

[54] **RECEPTACLE TYPE HUMIDIFIER FOR AIR CONVEYING DUCTS AND THE LIKE**

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[58] Field of Search 261/DIG. 15, 98, 261/105-106, 96, 100, 26, 30; 126/113

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Primary Examiner—Tim R. Miles

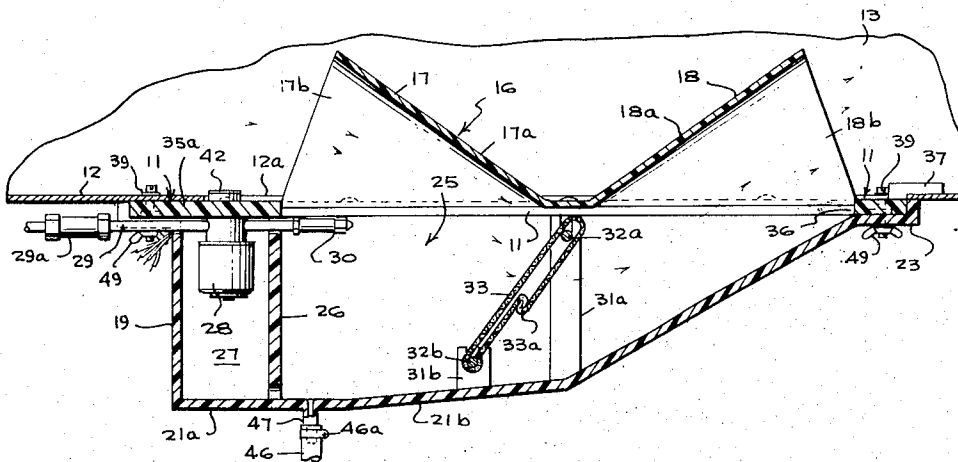
Assistant Examiner—Richard L. Chiesa

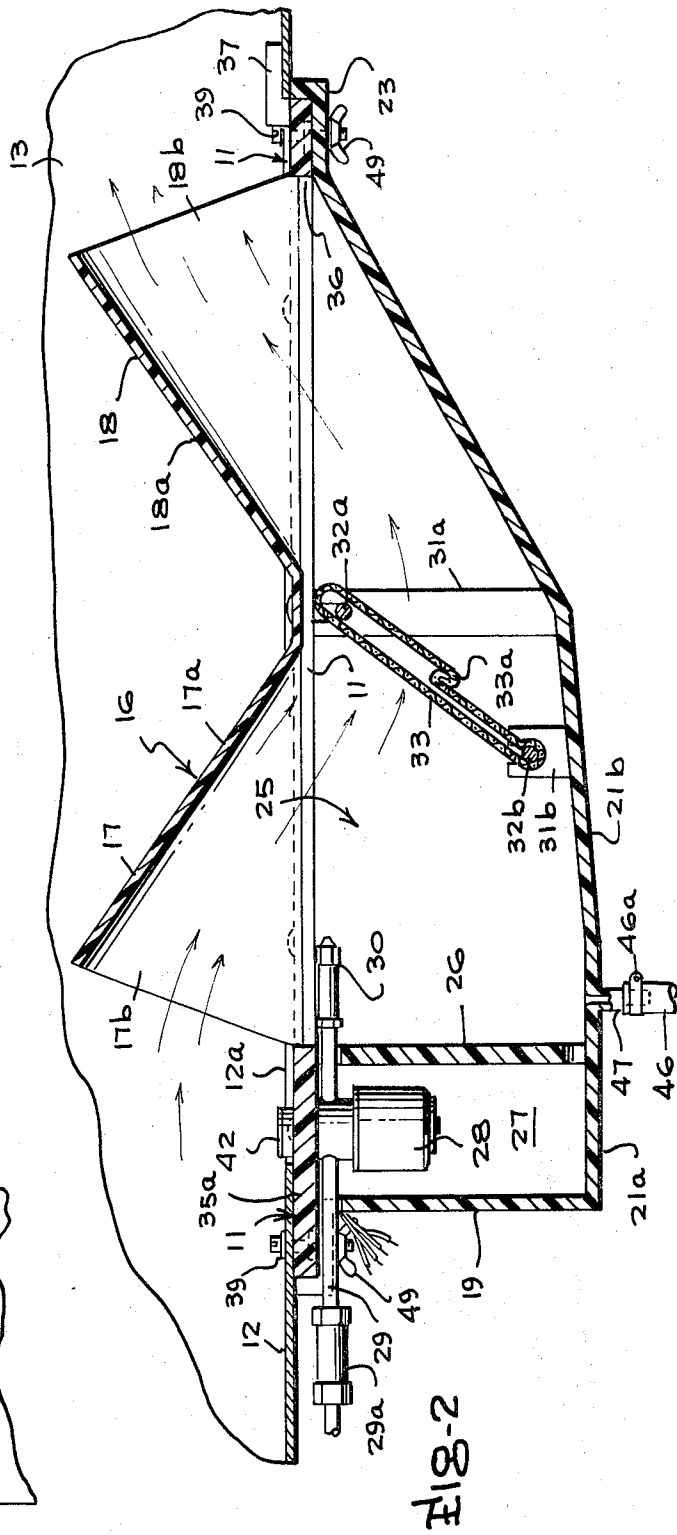
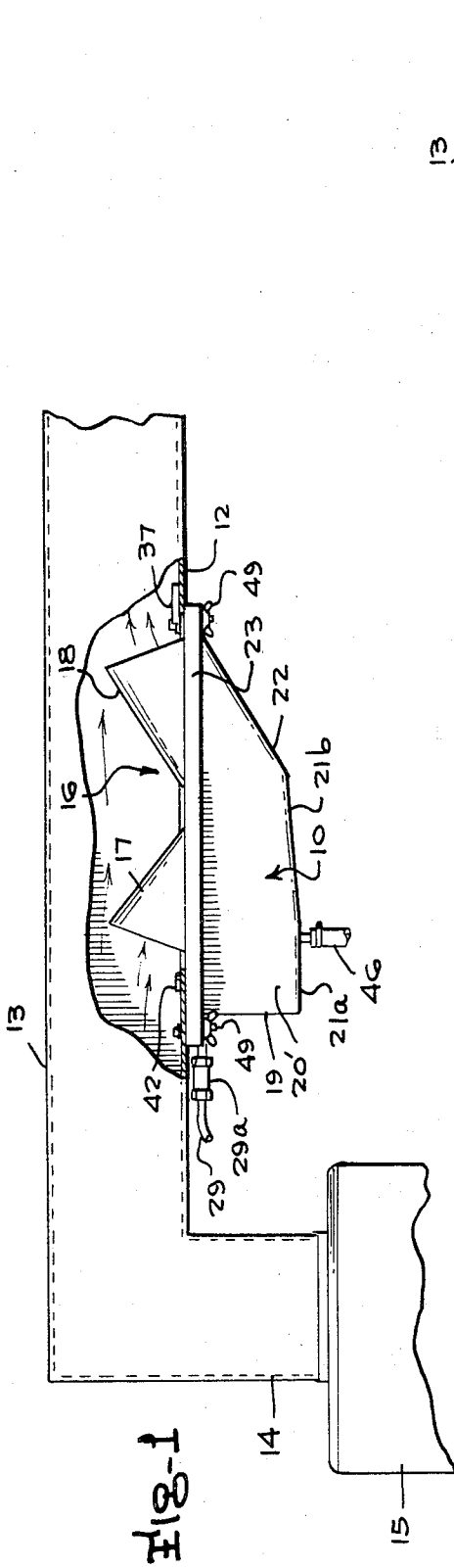
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[57] **ABSTRACT**

A humidifier assembly for use with a forced circulation warm air heating system, including a receptacle portion in the form of an upwardly opening basin and defining an evaporation chamber having a wire screen therein, and a mounting plate portion to which the receptacle portion can be removably fastened. An air scoop portion having hood formations extending along upwardly diverging axes may be assembled to the mounting plate portion and the latter fastened to the lower wall of the heating duct with the air scoop projecting through an opening in the duct lower wall to divert air downwardly into the evaporation chamber and return the air to the duct. A spray nozzle discharges a spray-mist pattern into the evaporation chamber and against the screen. A twin-duct collar may be substituted for the air scoop to adapt the unit to other installation conditions.

20 Claims, 10 Drawing Figures





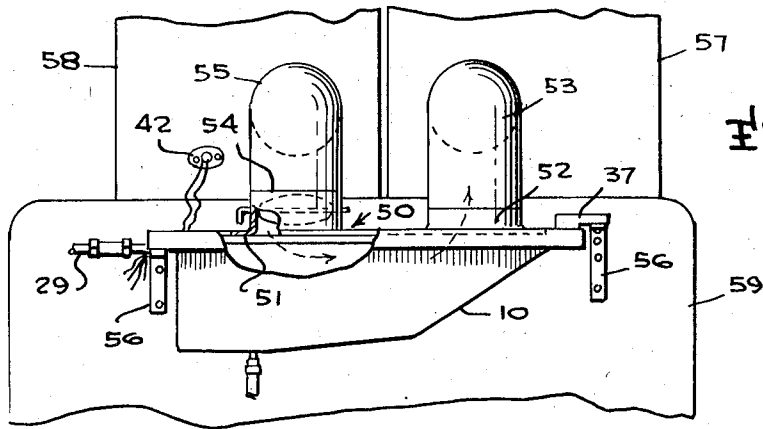


Fig-5

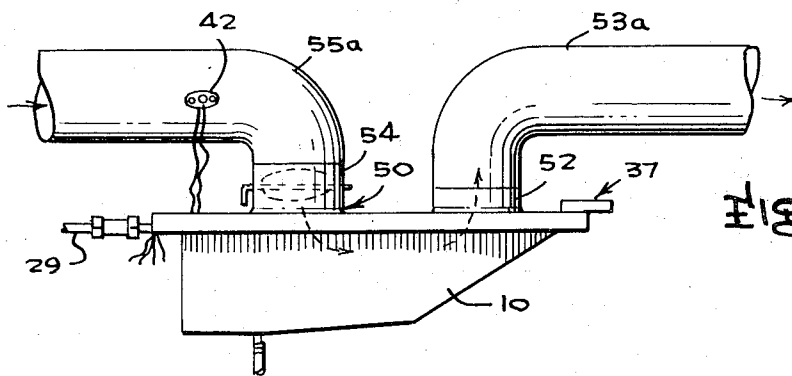


Fig-6

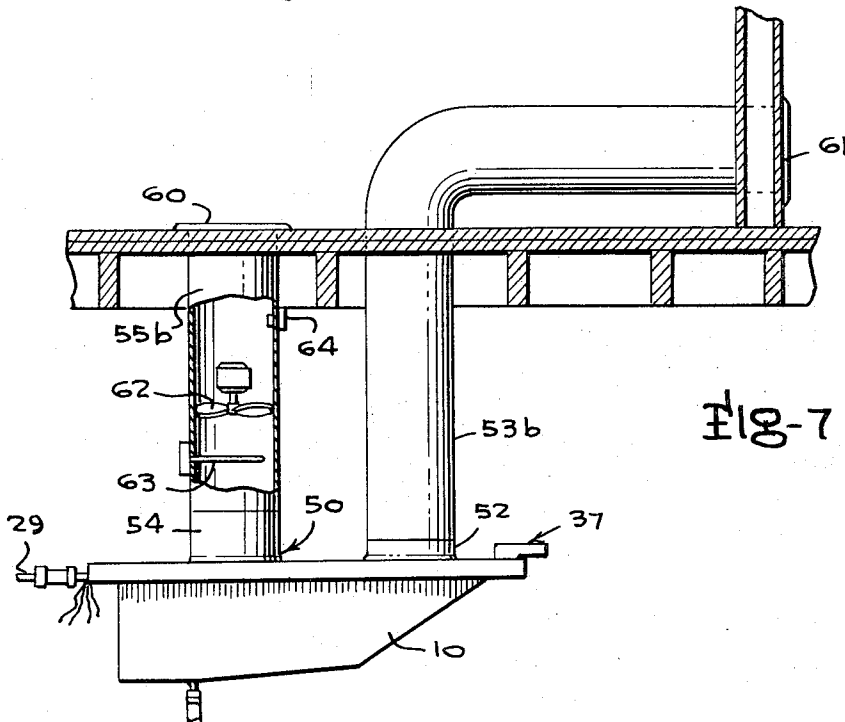


Fig-7

Fig-10

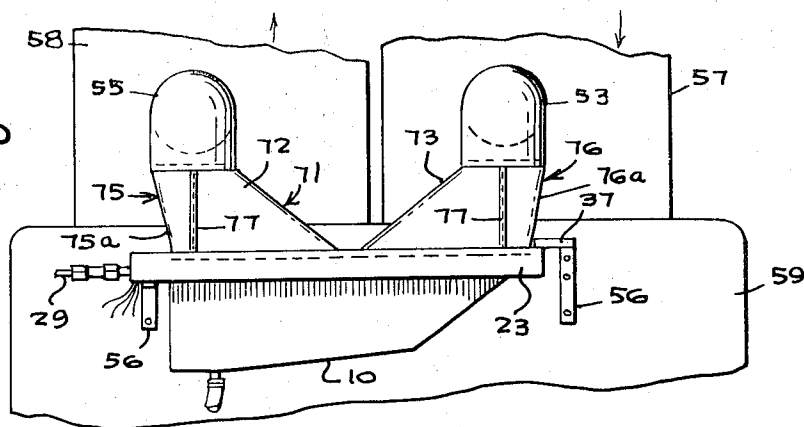


Fig-8

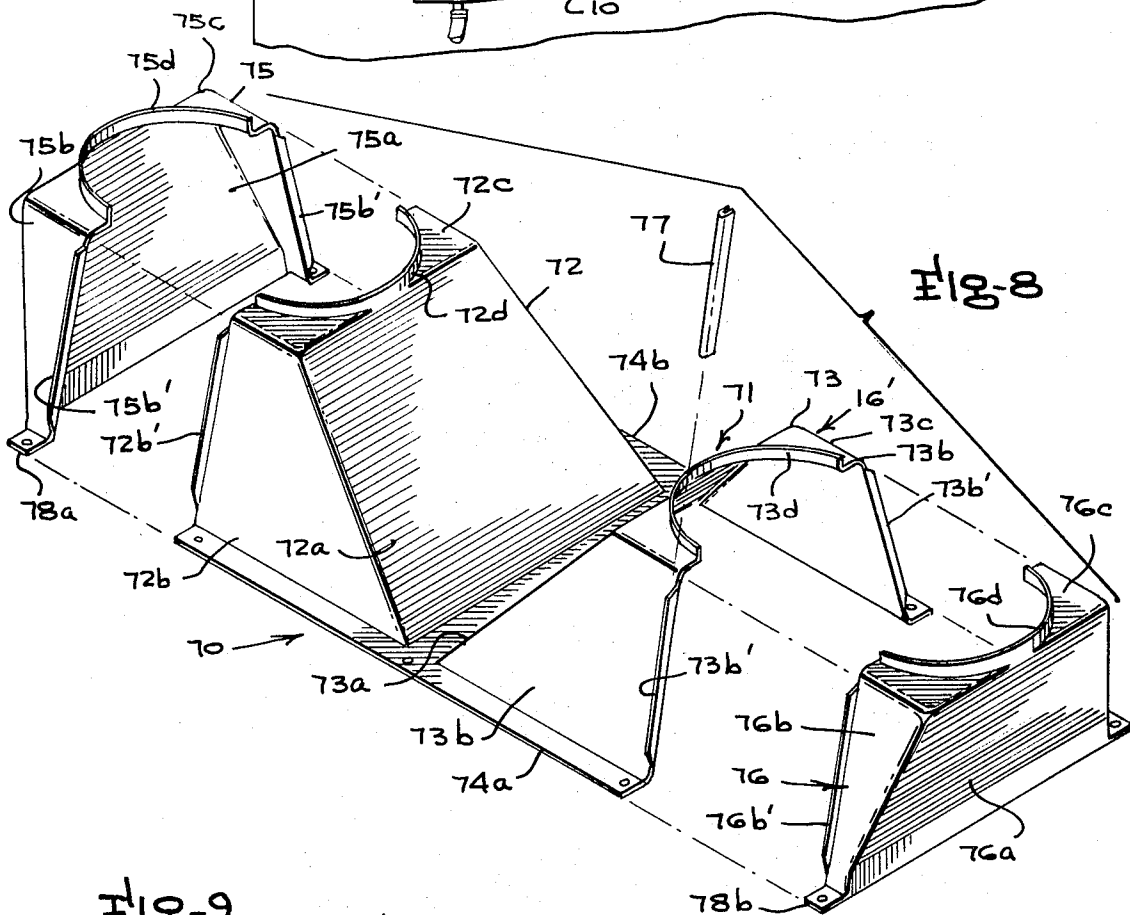
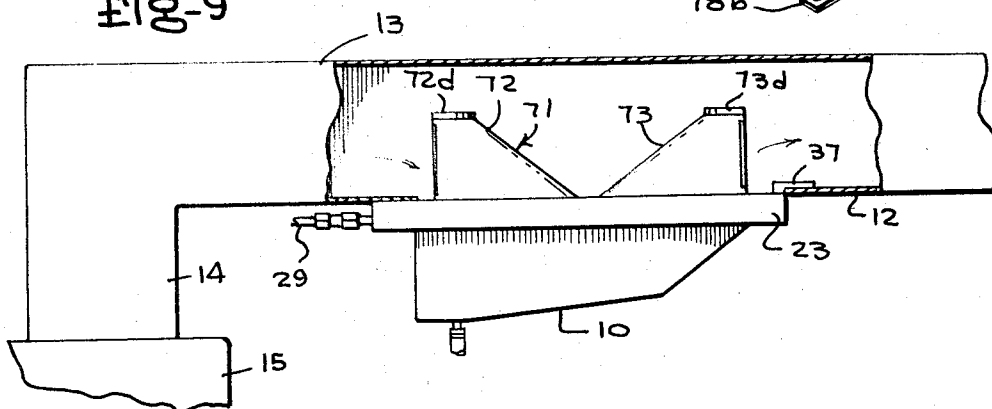


Fig-9



RECEPTACLE TYPE HUMIDIFIER FOR AIR CONVEYING DUCTS AND THE LIKE

BACKGROUND AND OBJECTS OF THE INVENTION

The present invention relates in general to humidifying apparatus, and more particularly to receptacle type humidifiers adapted to be removably attached to an air conveying duct, such as the main trunk horizontal duct of a hot air heating system, for use in association with a forced circulation warm air heating furnace or the like.

Heretofore, various means have been employed to supply water vapor to heated air in warm air heating systems, such as forced circulation warm air furnaces of the domestic type, to increase the relative humidity of the air being supplied through the duct system to the living space. One of the common humidifier arrangements for use in connection with warm air furnaces has been the provision of an open tray or receptacle located in the bonnet or riser of a warm air furnace which is supplied with water for free evaporation of the water into the warm air in the bonnet or riser. This type of humidifier is of limited and usually inadequate capacity, and becomes rapidly corroded or faulty and unreliable in operation. In some cases, rotating belts, wheels or drums of various types have been employed in the water-filled tray or receptacle to lift water droplets into more effective thermal exchange relation with the warm air in the bonnet, but such moving belts, drums or screens require frequent cleaning and servicing, due to deposits which rapidly form because of the water in the locality, and provide another source of unreliable operation.

Spray diffusing nozzle systems which discharge a mist or fog of water droplets into the bonnet or riser area have also been used, usually with a target plate, collecting trough, or other facility to collect unvaporized discharge from the nozzle. Many of these spray diffusing nozzle systems have been difficult to control in such a way as to reliably prevent unwanted discharge, such as drips, from the nozzle, which accumulate in the furnace and produce corrosive precipitate solids which adversely affect the life or operation of the furnace. These spray humidifier systems have usually required complex special controls in addition to the usual controls for the furnace, and for the most part have been too complex to be suitable for installation by the ordinary home owner as a "do it yourself" type of installation. It is important for a simple installation which would be within the capacity of the normal homeowner to install, to provide a humidifier which involves only a few components to be installed on the furnace or ducting system, and to have provision for insuring that no water can be accidentally discharged in the bonnet or riser region.

The furnace humidifier of the present invention is a simple receptacle type of installation, having as its three basic chassis components an upwardly opening main receptacle, a mounting plate for the receptacle, and an air scoop attached to the top side of the mounting plate. The mounting plate, which is attached to the receptacle portion, is designed to attach to a horizontal duct wall, such as the bottom wall of the main trunk horizontal duct extending from the furnace, with portions of the mounting plate extending through an opening cut in accordance with a template in the bottom

duct wall. The air scoop extends into the air stream within the duct, diverting a portion of the warm air through the receptacle portion, which contains a spray nozzle directing a mist-spray onto a screen, so that evaporation occurs both as a result of the mist discharged into the receptacle and as a result of the moisture on the screen. Suitable humidistat and temperature controls are provided for regulating a solenoid valve controlling water supply to the spray nozzle.

The basic receptacle device with the spray nozzle and wire screen therein may also be used in other types of installation, such as in a bypass installation between the return and supply ducts to the furnace, by use of a twin duct collar rather than the air scoop. Also various other types of arrangements for supplying water or water droplets in the receptacle may be employed.

An object of the present invention, therefore, is the provision of a novel receptacle type humidifier device for use with air conveying ducts of a warm air heating system or the like which is simple in construction and easy to install by the average homeowner or purchaser, which is extremely flexible regarding the types of installations in which it can be incorporated, which is readily removable for replacement or cleaning of components which may be subject to contamination, and which provides highly reliable humidity control for warm air furnaces of either the electric, gas or oil type, heat pump systems, various types of furnace configurations and installation situations, avoiding many complex installation conditions.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings illustrating preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a somewhat diagrammatic side elevation view of the receptacle type humidifier of the present invention installed in a main horizontal trunk duct, with portions of the duct broken away;

FIG. 2 is a vertical longitudinal section view of the receptacle type humidifier;

FIG. 3 is an exploded perspective view of the basic chassis components of the receptacle type humidifier;

FIG. 4 is a schematic diagram of the electrical control circuit showing the wiring for the receptacle type humidifier;

FIGS. 5, 6 and 7 are somewhat diagrammatic elevation views showing other installation conditions in which the receptacle type humidifier may be installed;

FIG. 8 is an exploded perspective view of a modified form of top member for the humidifier assembly serving as a combination air scoop and by-pass adapter; and,

FIGS. 9 and 10 are somewhat diagrammatic elevation views showing the humidifier assembly with the modified top adapted assembly, mounted in installation conditions similar to those of FIG. 1 and FIG. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings, wherein like reference characters designate corresponding parts throughout the several figures, and particularly to FIGS. 1, 2, 3 and 4, the receptacle type humidifier assembly of the present invention comprises a receptacle 10 in the form of

an upwardly opening basin or evaporation chamber, adapted to be supported by a mounting plate 11 providing the means by which the main receptacle 10 is supported in dependent relation from the lower horizontal wall portion 12 of an air conveying duct, such as the main trunk duct 13 leading from the warm air plenum 14 at the top of the furnace 15 to the registers or warm air outlets in the rooms to be conditioned. An air scoop member 16 is supported on the mounting plate 11 and extends above the mounting plate into the air stream in the main trunk duct 13, having upwardly inclining air inlet and air outlet excursions 17 and 18 opening along upwardly diverging paths to divert the warm air downwardly into the evaporation chamber defined by the receptacle 10.

The main receptacle 10 in the preferred embodiment is a moulded body, formed for example from high impact styrene or polypropylene, shaped to define substantially vertical front and side walls 19, 20 and 20', a bottom wall having two relatively inclined portions 21a and 21b and a rather steep upwardly inclining rear or downstream wall 22. These walls surround an evaporation chamber 25 and integrally join top flanges defining a rectangular flange frame 23 which is adapted to butt against the bottom surface of the lower main trunk wall 12 and is recessed to define an upwardly opening well 24 sized to receive the mounting plate 11 in nesting relation in the well. The well is defined by recess formations of right angular vertical section at the upper ends of the walls 19-22 and located inwardly of the outer surfaces of the flanges. The vertical surfaces of the well extend in a rectangular pattern to surround and engage the edges of the mounting plate 11 and the horizontal well surfaces form an upwardly facing rectangular frame bounding the evaporation chamber 25 to abut the undersurface of the mounting plate 11. The upstream end of the evaporation chamber 25 is spaced from the front wall 19 by a transverse partition 26 located a short distance downstream from the front wall 19 to define a separate component chamber 27 for housing the solenoid coil of a solenoid valve 28. The valve 28 is interposed in a water supply pipe 29 which terminates in a spray nozzle 30 disposed within the evaporation chamber 25 near its upstream end. The upper edge of the transverse partition 26 is recessed or notched at its center to accommodate passage of the water supply pipe 29 therethrough. The component chamber 27 also provides a cavity or substantially closed chamber for other components as later described. A drain hole 26a may be provided adjacent the bottom center of partition 26 so that any water or condensate which may occur in sub-compartment 27 will pass into chamber 25 and out through the bottom drain, and not collect in chamber 27.

Also within the evaporation chamber 25 along the confronting inner surfaces of the side walls 20 and 20' are a first pair of laterally aligned taller screen mounting ribs 31a and a second pair of shorter screen mounting ribs 31b, each of which have upwardly opening U-shaped recesses at their upper ends to receive the ends of wire screen supporting rods 32a, 32b. These transversely extending, horizontal screen supporting rods 32a and 32b are removably seated in the recesses of the mounting ribs 31a, 31b to support the wire screen 33 along an upwardly inclined path inclining downstream relative to the direction of air flow, in a position as illustrated in FIG. 2, to form a wetted surface through

which the air must pass before leaving the evaporation chamber 25. The air-mist mixture discharged from the nozzle 30 impinges on the air inlet excursion 17 and on the screen 33, which serves to increase the evaporation capacity of the humidifier as some of the air droplets in the spray evaporate directly to humidify the air entering the chamber 25 through the air inlet excursion 17 and the wetted screen and air inlet excursion surfaces also facilitate further evaporation into the heated air.

The mounting plate 11, as is illustrated in FIG. 3, comprises a main plate portion 35 defining a rectangular frame surrounding a rectangular opening 36 and having transverse end portions 35a and 35b at its upstream and downstream ends and longitudinal side portions 35c and 35d. A projecting lip formation 37 extends upwardly from the central portion of the downstream transverse frame portion 35b and extends in a downstream direction beyond the edge of the transverse portion 35b to extend into an opening which is cut in the bottom horizontal wall 12 of the main trunk duct and rest against the portion of the bottom duct wall 12 immediately downstream of the opening cut therein. The upstream transverse end portion 35a spans a sufficient distance longitudinally of the mounting plate to cover the component cavity or chamber 27 in the receptacle portion 10 and has holes 38 in the four corners thereof to receive bolts 39 which extend downwardly through openings drilled in the bottom wall of the duct 13 and are threaded into threaded washers or nuts 39a to secure the mounting plate in position. The mounting plate has downwardly opening rectangular recesses for the nuts 39a in the lower surface thereof. The two longitudinal side portions 35c and 35d of the mounting plate are rabbeted in their portions immediately adjoining the opening 36 to define downwardly spaced shoulder surfaces 35c', 35d' against which side flanges 40a and 40b of the air scoop portions 16 are mounted by suitable fastening screws 41. The spacing of the downwardly spaced shoulder surfaces 35c', 35d' below the top surface of the mounting plate portion 35 corresponds to the thickness of the flanges 40a, 40b so that these flanges are either flush with or spaced slightly below the plane of the top surface of main plate portion 35. In one preferred embodiment, the mounting plate 11 may be injection moulded of high impact styrene material similar to the material used for the receptacle portion 10.

The air scoop portion 16, as shown, comprises parallel, outwardly projecting side flanges 40a and 40b extending along the whole length of the air scoop, and includes upwardly inclining hood portions forming the air inlet excursions 17 and 18, having upwardly inclined, diverging top walls 17a and 18a, and triangular side walls 17b and 18b, defining upwardly inclined hoods which divert air from the air stream in the duct 13 downwardly into the evaporation chamber 25 in the path of the spray discharged from the nozzle 30 and through the wire screen 33, to pick up moisture from both of these surfaces, and then exit air back into the duct air stream through the air outlet excursion 18.

The screen 33 may be conveniently formed from conventional screen wire material or hardware cloth, such for example as 16 mesh aluminum wire screen material, which is preferably formed from a rectangular sheet of wire screen material folded or bent loosely about a transverse axis midway between its two ends and the two ends are then placed together and a double

fold is formed at these ends to form a closed loop screen. In one preferred example, a sheet of wire screen material of 14 by 18 inch size is folded inwardly along its two longitudinal edges to provide 1½ inch folds and provide a screen width of 11¼ inch. This screen material is then folded loosely about the transverse center axis located about 9 inches from the two opposite transverse ends, and the transverse ends are then placed in overlapping registering relation and a first fold, followed by a second fold, indicated at 33a in FIGS. 2 and 3 is then formed to produce a double folded joint which holds the screen wire material in a closed loop configuration. The lower supporting rod 32b is then inserted in the loop screen and the screen material is tightly creased about this rod 32b to hold the lower rod 32b at the appropriate position in assembled relation with the screen, and the projecting opposite ends of the rod 32b are inserted in the U-shaped recesses at the top of the shorter mounting ribs 31b. The upper screen supporting rod 32a in the preferred embodiment may have plastic caps fitted over the opposite ends of the rod to facilitate handling and interfitting of the ends of the rods into the U-shaped notches of the mounting ribs 31a. By reason of the screen construction and configuration as previously described, it is a simple matter for the user to replace the screen 33 when necessary by merely cutting an appropriate size sheet of wire screen material and fold it in the manner described to produce a new screen 33.

Supported on the portion of the mounting plate 11 which overlies the component chamber or cavity 27, in addition to the solenoid valve 28, are a temperature sensitive switch 42 and a terminal block 43 having four sets of terminal posts numbered 1, 2, 3 and 4. A hole 43a is formed in the mounting plate 11 to permit the sensitive portion of the temperature sensitive switch 42 to project upwardly into the heating system duct 13, and the terminal block 43 depends from the lower surface of the mounting plate 11. The various components are wired, in one example, in the manner illustrated in FIG. 4, showing the temperature switch 42 connected between the terminal block post numbers 1 and 4 and the solenoid valve 28 connected between the terminal block posts 2 and 3. The temperature switch in one preferred example is set to close when the temperature rises above 110°F and to open when the temperature falls below 90°F. Terminal posts 1 and 2 of the terminal block 43 are also connected by wiring extending externally of the humidifier unit to a step-down transformer 44 having a 24 volt secondary connected to the terminal posts 1 and 2 and a 120 volt primary connected across the terminals of the 120 volt furnace blower motor 48. The terminal posts 3 and 4 of the terminal block 43 are connected to a conventional humidistat 45, having a switch which is closed when the relative humidity is below the selected set point and opens when the relative humidity rises above that set point.

To install the humidifier unit, an opening is cut in the lower horizontal wall 12 of the main trunk duct 13, the opening in one preferred example being a rectangular opening 11 inches wide and 22½ inches long, with a rectangular extension 2 inches by 2 inches cut in the upstream transverse edge of the opening at a location spaced 2 inches from one of the side edges of the opening. The mounting plate 11 is then set into proper position by inserting the mounting plate lip 37 through the opening and extending it downstream beyond the

downstream transverse edge of the duct opening 12a with the downstream edge of the main plate portion 35 abutting against this downstream edge of the duct opening, and mounting holes are drilled into the lower duct wall through the mounting plate openings 38. The mounting plate 11 is then removed from its position against the main trunk, the air scoop 16 is assembled onto the mounting plate 11 by fastening screws 41, and the mounting plate and air scoop assembly are then repositioned against the bottom duct wall with the air scoop excursions or hood portions 17, 18, extending through the duct wall opening 12, and the mounting plate is secured to the duct wall 12 by the screws 39 and nuts 39a. A tube, such as a small diameter copper tube or a plastic tube such as polypropylene is connected by means of a saddle valve connection to a water line and is connected at its other end to the water supply pipe 29 extending a short distance from the solenoid valve 28 assembled on the mounting plate 11. A drain line, formed for example of plastic tubing 46 is secured by a conventional clamp 46a to the short drain outlet pipe 47 projecting from the bottom wall section 21a of the receptacle in communication with the evaporation chamber 25. The terminal posts numbers 1, 2, 3 and 4 of the terminal block 43 are then wired to the transformer 44 and the humidistat 45 as previously described and as shown in FIG. 4, and the transformer 44 is connected to the 120 volt blower motor circuit for the furnace blower motor 48, as indicated. The screen 33 is then assembled with the screen supporting rods 32a and 32b in the receptacle portion 10, and the receptacle 10 is then assembled to the mounting plate 11 by washers and wing nuts 49 threaded onto the threaded shanks of the bolts 39 which extend downwardly through the holes in the flange portions of the receptacle 10 and through the nuts 39a.

If desired, a strainer tube section 29a may be connected to the inlet end of the water supply pipe 29, containing a strainer which filters or strains the line water.

When the system is wired as illustrated in FIG. 4, power is supplied through the transformer 44 when the furnace blower 48 is switched on by the conventional furnace control circuits. When the air forced over the temperature sensitive switch 42 of the humidifier unit exceeds 110°F, the temperature switch 42 will close. If the humidistat switch 45 is closed, power is now applied to the solenoid valve 28, opening the valve 28 and causing the spray nozzle 30 to discharge a fine mist spray into the evaporation chamber 25 and against the inlet excursion 17 and the wire screen 33. The fine mist spray in the warm air entering the evaporation chamber 25 through the inlet hood or excursion 17 evaporates into the air, and additional evaporation takes place as a result of the moisture which impinges on the inlet excursion 17 and the screen 33. When the blower motor 48 is switched off, or the air passing over the temperature sensitive switch 42 falls below 90°F, or the humidistat switch 45 opens, the solenoid valve 28 will be deenergized, causing the spray to stop.

The basic components of this humidifier, except for the air scoop 16, can be employed as a by-pass humidifier between the cool air return duct and the warm air supply duct of a warm air heating system, by employing a twin duct collar 50 in place of the air scoop 16. The twin duct collar includes a flat base plate portion 51 having openings near the corners and midway along the side edges thereof to fit against the mounting shoulders

35c', 35d' of the mounting plate 11 in the same manner as the air scoop 16. A first upwardly projecting collar portion 52, which is of circular cross-sectional configuration in the forms illustrated in FIGS 5, 6 and 7 is adapted to be connected to a circular cold air duct member or extension 53, while a second upwardly projecting collar formation 54, which is also of circular cross-section in the illustrated embodiment, connects to a warm air duct portion 55. In the installation illustrated in FIG. 5, the assembly of the receptacle 10, mounting plate 11, and twin duct collar 50, can be attached to or supported by angle brackets 56 or any other desired means, and the duct portions 53 and 55 connect respectively to the cold air return duct 57 and the hot air supply duct 58 of the heating system which are connected directly to the furnace 59. When attaching the receptacle 10 to the angle brackets 56, the holes 38a shown in FIG. 3 are used for the bolts. The pressure differential between the warm air plenum 58 and the cold air return 57 causes air flow from the warm air plenum 58 through the duct portion 55 and collar 54 into the evaporation chamber 25 of the receptacle 10 where the air picks up moisture from the spray discharged from nozzle 30 and from the screen 33, and the moisture laden air then exits through the collar 50 and the duct portion 53 to the cold air return 57. The temperature switch 42 in this embodiment is mounted in the warm air plenum 58 and is connected by suitable wires to the terminal block 43 mounted on the mounting plate 11.

In cases where forced circulation heating systems employ round ducting, rather than rectangular ducting, the twin duct collar 50 may be used to adapt the humidifier unit to such a system, in the manner illustrated in FIG. 6, wherein the second collar portion 54 connects by a circular duct portion 55a to a warm air supply duct of the system, and the collar formation 52 connects by the circular duct extension 53a to a cold air return duct of the heating system, and the temperature sensitive switch 42 is mounted in the duct portion 55a in a manner similar to the installation of FIG. 5. A similar connection arrangement may be employed by cutting a hot air duct and connecting the upstream end to collar portion 54 and the downstream end to collar portion 52, so that all of the air in the duct passes through the humidifier.

The humidifier system of the present invention can also be employed in homes having radiant heat systems, hydronic heat systems, baseboard heating, or hot water radiators, by an installation as illustrated in FIG. 7. In such a case, the inlet collar formation 54 is connected by a duct section 55b to an input grille or register 60 in the floor of the building, the collar formation 50 may be connected by a duct section 53b to a grille 61 in a wall of the building for discharge of humidified air into a room, and a fan 62 is provided in the inlet duct section 55b to insure proper air flow through the receptacle portion 10. Depending upon the application, a heat source such as an electrical heating unit 63 may also be provided in the duct portion 55b along with a limit switch 64. In such an installation, the temperature sensing switch 42 is eliminated by the simple expedient of disconnecting the temperature switch from the terminal post numbers 1 and 4 and connecting a jumper wire between those posts of the terminal block 43.

In cases where a 120 volt controlled circuit for the furnace blower motor is not accessible or the furnace

blower has a 240 volt motor, the transformer 44 of the wiring circuit of FIG. 4 may be connected to a 120 volt branch circuit in the building where the installation occurs. In such a case, the temperature switch 42 will still insure that the solenoid valve 28 is not opened except when air at a temperature above 110°F is caused to flow over the temperature switch 42.

It will be appreciated that the temperature switch 42 may be eliminated from each of the configurations illustrated in FIGS. 1, 5 and 6, and if desired the solenoid valve 28 may be opened only when the furnace burner circuit is energized and the furnace blower circuit is energized, in a manner similar to that disclosed in U. S. Pat. No. 3,262,444. In that case, a single pole single throw normally open relay such as that disclosed in FIG. 1 of said U.S. Pat. No. 3,262,444 may be used, with the coil of the relay connected across post numbers 1 and 2 of the terminal block 43 and the contacts controlled by the relay connected in series with the coil of the solenoid valve 28 across posts 3 and 4 of the terminal block 43. Terminal block posts 1 and 2 should be connected in electrical parallel with the furnace burner circuit, and terminal block posts 3 and 4 should be connected in electrical parallel with the furnace blower circuit.

Instead of connecting the primary of the step down transformer 44 to the furnace blower circuit, or as an additional safety factor when the transformer primary is connected to the furnace blower circuit, an air movement sensing device, such as a sail switch may be wired in series between the secondary of the transformer 44 and the terminal block posts 1 and 2 with the sail or air responsive moving element of the switch located in the air return duct of the heating system or some other convenient location. In such a case, the primary of the transformer 44 need only be connected to a conventional 120 volt supply circuit, as the sail switch would maintain the circuit from the transformer secondary to the terminal posts 1 and 2 in open circuit condition so long as there was not sufficient air movement in the duct system to close the air movement sensing switch.

It will be apparent that the humidifier system herein described is of great flexibility, permitting convenient installation and wiring of the elements making up the system by unskilled personnel or homeowners and which is adaptable to a great variety of installation conditions. By virtue of the use of the spray nozzle and the additional screen element in the path of the spray mist to effect evaporation as a result of both the air moving through the spray pattern and also moving through the screen on which the spray droplets impinge, extremely efficient evaporation is achieved, resulting in an evaporation factor of about 67 percent of the water put into the receptacle. Any water not evaporated is withdrawn through the drain, so that the screen and elements within the receptacle are not continuously immersed in water and subject to the corrosion rate which would occur in such circumstances. The receptacle portion is easily removed from the mounting plate portion and the screen can be readily removed and cleaned when desired or replaced by the use of readily available wire screen material purchased from a hardware.

The foregoing receptacle, mounting plate and air scoop or twin-duct collar assembly may also be used with other types of structures for discharging water droplets into the air flow and screen zone. For example, instead of using the spray nozzle, a copper tube or tu-

bular conduit extension of other material may be attached to the outlet end of the supply pipe 29 and may be shaped to define a straight transverse, perforated end portion overlying and spanning the width of the screen 33 to discharge droplets or spray downwardly toward the screen when the valve 28 is open. Similarly, a transverse perforated rectangular spreader plate or a trough may be disposed in overlying spanning relation to the screen 33 with a conduit extension from the supply pipe 29 extending to the transverse center of the spreader plate or trough to discharge the water in drop-let form over the transverse width of the screen 33.

Referring now to FIGS. 8, 9 and 10, there is shown a modified form of the humidifier assembly, wherein a top assembly, indicated generally by the reference character 70, may alternatively form an air scoop having air inlet and air outlet excursions for an installation similar to that illustrated in FIG. 1, or may form an adapter for connections similar to those provided with the twin duct collar 50. The top adapter unit, as illustrated in FIG. 8, comprises a main central portion indicated by the reference character 71, adapted to be supported on and extend above the mounting plate 11, and having upwardly inclining air inlet and air outlet excursions 72 and 73 opening along upwardly diverging paths and bounded by upwardly inclined diverging walls 72a, 73a and truncated triangular side walls 72b, 73b. This central portion 71 forms the air scoop portion similar to the portion 16 in the previously described embodiment, and comprises parallel, outwardly projecting horizontal side flanges 74a and 74b extending along the whole length of the center portion 71. The top walls 72c and 73c together with the inclined walls 72a, 73a and side walls 72b, 73b define the hood portions or inlet and outlet excursions and have a semi-circular opening formed therein bounded by a semi-circular, upwardly projecting collar flange 72d, 73d. The vertical edges of the side walls 72b and 73b of the inlet and outlet excursions have shallow outwardly projecting flanges 72b', 73b' for a purpose to be later described.

The top adapter unit 70 also includes a pair of like, opposite end members 75, 76 having somewhat outwardly inclined end walls 75a, 76a, and truncated triangular side wall portions 75b and 76b also having outwardly projecting flanges 75b', 76b' at the free edges thereof to abut and mate with the flanges 72b', 73b' and be secured thereto by a U-shaped slide clip 77. Outwardly projecting bottom flanges 78a and 78b also project from the ends and sides of the end member 75, 76 and the end members include a top wall 75c, 76c having a semi-circular opening to complement and form a circular opening with the openings in the center section, and bounded by semi-circular collar flanges 75d, 76d.

The top adapter unit 70 when used for installations such as the type illustrated in FIG. 1, will be mounted on top of the mounting plate 11 and receptacle portion 10 with the side flanges 74a, 74b secured against the shoulder surfaces 35c', 35d' in the same manner as in the previously described embodiment, and the humidifier assembly will be supported by the lower wall of the main trunk duct 13 in the same manner, providing an installation such as is illustrated in FIG. 9. In this installation, the excursion or hood portion 72 forms the air inlet diverting air downwardly into the receptacle portion from the main trunk duct, whereupon the air is hu-

midified by the droplets from the spray nozzle and the moisture on the screen, and the air returns into the main trunk duct through the air outlet excursion 73. When the humidifier unit is to be used in an installation similar to those illustrated in FIGS. 5, 6 and 7, the end members 75 and 76 of the top adapter unit 70 are assembled to the center section 71 by the slide clips 77 fitted over the mating and abutting flanges 72b', 73b' and 75b', 76b', thus completing inlet and outlet collar formations to be connected to circular cross-section conduits or duct members such as the extensions 53 and 55 shown in FIG. 5, and resulting in an installation such as that illustrated in FIG. 10.

What is claimed is:

1. A humidifier assembly for use in association with a forced circulation warm air heating system including a heated air supply duct, the humidifier assembly comprising a receptacle member including bottom, side and end wall portions integrally joined together to form an upwardly opening space bounded at its top by abutment surfaces defining a rectangular opening, partition means extending to the level of the top of said space subdividing said space into a component cavity and an evaporation chamber, a mounting plate member including an elongated rectangular body portion having a large air passage aperture and peripheral portions framing the aperture and positioned to engage said abutment surfaces and cover said component cavity, means for supporting said mounting plate member at a fixed station relative to said duct, means for removably fastening said receptacle member to said mounting plate member, an upper member removably fastened to said mounting plate member having a pair of spaced conduit formations over said aperture defining an air inlet for communicating heated air into the evaporation chamber and an air outlet for exit of humidified air therefrom to the heating system, and evaporative means in said evaporation chamber including water droplet discharge means coupled through valve means to a water source for discharging water droplets into the evaporation chamber in the path of air entering through said air inlet.
2. A humidifier assembly as defined in claim 1, wherein said evaporative means further includes an evaporation screen of wire mesh disposed in said evaporation chamber in the path of said water droplets and in evaporative exchange relation to air approaching said air outlet to collect water droplets thereon and evaporate said droplets into the air.
3. A humidifier assembly as defined in claim 1, wherein said droplet discharge means is a spray discharge nozzle for discharging a mist-like spray pattern of droplets into the entering air stream.
4. A humidifier assembly as defined in claim 2, wherein said droplet discharge means is a spray discharge nozzle for discharging a mist-like spray pattern of droplets into the entering air stream and against said screen.
5. A humidifier assembly as defined in claim 4, wherein said screen is shaped into a configuration defining at least one large substantially parallel panel extending along an upwardly inclined plane terminating in rounded upper and lower ends, and support rods removably mounted in said receptacle member about which said rounded upper and lower ends are trained to support the screen.

6. A humidifier assembly as defined in claim 2, wherein said screen is shaped into a configuration defining at least one large substantially parallel panel extending along an upwardly inclined plane terminating in rounded upper and lower ends, and support rods removably mounted in said receptacle member about which said rounded upper and lower ends are trained to support the screen.

7. A humidifier assembly as defined in claim 1, wherein said upper member comprises a twin-duct collar member having a flat base-plate portion to be fixed against said mounting plate member in covering relation to said aperture and said conduit formations being integral collar formations extending upwardly from said base-plate portion to be coupled to a hot air supply conduit and a cool air return conduit of the heating system.

8. A humidifier assembly as defined in claim 2, wherein said upper member comprises a twin-duct collar member having a flat base-plate portion to be fixed against said mounting plate member in covering relation to said aperture and said conduit formations being integral collar formations extending upwardly from said base-plate portion to be coupled to a hot air supply conduit and a cool air return conduit of the heating system.

9. A humidifier assembly as defined in claim 1, wherein said upper member comprises a main central member having flanges to be fixed against said mounting plate member and a pair of upwardly diverging inclined hood portions disposed in covering relation to said aperture and defining said conduit formations, said upper member also including a pair of end members removably assembled to said central member and to said mounting plate member forming lateral wall portions of said conduit formations, said hood portions and end members including aligned top wall portions each having openings therein defining complimentary parts of a circle and having integral collar formations bounding said openings extending upwardly from said top wall portion to be coupled to an air supply conduit and an air return conduit of the heating system.

10. A humidifier assembly for use in association with a forced circulation warm air heating system including a furnace and a heated air supply duct extending from the furnace and having a horizontal bottom wall having a substantially rectangular opening cut therein, the humidifier assembly comprising a receptacle member including bottom, side and end wall portions integrally joined together to form an upwardly opening space bounded at its top by abutment surfaces defining a rectangular opening, partition means extending to the level of the top of said spaces subdividing said space into a component cavity and an evaporation chamber, a mounting plate member including an elongated rectangular body portion having a large air passage aperture and peripheral portions framing the aperture and positioned to engage said abutment surfaces and cover said component cavity, means for supporting said mounting plate member at a fixed station relative to said duct, means for removably fastening said receptacle member to said mounting plate member, an upper member removably fastened to said mounting plate member having a pair of spaced conduit formations over said aperture defining an air inlet for communicating heated air into the evaporation chamber and an air outlet for exit of humidified air therefrom to the heating system, and

evaporative means in said evaporation chamber including water droplet discharge means coupled through valve means to a water source for discharging water droplets into the evaporation chamber in the path of air entering through said air inlet.

11. A humidifier assembly as defined in claim 10, wherein said mounting plate member is slightly larger laterally and longitudinally than the opening in the duct bottom wall and includes an upwardly and outwardly projecting lip formation at one transverse edge thereof to extend into the opening and rest against the adjacent portion of the duct bottom wall bounding a transverse edge of the opening.

12. A humidifier assembly as defined in claim 10, wherein said evaporative means further includes an evaporation screen of wire mesh disposed in said evaporation chamber in the path of said water droplets and in evaporative exchange relation to air approaching said air outlet to collect water droplets thereon and evaporate said droplets into the air.

13. A humidifier assembly as defined in claim 11, wherein said evaporative means further includes an evaporation screen of wire mesh disposed in said evaporation chamber in the path of said water droplets and in evaporative exchange relation to air approaching said air outlet to collect water droplets thereon and evaporate said droplets into the air.

14. A humidifier assembly as defined in claim 10, wherein said evaporative means further includes an evaporation screen of wire mesh disposed in said evaporation chamber in the path of said water droplets and in evaporative exchange relation to air approaching said air outlet to collect water droplets thereon and evaporate said droplets into the air, and wherein said droplet discharge means is a spray discharge nozzle for discharging a mist-like spray pattern of droplets into the entering air stream and against said screen.

15. A humidifier assembly as defined in claim 11, wherein said evaporative means further includes an evaporation screen of wire mesh disposed in said evaporation chamber in the path of said water droplets and in evaporative exchange relation to air approaching said air outlet to collect water droplets thereon and evaporate said droplets into the air, and wherein said droplet discharge means is a spray discharge nozzle for discharging a mist-like spray pattern of droplets into the entering air stream and against said screen.

16. A humidifier assembly as defined in claim 10, wherein said upper member comprises a flat perimeter portion to abut said mounting plate member and a pair of upwardly extending, oppositely inclined hood formations to extend through said opening and be disposed within said air supply duct with one hood formation facing upstream to direct heated air downwardly into said evaporation chamber and the other hood formation facing downstream to return air into the air stream in the duct.

17. A humidifier assembly as defined in claim 11, wherein said upper member comprises a flat perimeter portion to abut said mounting plate member and a pair of upwardly extending, oppositely inclined hood formations to extend through said opening and be disposed within said air supply duct with one hood formation facing upstream to direct heated air downwardly into said evaporation chamber and the other hood formation facing downstream to return air into the air stream in the duct.

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18. A humidifier assembly as defined in claim 12, wherein said upper member comprises a flat perimeter portion to abut said mounting plate member and a pair of upwardly extending, oppositely inclined hood formations to extend through said opening and be disposed within said air supply duct with one hood formation facing upstream to direct heated air downwardly into said evaporation chamber and the other hood formation facing downstream to return air into the air stream in the duct.

19. A humidifier assembly as defined in claim 14, wherein said upper member comprises a flat perimeter portion to abut said mounting plate member and a pair of upwardly extending, oppositely inclined hood formations to extend through said opening and be disposed within said air supply duct with one hood formation

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facing upstream to direct heated air downwardly into said evaporation chamber and the other hood formation facing downstream to return air into the air stream in the duct.

20. A humidifier assembly as defined in claim 15, wherein said upper member comprises a flat perimeter portion to abut said mounting plate member and a pair of upwardly extending, oppositely inclined hood formations to extend through said opening and be disposed within said air supply duct with one hood formation facing upstream to direct heated air downwardly into said evaporation chamber and the other hood formation facing downstream to return air into the air stream in the duct.

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