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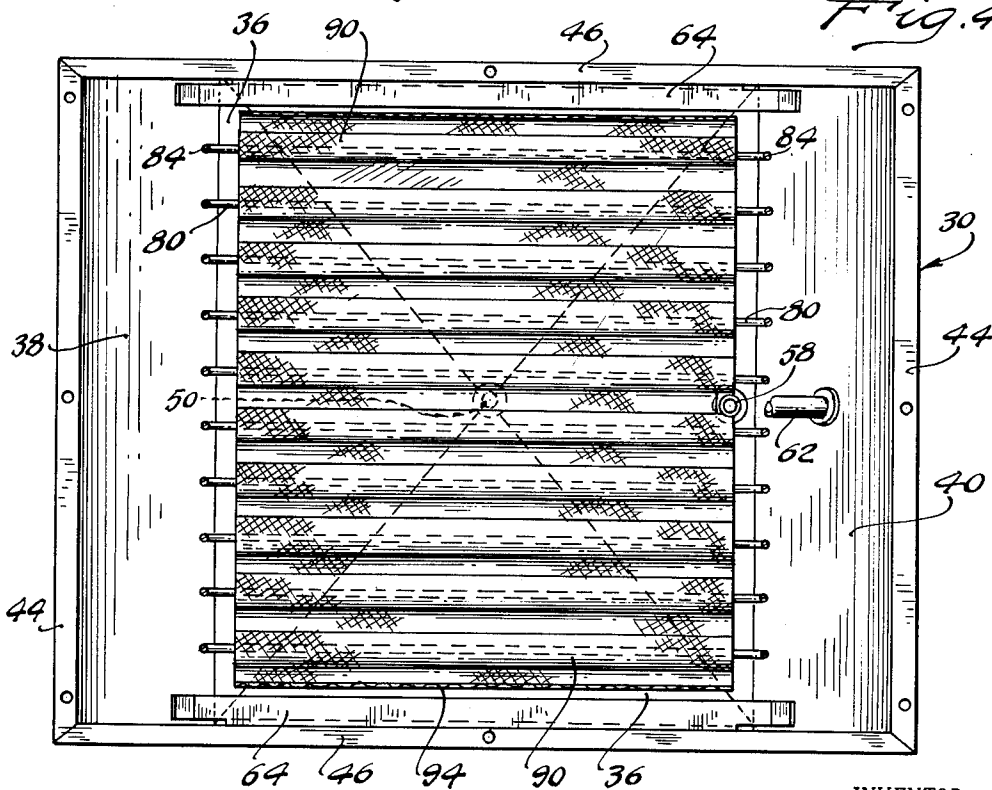
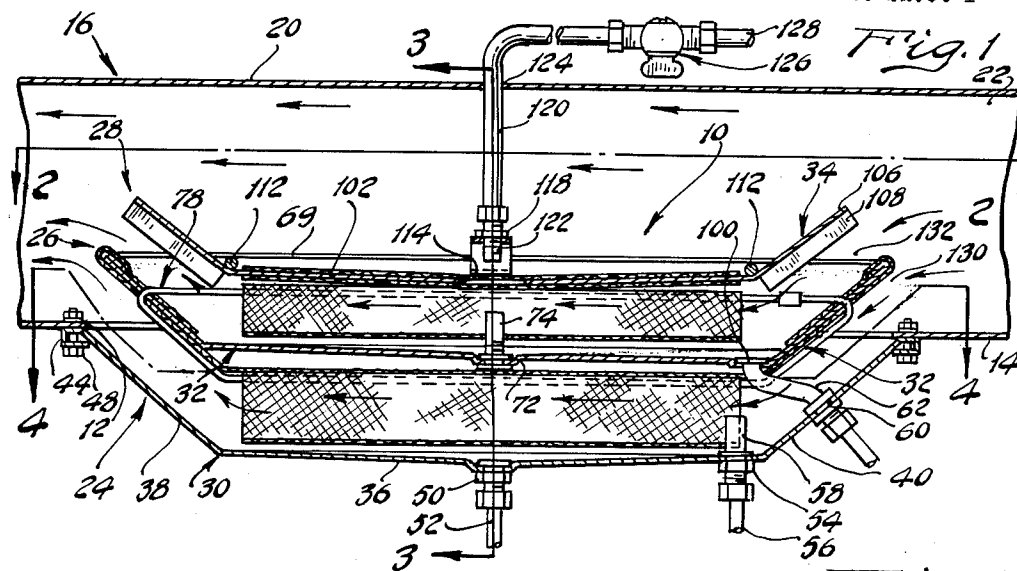
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3,136,829

HORIZONTAL-AIR-FLOW HUMIDIFIER

Filed Nov. 9, 1959

3 Sheets-Sheet 1



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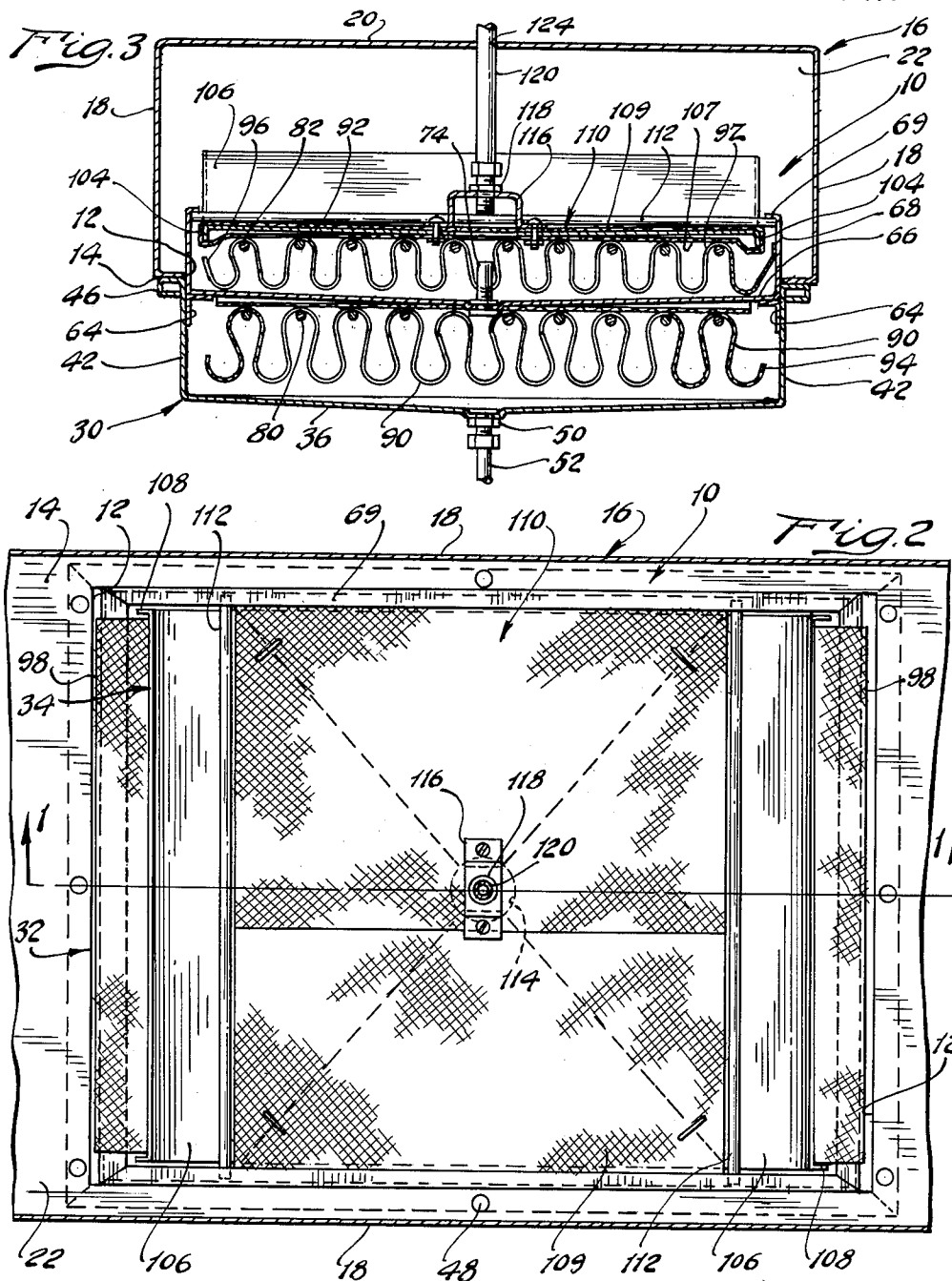
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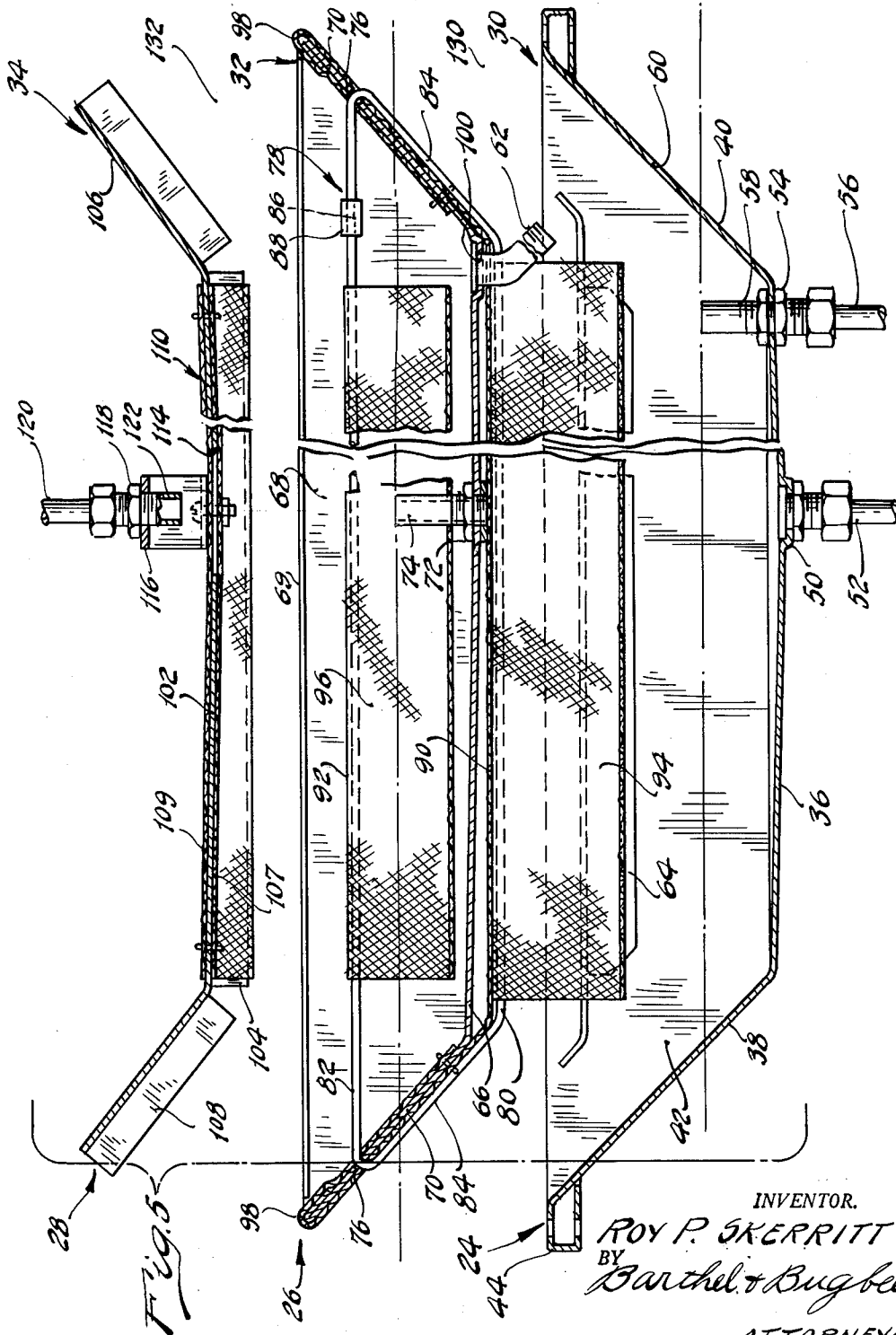
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3 Sheets-Sheet 3



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HORIZONTAL-AIR-FLOW HUMIDIFIER

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3 Claims. (Cl. 261-104)

This invention relates to humidifiers and, in particular, to humidifiers installed in heating and/or ventilating systems.

Hitherto, humidifiers installed in heating and/or ventilating systems have been usually of inadequate humidifying capacity to properly humidify the space intended to be humidified. The principal reason for this inadequacy lay in the fact that it was impossible or impractical to mount a sufficient number of humidifying plates or other humidifying structures within a heater or heating duct of sufficient area to provide an adequate rate and volume of evaporation of water to properly humidify the heated space, more especially since these humidifying plates were mounted vertically in spaced parallel relationship. The humidifying action of prior humidifiers has been further hampered by the fact that most of them operate on the principle of the upflow of water by capillary attraction through a porous humidifier plate or sheet, with the result that lime deposited from the water under the action of heat upon hard water has clogged the pores in these plates or sheets and consequently at first slowed down and eventually terminated the humidifying action by blocking the upward flow of water.

Another defect of prior humidifiers lay in the electrolysis produced by minerals left in the humidifier pan in concentrated form as the water was evaporated, reacting electrolytically with the metallic parts of the pan, valves, and other metal parts, the resulting flow of electric current causing corrosion and other deteriorating effects interfering with the proper action of the humidifier. Furthermore, the lime deposited within the pan was a further defect which additionally prevented adequate action of the humidifier. A further defect of prior humidifiers which sprayed the humidifying water into an air stream consisted of the production of lime dust from the hard water being sprayed, this lime dust being carried along with the air stream, especially where the air was being forced through the dust under abnormally high pressure. The humidifier of the present invention eliminates these defects and accomplishes adequate humidification in the manner set forth below in the specification and summarized in the following objects of the invention.

Accordingly, one object of this invention is to provide a horizontal-air-flow humidifier for heating and ventilating systems which enables the area of the capillary water-evaporating material to be enormously increased in contrast to prior humidifiers.

Another object is to provide a humidifier of the foregoing character adapted to be installed in a heated air duct outside the heater itself and consequently at a lower temperature than the temperature inside the heater, with a consequently great reduction in the clogging by lime of the capillary humidifying sheets employed in the humidifier, the present inventor having found by experimentation that such clogging decreases greatly with a decrease in the temperature to which the humidifier sheets are subjected.

Another object is to provide a humidifier of the foregoing character wherein the humidifier sheets are suspended and wherein the water is supplied from the top and descends therein while the air moves in a generally horizontal path past the humidifier sheets, thereby enabling the sheet to be much thinner and of greater height than is possible with humidifier capillary plates drawing water upward from a pan in which the plates are stand-

2

ing, the thin sheets presenting less obstruction to the flow of air than the necessarily thick upstanding humidifier plates, the thickness of which is required for sufficient structural strength.

Another object is to provide a humidifier of the foregoing character wherein the capillary humidifying sheets are arranged in tiers spaced apart from one another and wherein the water is supplied both above and below the sheets, thereby greatly increasing the evaporating capacity of the humidifier.

Another object is to provide a humidifier as set forth in the object immediately preceding wherein the minerals in the water are carried along by an overflow piping system along with an overflow of water which is supplied in excess of evaporation requirements.

Another object is to provide a humidifier as set forth in the two objects immediately preceding wherein the intermediate and lower pans of the humidifier are provided with independent drain pipes which are adapted to be opened periodically to drain off lime or other residue deposited therein before it can become obstructed.

Another object is to provide a humidifier of the foregoing character wherein the capillary humidifier sheets are disposed in undulating paths transverse to the direction of flow of the air through the humidifier, thereby greatly increasing the area of capillary material exposed to the air stream and consequently increasing the rapidity and volume of humidification.

Another object is to provide a humidifier of the foregoing character wherein humidification is accomplished not only by the contact of the air stream with the capillary humidifying sheets but also with the surface of the water in a plurality of partially-nested evaporator pans, the air moving in a generally horizontal but circuitous path by being first deflected downward then horizontally over the surface of the water in the pan and then upward in a circuitous path as well as past the evaporator sheets, whereby the humidifier is offset downwardly relatively to the main air stream so as to create the minimum of obstruction to the free flow of air therealong.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

FIGURE 1 is a central longitudinal section through a heating and ventilating duct and an evaporator installed therein, according to one form of the invention, taken along the line 1-1 in FIGURE 2;

FIGURE 2 is a top plan view of the humidifier, with the air duct in horizontal section, taken along the line 2-2 in FIGURE 1;

FIGURE 3 is a cross-section taken along the line 3-3 in FIGURE 1;

FIGURE 4 is a generally horizontal section with the lowest pan in top plan view, taken along the generally horizontal but partly inclined line 4-4 in FIGURE 1; and

FIGURE 5 is an enlarged exploded central vertical longitudinal section similar to FIGURE 1, but with the humidifier removed from the duct and with its components separated vertically from one another in order to clarify the showing.

Referring to the drawings in detail, FIGURES 1, 2, 3 and 5 show a humidifier, generally designated 10, according to one form of the invention as mounted in a rectangular aperture 12 in the bottom wall 14 of an air duct, generally designated 16, of a heating and/or ventilating system (not shown), the duct 16 having parallel vertical sides 18 and a top wall 20. The duct 16 is conventional, together with the heating and/or ventilating system to which it is connected, and its details are beyond the scope of the present invention. The duct 16, however, is as-

sumed to be substantially horizontal for the purpose of the present invention, so that the air to be humidified moves in a generally horizontal path through the air passageway 22 within the duct 16, as indicated by the upper arrows in FIGURE 1.

The humidifier 10 consists generally of a pan structure 23 including a lower component 26 and an upper component 28 disposed one above the other in vertically-spaced relationship and having lower, intermediate and upper pans 30, 32, and 34 respectively. The intermediate pan 32 also serves as a cover member for the lower pan 30, while the upper pan 34 serves as a top member for the humidifier 10. The lower pan 30 has a bottom wall 36 (FIGURES 1 and 3) which is inclined slightly downwardly from steeply inclined end walls 38 and 40 and substantially vertical side walls 42. The lower pan 30 is provided at its periphery with hollow double-flanged end and side edge mounting portions 44 and 46 respectively suitably drilled in alignment to receive bolts 48 by which the humidifier is secured to the bottom wall 14 of the duct 16 adjacent the aperture 12 therein. The bottom wall 36 at its central lowest point is apertured and provided with a recessed drain connection coupling 50 to which a lower drain pipe 52 is connected. The bottom wall 36 near its junction with the end wall 40 is also apertured and provided with an overflow fitting 54 to which an overflow pipe 56 is connected, the coupling 54 having a riser portion 58 which regulates the desired depth of the water in the lower pan 30. The end wall 40 is additionally apertured to receive a coupling 60 for a drain line 62 from the intermediate pan 32 and in turn connected by way of a suitable shutoff valve (not shown) to a drain (also not shown).

Secured as by welding to the opposite side walls 42 of the lower pan 30 are elongated horizontal angle brackets 64 (FIGURE 3) upon which rests the bottom wall 66 of the intermediate pan 32. The latter is shallowly-inclined from its parallel vertical side walls 68 with their upper edge flanges 69 and from its steeply-inclined end walls 70 to a central overflow fitting 72 at its lowest point, the overflow fitting 72 having a riser portion 74 determining the desired depth of water in the intermediate pan 32.

The opposite end walls 70 of the intermediate pan 32 are provided with horizontal rows of laterally-spaced holes 76 arranged on the same horizontal level and serving to receive humidifying sheet frames, generally designated 78 of isosceles trapezoidal shape with parallel lower and upper rod portions 80 and 82 (FIGURE 5) and inclined end rod portions 84. The upper rod portion 82 is parted as at 86 to receive a coupling ferrule 88. The holes 76 are so located and the frame end rod portions 84 of such lengths as to locate the bottom rod portion 80 of each frame 78 beneath the bottom wall 66 in spaced relationship therewith. Draped over the lower and upper portions 80 and 82 of the frames 78 are loops 90 and 92 of lower and upper undulatory capillary humidifying sheets 94 and 96 respectively. The undulatory capillary sheets 94 and 96 are made from any suitable capillary sheet material, such as fibrous glass sheet material having a porous texture possessing a capillary action upon the water being evaporated. Draped over and secured to the opposite end walls 70 of the intermediate pan 32 are capillary humidifying sheets 98 of U-shaped cross-section (FIGURES 1 and 5) riveted or otherwise secured thereto, these being of the same capillary material mentioned above. The bottom wall 66 of the intermediate pan 32, near its junction with one of the end walls 70, is recessed and apertured as at 100 to receive the upper end of the intermediate drain pipe 62.

The upper pan 34 of the upper component 28 is not a pan with enclosing side walls as in the case of the lower and intermediate pans 30 and 32, but has a shallowly-inclined bottom wall 102 with downwardly-extending opposite lateral edge flanges 104 extending longitudinally

along the entire length of the bottom wall 102. The pan 34 also has steeply inclined opposite ends 106 with opposite lateral edge flanges 103. Stretched laterally across the bottom wall 102 and extending over the lower and upper sides thereof are the lower and upper courses 107 and 109 of a humidifier element 110 in the shape of an endless loop resembling that of a roller towel. The lower course 107 rests upon the tops of the loops 92 of the upper undulatory humidifying sheet 96, which in turn rests upon the upper rod portions 82 of the frames 78. The humidifier element 110 is held down against the tops of the loops 92 by two parallel cross rods 112 (FIGURES 1 and 3), the opposite ends of which project laterally beneath the upper edge flanges 69 of the side walls 68 of the intermediate pan 32.

The central or lowest portion of the bottom wall 102 of the upper pan 34 is provided with an aperture 114 which is straddled by an inverted U-shaped bracket 116 to which is connected a threaded fitting 118 for the lower end of a water supply pipe 120. The fitting 118 has a downwardly-extending tubular portion 122 through which the water drips onto the upper course of the humidifier element 110. The bracket 116 is bolted or otherwise secured to the bottom wall 102. The water supply pipe 120 passes through a hole 124 in the upper wall 20 of the duct 16 and is provided with any suitable conventional regulatory valve 126, which in turn is connected by a pipe 128 to a suitable source of water supply, such as the domestic cold water main. The right-hand end walls 70 and 106 of the intermediate and upper pans 26 and 28 also serve as air deflectors or scoops to intercept and deflect air passing through the air duct passageway 22 downward through the downwardly-offset central portions of the humidifier air channels or passageways 130 and 132 between the pans 30, 32 and 34.

In the operation of the invention, with the humidifier 10 installed and connected as above described and with the overflow and drain pipes 56 and 62 connected to a suitable drain, the operator opens the regulatory valve 126 (FIGURE 1) to supply water through the water supply pipe 120 from the pipe 128, whence it drips through the tubular portion 122 of the fitting 118 onto the upper course 109 of the humidifying element 110. From here, part of the water spreads out horizontally by capillarity over the upper course 109 and around the lateral edge flanges 104 to the lower course 107. The remainder of the water drips through the pores of the upper course 110 and through the aperture 114 directly onto the central portion of the lower course 107, whence it spreads laterally toward the edges thereof. When the upper humidifying element 110 becomes saturated, the excess water drips downward to the intermediate pan 32 of the intermediate component 26, whence it falls upon the loops 92 of the upper undulatory capillary humidifying sheet 96. This water spreads through the latter by capillary attraction, and, when the saturation point is reached drips onto the bottom wall 66 of the intermediate pan 32. This pan gradually fills up with water until the level rises to the top of the riser 74 of the overflow fitting 72, whereupon further arrival of water passes downward through the riser 74 onto the loops 90 of the lower undulatory capillary humidifying sheet 94. When the latter becomes saturated, further arrival of water drips off the loops 90 onto the inclined bottom wall 36. The water rises in the lower pan 30 until it reaches the top of the riser 58 of the overflow fitting 54, whence it escapes through the overflow pipe 56.

Meanwhile, the air which has been heated by the heating apparatus and forced through the duct 16 by a blower or other suitable means, passes through the lower and upper channels 130 and 132 respectively (FIGURE 1) between the lower pan 30, intermediate pan 32 and upper pan 34, picking up water not only from the capillary sheet material of the upper capillary element 110 and the intermediate and lower capillary elements 96 and 94, but

5

also from the surface of the water in the intermediate and lower pans 32 and 30 respectively. From FIGURE 1 it will be seen that the top member or upper pan 28 and the intermediate and lower pans 32 and 30 respectively are disposed in a partially-nested relationship, and that the end walls 40, 70 and 106 of the lower, intermediate and upper pans 30, 32 and 34 respectively are inclined relatively to one another to produce a so-called venturi effect which accelerates the flow of air through the lower and upper channels 130 and 132 respectively. Meanwhile, air passing through the upper course 109 of the upper capillary element 110 picks up further moisture and adds this to the screen of air passing through the duct 16.

In this manner, the duct 16 delivers a supply of highly-humidified air in a large volume to the room or other space being heated and/or ventilated, and thus accomplishes humidification in a rapid, efficient and economical way.

What I claim is:

1. A horizontal humidifier comprising
a water pan structure including

elongated generally-horizontal lower and intermediate water pans,

each of said lower and intermediate pans having laterally-spaced opposite side walls, longitudinally-spaced end walls inclined upwardly away from one another and a bottom wall,

flanged mounting means around the upper periphery of said lower pan,

and an elongated generally horizontal upper pan having longitudinally-spaced end walls inclined upwardly away from one another and a bottom wall,

said upper, intermediate and lower pans being disposed in a partially-nested relationship with the bottom wall of said intermediate

6

pan disposed below the upper edge of said lower pan and with the bottom wall of said upper pan disposed below the upper edge of said intermediate pan with the inclined end walls of said pans arranged in an overlying relationship with one another;

means for holding said pans in said vertically-spaced partially-nested relationship,

porous capillary water-evaporating means disposed in said pans,

and means for supplying water to said pans.

2. A horizontal humidifier, according to claim 1, wherein the said end walls of the said pans at one end of said pan structure are disposed approximately parallel to one another.

3. A horizontal humidifier, according to claim 1, wherein the said end walls of the said pans at both ends of said pan structure are disposed approximately parallel to one another.

References Cited in the file of this patent

UNITED STATES PATENTS

329,115	Wurster	Oct. 27, 1885
432,837	Renalds	July 22, 1890
631,061	Barbour	Aug. 15, 1899
1,116,861	Wilson	Nov. 10, 1914
1,418,296	Gohman	June 6, 1922
1,954,177	Jones	Apr. 10, 1934
2,002,273	Parker et al.	May 21, 1935
2,003,938	Husson	June 4, 1935
2,307,938	Mathias	Jan. 12, 1943
2,590,377	Cater	Mar. 25, 1952
2,838,294	Skerritt	June 10, 1959
3,055,645	Felderman	Sept. 25, 1962

FOREIGN PATENTS

1,213,589	France	Nov. 2, 1959
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