# United States Patent [19]

**Ernest**

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[45] **Oct. 8, 1974**


[54] **AIR HUMIDIFYING APPARATUS**


[76] Inventor: **Dale S. Ernest,** 4848 Chevy Chase Dr., Chevy Chase, Md. 20015



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[52] **U.S. Cl.** ..... **126/113,** 261/26

[51] **Int. Cl.** ..... **F24f 3/14**

[58] **Field of Search** ..... 126/113; 261/26, 27; 236/46 E



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,804,067 | 8/1957 | Elgin | 126/113 |
| 2,939,687 | 6/1960 | Goettl | 261/26 |
| 3,252,454 | 5/1966 | Lindberg | 126/113 |
| 3,262,444 | 7/1966 | Davidson | 126/113 |
| 3,640,266 | 2/1972 | Ernest | 126/113 |



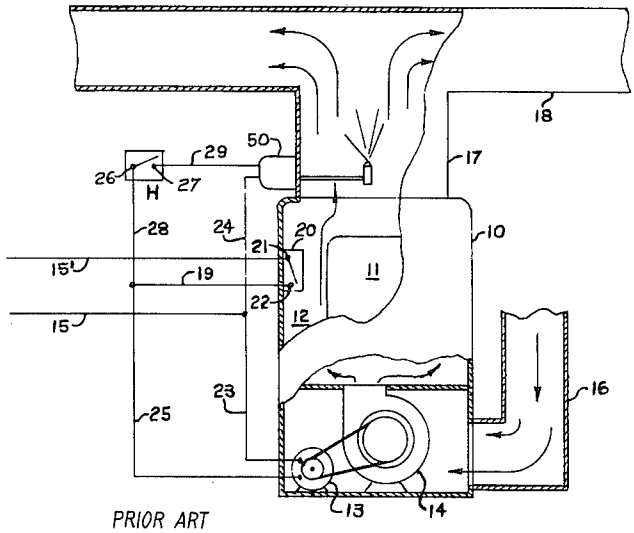
*Primary Examiner*—Carroll B. Dority, Jr.
*Assistant Examiner*—W. E. Tapolcai, Jr.
*Attorney, Agent, or Firm*—Cushman, Darby & Cushman



[57] **ABSTRACT**

An air humidifier arrangement for use with forced warm air furnaces, the arrangement having time delay circuitry electrically interconnected with the furnace blower to maintain operation of the blower for a limited time after the blower control switch is opened and the humidifier is shut off.


**6 Claims, 11 Drawing Figures**




PRIOR ART

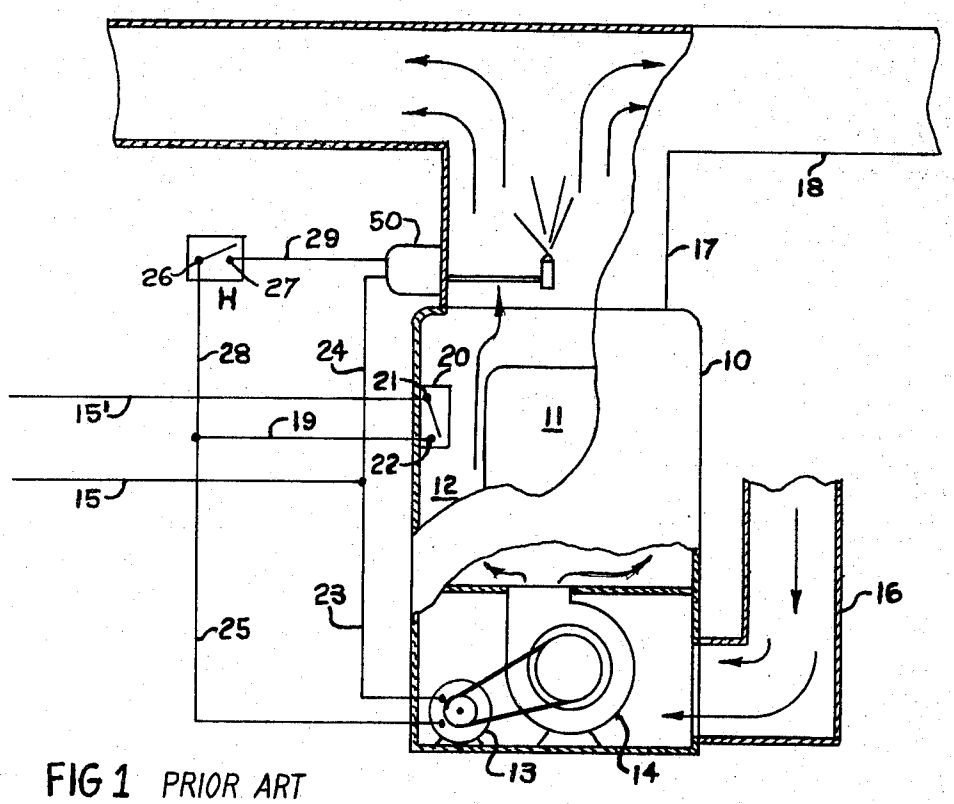



FIG 1 PRIOR ART

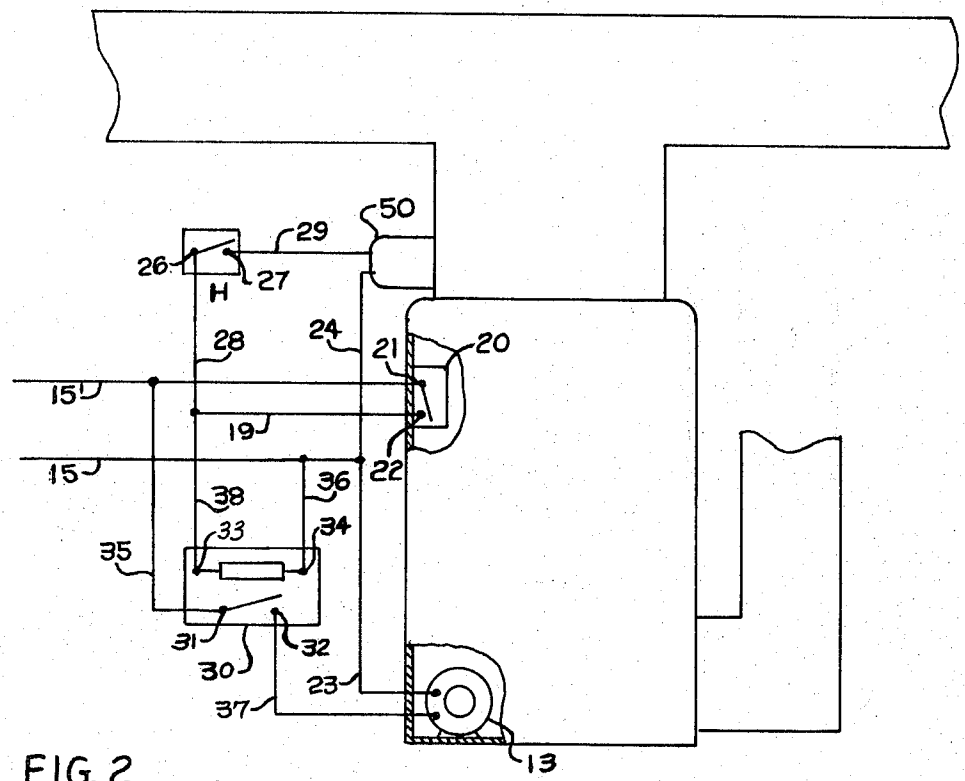



FIG. 2

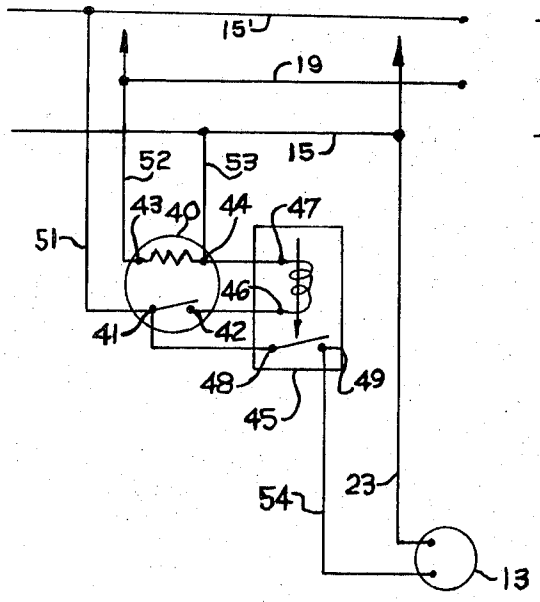



FIG. 3

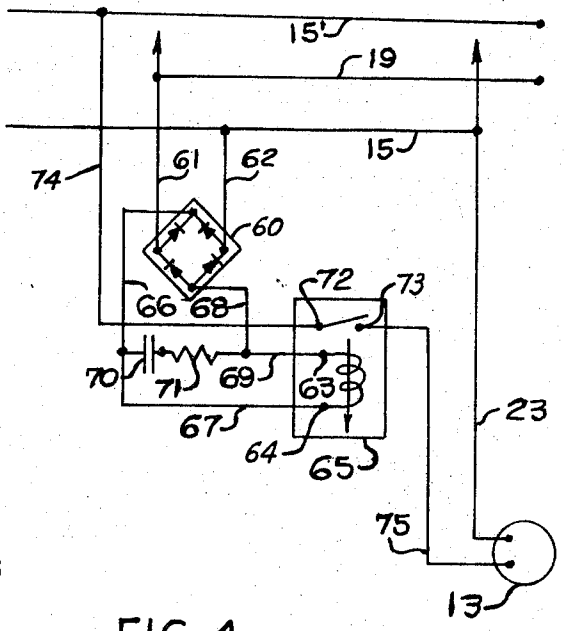



FIG. 4

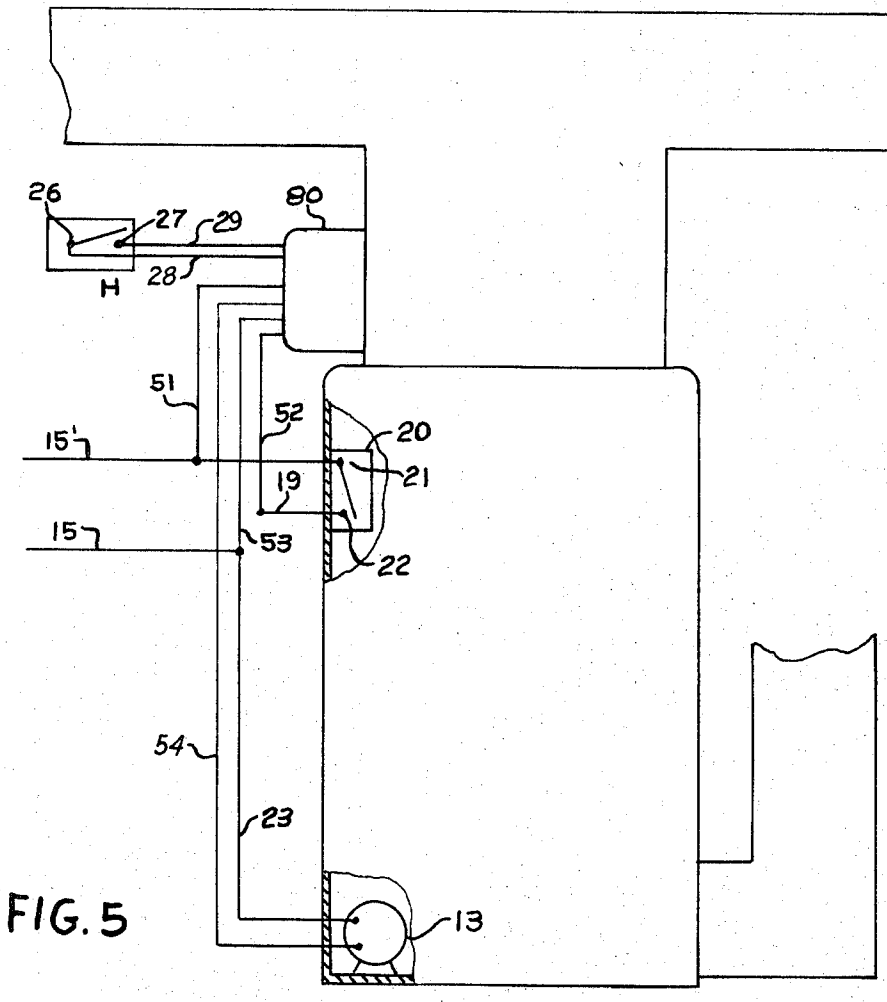



FIG. 5

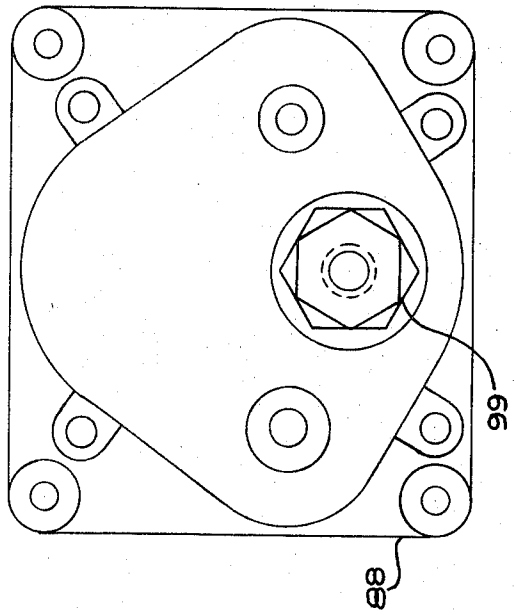



FIG. 8

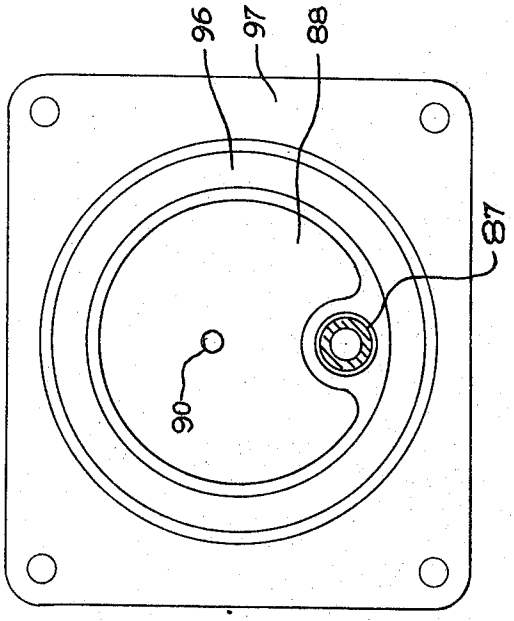



FIG. 7

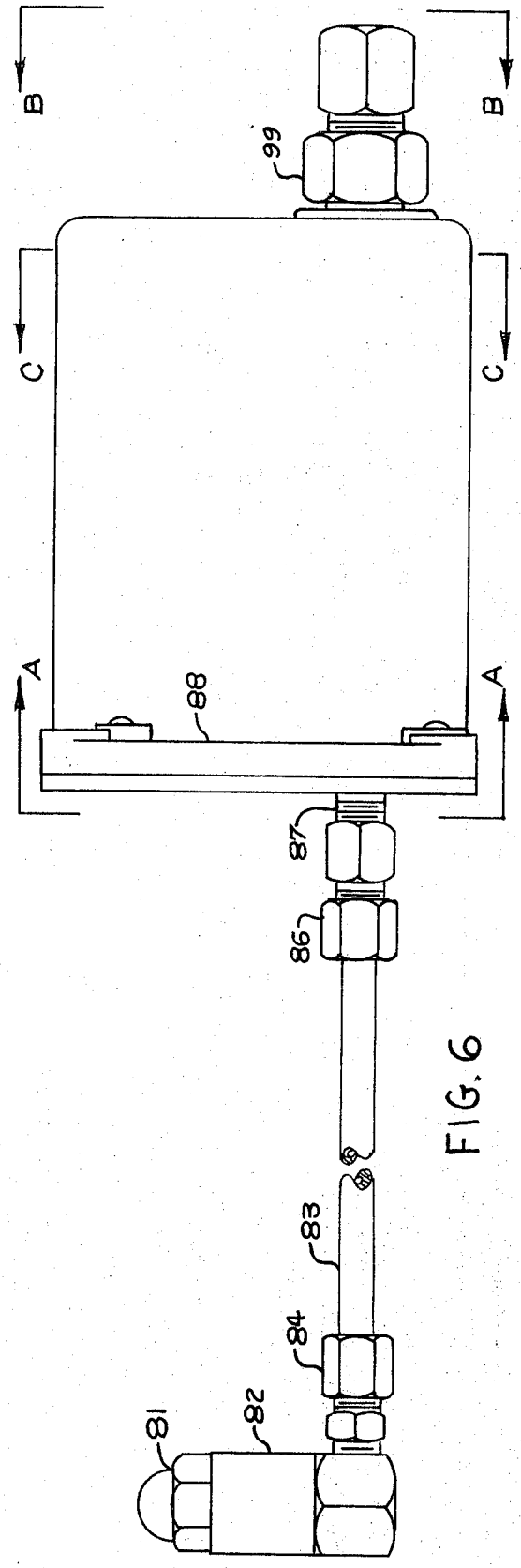



FIG. 6

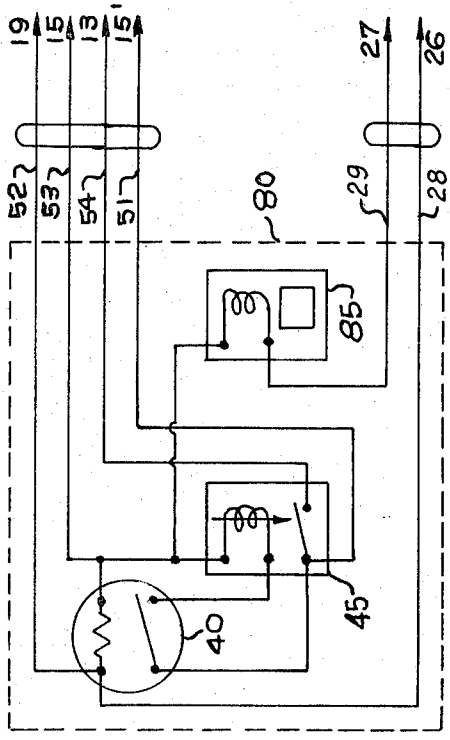



FIG. 10

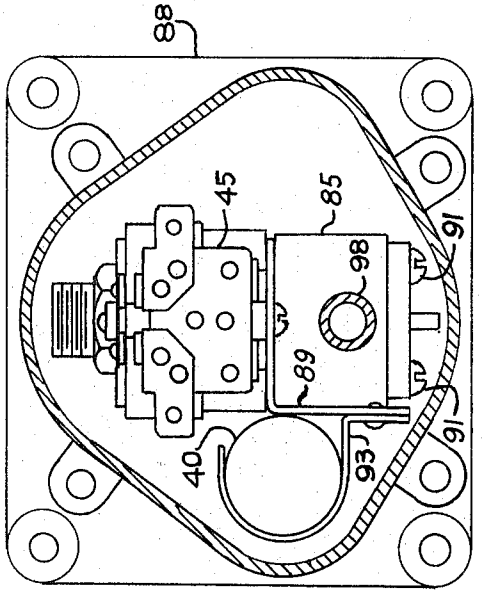



FIG. 9

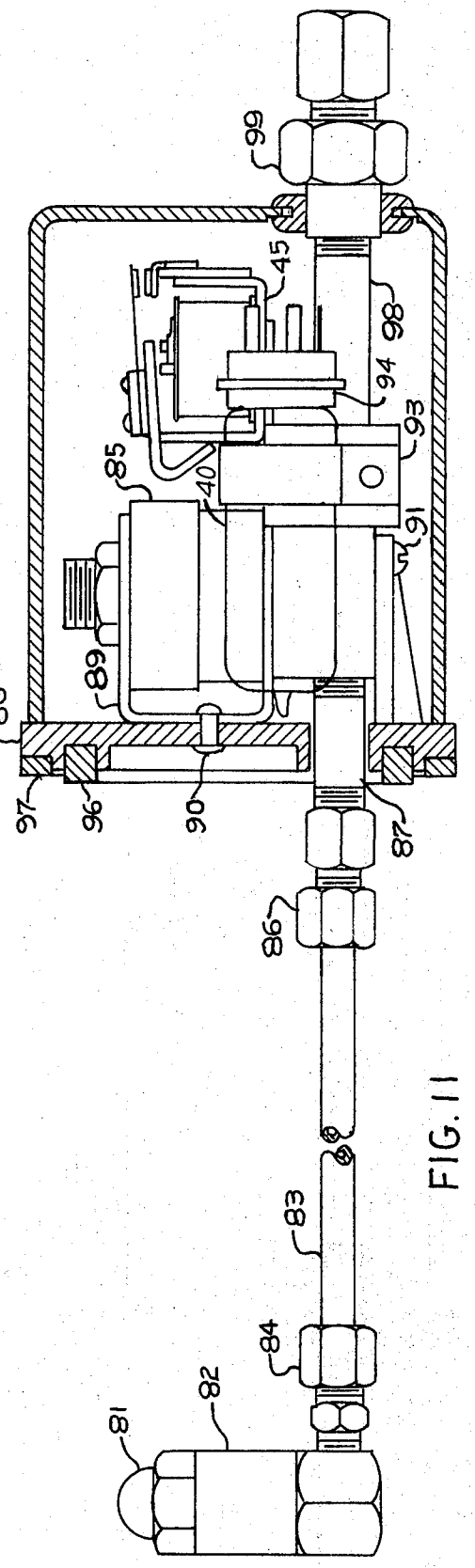



FIG. 11

# AIR HUMIDIFYING APPARATUS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to air humidifiers for forced warm air heating systems, and more particularly to humidifiers which introduce moisture in the form of a fine spray or mist into the plenum of a forced warm air furnace or into its associated ductwork prior to distribution of the air into the space served by the furnace.

2. Description of the Prior Art

Heretofore, various types of humidifiers which introduce moisture into forced warm air furnace heating systems customarily have been electrically connected to take their operating power from the blower motor circuit, thereby allowing them to function when the blower is operating. With the power coming from the blower motor circuit, the humidifier operation is conventionally controlled by means of an adjustable humidistat which is connected in series with the humidifier, the humidistat measuring the humidity in the space served by the furnace. If the humidity is lower than the setting of the humidistat, an electrical switch is closed which allows the humidifier to operate any time the blower is operating. When the humidity in the space being served by the furnace has been brought up to the setting of the humidistat, the humidistat switch opens and the humidifier ceases to operate. Such prior art systems are illustrated in FIG. **1.** A conventional furnace of the upflow type **10,** having the usual combustion chamber or heat exchanger **11,** heated by conventional means (not shown) is used as an example. The heat source is controlled by a room thermostat (not shown) located in the area served by the furnace and functions to heat the combustion chamber or heat exchanger **11** and consequently the air space **12** between it and the outer shell of the furnace **10.** A blower motor **13** is typically connected by a belt to a blower **14** which receives air through a cold air return duct **16** and forces the same through the air space **12** and thence into plenum **17,** from which it is distributed through the ductwork **18** to the area being served. One lead **15** from a household voltage source is connected to the blower motor **13** by lead **23** and to a solenoid valve controlled spray type humidifier **50** by lead **24.** The other household voltage lead **15'** is connected to the movable contact **21** of a normally open thermostatic blower control switch **20.** Fixed contact **22** is connected by means of lead **19** to a blower motor lead **25** and to movable contact **26** of a humidistat H by lead **28.** Fixed contact **27** of the humidistat is connected to the humidifier **50** by lead **29.**

Such a control circuit can allow operation of the humidifier until the blower motor cuts off, but it also permits possible leakage and rusting of the ductwork due to condensation of moisture as the ductwork cools between cycles. This situation has been recognized and various control systems have been devised to extend blower operation beyond humidifier shut off. U.S. Pat. No. 3,262,444 — Davidson utilizes the fuel supply requirements of the heating system to actuate contacts of a relay so as to limit the operation of the humidifier to that time when the furnace and the blower are operating concurrently. U.S. Pat. No. 3,635,210 — Morrow and my U.S. Pat. No. 3,640,266 utilize a second thermostatic switch, responsive to the temperature in the plenum, to cut off humidifier operation before the blower control switch stops the blower operation. With the foregoing control circuit examples, ductwork size may limit the rate of moisture addition thus preventing the desired household humidity which otherwise could be attained by longer humidifier operation.



## SUMMARY OF THE INVENTION

The present invention provides a humidifying system for a forced warm air furnace in which the initiation of humidifier operation is dictated by the control arrangement which normally operates the blower, the blower being allowed to run after the humidifier is shut off thereby purging the ductwork of excess moisture. Further, the present invention provides a novel and compact humidifier assembly for forced warm air furnaces which is simple, inexpensive to make, requires a minimum of maintenance and is easy to install in existing furnaces. Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate the preferred embodiment of the present invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view, partially in section, of a warm air furnace of the upflow type, employing a conventional spray type humidifier as illustrated by the electrical schematic diagram forming a portion of the figure;

FIG. **2** is an elevational view of a system of the type shown in FIG. **1** with the addition of a time delay arrangement according to the invention;

FIG. **3** is a schematic diagram illustrating a thermal delay relay and power relay arrangement which may be substituted for the delay relay **30** shown in FIG. **2**;

FIG. **4** is a schematic diagram illustrating a rectifier and power relay arrangement which may be substituted for the delay relay **30** shown in FIG. **2**;

FIG. **5** is an elevational view, partially in section, illustrating the humidifier, and the thermal delay relay and power relay arrangement of FIG. **3,** located within a single housing;

FIG. **6** is an elevational view, partially segmented, illustrating structural details of the arrangement shown in FIG. **5**;

FIG. **7** is a sectional view taken along line A—A of FIG. **6**;

FIG. **8** is a sectional view taken along line B—B of FIG. **6**;

FIG. **9** is a sectional view taken along line C—C of FIG. **6**;

FIG. **10** is a schematic diagram illustrating the electrical connections of the arrangement shown in FIG. **5**; and

FIG. **11** is an elevational view, partially segmented and in section, illustrating structural details of the arrangement shown in FIG. **5.**

## DESCRIPTION OF THE PREFERRED EMBODIMENT

In this invention, the furnace circuitry shown in FIG. **1** is modified by the introduction of a fast closing, delayed opening relay arrangement, or similar device, **30** as shown in FIG. **2.** Movable contact **31** is connected to household voltage lead **15'** by lead **35** and fixed

contact 32 is connected to blower motor 13 by lead 37. Control circuit terminal 33 is connected to contact 22 by leads 19 and 38, and terminal 34 is connected to household voltage lead 15 by lead 36. In operation, when the thermostatic blower control switch 20 closes, the humidifier 50 is energized if the contacts of humidistat H are closed. At the same time, the control element of the delayed opening relay arrangement between terminals 33 and 34 is also energized. The resultant closure of contacts 31 and 32 applies power to blower motor 13. When the thermostatic blower control switch 20 opens, the humidifier 50 is shut off, and after a predetermined delay, 15 seconds for instance, contacts 31 and 32 open, shutting off the blower. This delay period permits the ductwork to be purged of excess moisture.

Since delayed opening relays capable of carrying blower motor operating current are rather expensive, it may be more desirable to arrange less expensive components in an electrical circuit to perform the same function. FIG. 3 and FIG. 4 illustrate two of many possible circuits that could be used. In FIG. 3, movable contact 41 of normally open thermal relay humidifier relay delay relay 40 is connected to household voltage lead 15' by lead 51. Fixed contact 42 is connected to coil terminal 46 of power relay 45. Terminal 43 of the thermal element of relay 40 is connected to lead 19 by lead 52 and terminal 44 of the thermal element is connected to household lead 15 by lead 53 and also to coil terminal 47 of power realy 45. Movable contact 48 of power relay 45 is connected to contact 41 of thermal delay relay 40. Contact 49 of power relay 45 is joined to blower motor 13 by lead 54. In operation, when the thermostatic blower control switch 20 closes (see FIG. 2), the humidifier 50 is energized if the humidistat H contacts are closed. After a short delay (about 2 seconds) the coil of relay 45 is energized and contacts 48 and 49 close, thereby actuating the blower motor 13. When the thermostatic blower control switch 20 opens, the humidifer 50 is shut off and after a predetermined delay established by the thermal element of realy 40 (about 15 seconds), contacts 41 and 42 open. This interrupts the power to the coil of relay 45 and contacts 48 and 49 open thereby shutting off blower motor 13.

In the circuit shown in FIG. 4, lead 19 and household voltage lead 15 are connected as inputs to a full wave rectifier 60 by leads 61 and 62, respectively. The output terminals of rectifier 60 are connected to the terminals 63 and 64 of D.C. power relay 65 by leads 66, 67, 68 and 69. Connected across terminals 63 and 64 of power relay 65 are capacitor 70 and resistor 71. Movable contact 72 of power relay 65 is connected to household voltage lead 15' by lead 74 and fixed contact 73 is joined to blower motor 13 by lead 75. In operation, when the thermostatic blower control switch 20 closes (see FIG. 2), the humidifier 50 is energized if the humidistat H contacts are closed. D.C. power is applied to the coil of power relay 65 closing contacts 72 and 73 thereby energizing blower motor 13. Simultaneously capacitor 70 is charged. When the thermostatic blower control switch 20 opens, the humidifier 50 is shut off. However, contacts 72 and 73 remain closed until the power stored in capacitor 70 dissipates to the drop out voltage of power relay 65 (about 15 seconds). At this time, contacts 72 and 73 open to shut off blower motor 13.

For compactness and ease of installation, the components of the circuit shown in FIG. 3 could be incorporated with the humidifier 50 in a single unit 80 attached to the furnace plenum as shown in FIG. 5. Of course, this is also true for the other embodiments of the invention.

Structural details of the arrangement shown in FIG. 5 are illustrated in FIGS. 6 – 11. Referring to FIGS. 6 and 11, it can be seen that the humidifier includes a fog or mist producing nozzle 81 of conventional design fixed in an adapter 82 mounted on an extension tube 83 by a suitable attachment fitting 86 and pipe 87, said pipe passing through the mounting flange 88 and being connected to solenoid valve 85. The fog or mist producing nozzle 81 and its adapter 82 are extended into the plenum 17 through a hole in the plenum wall to which the mounting flange 88 of the unit 80 is attached by a plurality of screws (not shown). The solenoid valve 85 is modified by replacing its magnetic flux yoke with a combination magnetic flux yoke and mounting bracket 89. This combination magnetic flux yoke and mounting bracket 89 is attached to the humidifier mounting flange 88 by means such as a rivet or screw 90. The humidifier mounting flange 88 also has an attachment means for affixing the body of the solenoid valve 85 by means of screws 91 for additional rigidity. This combination magnetic flux yoke and mounting bracket 89 has provision for supporting the thermal delay relay 40 which is a commercially available gas-filled tube produced, for example, by the Amperite Corp. of Union City, N.J. The tube functions as a normally open relay which closes in approximately 2 seconds when power is applied to its heater circuit. The gases in the tube envelope cause the heating element for the contacts to dissipate heat slowly enough to provide approximately 15 seconds delay in opening after power is interrupted to the heater circuit. This tube is held in position by means of a clamp 93. For purposes of clarity, internal details of the thermal delay relay 40 are not shown in FIGS. 6 and 9. The necessary electrical connections are made to it by means of a conventional 9 pin miniature tube socket 94 (omitted from FIG. 9 for clarity). Also mounted on the combination flux yoke and mounting bracket 89 is the power relay 45. Sealing the joint between the plenum wall and the humidifier mounting flange 88 is a sponge rubber gasket 96 which is contained in an annular groove in the humidifier mounting flange 88. A rubber vibration isolator 97 is also used between the plenum wall and the humidifier mounting flange 88 to reduce the operating noise of the solenoid valve 85 and the power relay 45. Pipe 98 connects the inlet of solenoid valve 85 to the strainer 99, which may be disassembled for cleaning. Protecting these components is a housing through which the electrical wires pass for making the necessary connections shown in FIGS. 5 and 10. Strainer 99 is connected in conventional fashion to the household water supply.

It will be understood that all particulars as to illustrated components and physical configuration are by way of example only, and not by way of limitation. The object in stating them is to indicate one particular organization in which proper functioning of all elements will occur. It will be understood by those skilled in the art that changes may be made in the light of this disclosure.

What is claimed is:

1. An air humidifying apparatus for introducing moisture into the flow of air from a forced warm air furnace, said air flow being produced by an electrically operated blower associated with said furnace, the apparatus including:

a source of voltage;

a humidifier electrically interconnected with a blower control switch across said source;

a delayed opening relay energizing means connected in series with said switch across the source;

contact means operatively related to the relay energizing means and electrically interconnected with said blower across the source, whereby on closure of said switch the humidifier is actuated to introduce moisture into the air flow and the relay energizing means is supplied voltage from said source to actuate the contact means to thereby start the blower, and on opening of the switch the humidifier is shut off and, after a delay determined by said relay energizing means, the contact means is returned to its initial state to stop the blower.

2. An air humidifying apparatus as set forth in claim 1, further comprising a humidistat joined in the electrical interconnection of the humidifier and said blower control switch.

3. An air humidifying apparatus as set forth in claim 1, wherein said delayed opening relay energizing means comprises a thermal relay having associated contacts which on closure complete a circuit across said source through a winding of a power relay, said contact means electrically interconnected with the blower being actuated on energization of said power relay winding.

4. An air humidifying apparatus as set forth in claim 1, wherein said delayed opening relay energizing means comprises a full wave rectifier having a resistance-capacitance circuit and a winding of a power relay connected in parallel across the rectifier output, said contact means electrically interconnected with the blower being actuated on energization of said power relay winding.

5. An air humidifying apparatus as set forth in claim 1, wherein said contact means is connected in series with said blower across the source.

6. An air humidifying apparatus as set forth in claim 5, wherein said contact means is normally open.

* * * * *