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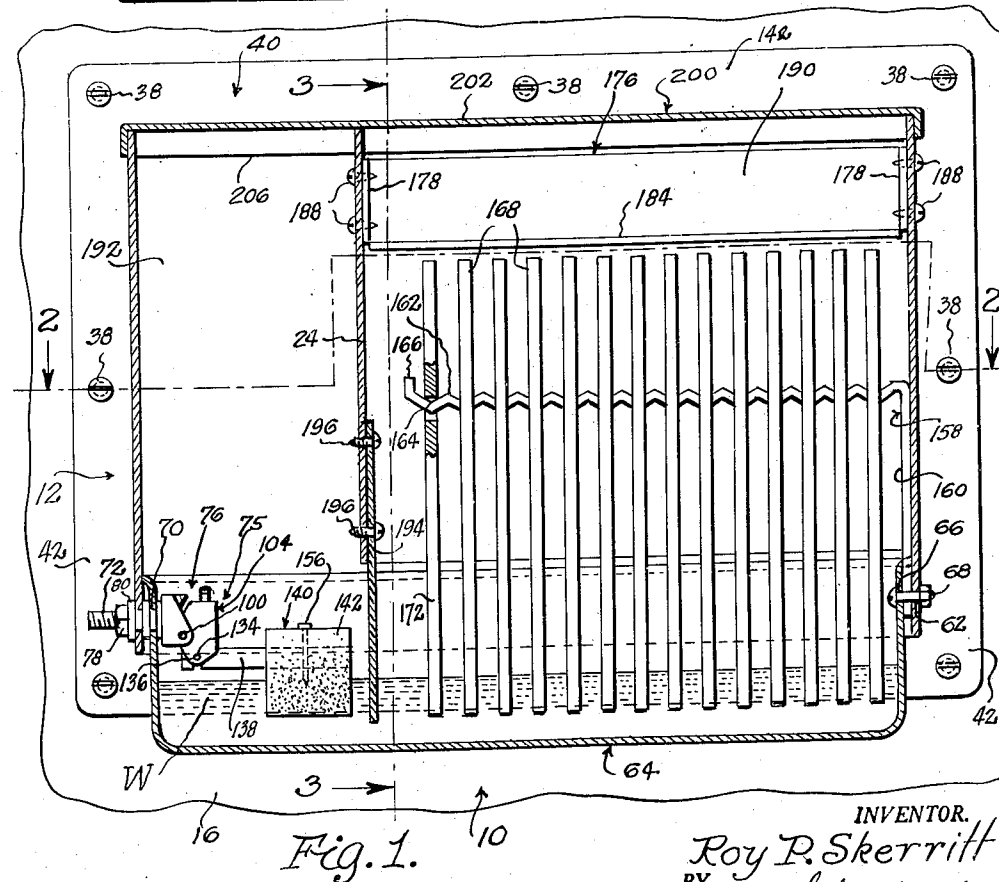
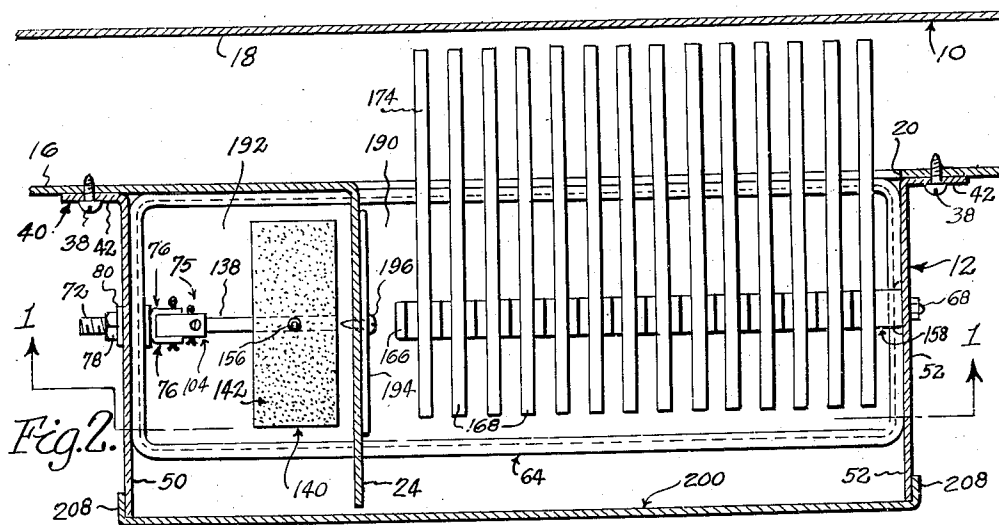
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HEATING SYSTEM HUMIDIFIER

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2 Sheets-Sheet 1



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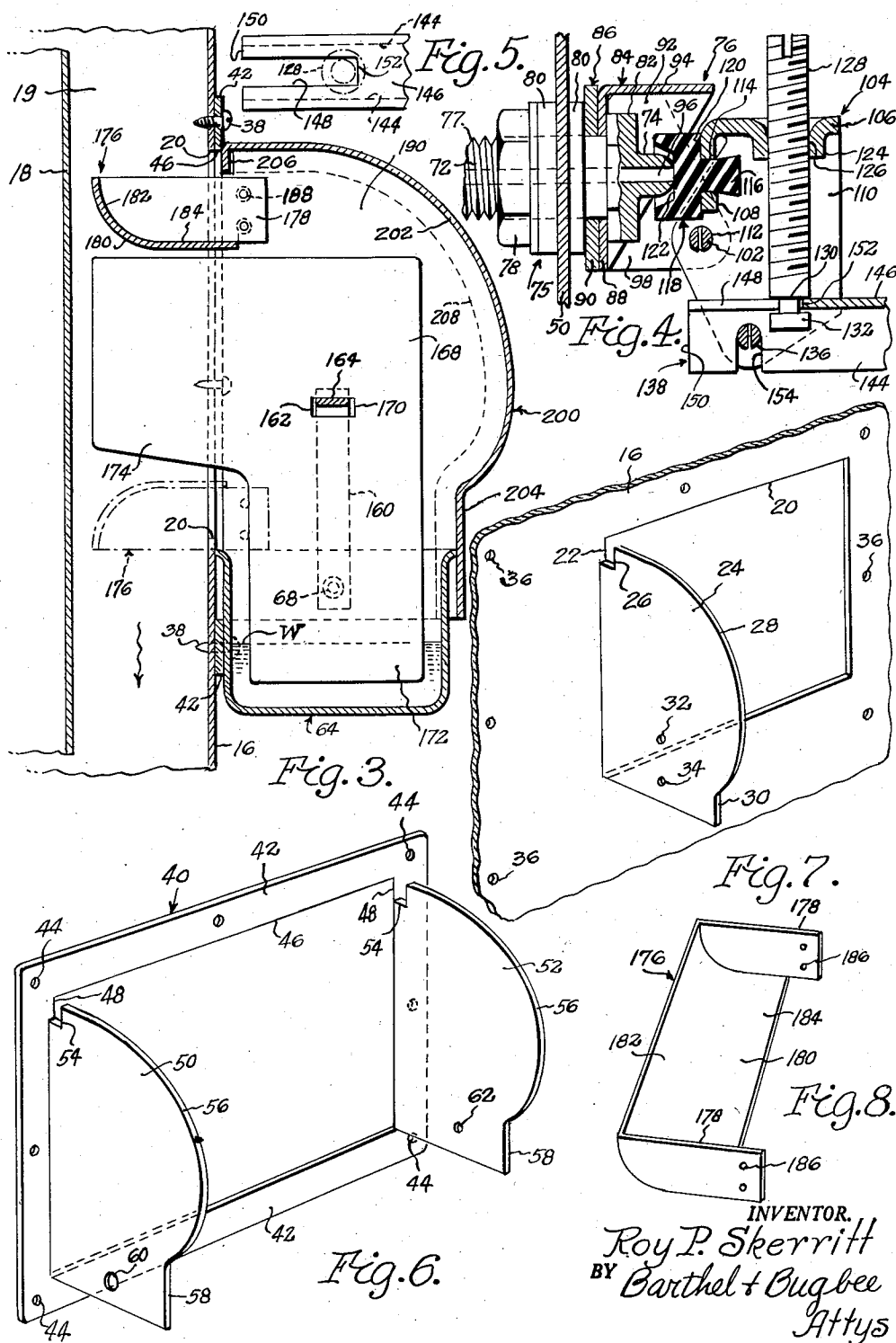
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HEATING SYSTEM HUMIDIFIER

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4 Claims. (Cl. 126—113)

This invention relates to humidifiers and, in particular, to heating system humidifiers.

One object of this invention is to provide a heating system humidifier which is adapted to be quickly and easily installed in the side of a heating duct or furnace casing, means being provided for causing the heated air to be deflected over the liquid in the humidifier and there subjected to humidification before being returned to the heating duct or furnace casing, as the case may be.

Another object is to provide a heating system humidifier of the foregoing character which is especially well adapted for use in furnaces of so-called counterflow heating systems and wherein the moving heated air is deflected into the humidifier by a scoop placed in the path of the moving air, the humidifier preferably containing evaporator plates which assist in evaporating the water in the humidifier pan.

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 vertical section, partly in side elevation, of a heating system humidifier, according to one form of the invention, taken along the line 1—1 in Figure 2, and showing the humidifier attached to the side of a counterflow heating furnace;

Figure 2 is a horizontal section, partly in top plan view, taken along the line 2—2 in Figure 1;

Figure 3 is a vertical cross-section taken along the line 3—3 in Figure 1;

Figure 4 is an enlarged fragmentary side elevation, partly in central vertical section, of the water flow control valve and adjacent portion of the float-operated mechanism shown in the lower left-hand corner of Figure 1;

Figure 5 is a fragmentary top plan view of the free end of the float arm shown in vertical section at the bottom of Figure 4;

Figure 6 is a perspective view of the mounting bracket of the humidifier shown in Figures 1 to 3 inclusive;

Figure 7 is a fragmentary perspective view of a portion of the outer casing side wall of the furnace of Figures 1 to 3 inclusive, wherein a supporting arm is formed integral with and struck outward from the outer casing side wall of the furnace; and

Figure 8 is a perspective view of the air deflector or scoop shown in the upper portion of Figure 3.

Referring to the drawings in detail, Figures 1 to 3 inclusive show a side portion of the furnace, generally designated 10, for a so-called counterflow heating system equipped with a humidifier, generally designated 12, according to one form of the invention. The furnace 10 has outer and inner casing side walls 16 and 18 respectively spaced apart from one another to form a vertical hot air passageway 19, the outer casing side wall 16 being provided with a horizontally-elongated rectangular aperture 20 for the installation of the humidifier 10 (Figure 7). Struck outward from the aperture 20 along one of the vertical edges 22 thereof is a support or third bracket arm 24 having a notch 26 adjacent its junction with the

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edge 22 and an arcuately curved upper edge 28 which extends downwardly and then rearwardly to a vertical portion 30 parallel to the aperture edge 22. The third bracket 24 is provided with vertically-spaced holes 32 and 34, one above the other.

The furnace casing side wall 16 is provided with sheet metal screw holes 36 for the reception of sheet metal screws 38 (Figures 1 to 3 inclusive) whereby a mounting bracket, generally designated 40 (Figure 6), is secured thereto. For this purpose, the mounting bracket 40 is provided with an open-centered rectangular border 42 having screw holes 44 therein aligned with the screw holes 36. The mounting bracket 40 has an aperture 46 in the center thereof with vertical edge 48 from which first and second bracket arms 50 and 52 have been struck outward in a manner similar to that of the third bracket arm 24 of Figure 7. The bracket arms 50 and 52 are similar in size and outline to the bracket arm 24, and all three bracket arms 50, 52 and 24 are parallel to one another as well as perpendicular to the sheet metal from which they are struck outward. The first and second bracket arms 50 and 52, like the third bracket arm 24, also have notches 54 adjacent their junction with the border 42 and aligned with the notch 26 in the mounted position thereof. The bracket arms 50 and 52 also have downwardly-curved arcuate edges 56 terminating in vertical edges 58 similar to the edges 28 and 30 of the third bracket arm 24. The first and second bracket arms 50 and 52 also have holes 60 and 62 which are aligned with one another and are of different sizes.

Mounted in the mounting bracket 40 is an elongated rectangular humidifier pan, generally designated 64, one end of which is drilled at 66 to receive a bolt 68 which passes through the hole 62 to secure the pan 64 to the second bracket arm 52 (Figure 1). The opposite end of the pan 64 is provided with a larger hole 70 which serves to receive the stem 72 of the valve member 74 forming part of a float-operated water control valve assembly, generally designated 75 having a water control valve, generally designated 76 (Figures 1 and 4). The stem 72 of the valve member 74 passes through the hole 70 in the humidifier pan 64 and the hole 60 in the first bracket arm 50 of the mounting bracket 40 and is secured thereto by a nut 78 on the threaded portion 77 of the stem 72. Washers 80 are mounted on opposite sides of the bracket arm 60. The water pipe (not shown) is coupled to the threaded stem portion 77 to supply water thereto.

The valve member 74 has an enlarged head 82 which serves to hold in position a spray hood, generally designated 84, and a float mechanism supporting bracket 86, the rear walls 88 and 90 of which are drilled for the passage of the stem 72 (Figure 4). The hood 76 has parallel side walls 92 and a top wall 94 for confining the water spray issuing from the port 96 of the valve member 74 to a downward direction toward the pan 64 and to prevent it from falling on other parts of the humidifier, where it might otherwise cause corrosion or lime deposit.

The float mechanism supporting bracket 86 has parallel side arms 98 (Figure 4) perpendicular to the rear wall 90 by which it is supported and drilled with aligned holes 100 to receive an upper pivot pin 102, here shown as a cotter pin.

Pivotaly mounted on the pivot pin 102 is a float arm base, generally designated 104, having a top wall 106, a front wall 108 and parallel side walls 110. The side walls 110 are drilled with aligned holes 112 to receive the pivot pin 102. The front wall 108 is provided with a hole 114 for receiving the neck 116 of a combined valve plunger and spray shield, generally designated 118 (Figure 4), having an enlarged head 120 provided with a cup-shaped valve seat 122 into which the valve

nozzle 74 extends and which closes the valve port 96 in the valve stem 72. The valve plunger 118 is preferably of synthetic rubber or other resilient material, and the cup-shaped valve seat 122 serves to deflect the water spray issuing from the valve port 96 into the interior of the spray hood 84, whence it is deflected downward by the latter into the pan 64.

The top wall 106 is provided with an upstruck portion 124 which is drilled and internally threaded as at 126 to receive a headless screw 128. The latter is provided at its lower end with an annular groove 130 forming a neck of smaller diameter between the screw 128 and an enlargement 132 on the lower end thereof. The parallel side walls 110 near their lower ends are drilled with aligned holes 134 to receive a lower pivot pin 136 which, like the upper pivot pin 102, is shown as a cotter pin. The holes 134 and pivot pin 136 are located horizontally a short distance away from the axis of the screw 128 so as to create a slight leverage factor between the pin 136 and the neck 130 of the screw 128 (Figure 4). Preferably the upper and lower pivot pins 102 and 136 are parallel to one another, the latter being located between the pivot pin 102 and the axis of the screw 128.

Removably secured to the float arm base 104 by being connected to the screw neck 130 and lower pivot pin 136 respectively is a float arm 138 of a float and arm unit, generally designated 140, including a float 142. The float arm 138 is of channel cross-section with side flanges 144 interconnected by a web 146 having a horizontal slot 148 extending inward from the arm end 150 thereof to a slot end 152 (Figure 5). The horizontal slot 148 is of a width sufficient to slidably receive the neck 130 of the screw 128 but insufficient to pass the screw 128 or its head 132. The webs 144 are provided with vertical slots or notches 154 aligned with one another and disposed immediately above the lower pivot pin 136 when the neck 130 is located adjacent the end 152 of the horizontal slot 148 (Figure 4). The neck 130 is slightly wider than the thickness of the web 146 of the float arm 138 so as to permit a slight amount of play and facilitate removal of the float and arm unit 140 by unhooking the notches 154 from the lower pivot pin 136 and sliding it off the neck 130 of the screw 128, as explained below in connection with the operation of the invention. The float arm 138 is of sufficient width to fit loosely between the side walls 110 of the float arm base 104.

The opposite end of the float arm 146 from the slotted end 150 is seated in the float 142 which, for example, may consist of a rectangular block of foam glass, namely, glass which has been aerated while molten so as to be composed almost entirely of tiny glass bubbles filled with air or other gas so as to produce a light and very buoyant material. The channel-shaped float arm 138 is shown for purposes of simplicity as seated directly in the foam glass float 142 (Figures 1 and 2) and secured therein by a fastener 156 extending downwardly through the float 142 and float arm 138 to lock the assembly thereof together.

In order to enhance evaporation of the water W from the humidifier pan 64, the latter is provided with an inverted L-shaped evaporator plate-supporting bracket 158 having a vertical arm 160 which is mounted between the end wall 66 of the humidifier pan 64 and the second mounting bracket 52 and drilled to receive the same bolt 68 which secures the members 66 and 52 to one another (Figure 1). The horizontal arm 162 is corrugated or undulated to provide horizontally-spaced notches 164 and terminates in an upturned end or hook portion 166. Mounted on and suspended from the horizontal arm 162 of the evaporator plate supporting bracket 158 are multiple approximately L-shaped evaporator plates 168 (Figure 3) having holes 170 therein located above their centers of gravity in such a manner as to

receive the horizontal arm 162 and hang freely therein while resting in the notches 164 and thereby spaced apart from one another in vertical parallel spaced relationship. The evaporator plates 168 are of compressed glass fiber or other suitable material providing upward flow of water by capillarity. The lower ends of the vertical portions 172 of the plates 168 depend a sufficiently great distance below the horizontal arm 162 of the bracket 158 to be immersed in the water W in the evaporator pan 164. The upper ends of the vertical portions 172 of the plates 168 have offset horizontal portions 174 projecting into the hot air passageway 19 between the outer and inner casing side walls 16 and 18 (Figures 2 and 3).

In order to deflect the air passing through the passageway 19 and direct it inwardly toward the curved wall 202 of the housing 200 and downwardly between the evaporator plates 168, the humidifier 12 is provided with a scoop or air deflector, generally designated 176 (Figures 1, 3 and 8), consisting of parallel plate-like side arms 178 interconnected by a trough-shaped portion 180 which is partly of arcuate cross-section as at 182 and partly flat as at 184. The outer ends of the side arms 178 are drilled as at 186 to receive fasteners 188 by which the side arms 178 are secured to the second and third bracket arms 52 and 24 (Figure 1). As shown in Figure 3 in dotted lines, the air deflector or scoop 176 may be placed in an inverted position if the air is moving upward in the passageway 19, rather than in the upwardly facing position shown in solid lines therein, for air traveling downwardly through the passageway 19, as indicated by the arrow in Fig. 3.

In order to separate the portion or chamber 190 of the evaporator 12 containing the evaporator plates 168 and the aperture 20 from the portion or chamber 192 containing the float and control valve assembly 75 (Figures 1 and 2), and protect the latter from the heat traversing the former, a shield plate or partition plate 194 is provided forming, in effect, a continuation of the third bracket arm 24 and secured thereto by the fasteners 196. The shield plate 194 extends downward below the level of the water W in the pan 64. In order to permit ready access to the evaporator plate chamber 190 and float and control valve chamber 192, the evaporator 12 is provided with a cover, generally designated 200 (Figures 2 and 3) having an upper portion 202 of arcuate cross-section conforming to the curvature of the edge portion 56 of the mounting bracket arms 50 and 52 and of a length sufficient to extend therebetween, and terminating at its lower edge in a vertical portion or skirt 204 which overhangs and extends downward past the upper edge of the evaporator pan 64 (Figure 3), and fits against the vertical lower edge portion 58 of the mounting bracket arms 50 and 52 (Figure 6). The upper edge of the cover 200 is provided with a straight vertical flange 206 which fits into the notches 26 and 54 of the bracket arms 24, 50 and 52, thereby retaining the cover 200 in position yet permitting its instant removal by lifting it upward. The cover 200 along its lateral edges is provided with curved flanges 208 (Figure 2) which follow the edge curvature of the bracket portions 56 and 58 (Figure 6) so as to prevent escape of air from the humidifier 12. The cover 200 is shaped to provide an outwardly convex curved wall extending about the axis of said pan.

In the operation of the invention, let it be assumed that the humidifier 12 has been mounted on the casing side walls 16 of the furnace 10 by means of its mounting bracket 40, and that the evaporator plates 168 have been placed in position with their upper horizontal portions 174 projecting into the air passageway 19 between the outer and inner casing side walls 16 and 18 of the furnace 10 (Figures 2 and 3). Let it also be assumed that a water pipe has been coupled to the threaded portion 77 of the valve stem 72 of the control valve 76 so as to provide a constant supply of water thereto. Let it finally be assumed that the scoop 176 or air deflector has been placed

in its proper position, depending upon the direction of flow of the air in the air passageway 19, so as to deflect air into the spaces between the evaporator plates 168 in order that it may take up moisture from the plates 168 as they draw the water upward by the force of capillary attraction from the water W in the humidifier pan 64.

With the cover 200 in place (Figure 3) to close in the chambers 190 and 192 of the humidifier 12, air passing downward along the passageway 19 encounters the scoop or deflector 176 and passes into the space between the evaporator plates 168 (Figure 3), and is deflected by the outwardly convex curved wall thence downwardly between them and outward adjacent the lower edge of said opening into the air passageway 19 again after taking up moisture from the evaporator plates 168. As the water W in the pan 64 is evaporated in this manner, its level falls, causing the float 142 to move downwardly around the lower pivot pin 136, pulling the screw 128 and float arm base 104 downwardly by reason of the connection therebetween at the neck portion 130 of the screw 128 and at the lower pivot pin 136.

The downward motion of the float arm base 104 around the upper pivot pin 102 causes the valve plunger 118 and its cup-shaped valve seat 122 to swing away from the nozzle or valve member 74, thereby uncovering the port 76 in the valve stem 72. The water spurting from the port 96 as a result of this action is deflected to the left (Figure 4) by the cup-shaped valve seat 122 against the valve stem head 82 and spray hood 84, which in turn deflect it downwardly into the pan 64. As the water level rises in the pan 64 by the replenishment of water from the valve 76, the float 142 and float arm 138 consequently rise, swinging the float arm base 104 upwardly so that the valve plunger 118 is moved to the left into yielding closing engagement with the water discharge port 96, cutting off the flow of water until replenishment is again required in the evaporator pan 64, whereupon the foregoing action is repeated.

The water level in the pan 64 is readily adjusted to the location desired by rotating the screw 128 in the threaded bore 126 of the float arm base 104, thereby changing the positions of the float arm 138 and float 142 relatively to the float arm base 104, and consequently changing the water level at which the float and float arm assembly 142 will close the water discharge port 96 by means of the valve plunger 118.

As explained above, the float and float arm assembly 142 is readily detached from the float arm base 104 by unhooking its notched portions 154 of the float arm 138 and sliding the latter off the neck 130 of the screw 128 by means of the open-ended slot 148 therein.

What I claim is:

1. A heating system humidifier comprising a mounting structure having an approximately vertical mounting portion with an aperture having upper and lower edges, an elongated humidifier pan secured to one side of said mounting structure and extending horizontally along the lower portion thereof below said aperture with its longitudinal axis disposed approximately parallel to said

mounting portion, means for maintaining a body of water in said pan at a predetermined depth therein, a plurality of evaporator plates, an evaporator support disposed adjacent said pan, said plurality of evaporator plates being mounted approximately vertically on said support in spaced approximately parallel relationship and disposed approximately perpendicular to said mounting portion with their lower end portions extending downwardly into said pan beneath the intended water level thereof and with their upper portions disposed adjacent the aperture in said mounting portion, a housing supported on said mounting structure extending above said pan and having an outwardly convex curved wall extending about the axis of said pan from the outer side of said pan to said mounting portion above said opening, and deflecting means arranged to deflect air into the housing adjacent one of said edges and toward said curved wall, said curved wall directing the air out of said housing adjacent the other of said edges of said aperture, whereby air is directed into moisture receiving relation with said plates.

2. A heating system humidifier, according to claim 1 wherein the upper portions of the humidifier plates extend into said housing and are provided with extensions projecting through the aperture beyond the mounting portion on the opposite side thereof from said pan.

3. A heating system humidifier, according to claim 1 wherein the air deflecting means comprises an air scoop disposed adjacent said plates and connected to said mounting structure, said air scoop projecting through said aperture beyond said mounting portion on the opposite side thereof from said pan and having a curved wall the innermost portion of which extends vertically and the outermost portion of which extends horizontally to deflect air into said housing.

4. A heating system humidifier, according to claim 2 wherein said deflecting means includes an air scoop disposed adjacent said plates and connected to said mounting structure, said air scoop projecting through said aperture beyond said mounting portion on the opposite side thereof from said pan and having a curved wall the innermost portion of which extends vertically and the outermost portion of which extends horizontally to deflect air into said housing.

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