April 8, 1969 R. W. ABBOTT ETAL 3,437,318

DUAL-MOUNT FURNACE HUMIDIFIER

Filed Sept. 14, 1967 Sheet 1 of 2

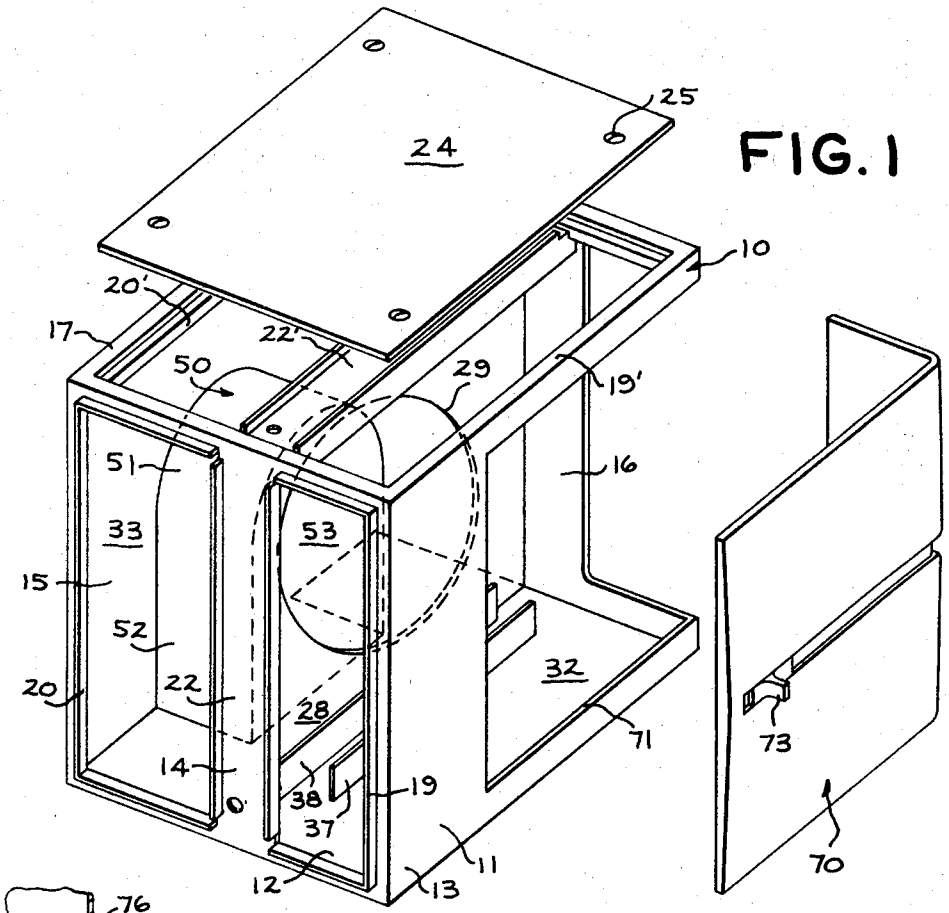



FIG. 1

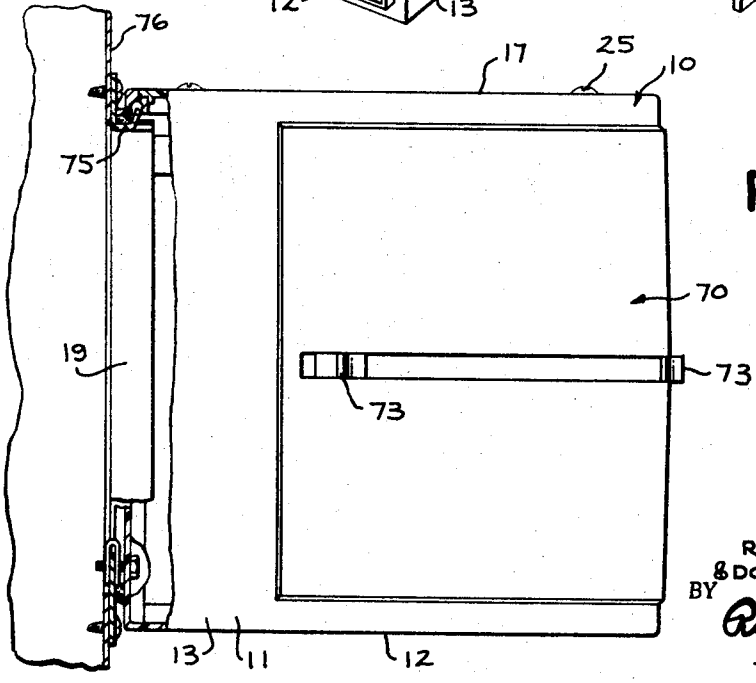



FIG. 4

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FIG. 2

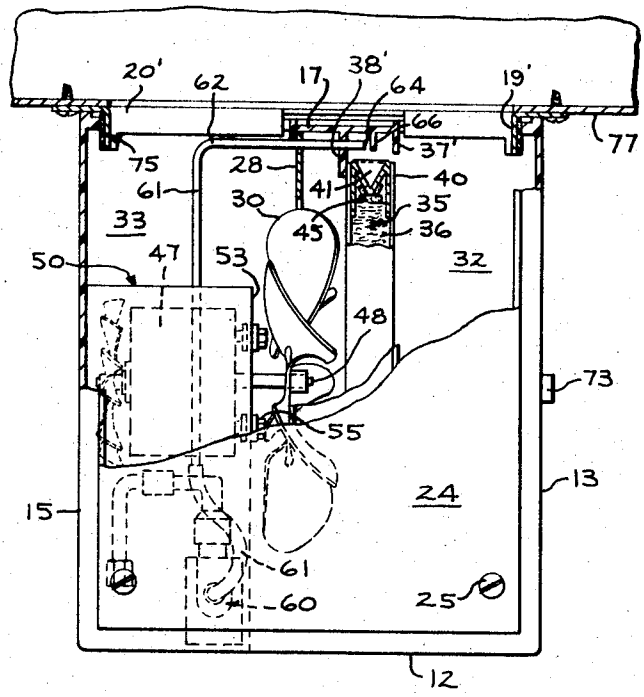
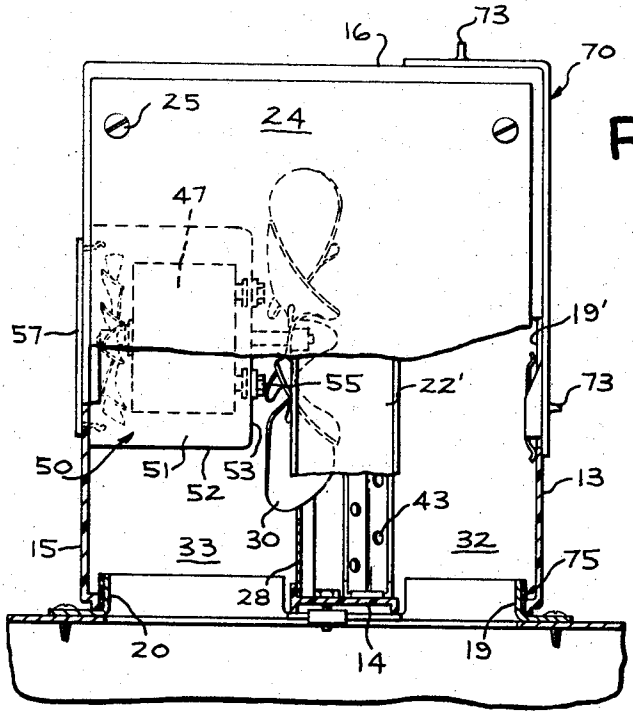



FIG. 3




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# DUAL-MOUNT FURNACE HUMIDIFIER

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U.S. Cl. 261—24 8 Claims

## ABSTRACT OF THE DISCLOSURE

A furnace humidifier that is adapted to be mounted either against a vertical side or the horizontal underside of a warm air distribution duct. The humidifier housing is of compact box-like construction having one side wall and a top wall of general similarity. Each of these two walls has an air inlet opening and an air outlet opening separated by a central wall panel. There is an orifice plate arranged generally perpendicular to the said central wall panels for dividing the housing into an evaporating chamber and a fan chamber. An evaporating element is positioned in the evaporating chamber across the face of the orifice plate, while a motor driven fan is located in the fan chamber. Accordingly the evaporating element is arranged perpendicular to both mounting faces of the humidifier housing.

## BACKGROUND OF THE INVENTION

There are many annoying effects resulting from heating rooms with forced warm air that has not been humidified. For example, dry heated air recirculating through the furnace system absorbs moisture from the human body causing the body to feel cool and chilly even through the temperature is relatively high. Since dry air requires higher temperatures for comfort than does humidified air, there is also a substantial increase in expenditures for fuel required to heat comfortably with non-humidified air. Moreover, dry room climate may result in discomfort in the nose and throat areas of the occupants as well as restricted breathing passages and chronic coughing conditions.

These deleterious effects are substantially avoided by installing a humidifier in the furnace plenum or warm air distribution duct of the heating system. The humidifier must be located on the supply or warm air side of the furnace and it must be furnished with a power cable, water supply line and a water drain line. The main elements of a furnace humidifier are an evaporating element and a motor driven fan and means for wetting the element so that the warm air is caused to pass through the element and pick up a percentage of the moisture from the element before the warm air proceeds through the distribution duct. The fan motor is customarily wired from a source of electrical power in a manner to operate only when the furnace blower is operating. In addition, a humidistat is furnished with the humidifier and it controls a solenoid water valve that governs the amount of water furnished to the evaporating element. The humidistat would be connected in series with the fan motor and solenoid valve. Hence, if the humidity is high in the cool air return duct of the furnace system, the humidistat will open the circuit to the solenoid valve and fan motor even though the furnace blower may be running. A slight amount of excess water is allowed to drain from the evaporating element and accumulate in a sump in the bottom of the humidifier housing, and this overflow is removed through a drain connection leading from the sump.

Hardships may be experienced during the installation of furnace humidifiers due to cramped working conditions



in certain furnace areas which make it difficult to design a universal type of furnace humidifier for the myriad sets of conditions that are present in homes throughout the country. Sometimes the humidifier can only be mounted to the vertical face of the furnace plenum, and other times the humidifier must be mounted to the underside of a horizontal warm air distribution duct.

The principal object of the present invention is to provide a furnace humidifier that is adapted to be mounted either to a vertical side or a horizontal underside of a warm air distribution duct.

A further object of the present invention is to provide a furnace humidifier of the class described with an evaporating element that is arranged generally perpendicular to the mounting wall of the humidifier housing.

A further object of the present invention is to provide a furnace humidifier that is divided into an evaporating chamber and a fan chamber, where the evaporating chamber is provided with an angular service cover in one corner therefor for facilitating the ease of removing and rereplacing the evaporating element.

A further object of the present invention is to provide a furnace humidifier of the class described with a motor compartment that is extended down to the bottom wall of the humidifier housing for improving the air flow characteristics of the fan.

A still further object of the present invention is to provide a furnace humidifier of the class described with a motor compartment of a size to mount control components therein.

## SUMMARY OF THE INVENTION

The present invention, in accordance with one form thereof, relates to a furnace humidifier that has walls forming a box-like housing. One side wall includes an air inlet opening and an air outlet opening separated by a vertical wall panel. A top wall of the housing also has an air inlet opening and an air outlet opening separated by a central wall panel. A cover means is provided for the openings in one wall of the housing for closing the openings in either the side wall or the top wall so that the wall with the remaining air openings may serve as a mounting wall for the humidifier. An orifice plate is arranged perpendicular to the central wall panels to separate the housing into an evaporating chamber and a fan chamber. Other improvements include an angular cover plate for the walls of the evaporating compartment, and a cover for the fan motor that is extended down to the bottom wall of the housing for improving the air flow characteristics of the fan compartment.

## BRIEF DESCRIPTION OF THE DRAWINGS

Our invention will be better understood from the following description taken in conjunction with the accompanying drawings and its scope will be pointed out in the appended claims.

FIGURE 1 is an exploded perspective view of a furnace humidifier housing with both the top cover and the angular cover plate removed, and also shown minus the evaporating element and the fan for the sake of simplicity.

FIGURE 2 is an elevational view the complete furnace humidifier of FIGURE 1 shown mounted to the underside of a warm air distribution duct with parts broken way and others in cross-section to show the nature and relationship of the various elements.

FIGURE 3 is a top plan view of the furnace humidifier embodying the present invention shown mounted to the vertical side of a furnace plenum or warm air distribution duct with a portion of the top cover broken away and other elements in cross-section to show the interior construction of the humidifier.

FIGURE 4 is a right side elevational view of the

humidifier of FIGURE 3, again showing the method of mounting the humidifier to the vertical wall of the duct.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to a consideration of the drawings and in particular to FIGURE 1, there is shown a furnace humidifier **10** having walls forming a box-like housing **11** which in the preferred embodiment is formed of molded plastic material such as a glass filled polyester material. This housing has a bottom wall **12**, and a series of vertical side walls **13**, **14**, **15** and **16**, as well as a top wall **17**. One of the side walls, side wall **14**, has an air inlet opening **19** and an air outlet opening **20**. These air openings **19** and **20** are of rather large size, which when subtracted from the area of the side wall **14** leaves a substantially central, vertical panel **22**.

Now turning to a study of top wall **17**, it also has an air inlet opening **19'** and an air outlet opening **20'** which are similar in size and shape to the same openings **19** and **20** in the side wall **14**. By the same token, the top wall **17** also includes a substantially central panel **22'** corresponding in nature to the central, vertical panel **22** of the side wall **14**. Hence, the side wall **14** and the top wall **17** are alternate mounting faces for the humidifier housing **11**. A removable cover plate **24** is adapted to fit over either the top wall **17** or the side wall **14** so as to close the openings in either wall so that only the openings in the alternate wall are open for purposes of mounting the humidifier to either a vertical face or the underside of a warm air distribution duct. This cover plate **24** includes a series of fastening means **25** in each of the four corners of the plate which comprise a screw member extending therethrough with a blade (not shown) fixed to the inner end thereof so that the turning action of the screw will cause the blade to slip under the edge of one of the openings **19**, **20** or **19'**, **20'** in the two walls of the housing, and be held in place. Hence, turning through an angle of about 45° will bring the blade into or out of fastening position.

Positioned within the humidifier housing **11** is a vertical orifice plate **28** which is arranged generally perpendicular to the wall panels **22** and **22'** of the side wall **14** and the top wall **17** respectively as is seen in FIGURE 1. This orifice plate has a large central opening **29** that is adapted to receive a fan **30** therein, as is best seen in FIGURE 2. This orifice plate **28** separates the housing **11** into an evaporating chamber **32** and a fan chamber **33**. The evaporating chamber **32** includes the air inlet openings **19** and **19'**, while the fan chamber **33** includes the air outlet openings **20** and **20'** as is clear from FIGURE 1.

Located within the evaporating chamber **32** is an evaporating element **35** which is positioned across the face of the orifice plate **28** and held in position by retaining flanges **37**, **38** rising from the bottom wall **12** of the housing as seen in FIGURE 1, and flanges **37'** and **38'** hanging from the roof of the top wall **17**, as is best seen in FIGURE 2. Such an evaporating element **35** includes a main evaporating pad **36** of cross-corrugated folded metal or other non-organic strips to provide a large quantity of wetted surface area. Such an evaporating pad **36** of folded strips is held together by a metal frame **40** which is wrapped and held around the marginal edges of the pad. The top edge of the metal frame **40** is provided with a V-shaped water trough **41** for receiving and distributing water along the length thereof. Suitable holes **43** are formed in the two sides of the trough as is best seen in the plan view of FIGURE 3 so that the water may drain onto the evaporating pad **36**. It is important to provide a wicking material **45** against the underside of the trough **41** in contact with the holes **43** in order to break the surface tension of the water. This wicking material serves as a spreader to induce water flow across the entire top edge of the evaporating element **36** so that the water trickles down the pad and forms hundreds of small pools of water therein. The lower edge of the frame **40** of the evaporating pad **35** is provided with suitable openings so that the water may spill onto the floor of the evaporating chamber **32** and be drained therefrom by a drain line (not shown).

Turning now to a consideration of the fan chamber **33**, it is provided with a drive motor **47** having a shaft **48** supporting the fan **30** in the central hole **29** of the orifice plate **28**. Because of the moisture laden air that circulates through the fan chamber **33**, the drive motor **47** is protected from the moisture by a motor cover **50** that surrounds the motor and is joined with the side wall **15** of the humidifier housing. This cover **50** forms a compartment for the motor, and the cover is extended down to join with the bottom wall **12** of the housing. This cover **50** thus has a semi-circular top wall **51**, two opposed side walls **52** and a front wall **53** closely spaced from the blades of the fan **30** as is best seen in FIGURE 2. Actually, the drive motor **47** is mounted to the front wall **53** of the motor cover **50** as by means of mounting bolts **55**. The side wall **15** of the humidifier housing has a portion removed for gaining access to the interior of the motor compartment of cover **50**. This opening is adapted to be closed by a removable cover plate **57** as is seen in FIGURE 3. About the bottom half of the motor compartment **50** is available for storage purposes, and it is provided with a solenoid operated water valve **60** shown in dotted line in FIGURE 2. A feed water line **61** extends from the valve out a suitable opening in the motor cover in a generally vertical direction, and the line has a horizontal bend **62** which terminates at **64** generally over the water trough **41** in the evaporating element **35** as is best seen in FIGURE 2. A small deflecting flange **66** is positioned closely adjacent the discharge end **64** of the water tube to deflect the water down into the trough **41**. The motor compartment also includes provision for receiving the necessary electrical power and control cables for energizing and controlling both the drive motor **47** and the solenoid water valve **60**.

Although it is quite convenient to have space available within the motor compartment for storing the solenoid operated water valve and other necessary components, the principal purpose for having the lower extension of the motor cover **50** is to provide a better air flow characteristic within the fan chamber **33**. This improved air flow characteristic increases the amount of air flow apparently due to the tendency for the lower extension of the motor cover **50** to act as a scroll cut-off in the same manner that a cut-off operates in a conventional Sirocco blower housing to divert the flow from within the housing through the air outlet rather than having the air tending to recirculate in the fan chamber **33**. This improved air flow is primarily noticeable when the side wall **14** of the housing **11** is connected to a vertical wall as seen in FIGURE 3, although there is also a noticeable improvement when the humidifier housing is top mounted. Thus, the storage area in the motor cover extension beneath the drive motor **47** is merely a bonus obtained in using this improved air flow design. In this arrangement, it is necessary that the fan **30** revolve in a counter clockwise direction as viewed from the evaporating chamber **32**, as quite different results would be obtained if the rotation were in the opposite direction.

For efficient humidifier operation, the evaporating element **35** should be replaced at least once a year. If the water supply contains an abnormally high mineral content, it may be necessary to replace the evaporating element more frequently. Thus it is necessary to provide easy access to the evaporating element, and this is best performed by an angular cover plate **70** which is adapted to fit over a corner opening **71** that is located partially in side wall **13** and partially in side wall **16** as is best seen in FIGURE 1. With the angular cover plate **70** removed it is possible to grasp the evaporating element

35 and angle it out through the corner opening 71 in the housing depending on whether there is an obstruction nearest the side wall 13 or the side wall 16. Thus this gives the user greater choice of possibilities of removing the evaporating pad depending upon the crowded working conditions surrounding the humidifier housing 11. Simple slide fasteners 73 are formed in the two opposite side edges of the angular cover plate 70 and these may be slid to and fro engaging connection with the adjacent edge of the corner opening 71 as is best seen in the plan view of FIGURE 3.

There is a certain amount of vertical clearance between the supporting flanges 37, 38 and 37', 38' and the evaporating element 35 so that the evaporating element is interposed therebetween by first raising the element between the flanges 37' and 38' and lifting the element over the flange 37, and then allowing the element to drop into position between the various cooperating flanges.

A special mounting frame 75 for the humidifier is fastened to the supporting structure whether it be a furnace plenum 76 as in the case of a vertical mount or a warm air distribution duct 77 as in the case of mounting the humidifier to the underside of the duct.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A furnace humidifier having walls forming a compact box-like housing that is adapted to be mounted either to the vertical side or the horizontal underside of a warm air distribution duct, said housing having a bottom wall, vertical side walls and a horizontal top wall, one of the side walls having an air inlet opening and an air outlet opening, said openings being separated by a substantially central panel of said one side wall, an orifice plate arranged generally perpendicular to said central panel and separating the housing into an evaporating chamber and a fan chamber, an evaporating element positioned in the evaporating chamber across the face of the orifice plate, a fan located in the fan chamber and comprising a drive motor with an air moving device cooperating with the said orifice plate for drawing air into the air inlet opening, through the evaporating element and orifice plate and discharging the air from the air outlet opening, and water supply means for wetting the evaporating element.

2. A furnace humidifier as recited in claim 1 where the top wall of the housing has a set of air inlet and outlet openings similar to the openings in the said one side wall, and a cover means for sealing the openings in one wall of the housing while the housing is supported from the wall of the housing with the other set of air openings.

3. A furnace humidifier as recited in claim 2 wherein the fan chamber includes a cover for the fan drive motor, which cover is extended beneath the motor to the housing bottom wall to act as a scroll cutoff to divert the air flow in the fan chamber through the air outlet opening, the rotation of the air moving device being in a counter clockwise direction when viewed from the evaporating chamber, the motor cover extension also serving as a wiring and apparatus compartment.

4. A dual-mount furnace humidifier having walls forming a box-like housing that is adapted to be mounted either to a vertical side or a horizontal underside of a warm air distribution duct, said housing having a bottom wall, vertical side walls and a top wall, one of the side walls having an air inlet opening and an air outlet opening, said openings being separated by a central wall panel, a vertical orifice plate arranged generally perpendicular to the said central wall panel and dividing the housing into an evaporating chamber and a fan chamber, an evaporating element positioned in the evaporating chamber across the face of the orifice plate, a drive motor and fan located in the fan chamber with the fan centered within the orifice plate and in close proximity to the evaporating element, and water supply means for wetting the evaporating element, the top wall of the housing also having an air inlet opening and an air outlet opening, and a removable cover means for closing the openings in either the side wall or the top wall of the housing so that the wall with the remaining openings may serve as the mounting wall for the humidifier.

5. A dual-mount furnace humidifier as recited in claim 4 wherein the housing walls forming the evaporating chamber have a removable angular cover plate at one corner thereof remote from the side wall with the air openings therein for facilitating the removal and replacement of the evaporating element, and adjustable fastening means for holding the angular cover plate in place.

6. A dual-mount furnace humidifier as recited in claim 4 wherein the fan chamber includes a cover for the fan drive motor, said cover being extended down beneath the motor to the housing bottom wall to improve the air flow characteristics of the fan chamber when the fan rotates in a counter clockwise direction when viewed from the evaporating chamber.

7. A dual-mount furnace humidifier as recited in claim 4 wherein the fan chamber is reduced in volume by a motor compartment that encloses the fan drive motor and extends down from the motor to the housing bottom wall to improve the air flow characteristics of the fan chamber when the fan rotates in a counter clockwise direction when viewed from the evaporating chamber with the side wall openings at the left side thereof.

8. A dual-mount furnace humidifier as recited in claim 7 wherein the side wall nearest the motor compartment includes a removable cover plate for gaining access to the motor compartment, and an electroresponsive water valve positioned within the motor compartment beneath the drive motor for controlling the said water supply means for the evaporating element.

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