United States Patent [19]

Bitz

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[54] **AIR HUMIDIFYING UNITS FOR ROOM-TYPE AIR CONDITIONERS**

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[52] **U.S. Cl.** **165/21,** 261/80, 165/60

[51] **Int. Cl.** **F24j 3/14**

[58] **Field of Search** 165/19, 20, 21; 261/80, 60

[56] **References Cited**

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Primary Examiner—Charles Sukalo
Attorney—Synnestvedt & Lechner

[57] **ABSTRACT**

An air-humidifying unit for use with room air conditioners of the window or through-the-wall type having energizable and de-energizable air-cooling means and means for circulating air past the air-cooling means and into the room, the unit being adapted for installation in a new air conditioner during its manufacture or in previously manufactured air conditioners as an attachment thereto. The unit includes a housing mounted opposite to the outgoing air passageway of the air conditioner, the housing enclosing a water tank and an endless water-absorbing belt mounted with lower runs thereof immersed in the water in the tank and upper runs thereof in the path of air issuing from the air passageway. The drive of the belt is under the control of a humidistat.

5 Claims, 8 Drawing Figures

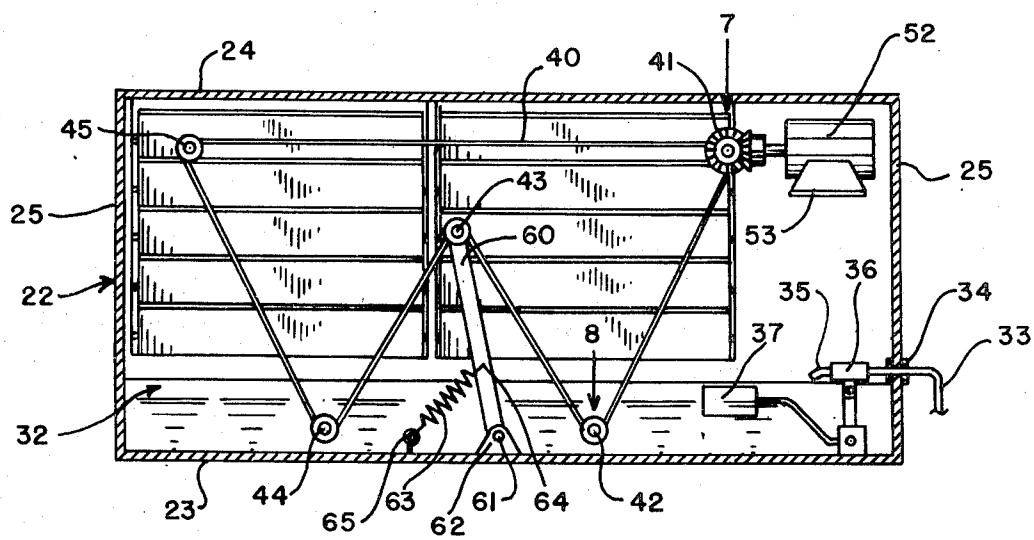


FIG. 1

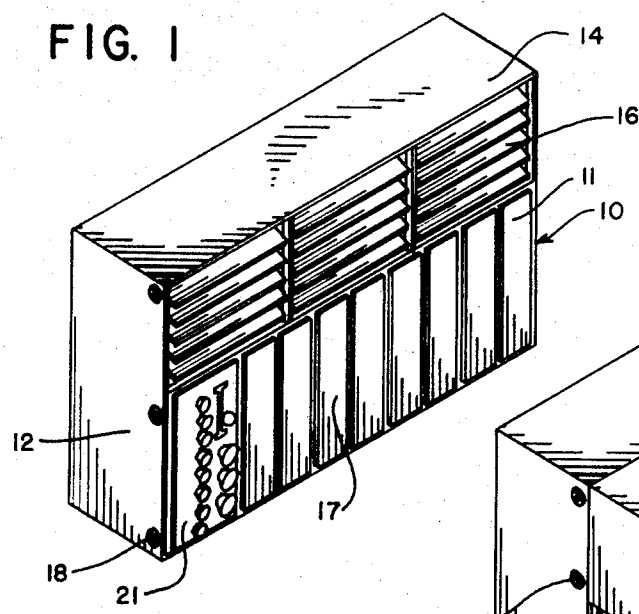


FIG. 2

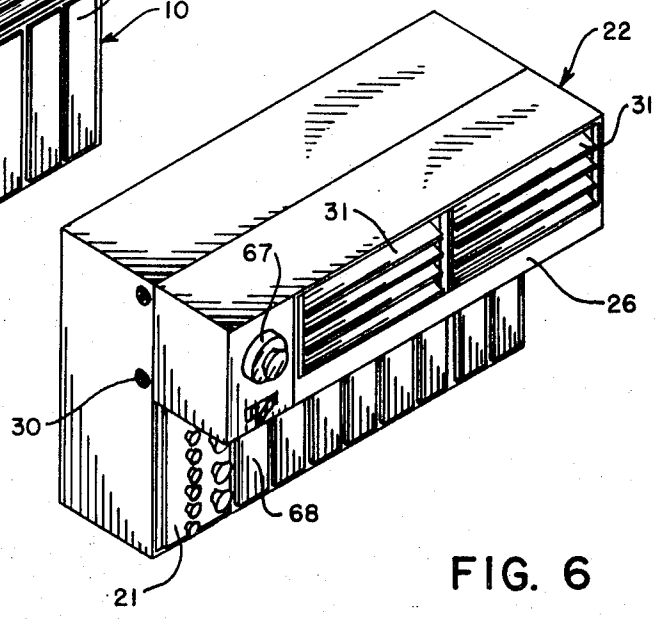


FIG. 5

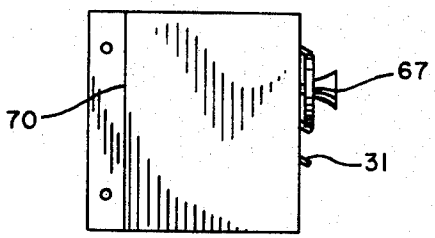


FIG. 6

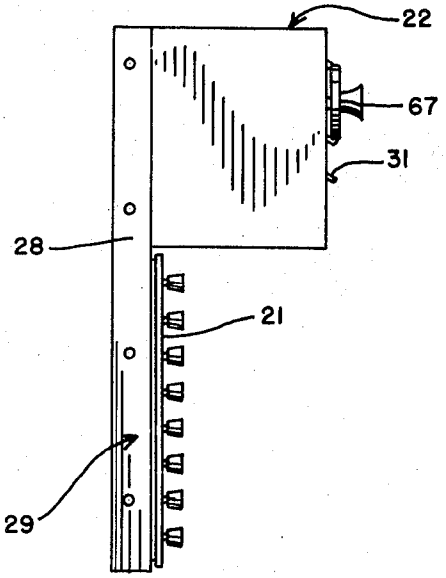
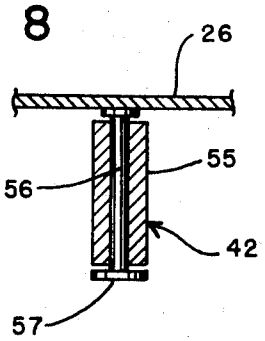


FIG. 8



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FIG. 3

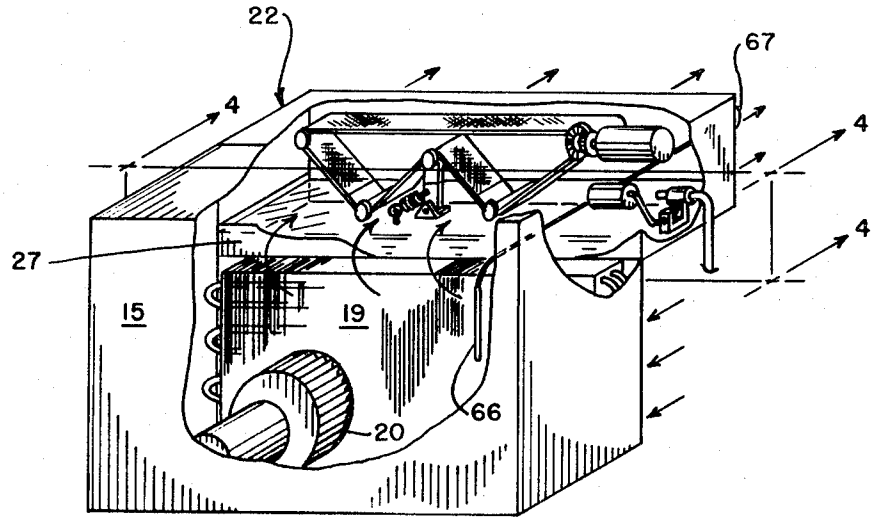


FIG. 4

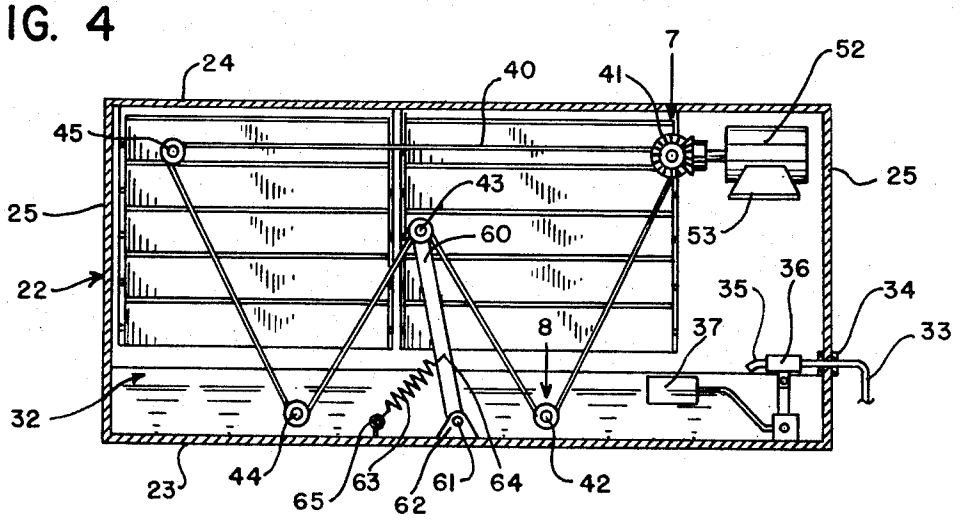
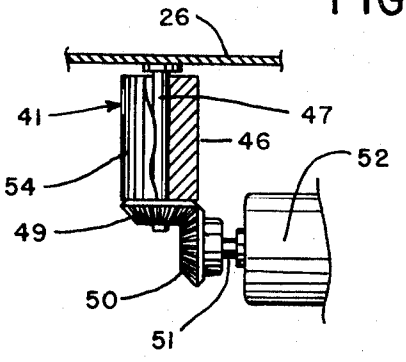


FIG. 7



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AIR HUMIDIFYING UNITS FOR ROOM-TYPE AIR CONDITIONERS

BACKGROUND OF THE INVENTION

Room air conditioners of the window or through-the-wall type, normally employed only in hot summer weather, as conventionally constructed include an energizable and de-energizable refrigerating system for cooling a stream of air which may be selectively drawn from the exterior of the room or from the interior thereof, or both, and discharged into the room, the air conditioner serving, when the refrigerating unit is energized, as an air cooling, filtering, dehumidifying and circulating means, and when the refrigerating system is de-energized, as an air filtering and circulating means. It has heretofore been proposed to adapt such air conditioners for use in situations where humidification rather than dehumidification of the circulated air is essential as in winter months in climates where room heating is required and the heating system is such that it does not itself supply the desired moisture vapor content to the room air. Examples of such prior proposed conditioners are illustrated in U.S. Pats., No. 2,303,865, issued Dec. 1, 1942, and No. 2,062,042, issued Nov. 24, 1936.

A major disadvantage of the previously proposed air conditioners embodying air-humidifying systems in addition to the conventional refrigerating means and exemplified by the above-mentioned patents, is that they require substantial modification of the air conditioner per se and do not lend themselves to association with air conditioners of standard types as an attachment thereto.

OBJECTS OF THE INVENTION

Accordingly, a principal object of the instant invention is the provision of a humidifying unit enclosed in its own individual cabinet or housing, the latter being adapted for mounting on a conventional type of air conditioner in the path of air flow therefrom.

More particularly, an object of this invention is the provision of an air-humidifying unit for assembly with an air conditioner during or after the manufacture thereof which requires no modification of the air conditioner other than the substitution of the unit for the front cover plate, in whole or in part, of the air conditioner.

Another object of this invention is the provision of a humidifying unit adapted for association with old or new air conditioners of the window or through-the-wall type which includes a water tank and a water-absorbing element mounted for movement through the water in the tank and thereafter into the path of movement of the air whereby a more efficient conversion of water to water vapor and its dissemination into the air stream is obtained as compared to the previously proposed air conditioners of the above referred to types.

A further object of this invention is the provision of a humidifying unit as referred to above in which the water-absorbing element is an endless belt.

A still further object of this invention is the provision of a humidifying unit as referred to in the last-mentioned object of the invention in which the belt is driven by a motor, the operation of which is under the control of a humidistat located in the path of air flow from the room to the conditioner whereby the moisture vapor content of the air in the room may be maintained at the desired level.

Additional objects of the invention will become apparent from the description thereof which is to follow.

SUMMARY OF THE INVENTION

In accordance with the instant invention, a self-contained humidifying unit is provided, the unit being adapted for substitution for at least a portion of the front cover plate of a conventional window or through-the-wall air conditioner, and particularly for the louvred portion of the front cover plate opposite the air passageway leading from the conditioner to the room. The humidifying unit includes a housing or cabinet structure, the lower portion of which defines a water tank or pan. The water is maintained at the desired level in the tank by preferably connecting the tank to a water main or other water source through a float-controlled valve. An endless belt of water-absorbing material is supported for movement into the water bath in the tank and thereafter above the water bath and into the path of the air stream discharged by the air conditioner. The front or forward wall of the housing is suitably louvred to permit the emission of air therefrom into the room. The belt is driven by a motor of conventional type, the operation of which is suitably controlled by a humidistat located in the path of room air being drawn into the conditioner whereby the moisture vapor content of the room may, within reasonable limits, be selected as desired.

Under hot and dry conditions of the outside air, the humidifier is operated simultaneously with the refrigerating or air-cooling mechanism of the air conditioner whereby the air passing into the room, which may be drawn from both inside and outside the room, is cooled and humidified. On the other hand, where the unit is used during the winter season in conjunction with room heating, the cooling unit is de-energized and the air-circulating system adjusted to draw warm air from the room and through the humidifying unit and discharge it into the room.

As will be appreciated from the above, the humidifying unit of this invention requires no radical changes or modifications in standard-type air conditioners employed in windows or other openings of a room wall. When the unit is employed in conjunction with room heating, the closed circuit through which the air is caused to travel as it passes from the room to the air conditioning and humidifying units and then again to the room eliminates contact of such recirculated air with cold exterior air which could cause freeze-ups in the circulating system.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a standard type air conditioner for installation in a window or other opening in the wall of a room;

FIG. 2 is a perspective view of the air conditioner of FIG. 1 modified to incorporate the humidifying unit of the instant invention;

FIG. 3 is a perspective view of the unit of FIG. 2 but looking from the rear side thereof, parts being broken away for clearness of illustration;

FIG. 4 is a sectional view on an enlarged scale taken on the line and in the direction of the arrows 4—4 of FIG. 3;

FIG. 5 is an end view of a humidifying unit of the instant invention in one embodiment thereof;

FIG. 6 is an end view of a humidifying unit of the instant invention in a second embodiment thereof;

FIG. 7 is a detail view on an enlarged scale looking in the direction of the arrow 7 of FIG. 4; and

FIG. 8 is a detail view on an enlarged scale looking in the direction of the arrow 8 of FIG. 4.

Referring first to FIG. 1, there is shown a standard-type air conditioner 10 such as the Model S Series conditioner presently manufactured by Friedrich Refrigerators, Inc. of San Antonio, Tex. However, it will be understood that the unit of this invention, hereafter to be described, is not limited for use with this particular model, and other models, such as Friedrich models of the Y and E Series and air conditioners manufactured by Fedders Corporation of Edison, N.J. and sold under the trademarks Ductaire, Adapomatic and Adaptopak, as well as the air conditioners of other manufacturers, may be used. The conditioner includes a suitable sheet metal casing or housing defined by a front panel 11, end panels 12, a top panel 14, a bottom panel (not shown), and a rear panel 15 (see FIG. 3). The front panel 11 is provided with an upper louvred section 16 through which conditioned air is discharged into the room and a lower louvred section 17 through which air is drawn into the conditioner from the room when the recirculation of room air is desired. The two sections 16 and 17 of front panel 11 are usually formed as an integral piece and the panel is removably secured in place. Thus, panel 11 is provided with right-angled flanges projecting rearwardly from its several edges, the flanges being received within the casing defined by the end, top and bottom walls, the flanges fitting snugly against the walls. The front panel is secured by screws or bolts 18 penetrating the end walls adjacent the forward edges thereof and the underlying flanges of the front panel. The casing encloses the usual elements of an air conditioner including an energizable and de-energizable air-cooling system and an air-circulating means or fan controllable to draw air from the inside or outside or both of the room past the air-cooling mechanism and through the louvres in the upper section 16 of the front panel and into the room, said system and means being indicated by the reference characters 19 and 20 respectively in FIG. 3. In addition, the conditioner may serve as a room heater for cold weather, the conditioner in such case also including an energizable and de-energizable heating unit in the path of the air flow. Inasmuch as the air-cooling and heating systems, air-circulating means and other such standard parts per se form no part of the instant invention and may be of any conventional type, they have been shown only diagramatically. The air conditioning unit 10 carries a control panel 21 (see FIG. 1) carrying the necessary control elements to, in addition to adjusting the unit as a whole between an off and on condition, energize the cooling and heating units, if the latter unit is included, under thermostatic control, energize the air-circulating means or fan with or without heating or cooling, set the air-circulating means for automatic control by the thermostat means, and to adjust the air-circulating means to draw air from the inside or from the of the room, or both, or to exhaust air fromthe room to the outside thereof.

Referring now particularly to FIGS. 2, 3 and 4, the air conditioner is shown with the humidifying unit 22 of the instant invention installed thereon at the location of the upper section 16 of panel 11. The humidifying unit 22 includes a housing or cabinet having bottom and top walls 23 and 24 respectively, end walls 25, and a front wall 26, the rear side of the cabinet being left open except for a low wall 27 employed for purposes hereafter to be described. The several walls, which suitably are made of plastic sheet materials but which may be made of other materials such as sheet metal, are secured together to form the housing in any desired way. To accomodate the unit 22, the upper section 16 of the conventional front wall 11 of the conditioner may be cut away, leaving only the lower section 17 thereof. Alternatively, unit 22 may be provided with a downwardly extending panel 29 (see FIG. 6) of the same type as and in substitution for front panel section 17 of the air conditioner. In any event, the top and end walls of the housing of unit 22 suitably include extensions or flanges 28 received within the cabinet structure of the air conditioner 10 similarly as were the flanges of the original front panel 11. The extensions or flanges on at least the end walls are suitably secured to the end walls of the conditioner casing structure as by screws 30. Front wall 26 is louvred as indicated at 31, the louvres preferably being in the form of adjustable vanes as is conventional in air conditioning units, whereby the air stream issuing from the unit may be directed in different paths.

Referring now particularly in FIGS. 3 and 4, the lower portion of the cabinet or housing of the humidifying unit defines a water tank or reservoir indicated generally at 32. As will be noted, the louvred section of the front wall 26 is elevated sufficiently above the bottom wall to leave an imperforate lower portion which forms the front wall of the tank or reservoir. Rear wall 27 previously mentioned extends upwardly only sufficiently to define the rear wall of the tank in order to leave the major portion of the back side of the unit open to the passage of air thereinto from the air conditioner. In order to keep the tank supplied with water, a water line 33 connected to any suitable source of supply, such as the water main of the building in which the unit is to be employed, penetrates end wall 25 of the housing through a suitable fitting 34. The conduit or pipe 33 terminates in a discharge nozzle 35 overlying the reservoir. Between the discharge nozzle 35 and end wall 25, conduit 33 is provided with a float-controlled valve 36 of conventional type, the float 37 and its associated structure serving to maintain the valve in an open position when the water is below a desired level and to close the valve when the water reaches such desired level. Alternatively, the tank may be manually filled from time to time through an opening (not shown) in upper wall 24 which may be provided for that purpose and which may be closed at other times by a plug or cap (not shown).

Referring now particularly to FIGS. 3, 4, 7 and 8, an endless belt 40 composed of a water-absorbing material is mounted within the housing of unit 22 for travel longitudinally of the housing and into and out of the water bath. The belt may be made of any suitable material such as natural or synthetic fibers, foamed rubber, or a plastic material such as a propylene water-absorbing material. In any event, the belt is of a character to readily absorb water during its travel beneath the surface thereof and to readily give up moisture vapor to the air during its travel above the water bath. The belt

is mounted on a plurality of support means 41 to 45 inclusive for travel in a path as illustrated, whereby each portion of the belt is immersed in the water bath, then raised above the water into the path of the air stream passing through the unit 22, is again immersed in the bath, is then again raised above the bath, and thereafter proceeds in a straight horizontal run above the water bath and in the path of the air stream.

Belt support means 41 (see particularly FIG. 7) comprises a roller 46 mounted for rotation on a pin 47 secured in any suitable way to the front wall 26 of the housing to project at right angles thereto. Roller 46, which may suitably be made of a plastic material, has a bevel gear 49 affixed to its end remote from wall 26. Gear 49 meshes with a bevel gear 50 secured for rotation with the drive shaft 51 of an electric motor 52 mounted on a shelf or platform 53 supported by any suitable means within the housing or cabinet structure of unit 22 as by being secured to the inner face of the front wall 26 and the adjacent end wall 25 of the housing. Roll 46 is of relatively large diameter and suitably is fluted as illustrated at 54 to provide adequate driving contact with the belt.

Referring now particularly to FIG. 8, support means 42, in its preferred embodiment, consists of a roller 55, preferably of substantially smaller diameter than roller 46, roller 55 being supported for rotation on a pin 56 of the same type as pin 47 and similarly mounted on the front wall 26 of the housing. Pin 56 has a head or flange 57 to maintain the parts in assembled relationship. Alternatively, the roller 55 may be omitted and the belt allowed to ride on pin 56. Support means 43, 44 and 45 are of the same construction as support means 42 except that, with respect to support means 43, the pin 56 is secured to and projects from a lever arm 60 adjacent the upper end of the arm. Lever arm 60, which lies adjacent to the front wall of the housing, is pivotally mounted for rocking movement in directions longitudinally of the housing by a pivot pin 61 carried by a bracekt 62 affixed to the housing bottom wall 23. Lever arm 60 is urged to rock in a counterclockwise direction, as viewed in FIG. 4, on pivot pin 61 by a tension spring 63 which has one end connected as at 64 to the lever arm intermediate the length of the latter and its other end connected to a pin 65 suitably affixed to the front wall of the housing. The lever arm and its associated structure serves as a belt tightener as well as a means to elevate the central portion of the lower run of the belt above the level of the water in the tank or reservoir. As will be observed, the construction and arrangement of the belt support means 41 to 45 are such as to permit easy removal and replacement of the belt 40.

The operation of motor 52 is controlled by a humidistat which may be of any conventional or suitable type and which is illustrated only diagramatically at 66 in FIG. 3. The humidity-measuring element of the humidistat is positioned to lie in the path of room air returning to the conditioning unit through the louvres of front panel 17 of the conditioner. The setting of the humidistat is controlled by a knob 67 mounted on the front wall of the housing enclosing unit 22. The circuit to motor 52, in addition to the humidistat control, suitably includes an off-on switch 68 as shown in FIG. 2. Alternatively to positioning the controls 67 and 68 on a separate panel, they may be included and integrated with those on the main control panel 21, if desired.

As previously pointed out, a unit incorporating the instant invention as described above may be of either of the forms illustrated in FIGS. 5 and 6. Also, it may be installed on a conventional room air conditioner either during its manufacture or thereafter. Assuming for the purposes of the present explanation that the unit is to be installed on a previously manufactured air conditioner, the front wall or panel 11 of the air conditioner is first removed. If the unit of the instant invention is in the form shown in FIG. 5, the upper portion 16 of panel 11 is severed from the lower portion 17 and the latter replaced in the air conditioner housing. The unit 22 of the instant invention is then positioned opposite the opening left by removal of panel portion 16 and the rear margins of its top, bottom and end walls are slid into the air conditioner housing for a short distance as, for example, the distance between the rear edge of end panel 24 and line 70 as shown in FIG. 5. The overlapping margins of the end panels of the unit and of the housing are then secured together as by screws or bolts 30 previously referred to. Water line 33 is then connected to any suitable water source, such as a water main, and the circuit to motor 52 is connected into a main electrical circuit. The unit is then ready for operation in conjunction with the operation of the air conditioner set to circulate and cool or heat the air, or to circulate the air only, as conditions may require. If the unit in the form shown in FIG. 6 is employed, the preparatory steps are the same except that the unit with its depending front wall potion 29 is substituted as a whole for the front panel 11 of the conditioner.

Upon completion of the installation of the unit, the dial 67 of the humidistat is set to provide the desired relative humidity of the room air. Assuming that it is wintertime and humidification, or humidification plus heating, of the air is what is desired, the controls on panel 21 of the air conditioner are adjusted to de-energize the cooling means, to energize the heating means, if heating is required, and to cause recirculation of the air within the room. Switch 68 is then turned to its on position to energize motor 52. Upon the operation of the unit, the air stream passing therethrough evaporates moisture carried by the exposed portions or runs of belt 40 and discharges it as moisture vapor into the room. When the desired relative humidity has been reached, the humidistat de-energizes motor 52 and brings the humidification unit to a halt, the unit remaining inactive until the relative humidity has fallen sufficiently that the humidistat again energizes the motor. If the unit of the instant invention is to be employed when the air is hot but dry, the operation is the same except that the controls on the panel 21 of the air conditioner are set to cause operation of the air-cooling unit and, if desired, to draw air both from the room and from the exterior of the building. Inasmuch as the humidity-measuring means of the humidistat is in the path of air flow from the interior of the room to the air conditioning unit, the relative humidity of the air within the room will again be the controlling factor in the operation and nonoperation of the humidifying unit.

As will be appreciated from the foregoing description, a unit of the present invention, and particularly one of the construction of FIG. 6, may be substituted for the front panel of the air conditioning unit with which it is designed for association at any selected time, and similarly, may be disassociated therefrom whenever desired. For example, in climates requiring air

cooling but no humidification in the summer months and only humidification in the winter months, the unit may be installed on the air conditioner for the winter months and then removed and replaced by the standard front panel **11** of the air conditioner. Alternatively, the unit may be left in place on the air conditioner during the summer months, it only being necessary to cut off the water supply to the tank and leave the switch **68** in its off position to inactivate the unit.

It will be understood that the capacity of the humidifying unit with respect to the quantity of moisture vapor discharged thereby will depend upon a number of factors including the water-absorbing capacity of the belt, the width of the belt and the lengths of the exposed runs thereof, the speed at which the belt is driven, and the like. Also, in the application of the humidifying unit to an air conditioner designed to perform its air conditioning function in respect to a room of a particular size, or rooms in a particular range of sizes, the above-mentioned factors will be selected to provide the proper humidification for a room of such size or rooms of such range of sizes.

Having thus described my invention in complete detail, it will be understood that these details need not be strictly adhered to, but various changes and modifications may be made, all falling within the scope of the invention.

Iclaim:

1. A unit for attachment to a room air conditioner including air temperature controlling means, means for circulating air past said air temperature controlling means, a horizontal air passageway leading from said air temperature controlling means to the room, and a front panel member having a perforate portion at the location of said air passageway, said unit comprising a casing, means for removably mounting said casing on an air conditioner exteriorly thereof and opposite to the horizontal air passageway leading to the room and in substitution for a perforate portion of the front panel thereof at the location of said air passageway, said casing being constructed and arranged to define a path for air movement therethrough from said air passageway to said room, and there is means within said casing and in the path of movement of air therethrough for subjecting air to humidification, said last-named means comprising means in said casing for containing a water bath and a water-conveying element mounted for movement into said water bath-containing means and therefrom into said path for air movement into said room, and there is means for moving said water-conveying element.

2. A unit as defined in claim **1** wherein said water-conveying element comprises a traveling endless belt and said means for moving said water-conveying element comprises means for driving said belt.

3. A unit as defined in claim **2** wherein said unit includes a humidistat and said means for driving said belt comprises a motor and there is means controlled by said humidistat for energizing and de-energizing said motor.

4. A unit as defined in claim **1** wherein said means for containing a water bath comprises a tank and means for supplying water to and maintaining a constant level thereof within said tank.

5. A unit as defined in claim **1** wherein said means within said casing for containing a water bath comprises a water tank, and there is means for supplying water to and maintaining a constant level thereof within said tank, and wherein said water-conveying element comprises an endless, water-absorbing, traveling belt, there is means supporting said belt for travel within said tank below and above said water level, and there is a humidistat and means under the control of said humidistat for driving said belt.

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