In the detailed description which follows, reference will be made to the drawing comprised of the following figures:

FIG. 1 is a perspective cut-away view of the invention mounted above a water closet and illustrates the air flow means, the water transfer means and the cooling fin means disposed therein;

FIG. 2 is a side view of the continuous water transfer means;

FIG. 3 is a top view of the heat transfer means illustrating the location of the cooling fins;

FIG. 4 is a side view of the heat transfer means showing the cooling fins extending perpendicularly from the cold side of a thermoelectric module and heat dissipation fins extending from the hot side of the thermoelectric module; and

FIG. 5 is a schematic diagram illustrating the control means for energizing the air flow means and alternatively energizing the water transfer means or the heat transfer means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the FIGURES wherein like reference numbers refer to like parts, FIG. 1 illustrates a combination humidifier-dehumidifier device 10 incorporating the present invention. The humidifier-dehumidifier device 10 includes a housing 12 which is mounted on a water closet 14 of a toilet. The normal inlet and outlets are illustrated within the water closet 14. The housing 12 includes front wall 16 and a rear wall 18, sides 20 and 22 and a top 24. The front wall 16, rear wall 18 and sides 20 and 22 have a lip or flange 26 around their bottom edge to support the housing on the water closet 14. Sets of louvers 28a and 28b are located in sides 20 and 22 respectively to permit a flow of air through the housing 12.

Air flow means 29 are illustrated mounted in side wall 20. The air flow means 29 includes an axial flow fan 30 mounted in the center of louvers 28a. When the axial air flow fan 30 is energized, air is drawn in louvers 28a and forced through the housing 12 and out of louvers 28b.

Water transfer means 32 are shown mounted directly in the air flow to the right of the axial flow fan 30. The water transfer means 32, as best seen in FIG. 3, includes rollers 34 and 36 mounted on a frame 38. The frame 38 includes a base 40 which is mounted by suit-

able means to the top 24 of the housing 12. Drive means 42 are mounted adjacent to roller 36. Drive means 42 includes a motor 43 illustrated mounted to the top 24 of housing 12. A pulley 44 is mounted on a drive shaft 46 of the motor 43. Roller 36 has a pulley 48 concentrically mounted along an axis 36a. A belt 50 extends between the pulley 44 and the pulley 48 to transmit motion from drive means 42 to roller 36. A water absorbent material or screen 52 is stretched over rollers 34 and 36.

As illustrated in FIG. 1, roller 34 is immersed in the water of water closet 14. As the roller 36 is rotated, the water transfer means moves the portion of the water absorbent material or screen 52 which was immersed in the water to a position directly in the flow of air. The flow of air picks up moisture from the water absorbent material or screen 52 of the water transfer means 32 through evaporation. The moist air is, in turn, expelled through louvers 28b into the surrounding atmosphere.

As the wet surface of the water absorbent material or screen 52 gives up moisture to the flow of air, it also captures dirt and dust particles in the air flow. This dust and dirt, as well as mineral precipitate on the screen 52, is transmitted back to the water in the water closet 14. The water cleans the water absorbent material or screen 52 and the dirt, dust and mineral precipitate from the screen 52 settle to the bottom of the water closet 14 to be expelled from time to time in the flushing action of the toilet. This is advantageous since it eliminates the necessity of cleaning the reservoir. Additionally, precipitate, such as lime, cannot build up on the screen 52. The continuous bending of screen 52 in combination with the flushing action of the water closet act to clean the screen 52. Thus, the present invention is essentially self-cleaning while aiding in the purification of household air.

FIG. 3 illustrates the cooling fins 54 used during the dehumidification sequence of operations of the present invention. The cooling fins 54 are mounted within housing 12 by suitable means and are positioned to extend upward into the flow of air created by air flow fan means 30.

As best illustrated in FIG. 4, the cooling fins 54 are connected to the cool side 56 of a thermoelectric module 57 which utilizes the well known "Peltier" effect. The hot side 58 of the thermoelectric module includes heat dissipation fins 60 attached thereto which extend into the water in the closet 14. The closet 14 thus serves the dual purpose of first acting as a catch basin and receiving the condensed moisture from the moist air flowing through the housing 12 and, secondly, acting as a heat sink by cooling the heat dissipation fins 60.

An alternative construction includes a compressor, cooling coil arrangement of the type well known in the art. That is, the cooling coil would be positioned in the moist air stream and the condensing coil would be positioned in the reservoir. This compressor arrangement would be substituted for the thermoelectric module 57 and would operate to remove moisture from an air stream just as the module 57. The advantages discussed for the module 57 would also apply to such a compressor, cooling coil arrangement.

In use, the axial flow fan 30 is energized thus creating a flow of air through the housing 12. The incoming moist warm air is caused to flow over cooling fins 54 which are positioned in the flow of air. The thermoelec-

tric module 57 is energized causing the cooling fins 54 to cool. The cool surfaces of the fins 54 cause moisture in the warm air to condense. The moisture collected on the cooling fins thus flows into the water in the water closet 14. The air, with moisture removed, flows out the louvers 28b into the surrounding atmosphere.

FIG. 5 illustrates a schematic diagram of the control circuit utilized in the present invention. A first switch 62 energizes the fan 30. By means of a double pole, double throw switch 64, an operator can select the mode of operation he desires. It is understood the selector control means can be attached to a double set point humidity sensor to automatically operate either mode depending on the conditions of the household air.

By the combination of certain elements, i.e. air flow, water closet and housing, the applicant has set forth an economical humidifier-dehumidifier device which utilizes a common household fixture. Alternatively, should either a humidifier or a dehumidifier be desired, the components are removable to allow use as a single system. For example, should an operator just want a humidifier, the heat transfer means would be removed. Alternatively, a dehumidifier could be obtained by removing the water transfer means from the housing. Thus, one or both systems may be incorporated into a single housing which is constructed to fit an existing cycling water closet presently found in a majority of households.

What is claimed is:

1. A humidifier-dehumidifier device for cooperative operation with a flushable water reservoir, having a water inlet and outlet and means to drain and fill said water reservoir, comprising in combination:

support means to support said device in combination with said water reservoir, said support means defining an air cavity above said water reservoir;

an air inlet and outlet to said cavity to permit the flow of air from the surrounding atmosphere through said air cavity;

air flow means to move a flow of air into and through said air cavity;

water transfer means in communication with said water reservoir to transfer water from said water reservoir into said air flow to humidify said flow of air;

heat exchange means, said heat exchange means having a relatively hot side and a relatively cold side, said cold side being disposed in said air flow to condense the moisture and thereby dehumidify said flow, said hot side being in communication with said reservoir; and

control means to alternatively energize said water transfer means or said heat transfer means to humidify or dehumidify said flow of air respectively.

2. The apparatus as described in claim 1, wherein said air flow means to move a flow of air comprises a fan.

3. The apparatus as described in claim 1, wherein said water transfer means comprises a strip of water transfer material.

4. The apparatus as described in claim 1, wherein said water reservoir comprises a water closet.

5. The apparatus as described in claim 1 wherein said heat exchange means is a thermoelectric device.

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6. A humidifier apparatus for cooperative operation with a water closet having a water reservoir, comprising in combination:

support means to support said apparatus in combination with said water closet, said support means defining an air cavity above said water reservoir; an air inlet and outlet to said cavity to permit the flow of air from the surrounding atmosphere through said air cavity;

air flow means to move a flow of air through said air cavity; and

water transfer means in communication with said water reservoir to transfer water from said water reservoir of said water closet into said air flow in said air cavity to humidify said flow of air.

7. A dehumidifier apparatus for cooperative operation with a water reservoir having a water inlet and out-

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let means to drain and fill said reservoir with water, comprising in combination:

support means to support said apparatus in combination with said water reservoir, said support means defining an air cavity above said water reservoir; an air inlet and outlet to said cavity to permit the flow of air through said cavity;

means to induce the flow of air through said air inlet and outlet; and

heat exchange means, said heat exchange means having a hot side and a cold side, said cold side being disposed in said air flow to condense the moisture and thereby dehumidify said flow of air, hot side in communication with said reservoir.

8. The apparatus as described in claim 7 wherein said heat exchange means is a thermoelectric device.

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