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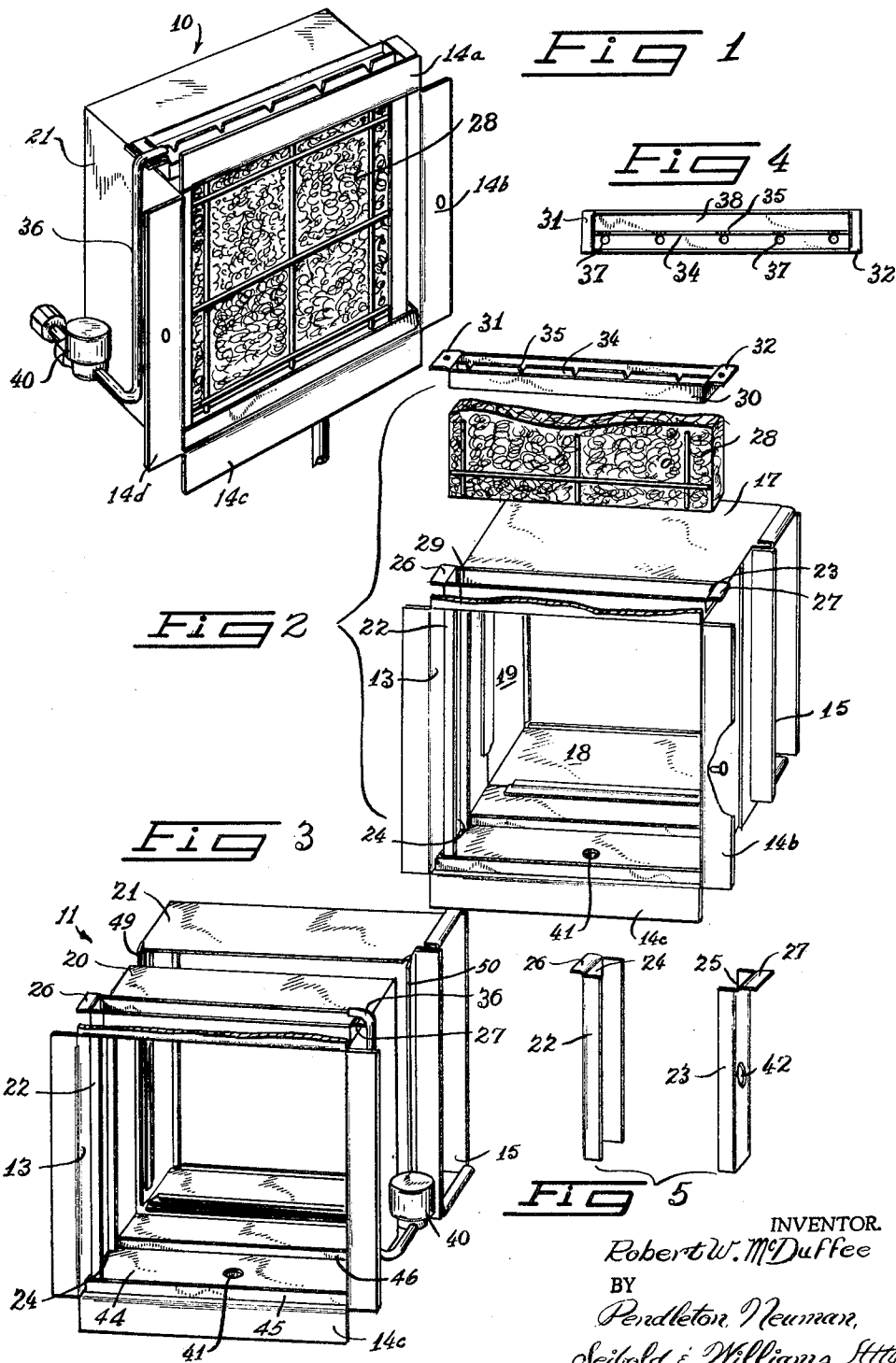
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3,171,401

HUMIDIFIER

Filed Jan. 14, 1963

2 Sheets-Sheet 1



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Fig. 6

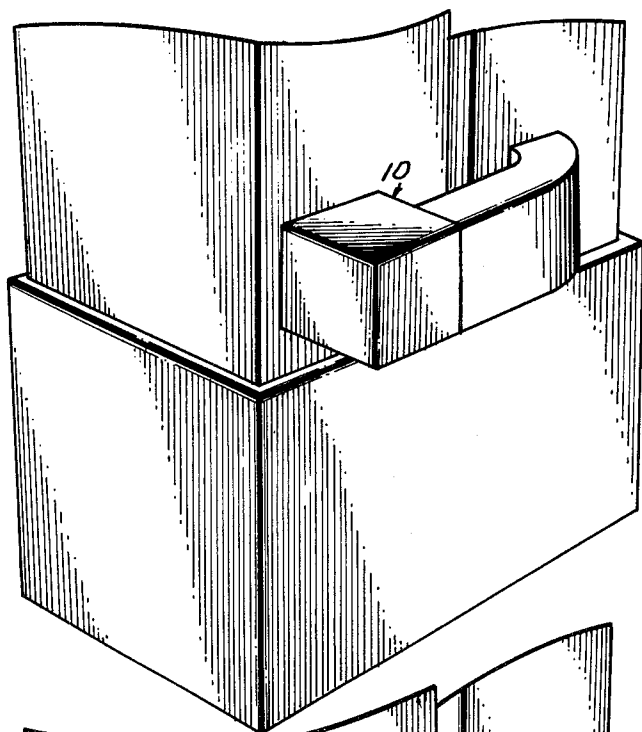
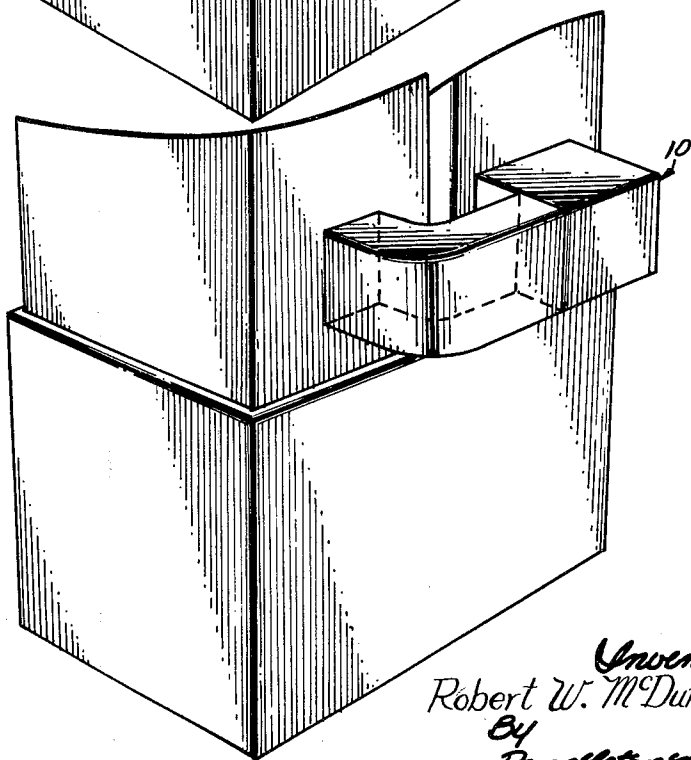


Fig. 7



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HUMIDIFIER

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This invention relates to improvements in apparatus for conditioning air such as is used in conjunction with warm air furnace systems to produce and maintain desirable moisture conditions in rooms or other enclosures heated by said furnace.

The general object of the present invention is to provide an improved air conditioning device adapted for use with various air heating means to produce and maintain a desired moisture content in the heated air.

Another object of the invention is to provide an improved apparatus for use in humidifying air passing through a warm air furnace system which apparatus is constructed and arranged so that the path of flow of dry air is directed directly through a wet humidifying element to obtain the optimum rate of humidification of such air.

Another object of the invention is to provide an improved apparatus for use in humidifying air passing through a warm air furnace system which apparatus is constructed and arranged so that a substantial portion of air passing through the system is directed directly through a wet humidifying element by means of the blower or air circulating means of the furnace.

A still further object of the invention is to provide an improved humidifier apparatus which is constructed and arranged so that it can be disposed in a furnace system in such manner that warm air from the warm air plenum of the furnace is made to pass through the humidifier to pick up substantial amounts of water vapor.

Another object of the invention is to provide an improved humidifier apparatus which is constructed and arranged so that air to be humidified or humidified air can be made to enter or discharge from the humidifier at the bottom, top, or either side thereof.

Other objects and advantages of the invention will be apparent from the following description and appended claims taken in connection with the accompanying drawings wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a perspective view of the front portions of the humidifier apparatus of the invention showing the parts thereof in assembled condition.

FIG. 2 is a perspective view of a unitary form of the humidifier apparatus of the invention showing the humidifying element and water distribution pan removed therefrom and further showing the manner in which these parts are assembled in the apparatus.

FIG. 3 is a perspective view of a modified form of the humidifier apparatus of the invention without the humidifying element or water distribution pan in place and illustrating an embodiment of the apparatus wherein it is formed in two separate parts which are adapted for rotation relative to each other.

FIG. 4 is a plan view of the water distribution pan of the humidifying apparatus.

FIG. 5 is a perspective view of the two members which are interiorly disposed on each side of the humidifier housing to accommodate the humidifying filter element.

FIGURES 6 and 7 show diagrammatically the humidifier apparatus of the invention attached to a warm-air furnace and illustrate that the humidifier can be attached to either the warm-air plenum or cold-air return plenum of the furnace.

Referring to the drawings, a humidifier unit 10 embodying the principles of the invention comprises a housing

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11 fabricated of metal such as stainless steel or other suitable material which can be varied in size depending upon the size and type of furnace system with which it is used. In order to achieve maximum surface area for moisture pick-up, housing 11 is preferably constructed with a square duct 13 through which the dry air enters or the humidified air discharges from the unit depending upon how the unit is mounted with respect to the direction of dry air flow. Planar flanges 14 (which include flanges 14a, 14b, 14c and 14d) surrounding duct 13 are provided to permit ready attachment of the humidifier unit to the wall of the furnace or duct work system by means of screws or the like. As shown in FIGS. 2 and 3, air duct opening 15 is provided at one side of the humidifier unit for admission of dry air into the unit or for discharge of humidified air depending upon positioning of the unit in the furnace system with respect to direction of air flow. The construction of the present humidifier is such that the dry air to be humidified can enter opening 15 in which case this opening is the dry air inlet and the humidified air can discharge through duct 13 or in this case discharge duct 13. If desired, the air flow can be reversed and the dry air enter duct 13 and humidified air discharge from the humidifier through opening 15. The opening 15, which for purposes of description will be referred to as the dry air inlet, can be disposed on either side of the humidifier, or at the bottom or top thereof depending upon the direction of dry air flow and the positioning of the unit within the furnace system. In one embodiment as shown in FIG. 2, the air inlet 15 comprises a removable panel, such as top panel 17, bottom panel 18 or side panel 19 which panels can be attached to humidifier casing 11 by means of screws or the like and removed as desired to form the dry air inlet. In another embodiment, the humidifier casing 11 can be formed in two parts capable of being joined as illustrated in FIG. 3. In this construction the casing 11 is of square shape and is comprised of a first element 20 which includes the discharge duct 13 and a second element 21 which is removably attached thereto in telescopic manner by means of screws or by frictional engagement by means of flanges 49 and 50 and so forth. One side of element 21 is provided with the air inlet 15 and by disassembling and rotation of the elements relative to each other the duct 15 can be disposed on either side, or at the top or bottom of the humidifier.

Interiorly disposed on opposite sides of the casing 11 are inserts 22 and 23 which are generally U-shaped in cross section and having longitudinally extending channels 24 and 25 in which an evaporating filter element 28 is slidably inserted and retained in place. Preferably the channel inserts 22 and 23 are adjustably secured to the casing by nuts and bolts received in slot 42 or in any other manner which will permit their longitudinal adjustment for a purpose as will be explained hereinafter. The inserts 22 and 23 are provided at the top thereof with laterally projecting flanges 26 and 27 respectively.

Interposed between the dry air inlet and humidified air discharge duct 13 is a humidifying filter element or evaporating filter 28 composed of a porous, air-penetrable material which can be maintained in wet condition and through which the dry air is passed to pick up water vapor. For example, expanded metal sheets or other materials such as glass wool, ceramics, nylon or charcoal materials can be assembled so as to form a filter element satisfactory for use. The evaporating filter 28 corresponds substantially in shape and size to the air discharge duct 13 to insure that the dry air passes directly through and in intimate contact with the moisture therein. The thickness of the evaporating filter 28 varies but is sufficiently great so that it is exposed to and retains appreciable quantities of water in relation to the air flow of

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the system but is not excessively thick so as to seriously impede or obstruct air flow through the humidifier. Generally, with an evaporating filter composed of extruded strands of aluminum intertwined to produce a honey-comb effect, a thickness of about 2 inches is satisfactory and suitable. The humidifying filter element or evaporating filter 28 can be fabricated of any suitable air-penetrable, preferably non-rusting material, capable of being maintained in a wet condition.

A slot 29 extends across the top of the casing 11 through which the evaporating filter 28 is inserted into channels 24 and 25 formed by the inserts 22 and 23 of U-shaped cross section. An elongated water distribution pan 30 is adapted to fit within slot 29 and is supported therein by means of the ears 31 and 32 which rest on the horizontal flanges 26 and 27 provided on the top of the inserts 22 and 23 respectively. The pan 30 should be maintained level for proper distribution of the water over substantially the entire area of the evaporating filter pad and this can be done by raising or lowering either of the inserts 22 and 23 and locking them in the desired position on the casing 11 by means of nuts and bolts or the like. Uneven distribution of the water on the evaporating filter pad results in dry areas therein and with the dry air passing over such areas the degree of humidification is seriously lessened. The water distribution pan 30 is provided with a vertically upstanding center strip 34 which has along its upper periphery a series of spaced V-shaped notches 35. This center strip 34 serves as a weir for the water which is introduced into the reservoir pan by means of water conduit 36. A series of spaced ports 37 are provided in the bottom of pan 30 on one side of the center strip 34 through which the water flows onto the evaporating filter 28. The water is normally supplied to a water reservoir 38 behind the weir 34, that is, on the side of the weir having a solid bottom. Water flow through conduit 36 is regulated by conventional flow regulating means. Since the water flow regulating means forms no part of the present invention, it will not be shown or described in detail but it will be designated generally by the numeral 40. The water flow regulating means 40 can be electrically responsive to a humidistat of known type whereby water flow is controlled in response to the atmospheric moisture content of the room or enclosure where the humidistat is located. Excess water not retained by the humidifying filter pad 28 escapes through drainpipe 41 in the bottom 44 of the humidifier. It is preferable to employ an excess of water so that mineral deposits which tend to accumulate on the evaporating filter 28 are removed by the excess water. Upstanding flanges 45 and 46 together with bottom 44 form a sump for collection of water draining from an evaporating filter 28.

In operation, the humidifier can be mounted in a warm air furnace system in such manner that warm air from the hot air plenum of the furnace enters the dry air inlet 15 of the humidifier. As previously indicated, the humidifier can be mounted so that the direction of air flow is reversed with the dry warm air entering the duct 13. For purposes of description, it will be assumed that the direction of air flow is such that dry air enters inlet 15. Mounting of the humidifier on the furnace wall or furnace duct system is accomplished by attaching flanges 14 thereto by screws or the like. The humidifier is mounted so as to provide communication between the warm air plenum and the cold air return plenum with the flow of air naturally being from hot to cold. The air inlet 15 of the humidifier can be positioned on either side or at the bottom or the top panel of the humidifier casing with the only requirement being that it be spaced from the discharge duct 13 and permit the evaporating filter 28 to be interposed therebetween. With this construction and arrangement, the dry air driven by the blower of the furnace system passes through the wet evaporating filter 28 and picks up moisture with the humidified air dis-

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charging through discharge duct 13. The water level in section 38 of water distribution pan 30 is continually replenished from water supply line 36 in response to a signal from a humidistat or other control means. The water after passing through the V-shaped notches 35 in the weir 34 escapes through the ports 37 onto the evaporating filter 28. Excess water which is not retained by the evaporating filter 28 drains therefrom and carries away mineral deposits and is permitted to escape through drainpipe 41.

As seen, a substantial air flow produced by the furnace blower is caused to pass directly through and in intimate contact with the wet humidifying filter pad 28 thereby obtaining good humidification of substantial quantities of air passing through the system. Due to the increased efficiency of humidification of the present humidifier, it can be of smaller size than those normally required for reliable humidifying capacity to fill the vapor needs for small or large rooms or enclosures. The humidifier is exceptionally flexible and is capable of mounting in various positions so that either warm air or cold air can be humidified depending upon the circumstances. The construction of the humidifier is such that it can be installed in the furnace system in any desired position for up-flow, counter-flow, or horizontal flow from either side of the unit.

Those modifications and equivalents which fall within the spirit of the invention and the scope of the appended claims are to be considered part of the invention.

I claim:

1. In combination with an air furnace system having means associated therewith to circulate heated air, a humidifier apparatus comprising a housing of generally square cross section constructed in two parts, the first part of which having a duct opening therein for communication with the furnace system, planar flange means on said first part surrounding said duct opening on four sides thereof by which the first part can be secured to the furnace system, an evaporating filter element mounted adjacent to said duct opening, water distribution means disposed above said evaporating filter element for delivery of water thereto, the second part of said housing being constructed for telescopic fit within said first part, said second part of said housing having a duct opening in one side thereof and being constructed for rotation with respect to said first part of the housing whereby the duct opening in said second part can be variously disposed at 90° angles relative to the duct opening in said first part of said housing and means to supply water to said water distribution means.

2. A humidifier apparatus adapted for use with a furnace system which includes means to circulate heated air, said humidifier apparatus comprising a housing adapted for attachment to the furnace system, an inlet in said housing for admission of dry air into the interior thereof, an outlet in said housing for discharge of humidified air, support means including a pair of generally channel-shaped inserts attached to opposite interior walls of said housing, an evaporating filter element retained by said channel-shaped inserts in position between said dry air inlet and humidified air discharge outlet, a water distribution pan supported by the upper ends of said channel-shaped insert elements in position above said evaporating filter element for delivery of water thereto and means for supplying water to said water distribution pan, the channel-shaped inserts of said support means being individually vertically adjustable to enable leveling of said water distribution pan.

3. A humidifier apparatus adapted for use with a furnace system which includes means to circulate heated air, said humidifier apparatus comprising a housing having affixed thereto a planar flange by means of which the apparatus can be attached to the furnace system, an inlet in said housing for admission of dry air into the interior thereof, an outlet in said housing for discharge of humidi-

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fied air, support means including a pair of generally channel-shaped inserts movably attached to the opposite interior walls of said housing, an evaporating filter element retained by said channel-shaped inserts in position between said dry inlet and humidified air discharge outlet, a water distribution pan supported by said channel-shaped elements in position above said evaporating filter element for delivery of water thereto and means for supplying water to said water distribution pan, the channel-shaped inserts of said support means being individually vertically adjustable to enable leveling of said water distribution pan.

4. A humidifier apparatus adapted for use with a furnace system which includes means to circulate heated air, said humidifier apparatus comprising a housing of generally square cross section constructed in two parts, the first part of which having a duct opening therein communicating with said furnace for admission of dry air or discharge of humidified air, planar flange means on said first part surrounding said duct opening on four sides thereof by which the first part can be secured to the furnace system, support means including a pair of generally channel-shaped inserts adjustably attached to opposite interior walls of said first part, an evaporating filter element retained by said channel-shaped inserts in position adjacent said opening in said first part, a water distribution pan supported by said channel-shaped elements in position above said evaporating filter element for delivery of water thereto, the second part of said housing being constructed for telescopic fit within said first part, said second part of said housing having a duct opening in one side thereof and being constructed for rotation with respect to said first part of said housing whereby the duct opening in said second part can be variously disposed at 90° angles relative to the duct opening in said first part of said housing, and means to supply water to said water distribution pan, the channel-shaped inserts of said support means being individually vertically adjustable to enable leveling of said water distribution pan.

5. A humidifier apparatus adapted for use with a furnace system which includes means to circulate heated air, said humidifier apparatus comprising a housing adapted for attachment to the furnace system, a first opening in said housing for admission of dry air into the interior thereof, a second opening in said housing for discharge of humidified air, said housing having a slot extending substantially across the top side thereof adjacent one of said openings, support means including a pair of generally channel-shaped inserts adjustably attached to opposite interior walls of said housing, an evaporating filter element retained by said channel-shaped inserts in position between said openings in said housing, a water

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distribution pan supported by said channel-shaped insert elements in position above said evaporating filter element for delivery of water thereto and means for supplying water to said water distribution pan, the channel-shaped inserts of said support means being individually vertically adjustable to enable leveling of said water distribution pan.

6. A humidifier apparatus adapted for use with a furnace system which includes means to circulate heated air, said humidifier apparatus comprising a housing of generally square cross section constructed in two parts, the first part of which having a duct opening therein communicating with said furnace system for admission of dry air or discharge of humidified air, planar flange means on said first part surrounding said duct opening on four sides by which the said first part can be attached to the furnace system, a slot extending substantially across the top of said first part, support means including a pair of generally channel-shaped inserts adjustably attached to opposite interior walls of said first part, an evaporating filter element retained by said channel-shaped inserts in position adjacent the opening in said first part, a water distribution pan disposed within said slot in said first part of the housing above said evaporating filter element, the second part of said housing being constructed for attachment to said first part, said second part of said housing having a duct opening in one side thereof and being constructed for rotation with respect to said first part of said housing whereby the duct opening in said second part of the housing can be variously disposed at 90° angles relative to the opening in said first part of said housing, means to supply water to said water distribution pan, the channel-shaped inserts of said support means being individually vertically adjustable to enable leveling of said water distribution pan.

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