July 29, 1958 R. P. SKERRITT 2,845,057

FURNACE-INSTALLED HUMIDIFIER

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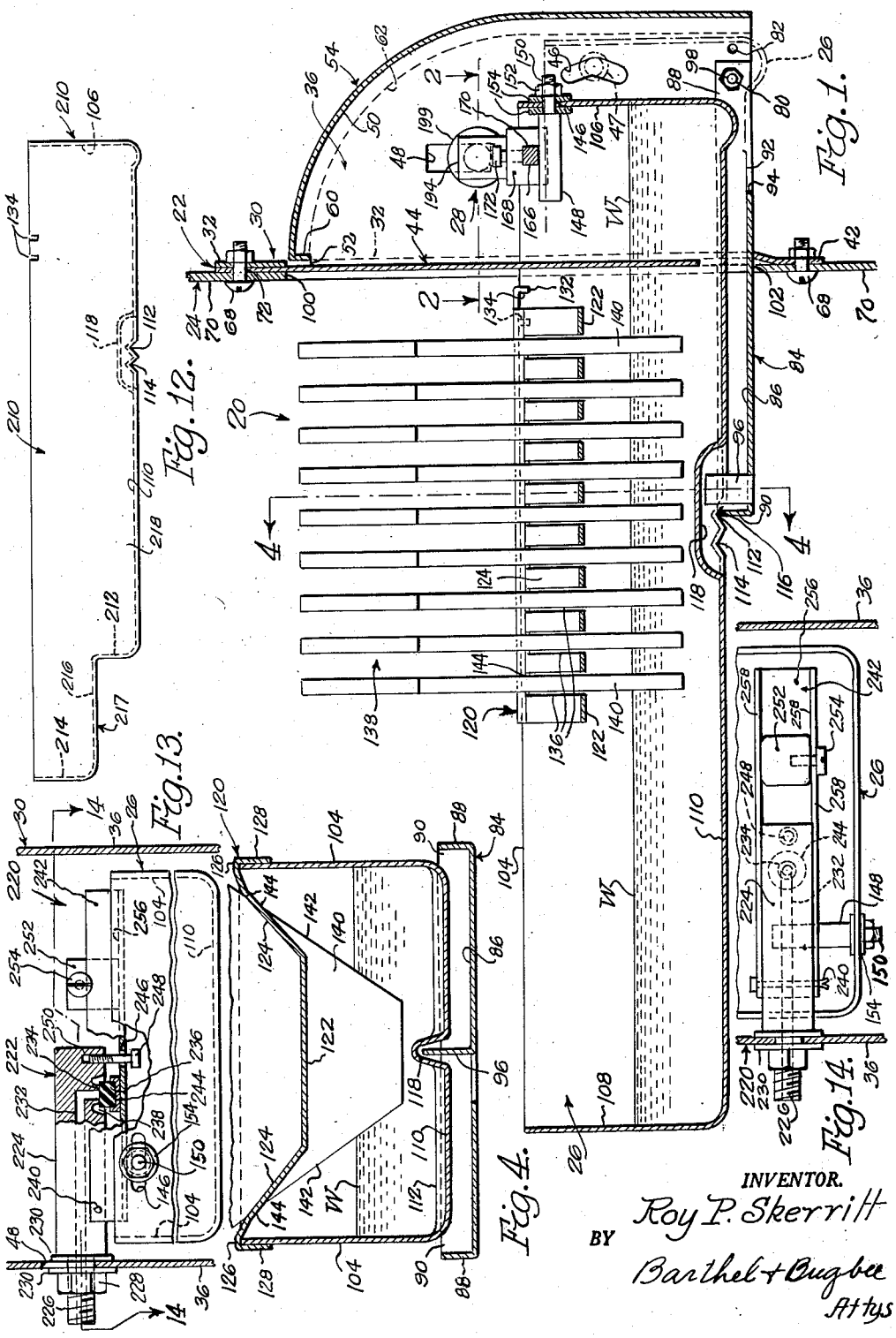


Fig. 1.

Fig. 12.

Fig. 13.

Fig. 4.

Fig. 14.

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FURNACE-INSTALLED HUMIDIFIER

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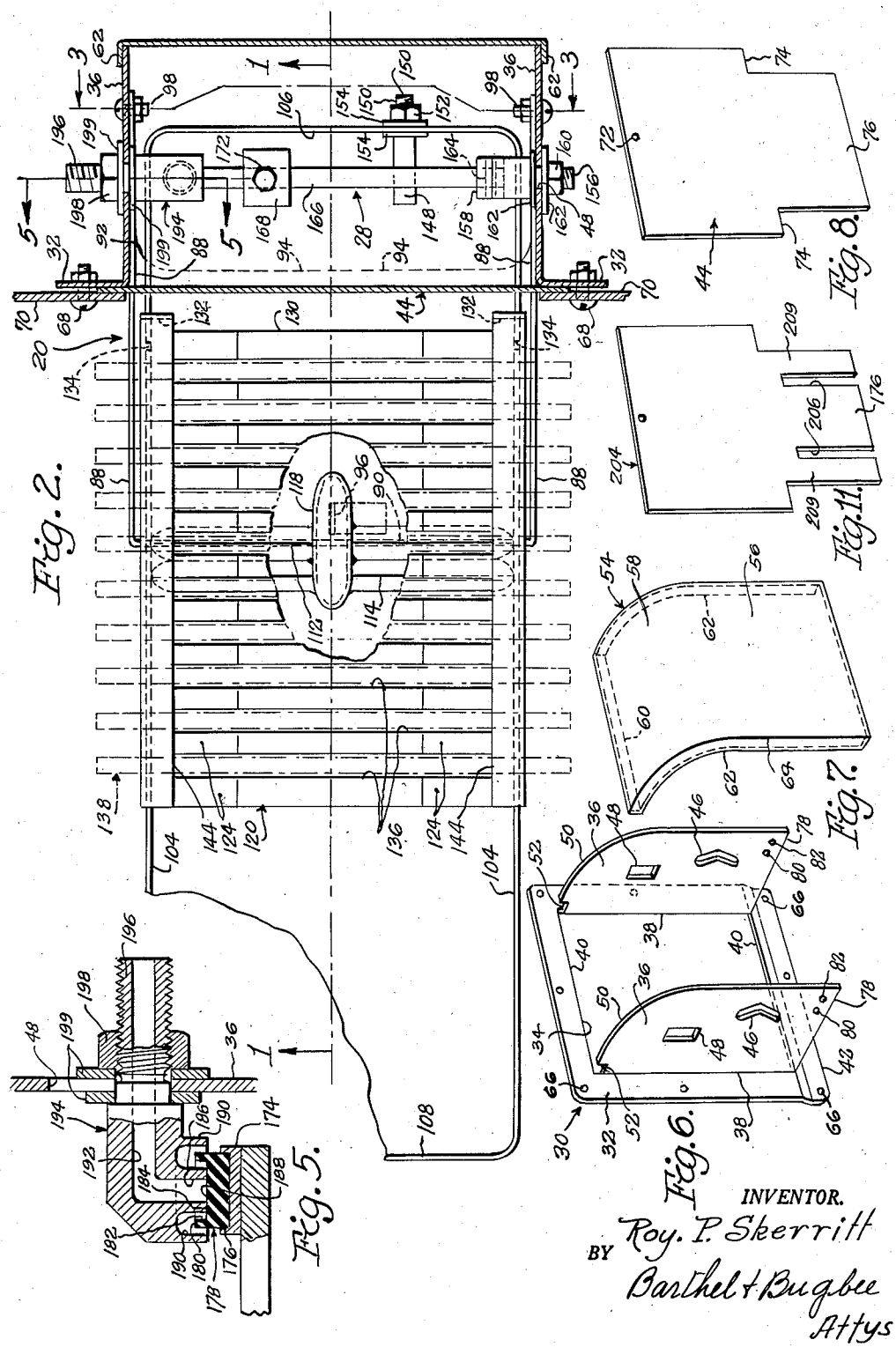


Fig. 2.



Fig. 5.



Fig. 8.



Fig. 11.



Fig. 7.



Fig. 6.

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Filed Jan. 4, 1954 3 Sheets-Sheet 3

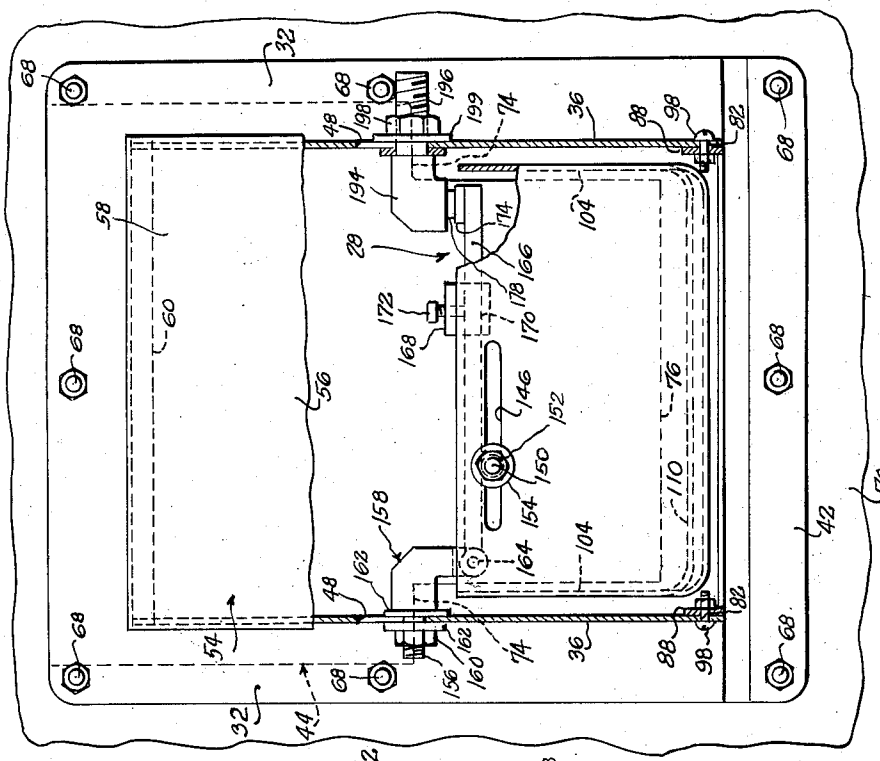


Fig. 3.

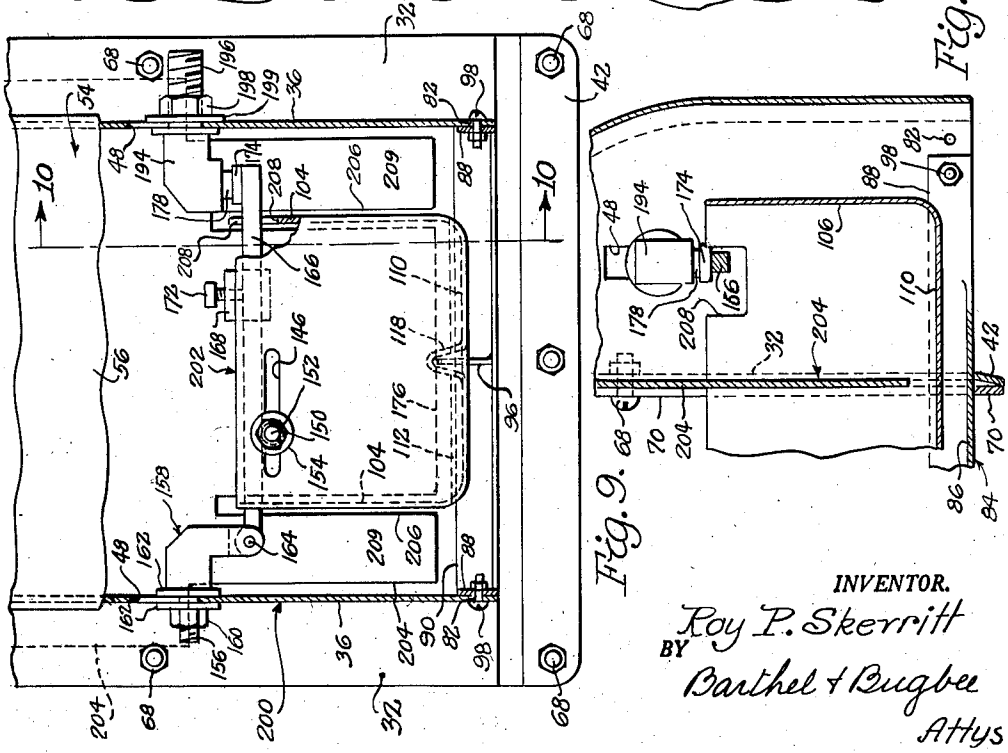


Fig. 10.



Fig. 9.

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United States Patent Office 2,845,057 Patented July 29, 1958



2,845,057

# FURNACE-INSTALLED HUMIDIFIER

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Application January 4, 1954, Serial No. 402,075

3 Claims. (Cl. 126—113)

This invention relates to humidifiers and, in particular, to furnace-installed humidifiers.

One object of this invention is to provide a furnace-installed humidifier wherein a mounting bracket is adapted to be secured adjacent an opening in the furnace wall, the bracket having outwardly-projecting spaced parallel wings and a humidifier pan fulcrum on which a humidifier pan is tiltably mounted and, by reasons of its tilting in response to variations in the water level due to evaporation, actuates a lever mounted on one wing of the bracket which in turn opens or closes the water supply valve mounted on the other wing of the bracket to start and stop the flow of the water for refilling the pan.

Another object is to provide a furnace-installed humidifier of the foregoing character wherein the speed of evaporation of the water is enhanced by the use of evaporator plates of porous material such as molded glass fiber, or ceramic material, mounted in an evaporator plate rack which is placed in and slidably movable along the tilting pan relatively to its fulcrum, and the balanced condition of the pan is restored by the use of this adjustably slidable plate rack as a counterbalancing weight applied to the pan in order to counteract the unbalancing effect of the weight of the evaporator plates, means being provided for locking the plate rack in its adjusted position.

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 vertical section through a furnace-installed humidifier according to one form of the invention, taken along the line 1—1 in Figure 2;

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

Figure 3 is a vertical cross-section taken along the line 3—3 in Figure 2, using a wide humidifier pan;

Figure 4 is a vertical cross-section taken along the line 4—4 in Figure 1;

Figure 5 is an enlarged fragmentary vertical section through the nozzle and seat of the water supply valve taken along the line 5—5 in Figure 2;

Figure 6 is a front perspective view of the mounting bracket of the humidifier shown in Figures 1 to 4 inclusive, with the cover plate omitted;

Figure 7 is a front perspective view of the cover plate used with the mounting bracket of Figure 6;

Figure 8 is a perspective view of a partition plate used with the mounting braket shown in Figure 6;

Figure 9 is a cross-section similar to Figure 3, but showing the use of a narrow humidifier pan with a modified baffle plate;

Figure 10 is a fragmentary vertical section taken along the line 10—10 in Figure 9;

Figure 11 is a perspective view of the modified baffle plate used with the narrow humidifier pan of Figures 9 and 10;

Figure 12 is a side elevation of a modified humidifier pan adapted to prevent flooding of the furnace when used in high water pressure areas;



Figure 13 is a fragmentary vertical section similar to Figure 3, showing a modification of the water control valve and its operating mechanism; and

Figure 14 is a top plan view, partly in horizontal section, of the modified humidifier shown in Figure 13, taken along the line 14—14 therein.

Referring to the drawings in detail, Figures 1 to 4 inclusive show a furnace-installed humidifier, generally designated 20, according to one form of the invention as consisting generally of a mounting structure 22 applied to a furnace 24, such as to the dome of a conventional hot air furnace, a humidifier pan 26 tiltably mounted upon the mounting structure 22, and a water-level-responsive water supply valve unit 28 mounted in the mounting structure 22 adjacent the outer end of the humidifier pan 26.

The mounting structure 22 is turn consists of a mounting bracket, generally designated 30 (Figure 6), stamped from sheet metal and having an attachment plate 32 with an approximately rectangular aperture 34 therein and forwardly-projecting parallel plate wings 36 projecting forwardly from the vertical edges 38 of the aperture 34 as fold lines, the aperture 34 having horizontal edges 40. The lower edge portion 42 of the mounting bracket 30 is offset slightly relatively to the remainder thereof in order to accommodate a partition plate, generally designated 44 (Figure 8). The wings 36 have aligned approximately V-shaped slots 46 in their lower portions to receive fasteners 47 (Figure 1) for the mounting of a humidifier pan for manual rather than automatic refilling, as described more specifically below. Above the V-shaped slots 46, the windings 36 are further provided with aligned rectangular holes 48 for the mounting of the water supply unit 28. The outer edges 50 of the wings 36 are preferably rounded and the wings 36 at their upper ends terminate in notches 52, both being provided for receiving and holding a cover, generally designated 54 (Figure 7).

The cover 54 is formed of sheet material or other suitable material and has a front face 56 with an upper curved portion 58 fitting the curved edges 50 of the wings 36, and a downwardly-projecting flange 60, the ends of which enter the notches 52 when the cover 54 is installed on the wings 36. Edge flanges 62 follow the contours of the lateral edges 64 of the cover 54 and overhang the edges 50 of the wings 36. The attachment plate 32 is suitably drilled as at 66 to receive fasteners 68 (Figure 1) by which it is secured to the wall 70 of the furnace 24.

The partition plate 44 is of generally rectangular outline with a hole 72 by which it is secured by one of the fasteners 68 between the mounting portion 32 of the bracket 30 and the furnace wall 70 (Figures 1 and 8). Right-angled notches 74 are cut in the lower opposite corners of the partition plate 44 in order that the lower portion 76 thereof will enter the interior of the humidifier pan 26 (Figure 3).

Near its lower edge 78, each of the wings 36 of the mounting bracket 30 is provided with a pair of holes 80 and 82 respectively. These holes are provided for the purpose of attaching a fulcrum plate, generally designated 84 (Figures 1 and 4), upon which the pan 26 is tiltably supported. The fulcrum plate 84 has a flat bottom 86 with side and rear flanges 88 and 90 rising from the side and rear edge thereof respectively. The front or forward portion of the fulcrum plate 86 is cut away as at 92 (Figures 1 and 2) so that the forward edge 94 thereof is set back from the forward ends of the side flanges 88. This cutaway portion 92 provides freedom of action for the forward end of the humidifier pan 26 when it tilts downward. The rearward edge flange 90 serves as a fulcrum for the humidifier pan 26, which is prevented from lateral displacement by an upstanding locating lug or tab 96 struck up out of the bottom portion 86 (Figures 1 and 4).

The fulcrum plate **84** is secured to the side wings **36** of the mounting bracket **30** by fasteners **98** passing through the holes **80** or **82** therein and likewise passing through the side flanges **88** of the fulcrum plate **84**. The fulcrum plate **84** projects through an opening **100** of rectangular outline formed in the furnace wall **70**, and rests upon the lower edge **102** thereof (Figure 1).

The humidifier pan **26** is of elongated shape having side walls **104**, front and rear walls **106** and **108**, and a bottom wall **110** (Figure 1). The bottom wall **110** is provided with parallel laterally-extending grooves **112** and **114** respectively for receiving the upper edge **116** of the fulcrum plate flange **90**. Two grooves **112**, **114** are shown, but more or less may be provided to facilitate the proper balancing of the humidifier pan **26**. In its mid-portion, the humidifier pan **26** is provided with an elongated longitudinal groove or recess **118** for receiving the locating lug **96** (Figures 1 and 4).

The humidifier pan **26** is optionally provided with an evaporator plate support, generally designated **120** (Figures 1, 2 and 4) also made from sheet metal in trough-shaped form and having a flat bottom wall **122**, inclined side walls **124**, narrow top walls **126**, adapted to engage the upper edges of the humidifier pan side walls **104**, and vertical edge flanges **128** adapted to overhang the side walls **104**. At its forward end the evaporator plate support **120** is cut back as at **130** (Figure 2) so that the top wall **126** projects slightly forward of the bottom and side walls **122** and front **124**, terminating in downwardly-bent hook portions **132** engaging suitably located laterally-aligned notches **134** in the upper edges of the side walls **104** (Figure 1). This construction prevents accidental displacement of the evaporator plate support **120** lengthwise of the humidifier pan **26**.

The bottom and side walls **122** and **124** of the evaporator plate support **120** are provided with multiple lateral slots **136** arranged in spaced parallel relationship. Mounted in the slots **136** and projecting downwardly through them are evaporator plates, generally designated **138**, of any suitable porous material, such as molded glass fiber, rock wool, ceramic material, or the like. These evaporator plates **138** have truncated triangular lower end portions **140** formed by converging lower side edges **142** for the purpose of passing through the slots **136** and entering the water W in the pan **26** (Figure 4). The spacing of the slots **136** correspondingly spaces the evaporator plates **138** apart from one another. The side edges **142** of the evaporator plates **138** engage the evaporator plate support **120** at the ends **144** of the slots **136**.

The front wall **106** of the humidifier pan **26** is provided with an elongated horizontal slot **146** (Figure 3) in which a valve-operating pin or rod **148** is adjustably mounted, the pin or rod **148** having a reduced diameter threaded outer portion **150** for receiving a nut **152** with washers **154**. Mounted in the rectangular hole **48** in one of the side wings **36** of the mounting bracket **30** is the threaded attachment portion **156** of the fulcrum bracket **158** of the water supply valve unit **28**. The bracket **158** is L-shaped and is held in place by a nut **160** threaded on the portion **156** aided by washers **162** (Figure 3). The lower end of the bracket **158** is drilled to receive a pivot pin **164** upon which one end of a correspondingly-drilled lever arm **166** is pivotally mounted. The arm **166** rests upon the operating pin or rod **148** and carries a counterweight **168** which is bored as at **170** to receive the rod **166** and secure it in its adjusted position by a set screw **172**. The free end of the arm **166** carries a cup-shaped or recessed valve seat support **174** (Figure 5) in the recess **176** of which a cupped valve seat **178** is secured, as by cementing or vulcanizing.

The cup-shaped valve seat **178** is of so-called elastic deformable material, such as natural or synthetic rubber or synthetic plastic and has an upstanding rim flange **180** providing a cup **182** into which the end portion **184** of a water nozzle **186** extends downward into engagement with the upper surface **188** of the valve seat **180**. The cup or recess **182** provides for immersion of the end portion **184** of the water nozzle **186** so as to protect it from erosion resulting from the heat in the furnace reacting with and oxidizing the metal at the end of the nozzle. The nozzle **186** is surrounded by a radially-spaced skirt or rim flange **190** which extends downwardly into overlapping relationship with the upstanding flange **180** on the valve seat **178**, so as to provide further protection for the nozzle end portion **184**.

Water reaches the nozzle **186** through a passageway **192** in a fixture **194** integral with the nozzle **186** (Figure 5) and having a reduced diameter tubular threaded portion **196** which passes through the other of the rectangular holes **48** in the other wing **36** and is held in position by a nut **198** threaded thereon, aided by washers **199**. Because of the vertically-elongated shape of the rectangular holes **48**, the fulcrum bracket **158** and the nozzle fixture **194** may be adjusted upward or downward, as desired.

The modified humidifier construction, generally designated **200**, shown in Figures 9, 10 and 11, is generally similar to the humidifier **20** shown in Figures 1 to 8 inclusive, and corresponding parts accordingly bear similar reference numerals. The modified humidifier **200** differs from the humidifier **20** in that it permits the use of a humidifier pan **202** which is narrower than the humidifier pan **26** in Figures 1 to 8 inclusive. Accordingly, a slightly different partition plate **204** is provided (Figure 11) substantially similar in all respects to the partition plate **44**, except that its lower portion **76** is provided with a pair of upwardly-extending elongated parallel notches **206**. These notches receive the side walls **104** of the humidifier pan **202** which is likewise of similar shape to the humidifier pan **26**. The side walls **104** of the humidifier pan **202** are optionally extended upward a sufficient distance to require notches **208** in their upper edges for the passage of the lever arm **166**. The notches **206** provide downwardly-extending side wings **209** on opposite sides of the narrow pan **202** for further protecting and shielding the apparatus from direct heat.

The modified humidifier pan, generally designated **210**, shown in Figure 12 is similar in general construction to the humidifier pans **26** and **202** previously described and similar parts likewise bear similar reference numerals. The humidifier pan **210**, however, is especially well adapted for protection of the furnace against flooding, especially when installed in geographical areas, such as mountainous areas, having high local water pressures for insuring that the city water will reach houses located on elevated ground. Prior tilting pan humidifiers have been unsuccessful in such localities for the reason that a sudden blast of water at high pressure is released when the nozzle is uncapped. Hitherto, this high pressure jet of water has tilted the forward end of the humidifier pan downward with a jolt, the delicately-balanced pan being held down by the force of the water jet for a sufficient length of time to cause the forward end of the pan to fill up and overflow, so that a sufficient amount of water cannot flow to the rearward end of the pan to cause it to tilt on its fulcrum and close the valve. The improved humidifier pan **210** solves this difficulty by providing a two-stage rear wall **212** and **214**, with a higher level bottom wall **216** in the humidifier pan extension **217** formed thereby. Normally, the water occupies the lower portion **218** of the pan **210** beneath the level of the upper bottom wall **216** and between the front wall **106** and lower rear wall **212**. The fulcrum pan **210** is balanced in this position for rocking motion in its fulcrum grooves **114** or **116** upon the fulcrum flange **90** of the fulcrum plate **84** (Figure 1). If, however, the pan **210** is installed in a high water pressure locality and the valve is kept open temporarily by the force of the downwardly-directed jet of water from the nozzle **186**, flooding is prevented by reason of the

fact that as soon as the water level rises above the level of the upper bottom wall **216**, it moves rearwardly into the upper pan portion **217** which is considerably longer than the lower pan portion **218**. The result is that the weight of the water filling the upper extension pan portion **217** quickly overbalances the effect of the water jet issuing from the nozzle **186** and closes the valve seat against the nozzle, nothwithstanding the force of the water jet issuing therefrom.

The further modified humidifier, generally designated **220**, shown in Figures 13 and 14, is generally similar to the humidifier **20** of Figures 1 to 8 inclusive, except that a different construction of water supply valve unit, generally designated **222**, is provided. The humidifier pan **26** and mounting bracket **30** remain the same as previously described above, together with the operating rod or pin **148** in the horizontally-elongated slot **146**. The valve unit **222** is provided with a combined bracket and nozzle fixture **224** having a threaded reduced diameter portion **226** adjustably mounted in one of the slots **48** of one of the wings **36** of the mounting bracket **30**, and anchored in position by a nut **228** and washers **230**. The member **224** is tubular, containing an L-shaped water passageway **232** terminating in an annular nozzle **234** similar to the nozzle **186** and similarly provided with a cupped valve seat **236** of elasticized deformable material.

An annular identation **238** surrounding the nozzle **234** provides a ring-shaped recess which further protects the nozzle **234**, in a similar manner to the protection afforded by the annular skirt **190** of the nozzle **186** (Figure 5). The nozzle fixture **224** is more elongated than the nozzle fixture **194** of Figure 5, and at a location adjacent its junction with the reduced diameter portion **226** is bored to receive a pivot pin or fulcrum pin **240** upon which an upwardly-facing lever arm **242** of channel-shaped cross-section is pivotally mounted. The valve seat **236** is mounted in a cupped valve seat support **244** secured within the channel arm **242**, the latter being drilled at **246** for the passage of a stop screw **248** threaded into a threaded hole **250** in the bottom of the fixture **224**.

Mounted in the channel of the lever arm **242** nearer the free end thereof than the valve seat **236** and stop screw **248** is a counterweight **252** bored and threaded to receive a clamping screw **254**. The clamping screw **254** is located at such a level that when the counterweight **252** is resting upon the floor or web **256** of the channel in the lever arm **242**, the shank of the screw **254** passes over the upper of one of the flanges **258**, whereas the head of the screw **254** engages the flange **258** and clamps the counterweight **252** in its adjusted position.

*Operation*

In the operation of the humidifier **20** shown in Figures 1 to 8 inclusive, let it first be assumed that the owner of the furnace **24** prefers to install the humidifier for manually-filled operation rather than for automatic filling. Such preference may arise, for example, for reducing the first cost of the apparatus. In this instance, the valve unit **28** and fulcrum plate **84** are omitted. The rectangular aperture **100** of suitable size is cut in the side wall or dome **70** of the furnace **24** and the mounting bracket **30** is secured to the wall **70** by means of the fasteners **68**. Since the valve unit **28** is omitted, it is unnecessary to provide the partition plate **44**, the principal purpose of which is to protect the water supply valve unit **28** and which is inserted in position between the attachment plate **32** and the furnace wall **70** (Figure 1). The humidifier pan **26** is inserted through the furnace opening **100** and supported on its upper edge **102**, as shown in the dotted lines indicated by the dotted reference arrow **26** in the lower right-hand corner of Figure 1. If desired, the evaporator plate support **120** and evaporator plate **128** may also be installed, in which case the partition plate **44** would be left off until the installation had been made, and then inserted and clamped in position by the remaining fastener **68** in the top central portion of the attachment plate **32**. The fasteners **47** are then inserted through the V-shaped slots **46** and through suitable holes in the humidifier pan **26** to secure the latter firmly in position.

With the manually-filled humidifier thus installed, the user inserts the water W from the front by means of a kettle or pitcher with a spout, after which he places the cover **54** in position by dropping its forward flange **60** into the notches **52** provided for it. The cover **54** then occupies the position shown in Figure 1, with the side flanges **62** thereof overlapping the side edges **50** of the wings **36**. The water W has to be replaced manually from time to time as it evaporates.

If, on the other hand, the owner wishes an automatically-filled humidifier **20**, either at the outset or after having installed the manual installation, he purchases the fulcrum plate **84** and water supply valve unit **28** shown in Figures 1 to 5 inclusive. Instead of installing the humidifier pan **26** rigidly in the dotted line position of Figure 1 on the furnace-opening edge **102**, he installs the fulcrum plate **84** in its place, securing the plate **84** in position by the screws **98**. He then installs the valve unit **28** in the aligned holes **48**, and inserts the humidifier pan **26** after equipping it with the operating rod or pin **148**. The latter is adjusted lengthwise of the slot **146** until it exerts the proper lifting force on the valve lever **166**, in accordance with the local water pressure, so as to urge the resilient valve seat **178** upward against the nozzle **186** with a suitable force. The fulcrum pan **26** is balanced upon one or the other of the grooves **112** or **114** and fulcrum flange **90** (Figure 1) with the locating lug **96** projecting upwardly into the recess **118** to prevent lateral motion of the humidifier pan **26**. As before, the evaporator plate support **120** and evaporator plates **138** are inserted in their proper positions, with the hook portions **132** resting on one of the notches **134**. The partition plate **44** is also inserted and clamped in position, and the humidifier pan **26** filled to the proper level. From Figure 1, it will be seen that the rear wall **108** of the humidifier pan **26** is located at a greater distance from either of the fulcrum grooves **114** than the forward wall **106**, so that a greater amount and consequently a greater weight of water lies in the portion of the pan rearwardly of the fulcrum grooves **112** or **114** than forwardly thereof. This greater weight of water causes the forward end wall **106** to tilt upward, causing the operating rod or pin **148** to move the lever arm **166** upward, pushing the valve seat **178** upward against the lower end **184** of the nozzle **186** (Figure 5), closing the nozzle **186** and halting further flow of the water.

When, as a result of the operation of the furnace, hot air in the chamber in which the humidifier pan **26** is located causes sufficient evaporation of the water W therein to require replenishment, the pressure of the water standing in the passageway **192** of the nozzle **186** overcomes the force exerted by the differential weight of the rearward portion of the humidifier pan **26**, pushing the valve seat **178** and lever arm **166** downward so as to open the valve **194** and permit the water to flow therefrom into the humidifier pan **26**. When the water level has risen to a sufficient height to overbalance the pressure of the water in the nozzle **194**, the consequent tilting of the humidifier pan **26** on the fulcrum flange **90** causes the upward motion of the operating rod **148**, lever arm **166**, and valve seat **178** to close the passageway **192** in the nozzle **186** and prevent further flow of water for the time being. Meanwhile, however, a small amount of water will remain in the annular recess formed by the cup-shaped depression **182** surrounding the nozzle **184** (Figure 5), protecting the lower end **184** of the nozzle **186** from oxidational erosion. The partition plate **44** further shields the valve unit **28** from the hot air of the furnace, preventing further erosion. If evaporator plates **138** have been mounted in the humidifier pan **26**, the counterweight **168** is employed with the lever arm **166**,

to compensate for the added weight thereof, otherwise the counterweight **168** is omitted.

The operation of the modified humidifier **200** (Figures 9, 10 and 11) is substantially identical with that of the humidifier **20** as described above, the sole substantial difference being the ability to use a narrow humidifier pan **202** in place of the wide pan **26** in the same mounting bracket **30**, the tabs **209** in the partition plate **204** filling in the spaces on opposite sides of the narrow pan **202**.

The operation of the modified humidifier pan **210** of Figure 12 has been described above in connection with its construction, hence requires no repetition. As stated above, the upper chamber **217** above the upper level bottom portion **216** provides a sudden increase of the volume and weight of water at the rearward end of the humidifier pan **210**, positively closing the valve unit **28** despite the rush of water tending to keep it open when the humidifier is installed in high water pressure localities.

The operation of the modified humidifier **220** of Figures 13 and 14 is also generally similar to that of the humidifier **20**, except that the lever arm **242** has the counterweight **252** located at the free end thereof rather than between the fulcrum and the valve seat **236**, as in Figures 1 to 8 inclusive. The excessive downward motion of the lever arm **242** is prevented by the head of the stop screw **248**, so that the valve **222** can open only to a desired extent.

What I claim is:

1. A furnace-installed humidifier comprising a mounting structure including a mounting bracket adapted to be secured adjacent an opening in the furnace wall and having a humidifier pan support including a fulcrum thereon, an elongated humidifier pan tiltably mounted upon said fulcrum at a location providing a greater volume of water in said pan rearwardly of said fulcrum than forwardly thereof and arranged to project through said opening into the interior of said furnace, a water supply valve arranged to discharge into the forward portion of said pan and including a valve seat element and a valve nozzle element, and valve-operating mechanism connected to one of said valve elements and responsive to the tliting of said pan upon said fulcrum for opening and closing said valve, said mounting bracket having side wings spaced apart from one another and projecting outwardly therefrom on opposite sides of said pan, one of said valve elements being mounted on one of said wings and said valve-operating mechanism being mounted on the other wing and operatively connected to said pan.

2. A furnace-installed humidifier comprising a mounting structure including a mounting bracket adapted to be secured adjacent an opening in the furnace wall and having a humidifier pan support thereon including a humidifier pan fulcrum, an elongated humidifier pan tiltably mounted upon said fulcrum and arranged to project through said opening into the interior of said furnace, means for holding said pan in assembly with said mounting structure, and an evaporator plate rack disposed substantially in its entirety in the upper portion of said pan above the maximum water level therein, said rack resting upon and having opposite edge projections slidably and adjustably engaging the upper side edges of said pan and extending thereacross, said rack being adjustably movable along said pan relatively to said fulcrum, and means for holding said rack in its adjusted position.

3. A furnace-installed humidifier comprising a mounting structure including a mounting bracket adapted to be secured adjacent an opening in the furnace wall and having a humidifier pan support thereon including a humidifier pan fulcrum, an elongated humidifier pan tiltably mounted upon said fulcrum and arranged to project through said opening into the interior of said furnace, means for holding said pan in assembly with said mounting structure, and an evaporator plate rack disposed substantially in its entirety in the upper portion of said pan above the maximum water level therein, said rack resting upon and having opposite edge projections slidably and adjustably engaging the upper side edges of said pan and extending thereacross, said rack being adjustably movable along said pan relatively to said fulcrum, and means for holding said rack in its adjusted position, said rack having spaced substantially parallel slots extending thereacross for receiving spaced parallel evaporator plates.

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