

# United States Patent

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[54] **ATOMIZER TYPE HUMIDIFIERS FOR USE IN HEATING PLANTS SUCH AS FURNACES AND THE LIKE**  
6 Claims, 4 Drawing Figs.

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261/(V.S.), 116

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**ABSTRACT:** Dispersing means for improving the mixture of water droplets emanating from atomizer-type humidifiers with the hot air conducted from a heating plant is disclosed. The dispersing means is of a configuration e.g. is a constricted tube, so as to cause turbulence in the hot air stream flowing through the dispersing means and it is into this turbulence that the atomized water droplets are projected. The resulting improved mixture deters "liming" and dripping in the system.

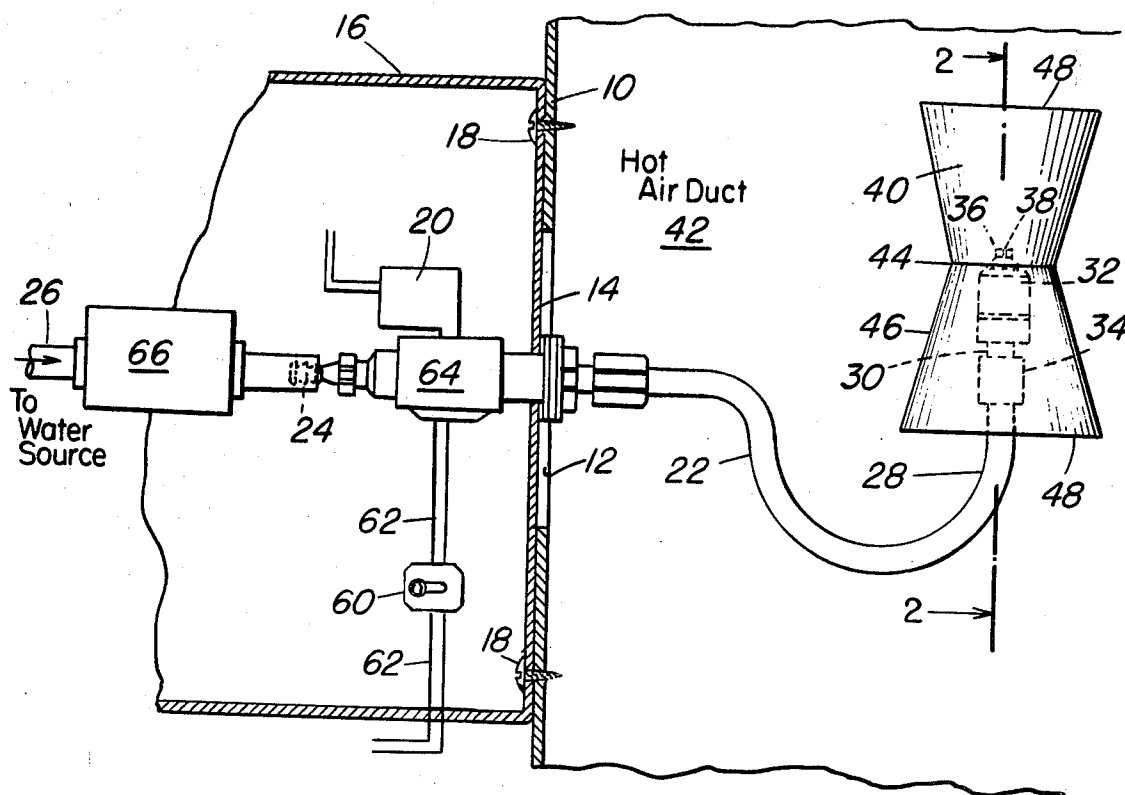


FIG. 1

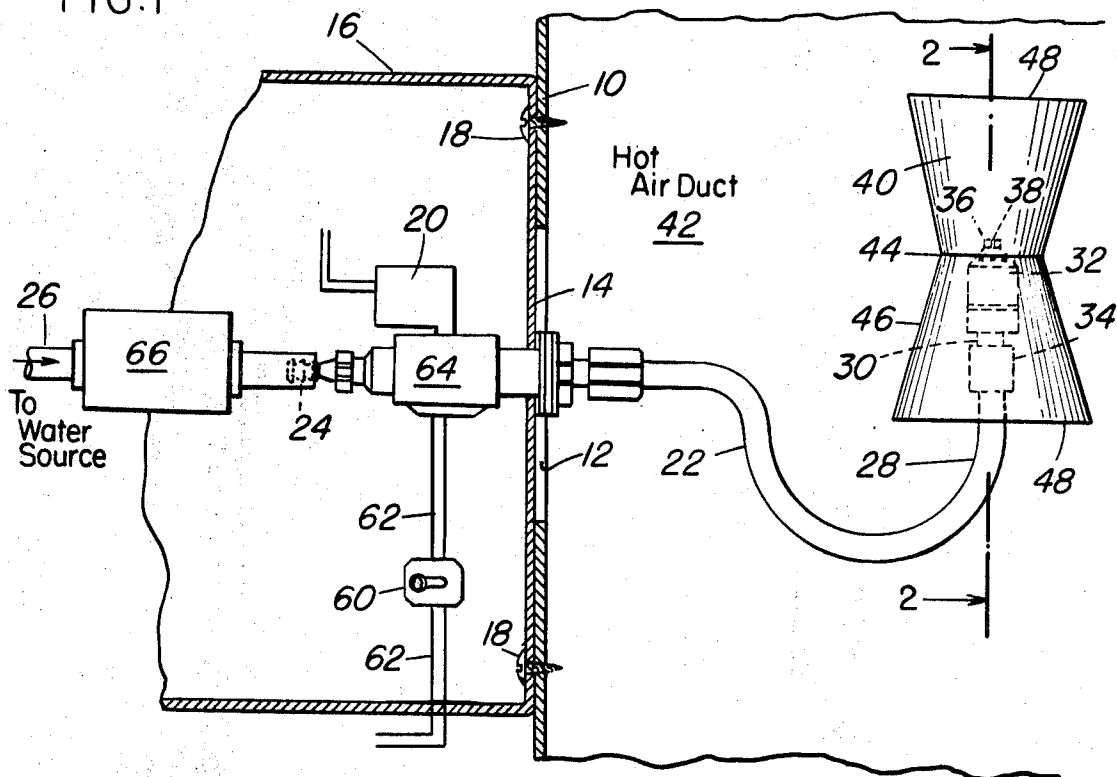


FIG. 2

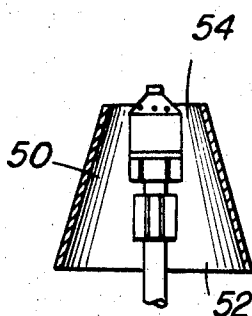
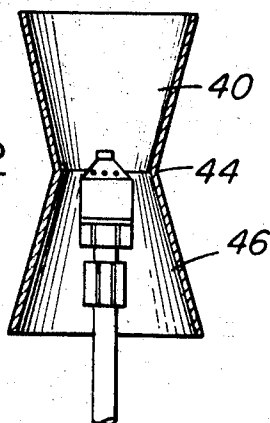


FIG. 3

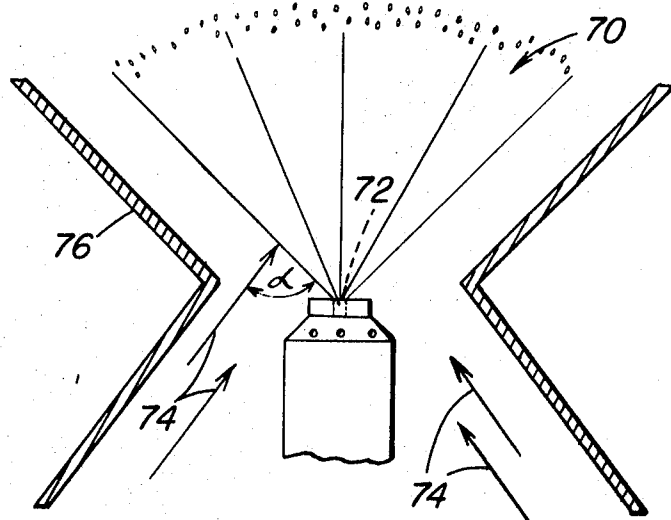


FIG. 4

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# ATOMIZER TYPE HUMIDIFIERS FOR USE IN HEATING PLANTS SUCH AS FURNACES AND THE LIKE

This invention relates to atomizer-type humidifiers for use in heating plants such as furnaces and the like for humidifying the hot air conducted from the heating plant for circulation in the rooms of a building such as a home or the like.

More particularly, this invention relates to a humidifier spray unit for attachment to the warm air riser of a warm air furnace, for purposes of introducing adequate humidity to the warm air prior to its discharge into living space, or the like.

Heretofore, many designs have been made of humidifying devices of various kinds for warm air space heaters, including the well-known type employing flash pans onto which water was gradually fed for evaporation at various rates, as well as other types having spray-diffusing nozzles therein. However, it is not uncommon that various difficulties have been found with these previously designed types of humidifiers, including malfunctions of the water control valves, discharges, such as dripping from the spray nozzles being excessive and accumulating in the bottom of the furnace, condensation due to improper droplet size and atomization, the rusting and other types of deterioration of certain of the elements of the humidifiers unit, and many other types of malfunctions.

Furthermore, most humidifier installations do not provide a sufficient rate of evaporation to raise the humidity to the desired level within the space being heated. Even in humidifier installations which are initially capable of providing sufficient humidity, the efficiency of evaporation is soon impaired by "liming" which is the result of evaporation of water on the spray nozzles, evaporating surfaces, etc., depositing the minerals present in the water on the surfaces with the detrimental impairment resulting.

A primary object of the present invention is to provide a humidifier which substantially eliminates discharges, such as dripping, which accumulate and cause liming and rusting and obviates the need for drip pans, drainage lines, etc.

Another primary object of the present invention is to provide a humidifier which reduces "liming" on the spray nozzle, evaporating surfaces, etc., to a minimum.

Another object of the present invention is to provide a humidifier of high capacity in a small size.

Another object of this invention, is to provide a humidifier of the construction hereinafter more fully set forth, which is an integral unit for installation by one other than a skilled mechanic, in a heating plant, such as a furnace.

A still further object of the invention is the provision of an atomizer-type humidifier unit which may be manufactured relatively inexpensively, and yet is foolproof in action, long lasting, easy to install, and obviates many, if not all, of the shortcomings of the presently used humidifiers.

Other objects will appear hereinafter.

The invention consists in the novel combination and arrangement of parts to be hereinafter described and claimed.

The invention will be best understood by reference to the accompanying drawings showing the preferred form of construction, and in which:

FIG. 1 is a vertical part-sectional detail view of the invention showing the same installed in a heating plant;

FIG. 2 is a fragmentary-sectional detail view taken substantially on line 2-2 of FIG. 1;

FIG. 3 is a fragmentary part-sectional detail view of an embodiment of the invention;

FIG. 4 is a geometric representation of the angle of impingement of air flow onto the sprayed mist in accordance with the present invention.

The heating plant with which the invention is intended to be associated may be the conventional hot air heater utilized for heating a home or the like. It is intended that the improved humidifier have the atomizer portion thereof located within the heating plant in the path of the outgoing heated air, thus to humidify the air through evaporation.

In the drawings which show the preferred form of construction of the invention, a wall 10 of such a heating plant is illustrated in FIG. 1. This wall has formed therein an opening 12

which may be closed by a plate (not shown) when the apparatus of this invention is not in place. Abutting the wall 10 is the face plate 14 of a cover box 16. The face plate 14 and the cover box 16 are secured to the furnace wall 10 by means of threaded studs 18 or other securing means. The cover box 16 provides an enclosure for an electrical solenoid water-supply control 20 of any conventional type for controlling the flow of water through a conduit 22. Any suitable control may be used for the intended purpose.

The water is supplied to the conduit 22 by a supply pipe 24 which is connected to a water source 26. The conduit 22 extends into the heating plant and at its interior end portion has an upturned end 28 which is connected in any suitable manner to a tube 30. These components, as well as all other water contacting components, are preferably fabricated from a nonrusting metal, although other suitable materials, e.g. plastic, is contemplated.

Supported by the tube 30 is an atomizer head 32 including a threaded stud 34 which is threaded onto the upper end portion of the tube 30. The atomizer head includes a suitable spray nozzle or tip 36 which as a restricted orifice 38 for producing a spray of water. The nozzle 36 effects projection of the spray of fine particles of water in the form of a mist.

In accordance with present invention, the mist is projected into tubular means 40 which serves to thoroughly disperse the mist into the flow of heated air in the hot air duct 42. In order to accomplish this said tubular 40 means is provided with a constriction 44 which causes a zone of turbulent air and mist. In the embodiment shown in FIGS. 1 and 2, the tubular dispersing means 40 comprises a substantially cylindrical conduit 46 having a constriction in diameter 44 about midway its transverse axis. The larger diameter of the dispersing means i.e. the diameter of either terminal end 48 is generally from about 6 to 12 inches, depending on the size of the furnace duct. The smaller diameter i.e. the constriction diameter, is generally from about one-fifth to three-fourths the larger diameter. The ratio of larger to smaller diameter is easily ascertainable with reasonable experimentation, but it is critical that the configuration be such as to insure tubular dispersing means is generally between 2 and 20 inches measured along its longitudinal axis. It is to be understood that the dimensions of the dispersing means is dependent upon the size of the furnace utilized, flow of hot air, etc. In general, however, the ratio of the dimension of the longitudinal axis to the larger (initial and terminal) diameter will be, (assuming the length of the longitudinal axis to be unity) about 1:25 to 1:5; preferable 1:1 to 1:3.

In another embodiment shown in FIG. 3, the dispersing means 50 can be frustoconical in configuration. In this embodiment, the larger diameter 52 is also from about 6 to 12 inches, the smaller diameter 54 (constriction) is from about one-fifth to three-fourths the larger diameter and the length (longitudinal axis) is about 2 to 10 inches. Again, the size is predicated on equipment size throughput, etc.

Generally, the mist is introduced from nozzle or tip 36 at a point from about 3 inches below the constriction to about 3 inches above said constriction. The nozzle must be placed in relation to said constriction so as to cause impingement of the mist or spray on the stream of air flowing through the dispersing means becomes streamlined. This relationship is translated into the geometric representation of FIG. 4. In this FIG. a spray or mist of water 70 is shown emanating from orifice 72. Arrows 74 represent the flow of air through dispersing means 76. Angle  $\alpha$  represents the angle of impingement of air flow 74 on spray 70. The preferred embodiment is illustrated therein, that is where the angle is 90° or thereabout. It is found that the angle of impingement  $\alpha$  can range from about 30° to about 150° with, as mentioned, 90° being preferred.

While the dispersing means of the invention has been described as being generally tubular in configuration, it should be understood that the configuration need not be so limited. Thus, a variety of cross sections may be employed other than circular, e.g. a square, rectangular, oval, etc., cross section may be employed.

In order to complete the invention, there is provided a switch 60 which is carried by a wall of the cover box 18 and has connection with circuit wires 62 which control the energization of the solenoid 20. The circuit wires 62 are intended to be connected in circuit with a humidistat located in the building or for compactness on the cover box. Such humidistat is not shown as it constitutes no part of the present invention.

The solenoid 20 can also be connected by the circuit wires 62 to a blower which is an integral part of the heating unit, so as to humidify the warm or heated air as it is forced through the duct thereof.

The advantages of locating the atomizer within the dispersing means 40 reside in the fact that the shape of said dispersing means causes turbulence with consequent intimate mixing of mist and heated air and with reduction of the formation of liquid droplets. This mixture will be carried with the flow in the duct and, consequently, avoid dripping, prevent formation of mineral deposits, i.e. "liming," etc. and, in addition, enhance the evaporation rate. Another advantage accruing from the present invention is that the dispersing means collects and promotes the flow of air regardless of furnace design. Thus, the apparatus of this invention eliminates dead air spaces which may exist over the heating bank of the furnace.

In accordance with the invention, an ion exchange unit 66 can also be incorporated to further reduce the formation of mineral deposits or "liming." The ion exchange unit removes the insoluble calcium and other salts from the water so as to prevent blockage of the water spray orifice. This blockage would otherwise change the water spray pattern which would then lead to water dripping due to poor mixing of the mist and hot air. Ultimately pressure would buildup, causing a reduction in the water flow rate and eventual malfunction of the unit.

Said ion exchange unit is incorporated into the water supply conduit at any place prior to the atomizer.

Thus the ion exchange cells are incorporated as an integral part of the humidifier. Any ion exchange resin which is capable of exchanging the insoluble calcium or other ions in the water with the water soluble ion sodium, or its equivalent is satisfactory. Complete deionization may also be accomplished if desired, with appropriate mixed bed resins removing both anions and cations. The resin used for the operation of these ion exchange cells remove calcium and other insoluble salts. The ion exchange cells desirably have a capacity for operating one year, at which time they are regenerated with sodium chloride and water.

The two ion exchange cells were employed, each 3 inches in diameter and 12 inches in length. Of course the size of the unit can be increased or decreased, depending on local conditions of water hardness, etc.

From the foregoing description, it is clear that there is provided a simple atomizer-type humidifier of economical manufacture which may be quickly and easily installed in the heating plant and which will be effective for its intended purpose. When the unit is sold, it is sold as an integral unit and installed in the heating plant as such. The component parts are made of such material as will best serve the purpose.

While the preferred form of construction for carrying the invention into effect has been illustrated and described, this is capable of variation and modification without departing from the spirit of the invention. It is not wished, therefore, to be limited to the precise details of construction set forth, but to be availed of such variations and modifications as come within the scope of the appended claims.

I claim:

1. A humidifier for a furnace having a duct defined by walls and through which hot air is conducted generally upwardly comprising, in combination:

a water supply conduit extending into the duct and having an interior end portion within and spaced from the walls of the duct;

an atomizer connected to said end portion of said conduit and spaced from the walls of the duct, said atomizer including means to direct water mist generally upwardly into the air flowing through the duct;

water mist dispersing means carried by said conduit to create a region of turbulence immediately above said atomizer, said dispersing means comprising:

converging nozzle means having a downwardly facing inlet of a transverse dimension greater than an upwardly facing outlet, said nozzle means having a maximum transverse dimension substantially smaller than the transverse dimension of said duct, whereby only a portion of the air flowing through said duct flows through said nozzle means, and

said nozzle means being located wholly outside the path of travel of water mist from said atomizer, whereby impingement of mist on the nozzle means and dripping of water from the nozzle means is avoided; and

air flowing through said duct outside said nozzle mixing with the air flowing through said nozzle and with said water mist in said region of turbulence, whereby thorough humidifying of the air is obtained without impingement of mist on said duct walls, and correspondingly without water dripping or accumulating in said duct.

2. A humidifier according to claim 1 wherein said converging nozzle is of frustoconical configuration.

3. A humidifier according to claim 1 wherein said atomizer has at least one orifice communicating with said conduit; and which further includes means to deliver mineral free water to said atomizer, whereby the formation of mineral deposits in said orifice is prevented.

4. A humidifier according to claim 4 wherein said means to deliver mineral free water to said atomizer includes an ion exchange unit connected to said conduit and disposed outside said duct.

5. A humidifier according to claim 1 wherein said atomizer directs water mist upwardly in a generally conical pattern; and air flowing through said nozzle means impinges on said mist pattern at an angle in the range of 30° to 150°.

6. A humidifier according to claim 5 wherein said air flowing through said nozzle means impinges on said mist pattern at an angle of 90°.

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