United States Patent

Dines

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[54] HUMIDIFIER

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[52] **U.S. Cl.**.....**219/271,** 126/113, 261/142

[51] **Int. Cl.**.....**F22b 1/28**

[58] **Field of Search**.....219/271–276, 284, 219/285, 362, 314–315, 323–324; 122/40; 236/44; 261/142; 126/113

[56] **References Cited**

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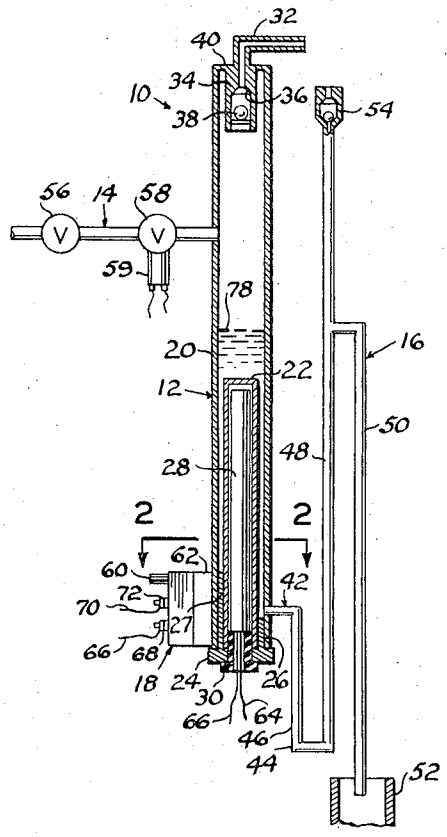
[57] **ABSTRACT**

A boiler formed by a water containing vertically disposed casing having a heater in its depending end portion is provided with a steam outlet at its upper end portion. An overflow tube, connected with the depending end portion of the case, drains minerals and salts tending to accumulate in the bottom of the casing. A thermal switch secured to the depending end of the case operates a water flow controlling solenoid valve which refills the casing in response to temperature changes of the casing in converting water contained thereby to steam.

5 Claims, 4 Drawing Figures



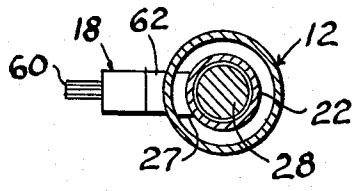


FIG. 2

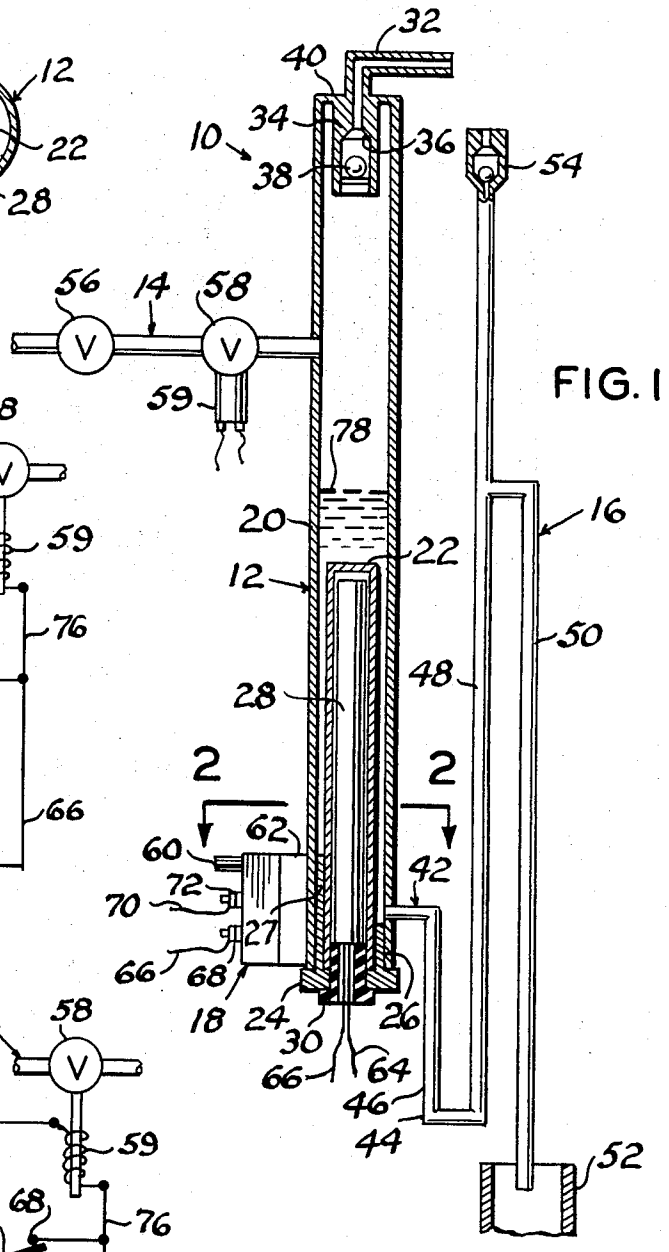


FIG. 1

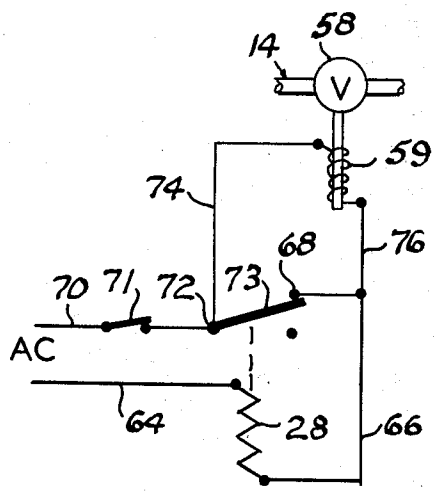


FIG. 3

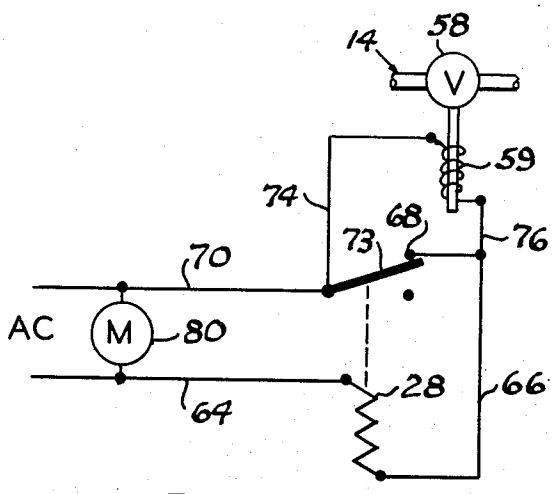


FIG. 4

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HUMIDIFIER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to humidifiers and more particularly to an improved humidifier which may be used as an individual unit or in combination with a forced draft heating unit.

It is generally well understood that for comfort it is necessary to maintain an adequate level of humidity within the air within buildings being heated. Further, it is recognized that a proper level of humidity permits room temperature to be kept slightly lower with no uncomfortable affects, thus, lowering fuel costs and further preventing furniture and other household items from drying out.

2. Description of the Prior Art

A plurality of humidifiers are disclosed by prior patents which generally are used in combination with a forced draft furnace controlled by a humidistat, such as U.S. Pat. Nos. 2,347,490; 3,294,081; 3,305,173 and 3,443,559.

Some of these prior art humidifiers employ the heated air from the furnace for evaporating water contained by porous elements in the path of hot air flow while others utilize a fine spray or mist or water in the air stream. This type of humidifier is generally bulky and usually gets out of order, such as by minerals and salts, deposited by the water, clogging the orifices forming the water spray in the air supply and collecting on the air ducts interior wall surfaces. Humidifiers which employ a separate heating element for evaporating water frequently become inoperative as a result of minerals and salts from the water forming a scale which restricts the water and steam openings.

This invention is distinctive over the above named patents by providing a humidifier which may be operated as an individual unit or in combination with forced draft furnaces. This device includes means for removing scale formed by minerals and salts in the water when the latter begins to accumulate. Further, this invention is distinctive over the humidifiers disclosed by the prior art by its simplicity and construction of relatively few components, thus reducing its initial cost, which includes a temperature responsive switch actuated by a water evaporating boiler and requiring only a source of water and a source of electrical energy to place it in operation.

SUMMARY OF THE INVENTION

A boiler is formed by an elongated vertically disposed casing having a heating element containing tube member sealed with and extending upwardly in the depending end portion of the casing. The upper end of the casing is provided with a normally open steam vent. Adjacent its upper end portion the casing is connected with a water supply pipe having a solenoid controlled valve interposed in the water supply pipe. An overflow tube is connected with the depending end wall portion of the casing for flushing the casing into a drain each time the casing is refilled. A temperature responsive switch, connected with the casing wall at its depending end portion, opens the solenoid controlled valve for admitting water to the casing in response to a temperature rise, above a predetermined setting, each time the heating unit evaporates the water, contained by the casing. Water entering the casing reduces the casing temperature below the predetermined setting of the temperature responsive switch thus closing the solenoid operated valve.

The principal objects of the invention are to provide a humidifier which utilizes a boiler to vaporize water which is automatically refilled by a temperature responsive switch each time the water in the boiler is evaporated and which flushes the boiler free of scale accumulated in the boiler each time it is refilled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectional view, partially in elevation, of the device;

FIG. 2 is a horizontal cross-sectional view, to a larger scale, taken substantially along the line 2—2 of FIG. 1; and,

FIGS. 3 and 4 are wiring diagrams illustrating different embodiments of the device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

The reference numeral **10** indicates the device, as a whole, comprising a boiler **12** connected with a water supply pipe **14**, overflow tube means **16** and a controlling thermal switch **18**. The boiler **12** comprises an elongated vertically disposed casing **20**, preferably formed from a selected length and diameter of copper tubing, having an elongated downwardly open tubular member or heater housing **22**, of similar material and diametrically slightly smaller than the inside diameter of the casing, vertically disposed in the depending end portion thereof. The depending ends of the casing **20** and housing **22** terminate in a common horizontal plane and are joined in fluid tight sealing relation by a centrally bored seal **24** having an annular flange **26** interposed between the innerwall surface of the casing and the outer wall surface of the tubular housing **22** thus maintaining the housing coaxial with respect to the longitudinal axis of the casing **20**. The housing **22** coaxially receives, in close spaced relation, an elongated electrical resistance heating element **28** which is maintained within the housing **22** by a centrally bored plug member **30** extending through the bore of the seal **24** and frictionally received by the depending inner wall surface of the housing **22**.

The upper end portion of the casing is provided with a diametrically reduced tubular vent **32** for exhausting steam to the ambient air in the manner hereinafter explained. A cage **34**, having a seat **36** opened and closed by a float-type ball valve **38**, is coaxially disposed within the casing and connected to the upper end wall **40** of the casing in communication with the bore of the casing vent **32**.

The drain tube means **16** comprises a first tube **42** diametrically smaller than the casing **20**, which is coaxially connected horizontally, at one end, with the casing wall in close spaced relation with respect to the upper limit of the sealing flange **26**. Intermediate its ends and adjacent the casing the tube **42** is deformed to describe a substantially U-shape, indicated at **44**, defining vertical parallel leg portions **46** and **48** with the leg portion **48** projecting upwardly substantially coextensive with the upper limit of the casing **20**. A second drain tube **50** is horizontally connected, at one end, with the first tube leg **48** at a selected position intermediate its ends, preferably spaced above the upper limit of the heater housing **22**, with the other end portion of the second tube **50** turned downwardly and opening into a drain, or the like, indicated at **52**, disposed below the lower limit of the first drain tube U-shaped portion **44**. The upper end portion of the first tube leg **48** is similarly provided with a float-type ball valve and cage means **54** which is normally open for admitting air to the tubes **42** and **50** to prevent a syphoning action and draining water contained by the casing **20**.

The water supply pipe **14** is connected with the wall of the casing **20** adjacent its upper end portion in upwardly spaced relation with respect to the horizontal plane defined by the connection of the second tube **50** with the first tube leg **48**. An "open-closed"water control valve **56** is interposed in the water supply line **14** and a solenoid controlled valve **58**, including a solenoid coil **59**, is interposed in the water line **14** between the valve **56** and casing **20**.

The thermal switch **18** is a conventional temperature responsive switch operated by differential expansion of a surrounding metallic case operating a low expansion metal bridge, contained by the case, which opens and closes a pair of contacts in the case manually adjusted by the external end of an adjusting screw **60**. The contacts of the thermal switch **18** open on temperature rise. This thermal switch **18** is commercially available from Fenwal, Inc. of Ashland, Mass. and is marketed under the trade name THERMOSWITCH, series No. 30000, relating to nonindicating surface mounting tem-

perature controls. The thermal switch **18** is elongated rectangular in general appearance and is mounted exteriorally on the depending end portion of the wall of the casing **20** with its axis parallel with the longitudinal axis of the casing. Thermal conduction means comprising a slug **62**, generally rectangular in transverse section, formed of heat conducting metallic material, such as copper, having a predetermined thickness, is interposed between the mounting surface of the thermal switch **18** and the outer surface of the casing wall for increasing the thermal inertia of the switch **18** by forming a time delay in the conduction of heat transmitted to the thermal switch **18** from the boiler **12**.

A spacer **27**, which may be an extension of the flange **26**, is disposed between the walls of the housing **22** and casing **16** substantially coextensive with the thermal switch case for more efficient heat conduction.

Referring more particularly to FIG. **3**, a source of electrical energy A.C. has one source wire **64** connected with the heater **28** with the other wire **66** of the heater connected to one terminal **68** of the thermal switch. The other current source wire **70** is connected to the other terminal **72** of the thermal switch through an "off-on" switch **71**. The contacts **68** and **72** of the thermal switch **18** are bridged by an arm **73** in FIGS. **3** and **4** for illustrative purposes since in actual practice they make and break with each other. Other wires **74** and **76**, connected, respectively, with the thermal switch terminal **72** and wire **66** are connected at their respective other ends to the terminals of the solenoid coil **59**.

OPERATION

In operation the device is assembled and connected with the water supply pipe **14** and current source A.C. as described hereinabove. The device is placed in operation by manually opening the water control valve **56** and closing the "off-on" current supply switch **71**. This places the resistant heater **28** in operation without water being present in the casing **20**. As soon as a predetermined temperature is reached, determined by the setting of the thermal switch **18**, the thermal switch opens its normally closed contacts, by moving the arm **73**, so that current is applied to the solenoid **59** over the wires **74** and **76** thus opening the solenoid valve **58** and admitting water, indicated by the lines **78**, to the casing. The water fills the casing to the level of the connection of the second tube **50** with the first tube leg **48** wherein any excess water entering the casing **20** drains through the second tube **50**. Water entering the casing **20** reduces the temperature of the casing and this reduction of temperature is sensed by the thermal switch **18** through the slug **62** which closes the thermal switch arm **73** with the contact **68** de-energizing the solenoid coil **59** and interrupting the water supply to the casing **20** wherein the resistance heater **28** heats the water **78** and vaporizes it. Steam, not shown, is generated and exhausted through the casing vent **32**. In the event of malfunction of the thermal switch **18** causing the solenoid valve **58** to remain open water entering the casing is continuously drained off through the drain tubes **16**. In the event impurities in the water restrict the overflow of water through the drain tubes the ball valves in the top of the casing and at the top of the first tube leg **48** are lifted by the water and seal with their respective seats to prevent water being discharged into the area around the device through the vent or upwardly open end of the first tube leg **48**. The close spacing between the outer wall of the heater housing **22** and inner wall surface of the casing **20** limits the volume of water contained therebetween and relatively quickly evaporates the water **78**. As this occurs the heater temperature again rises and opens the contacts of the thermal switch to refill the casing **20**.

Referring also to FIG. **4**, the current source wires **70** and **64** may be connected with the terminals of a forced draft furnace motor **80**, or the like, so that this humidifier may be operated only when the forced draft furnace is in operation and supplying heated air to the building.

Obviously the invention is susceptible to changes or alterations without defeating its practicability, therefore, I do not wish to be confined to the preferred embodiment shown in the drawings and described herein.

I claim:

1. A humidifier, comprising:
- a vertically disposed casing forming a primary water holding chamber,
  - said casing having an opening adjacent its upper limit to permit steam to issue from the water holding chamber;
- heater means within the depending end portion of said casing;
- water supply means connected with the upper end portion of said casing;
- tube means connected with the depending end portion of said casing and forming a secondary water holding chamber limiting the quantity of water contained by said casing;
- thermal switch means connected with the wall of the depending end portion of said casing and operatively connected with said water supply means for refilling said casing at predetermined intervals; and,
- thermal conduction means interposed between said switch means and said casing wall for increasing the thermal inertia of said switch means.

2. The humidifier according to claim **1** in which said heater means comprises:
- a downwardly open housing coaxially received in close spaced relation within the depending end portion of said casing; and,
- an electrical resistance heating element within said housing.

3. The humidifier according to claim **2** in which said water supply means includes:
- a water supply pipe;
- a solenoid valve interposed in said water supply pipe; and,
- wiring connecting a source of electrical energy with said heating element,
  - said solenoid valve and said thermal switch means.

4. The humidifier according to claim **3** in which said tube means comprises:
- a first tube substantially defining a U-shape and having an upwardly open leg portion extending upwardly substantially coextensive with said casing; and,
- a second tube horizontally connected, at one end, with said first tube above the upper limit of said housing,
  - the other end of said second tube projecting downwardly.

5. The humidifier according to claim **4** and further including:
- normally open float valve and cage means coaxially connected with the upper end portion of said casing and said first tube leg portion, respectively.

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