

[54] **HUMIDIFIER UNIT FOR WARM AIR HEATING SYSTEMS**

[72] Inventor: **Francis M. Payne**, Annandale, Va.

[73] Assignee: **The Spra-Kleen Company, Inc.**,
Washington, D.C.

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Primary Examiner—Tim R. Miles

Attorney—Le Blanc & Shur

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126/113, 237/78

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98/30; 261/DIG. 15, 100, 105, 98, 116, 126

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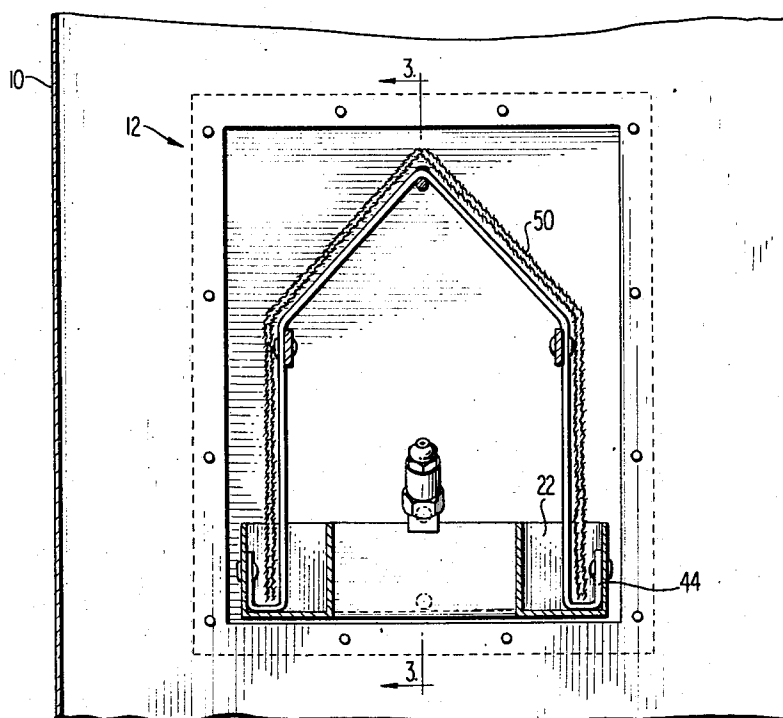
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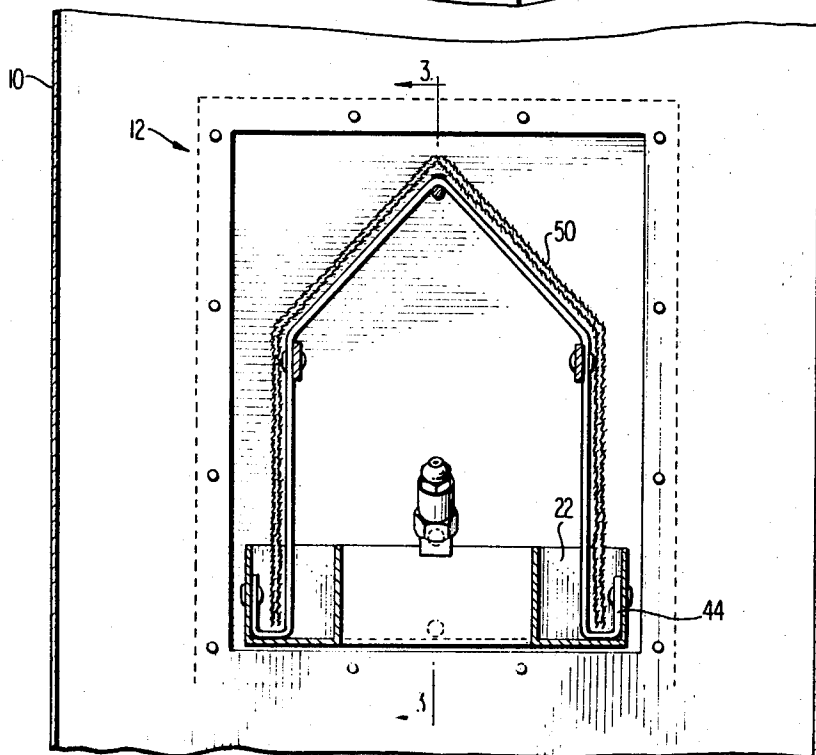
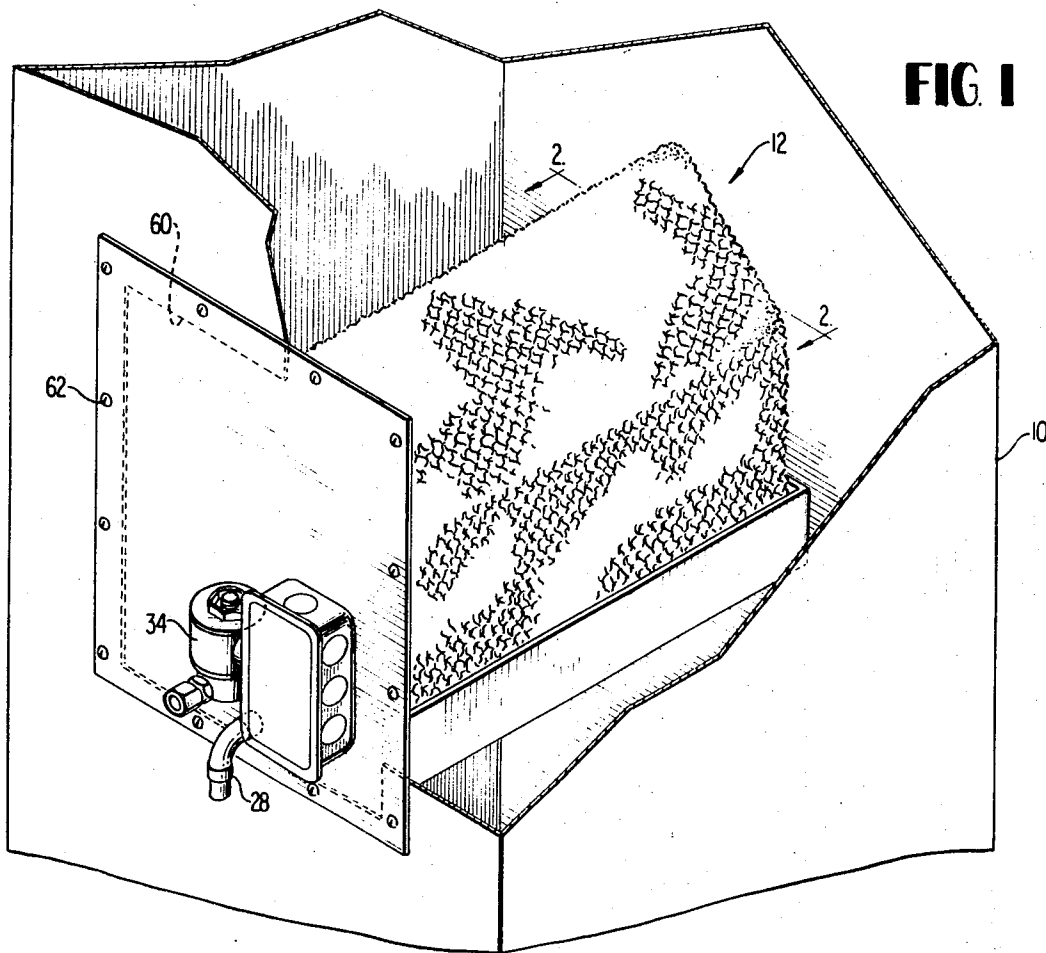
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[57] ABSTRACT

The humidifier includes a generally rectangular drainage pan having a channel-shaped frame surrounding a central opening. The drainage pan carries an end plate which mounts the humidifier in a vertical air duct in a warm air heating system. The framework above the drainage pan supports a hood formed of pervious material which hood, in conjunction with the end plate and drainage pan, forms an enclosure. A water spray nozzle is located within the enclosure in position to spray a water mist towards the pervious material and into the flow of air passing vertically through the opening in the drainage pan and through the pervious material.

13 Claims, 6 Drawing Figures





INVENTOR
FRANCIS M. PAYNE

BY
LeBlanc & Shue

ATTORNEYS

FIG 3

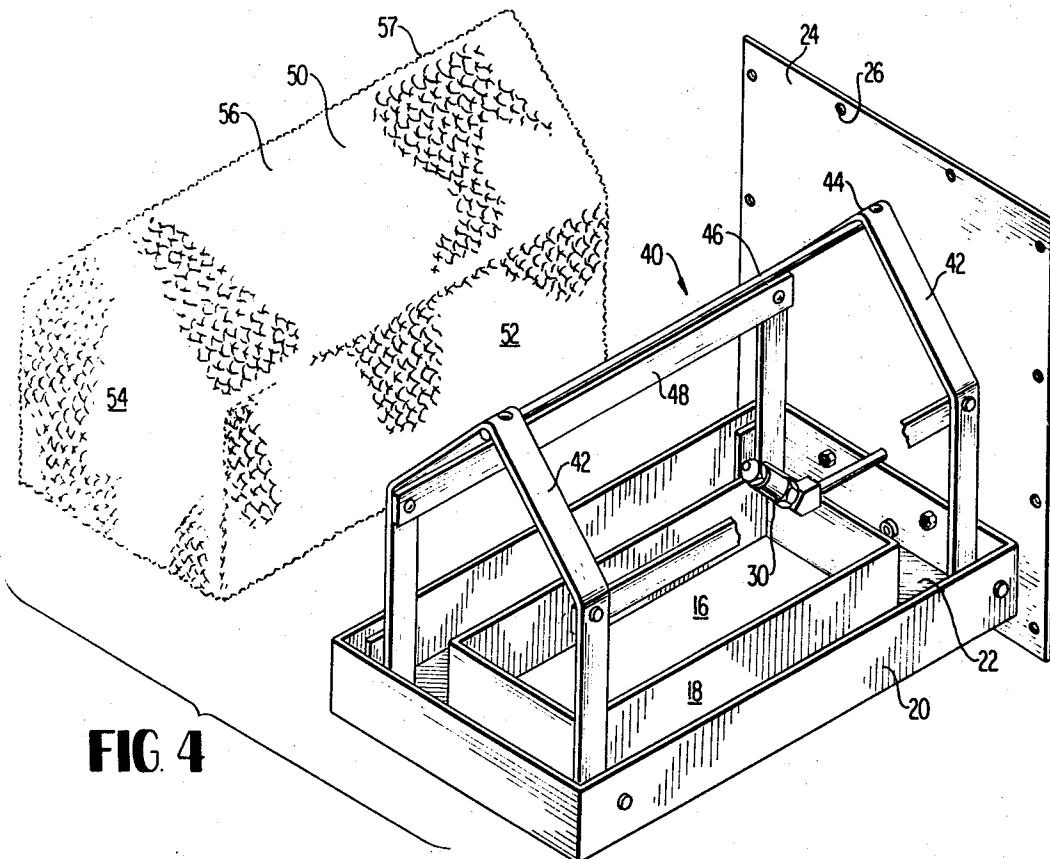
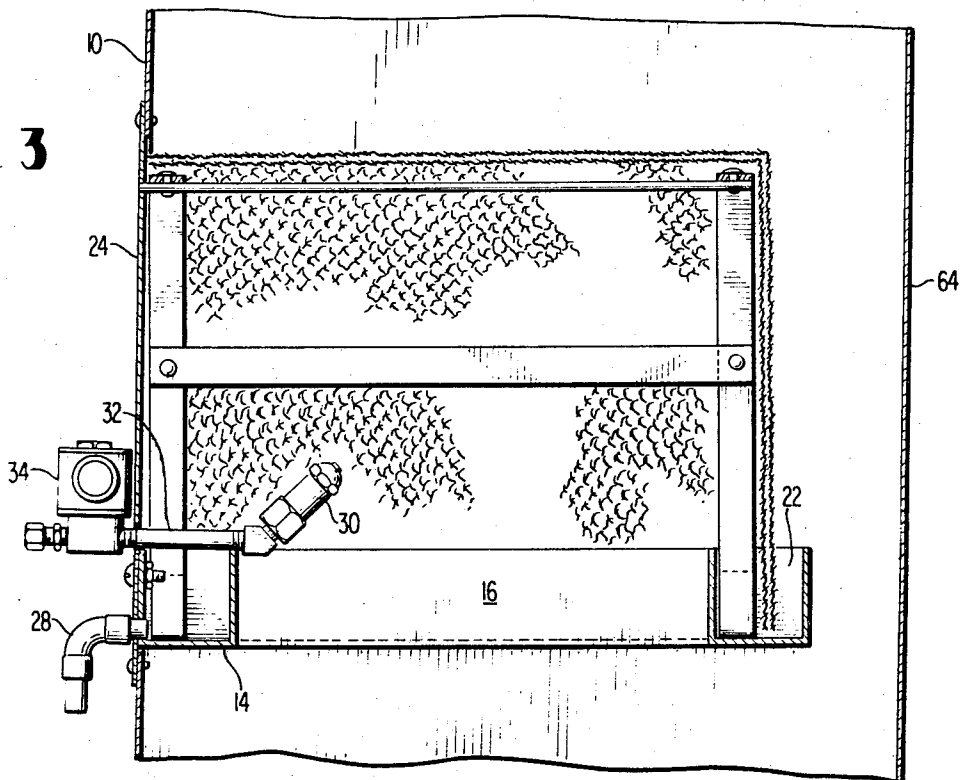


FIG 5

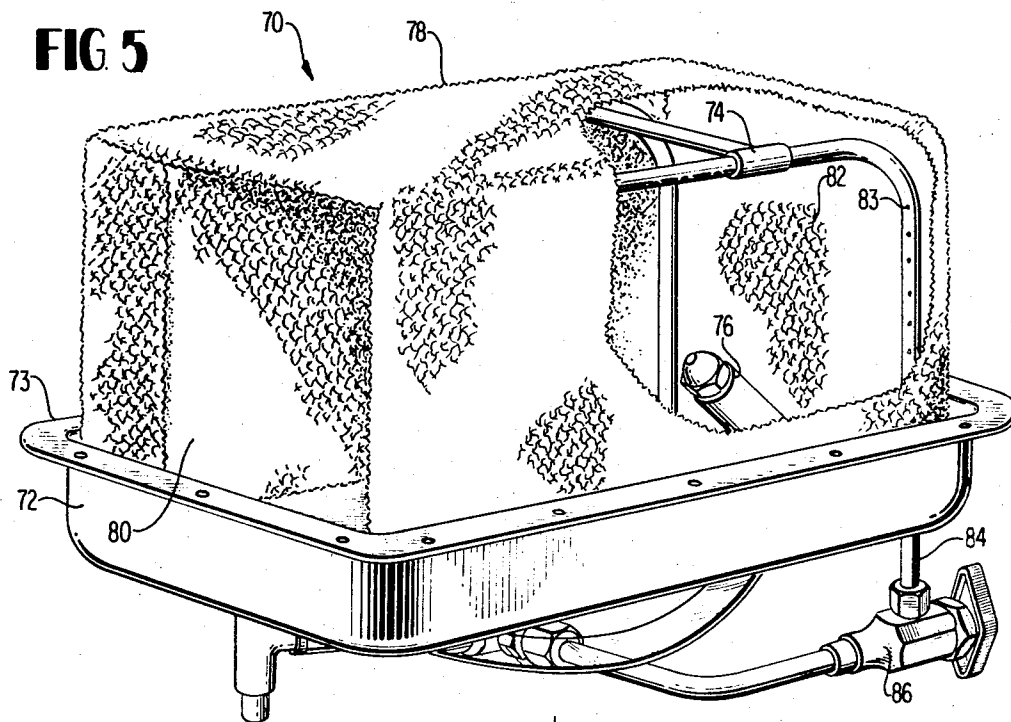
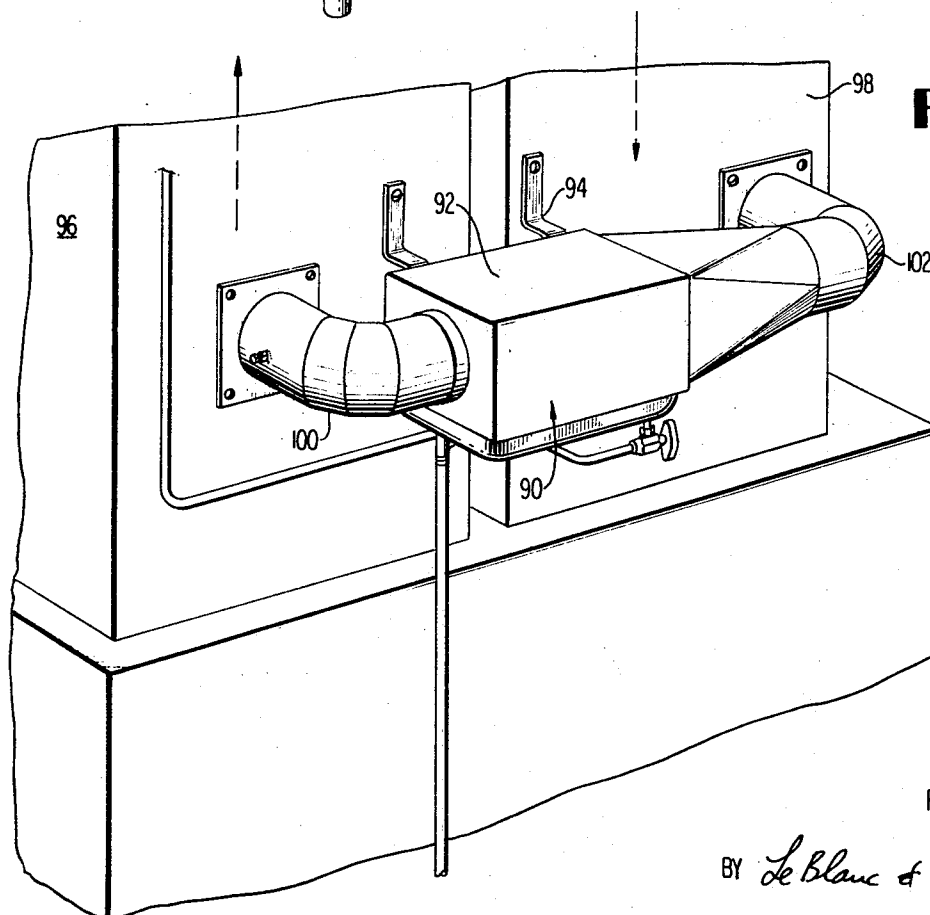


FIG 6



INVENTOR
FRANCIS M. PAYNE

BY *Le Blanc & Shue*

ATTORNEYS

HUMIDIFIER UNIT FOR WARM AIR HEATING SYSTEMS

The present invention relates to humidifiers for air ducts in warm air heating systems and more particularly relates to an improved humidifier specifically adapted for use in the vertically extending air ducts of such warm air heating systems.

In my prior patent, U.S. Pat. No. 3,334,877, there is disclosed an improved humidifier for use in the air ducts of warm air heating systems in which the air in either the hot air or return ducts passes through a fine water spray or mist emitted by a nozzle and through a mesh filter material for the purpose of humidifying, washing and filtering the air. In that construction, there is provided a rectangular drainage pan carrying a hood formed of wire mesh material and forming, with the drainage pan, an enclosure housing a water spray nozzle. The drainage pan of that humidifier is specifically adapted for mounting in a horizontally extending air duct with the hood projecting into the duct. A substantial portion of the air passing through the duct also passes through the hood, the air being washed, filtered and humidified as it passes through the water mist and filter material. While this unit is constructed in various sizes for different size ducts and has been utilized with great success, it is primarily intended for use in horizontally extending ducts.

In certain warm air heating installations, it is oftentimes difficult, if not impossible, to mount a humidifier of the foregoing described type in a horizontally extending air duct. Oftentimes only a vertically extending duct is available for installation of a humidifier. However, the necessity for horizontal disposition of the drainage pan in the foregoing described humidifier has among other reasons precluded its use for installation in a vertically extending duct. Accordingly, prior to the present invention, a humidifier of the foregoing described type which not only adds water to the air but also washes and filters the air and which is readily adaptable for installation in a vertically extending duct has not been available.

The present invention provides a novel, improved humidifier of the foregoing described type readily adapted for installation in a vertically extending air duct of a warm air heating system. To this end, the present invention provides a humidifier including a drainage pan having a central opening with a channel-shaped frame surrounding the opening. An end mounting plate is secured to the drainage pan and is adapted to secure the humidifier to the vertically extending wall of a duct with the drainage pan projecting into and disposed horizontally within the vertically extending duct. A frame upstands from the drainage pan and a wire mesh or other suitable filter material in the form of a hood is supported by the frame. The lower edges of the hood lie within the upwardly opening channel-shaped frame about the opening. The wire mesh hood is peaked and a water spray nozzle is disposed within the enclosure formed by the hood, drainage pan, and end mounting plate. The nozzle is adapted to spray a water mist against the upper inclined walls of the filter material. It will be appreciated that the air flowing into the enclosure through the opening in the drainage pan passes through the water mist spray and through the filter material and is thus humidified, washed and filtered. The excess droplets of water caught by the filter

material as the air carrying entrained water particles therewith passes through the filter material drains down the inclined walls of the hood into the channel-shaped frame about the central opening of the drainage pan. Thus water is precluded from dripping from the humidifier into the vertically extending duct. A humidistat is coupled to a solenoid actuated water valve which controls the flow of water to the spray nozzle, the humidistat being connected to the fan circuit of the furnace or actuated by the air flow such that the spray operates only when the furnace fan is in operation.

A further embodiment of the present invention employs a humidifier similar to that described and illustrated in my U.S. Pat. No. 3,334,877 in a bypass conduit between the hot air and return ducts. In this form of the invention, there is provided a housing carrying a drainage pan and a hood of pervious material forming an enclosure in which is located a spray nozzle. Opposite ends of the housing are connected through suitable conduits with the hot air and return ducts respectively. Air transmitted from one duct to the other passes through the enclosure and through the water spray mist supplied by the nozzle whereupon the air is humidified, washed and filtered.

Accordingly, it is a primary object of the present invention to provide a novel and improved humidifier for a warm air heating system.

It is another object of the present invention to provide a humidifier unit for the air duct of a warm air heating system wherein the humidifier unit is particularly adapted for installation in a vertically extending duct.

It is still another object of the present invention to provide a humidifier unit for installation in a vertically extending air duct of a warm air heating system wherein a spray nozzle directs a water mist against a hood formed of pervious material and wherein the hood is located to drain excess water into a drainage pan surrounding the opening through the humidifier unit.

It is a related object of the present invention to provide a humidifier unit adapted for installation in a bypass conduit communicating between hot air and return ducts in a warm air heating system.

These and further objects and advantages of the present invention will become more apparent upon reference to the following specification, claims and appended drawings, wherein:

FIG. 1 is a fragmentary perspective view of a vertically extending air duct in a warm air heating system with parts broken out and in cross section to illustrate a humidifier construction in accordance with the present invention installed therein;

FIG. 2 is a fragmentary cross-sectional view thereof taken generally about on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view thereof taken generally about on line 3—3 of FIG. 2;

FIG. 4 is a perspective view of the humidifier unit with the cover of pervious material removed;

FIG. 5 is a perspective view of another form of humidifier unit hereof; and

FIG. 6 is a fragmentary perspective view illustrating the installation of the humidifier unit illustrated in FIG. 5 in a bypass conduit interconnecting hot air and return ducts in a warm air furnace system.

Referring now to the drawings, particularly to FIG. 1, there is illustrated a vertically extending air duct 10 forming a portion of a warm air furnace system and in which duct 10 is mounted a humidifier unit, generally indicated at 12, constructed in accordance with the present invention. Referring more particularly to FIGS. 2-4, humidifier unit 12 comprises a generally rectangular drainage pan 14 having a central rectangular opening 16 passing therethrough. The inner margin of drainage pan 14 about opening 16 carries upturned flanges 18 while the outer margin of drainage pan 14 carries upturned flanges 20, flanges 18 and 20 forming with the bottom of pan 14 an upwardly opening, generally channel-shaped frame 22 surrounding opening 16 for purposes hereinafter described. One end of drainage pan 14 is suitably secured as by nuts and bolts along the lower inside face of an end plate 24. Plate 24 carries openings 26 for mounting the humidifier to one of the walls of vertically extending duct 10. A drain pipe 28 extends through the front or outer flange of the drainage pan 14 and through mounting plate 24 in communication with the channel portions 22 about opening 16 for draining water from drainage pan 14.

A nozzle 30 is carried by humidifier 12 and serves to provide a fine water mist or spray through which the air in duct 10 flows. Nozzle 30 is disposed in vertical registry over opening 16 and is connected to a water supply conduit 32 extending through end mounting plate 24. Conduit 32 is connected to a solenoid valve 34 which is operable to control the flow of water to nozzle 30. Solenoid 34 is electrically actuated by a humidistat, not shown, of the furnace, also not shown, so that the water supply operates only when the furnace fan is operating.

A framework 40 upstands from drainage pan 14 and includes a pair of inverted generally U-shaped brackets 42 having reversely bent lower end portions 44, the ends of which are preferably riveted to the outer upstanding flanges 20 of drainage pan 14.

The base portions of the generally inverted U-shaped brackets 42 are inclined to form peaks 44 for frame 40, the peaks 44 being interconnected by a longitudinally extending rod 46. A pair of longitudinally extending brackets 48 interconnect between U-shaped brackets 42. A washable filter of pervious material, preferably comprising wire mesh, is received over framework 40 to form a hood 50. Particularly, hood 50 comprises side and end walls 52 and 54, a pair of inclined upper walls 56 forming peak 57 and an open end adjacent end plate 24. Mesh 50 is received over inverted U-shaped brackets 42 with its lower edges being received within channels 22 of drainage pan 14. It will thus be appreciated that, when the hood 50 is disposed over framework 40, brackets 42, rod 46 and longitudinal brackets 48 form a support for hood 50 locating the lower edge portions of the side walls 52 and 54 of hood 50 in the side and rear channel portions 22 of drainage pan 14. End plate 24 closes off the open end of hood 50 and nozzle 30 lies within the enclosure defined by hood 50, drainage pan 14 and end plate 24.

A support for hood 50 is preferred although it will be appreciated that the wire mesh can be self-supporting, thereby eliminating the need for the various brackets disclosed.

To install humidifier 12 in vertically extending air duct 10, the wall of duct 10 is cut to provide a rectan-

gular opening 60 (FIG. 1). The humidifier 12 can thus be inserted through opening 60 and fasteners 62 are applied through openings 26 in end plate 24 and the wall of the duct to secure humidifier 12 in a position cantilevered from the vertically extending wall of the duct. It will be noted in FIG. 3 that the rear portion of the humidifier is spaced from the rear wall 64 of duct 10 whereby the humidifier unit does not completely fill the vertically extending duct but allows a percentage of the air flowing through the duct to bypass the humidifier. This precludes any restriction of the air flow through the duct.

In operation, water is provided to nozzle 30 through solenoid valve 34 under the control of the humidistat. When solenoid actuated valve 34 is open to provide water through conduit 32 to nozzle 30, the water issues from nozzle 30 as a fine spray or mist into the area enclosed by hood 50 and into the area in vertical registry above opening 16. The air passing through opening 16 and into the enclosure entrains particles of the water spray emitted by nozzle 30 whereby the air is humidified and washed. The air entrained water then flows through the pervious material of hood 50, particularly through the inclined walls 56 thereof. Excess droplets of water are caught by the mesh material forming walls 56 and end wall 54 and these droplets drip down along walls 56 and the side and end walls 52 and 54, respectively, for collection in the channels 22 of pan 14 for drainage through drain conduit 28. Thus, air passing through the water spray within enclosure 50 and through the filter mesh material forming the same is humidified, washed and filtered.

Referring now to FIG. 5, there is illustrated a humidifier unit 70 for use in a horizontally extending air conduit and for use as a part of the adapter unit illustrated in FIG. 6. Referring particularly to FIG. 5, there is disclosed generally rectangular drainage pan 72 having a flange 73 for connecting the humidifier in a horizontally disposed air conduit, not shown, a rectangular tubular framework 74 upstanding from drainage pan 72, a spray nozzle 76 suitably connected to a humidistat controlled solenoid operated valve, not shown, and a rectangular hood 78 of pervious or filter material preferably formed of wire mesh disposed over framework 74 and adapted for disposition in the air stream flowing in a horizontally disposed conduit. The hood 78 is open at one end as indicated at 80 and closed at its opposite end whereby air flowing through a horizontally disposed conduit enters the chamber defined by hood 78, passes through the water mist spray provided by nozzle 76 and passes through the opposite end wall 82 of filter material whereby a humidifying, washing and filtering action is effected. In this form, the framework 74 supporting the hood 70 is formed of hollow tubing having a plurality of perforations 83 at spaced intervals therealong and at various angles. The tubing is connected to a water inlet conduit 84 having a manually operable valve 86. By periodically opening valve 86 and providing water through conduit 84 to the perforated conduits, the filter material can be flushed and washed to remove any accumulation of dirt or other material. Note that this can be accomplished without removal of the humidifier unit from within the air ducts.

For installation wherein a horizontal mounting of the humidifier unit cannot be effected, there is provided in another form of the invention hereof specifically illustrated in FIG. 6 a humidifier unit generally indicated 90 disposed in a bypass conduit interconnecting between a hot air and return duct in a warm air furnace system. The humidifier unit 90 may be identical to that humidifier unit disclosed in FIG. 5 or to that disclosed in my prior U.S. Pat. No. 3,334,877, issued Aug. 8, 1967. Such units are enclosed by a rectangular housing 92 secured along its lower edge to the flanges of the drainage pan, for example, the flange 73 of drainage pan 72 illustrated in FIG. 5. The housing 92 completely encloses the humidifier. Suitable brackets 94 are utilized to connect housing 92 to a suitable support externally of the hot air and return conduits 96 and 98, respectively, in this case the housing 92 is connected to ducts 96 and 98 by brackets 94. Suitable conduits 100 and 102, which may be in the form of elbow joints, interconnect between the hot air and return ducts 96 and 98, respectively, and opposite ends of the housing 90 whereby air passing between ducts 96 and 98 passes through the wire mesh filter material of the humidifier unit and through the spray provided by the nozzle whereby the air may be humidified, washed and filtered. In this form, the hot air conduit 100 may be fitted with a damper to reduce the air flow if excessive furnace velocity results in moisture carry-through.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A humidifier for use with a warm air heating system having a substantially vertically extending air duct comprising: a drainage pan for mounting in the air duct and having an opening therethrough for receiving air passing through the duct, a frame mounted above the drainage pan and extending within the air duct, pervious material carried by said frame and defining with said drainage pan a chamber, a water spray nozzle carried by the humidifier and located to spray water within said chamber towards said material and into the path of the air flowing through the opening in the drainage pan, the chamber, and the pervious material.

2. A humidifier according to claim 1 wherein said drainage pan is mounted in the duct such that air flows through the opening towards said pervious material.

3. A humidifier according to claim 1 including a drain opening for said pan, a water supply conduit connected to said nozzle, and control means for automatically controlling the flow of water to the supply conduit.

4. A humidifier according to claim 1 wherein said drainage pan includes generally channel-shaped portions about said opening, said pervious material being in the shape of a hood overlying said drainage pan with the lower edges of said hood disposed to lie in vertical registry with the channel-shaped portions of said drainage pan.

5. A humidifier according to claim 1 wherein a portion of said pervious material lies in vertical registry over said drainage pan opening, said drainage pan including a portion for collecting water dripping from said pervious material, the portion of the pervious material overlying said drainage pan opening being inclined with a lower edge portion thereof extending to lie in vertical registry with said drainage pan portion.

6. A humidifier according to claim 1 in combination with the substantially vertically extending air duct, and means for mounting said drainage pan in a substantially horizontal position in said substantially vertically extending air duct.

7. A humidifier for use with a warm air heating system having an air duct comprising a drainage pan mounted in the duct and having an opening for receiving air passing through the duct, pervious material carried by said humidifier and configured to form with said drainage pan a chamber for receiving air flowing through the duct, a water spray nozzle positioned to spray water within said chamber towards said material and into the path of air flowing through the opening in the drainage pan into said chamber and through said pervious material.

8. A humidifier according to claim 7 in combination with the air duct, said air duct being inclined to the horizontal, means for mounting said drainage pan in a substantially horizontal position in said inclined air duct.

9. Apparatus according to claim 8 wherein a portion of said pervious material lies in vertical registry over said drainage pan opening, said drainage pan including a portion for collecting the water dripping from said pervious material, the portion of the pervious material overlying said drainage pan opening being inclined with a lower edge portion thereof extending to lie in vertical registry with said drainage pan portion.

10. A humidifier for use with a warm air heating system having a substantially vertically extending air duct comprising:

a drainage pan mounted in the air duct and having an opening for receiving air passing through the duct, said drainage pan including a generally channel-shaped portion on opposite sides of said opening, a frame mounted above the drainage pan and extending within the air duct, pervious material carried by said frame and defining with said drainage pan a chamber, said pervious material being in the shape of a peaked hood overlying said drainage pan with opposite side edge portions thereof disposed to lie in vertical registry with the corresponding channel-shaped drainage pan portions on opposite sides of said drainage opening, the inclined walls of said peaked hood lying in vertical registry over said drainage pan opening, a water spray nozzle carried by the humidifier and located to spray water within said chamber towards said material and into the path of the air flowing through the opening in the drainage pan, the chamber, and the pervious material.

11. A humidifier according to claim 10 wherein said frame includes a pair of generally inverted U-shaped brackets carried adjacent opposite ends of said drainage pan, said hood being received over said brackets with the lower edges being received in said channel-shaped portions of said drainage pan.

7

12. A humidifier according to claim 10 wherein said hood includes an end wall of pervious material, the lower edge portions of said end wall lying in vertical registry with said channel-shaped portion about said opening, said spray nozzle being positioned to spray water toward said inclined walls and said end wall.

13. A humidifier according to claim 12 including an

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end mounting plate, means connecting said drainage pan and said end mounting plate with the latter closing the opposite end of said hood, and means carried by said mounting plate for securing the humidifier in the air duct.

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