

Oct. 28, 1969

H. P. C. KEULS
AIR PURIFIER AND HUMIDIFIER

3,474,598

Filed Feb. 27, 1968

4 Sheets-Sheet 1

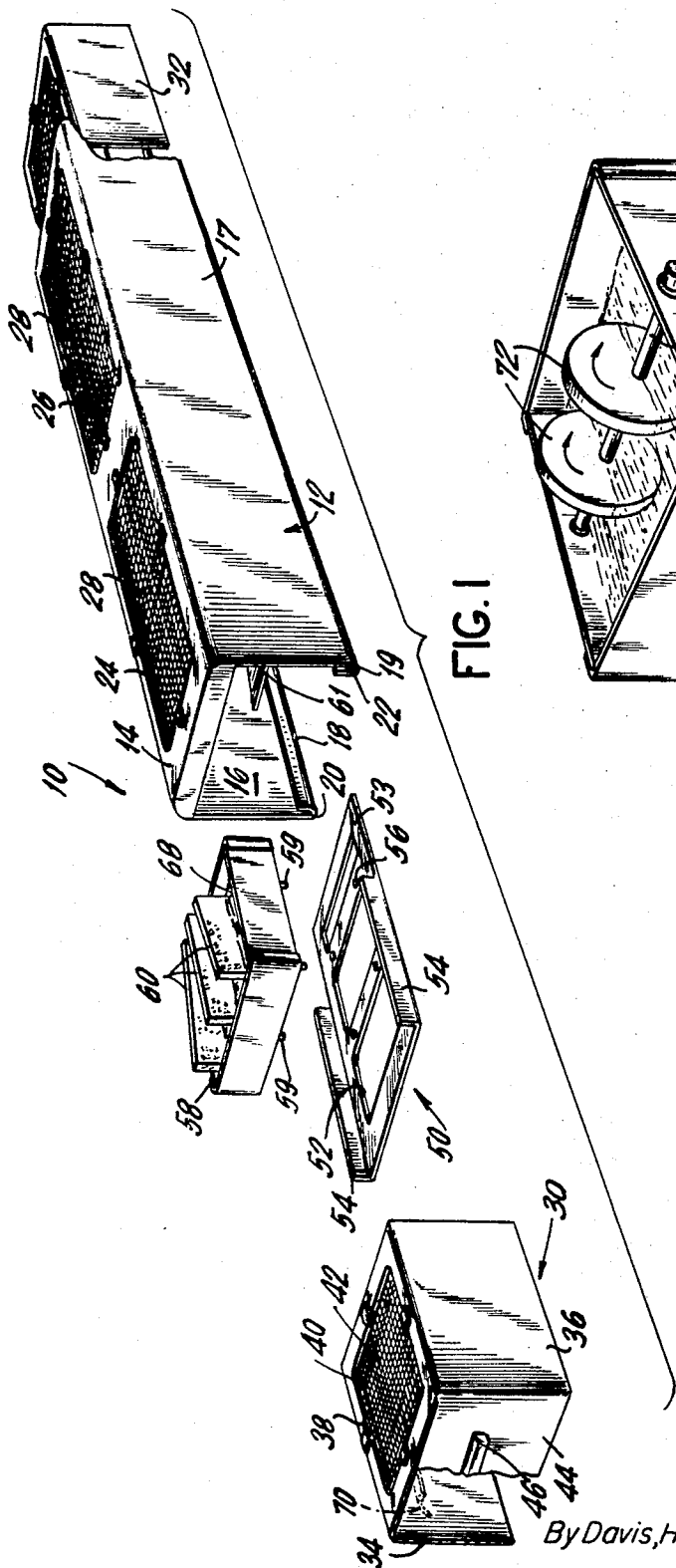


FIG. 1

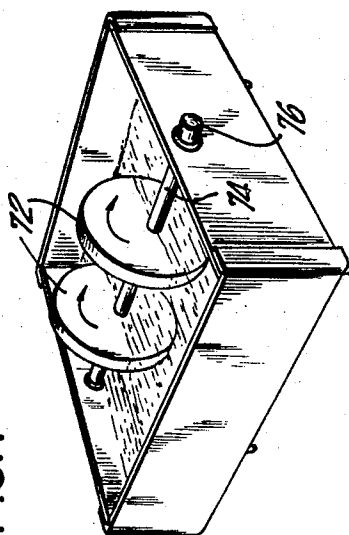


FIG. 5

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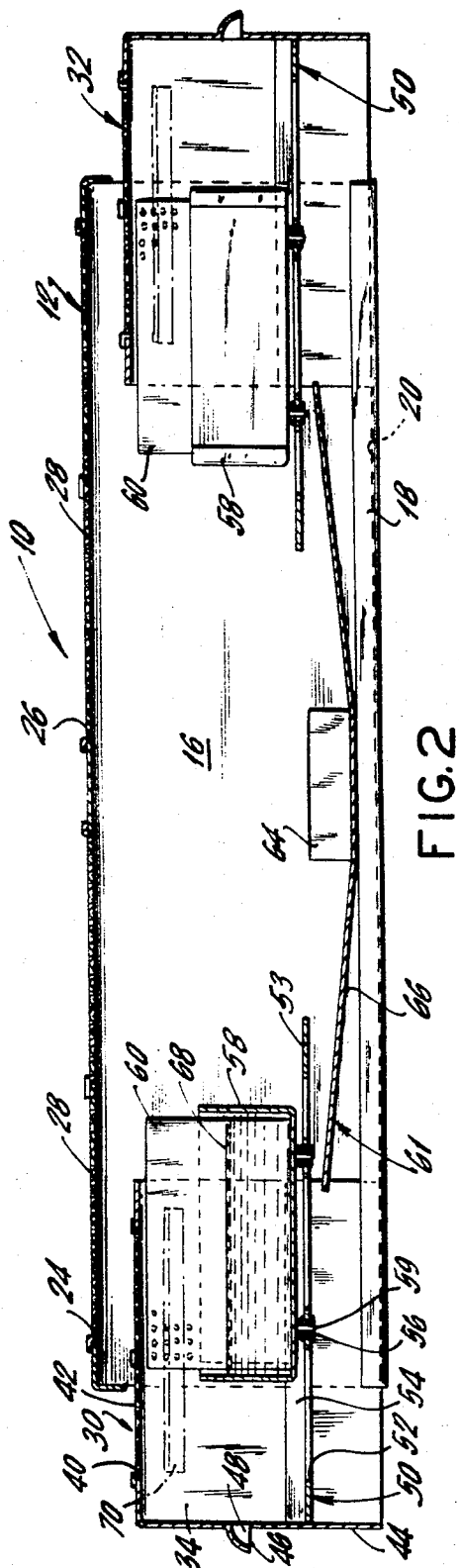


FIG. 2

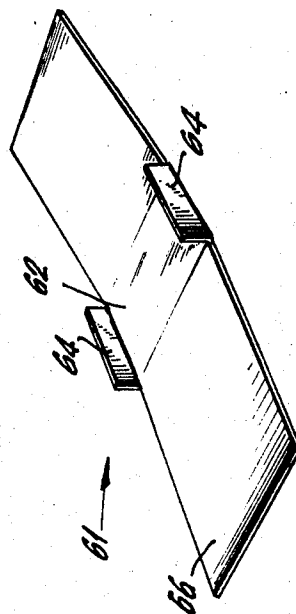


FIG. 4

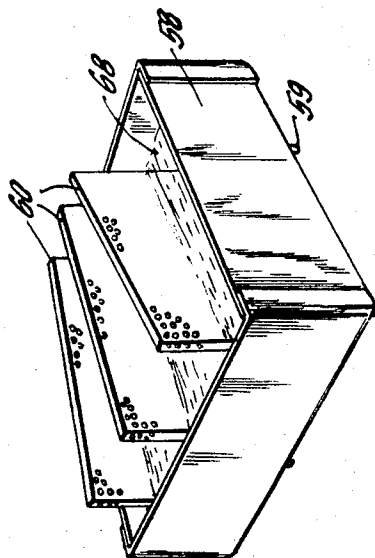


FIG. 3

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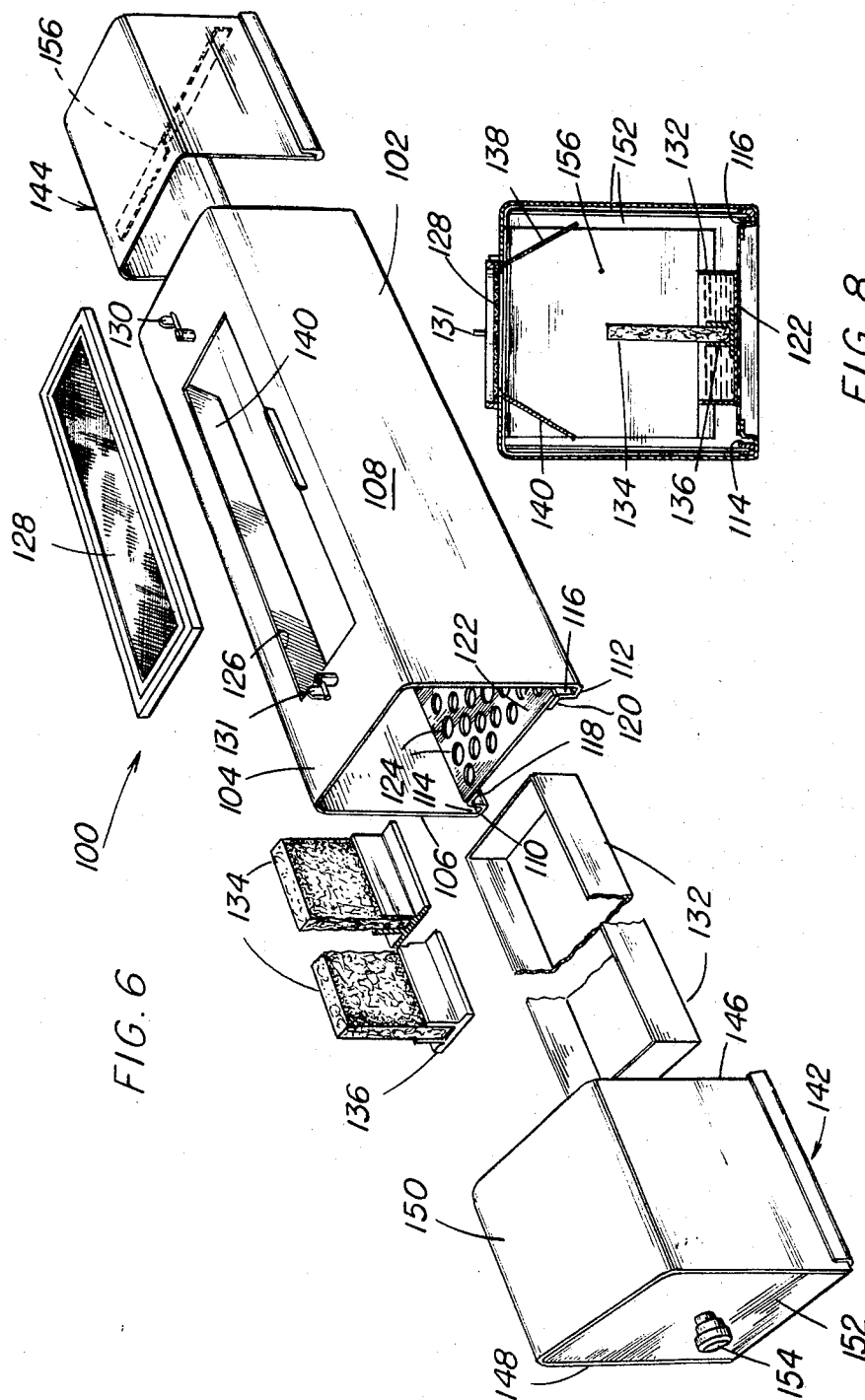


FIG. 8

FIG. 6

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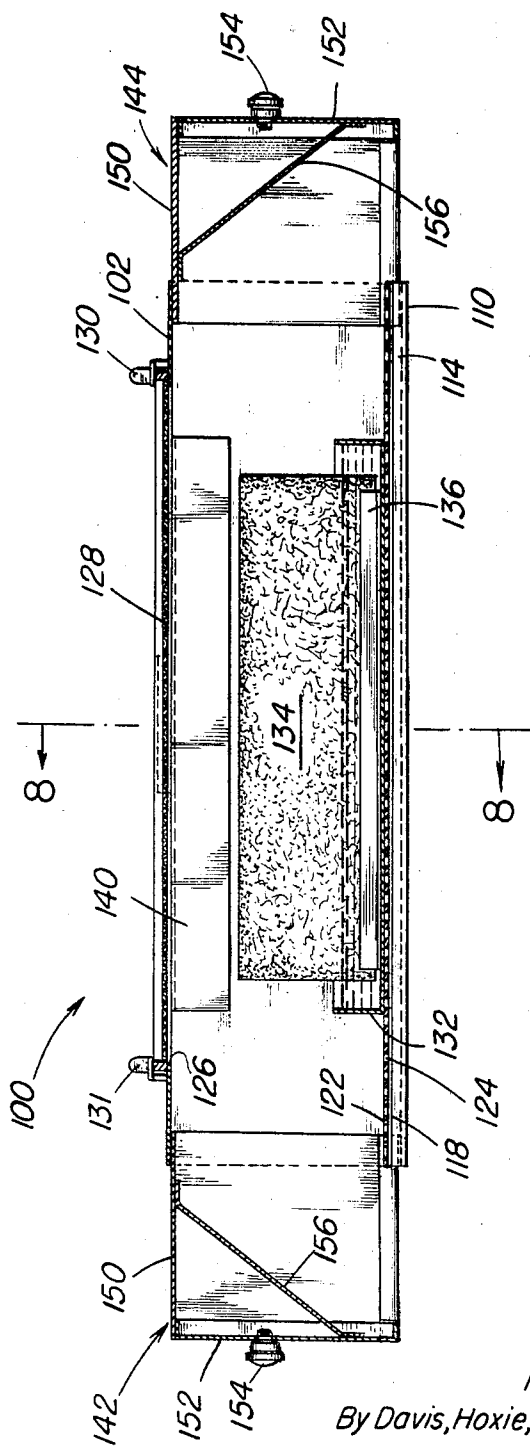
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FIG. 7



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AIR PURIFIER AND HUMIDIFIER

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Continuation-in-part of application Ser. No. 650,735,
July 3, 1967. This application Feb. 27, 1968, Ser.
No. 708,709

Int. Cl. B01d 47/02

U.S. Cl. 55—234

8 Claims

ABSTRACT OF THE DISCLOSURE

An air purifier and humidifier having an air outlet with a filter element thereacross, an air inlet and a removable reservoir. A water absorbing wick extends from the reservoir and air, entering through the inlet, is directed to flow over the reservoir by baffles mounted in the housing and impinge upon the wick causing dirt entrained in the air to become wet and adhere to the wick.

This is a continuation-in-part of copending application Ser. No. 650,735 filed on July 3, 1967.

This invention relates to air purifiers and humidifiers and, more particularly, to such devices for use with heating and air conditioning systems.

Many office buildings and apartment houses are equipped with a central air conditioning and heating system, referred to herein as an air temperature control system, of the type employing a forced air flow. Outside air enters the system through a filtered louver which removes a substantial portion of the dirt and dust suspended in the air. The air then flows across coils and through ducts during its passage to the individual rooms. Each room is provided with one or more units through which the air flows, entering into the room usually through a horizontal louver on the top of the unit.

The ducts, coils, and other equipment within the system accumulate substantial dust and dirt with time and, albeit the air is partially purified as it enters the building, it often becomes dirt laden as it flows through the duct system. The resident dust and dirt in the system produces an unpleasant odor which is carried into the individual rooms by the flowing air. Consequently, there is a need for an air purifier to remove the dust, dirt and odor as the air leaves the air temperature control system and enters into the individual rooms. Furthermore, forced hot air systems are noted for their dryness during the heating season and it is desirable to humidify the air as it enters the room.

Accordingly, it is one object of this invention to provide an air purifier to be used in conjunction with a standard air temperature control system exhaust unit which effectively purifies and humidifies the air.

It is another object of this invention to provide an air purifier and humidifier which is adjustable in length to permit use with existing exhaust units of different lengths and which is cleaned easily.

Brief summary of invention

Briefly, this invention, in one form, comprises an inverted U-shaped housing wherein the bottom of the side walls are turned inwardly and upwardly to provide glide channels along the length of the housing. The top wall is provided with at least one elongated air outlet which has a removable filter element mounted thereacross.

A sleeve formed of a pair of side walls, an end wall, and a top wall, is slidably mounted within each end of the housing. The lower portion of the side walls are placed within the longitudinal glide channels to facilitate relative sliding motion between the sleeves and the housing.

A water reservoir is removably mounted within the purifier and has at least one wick supported therein which absorbs water from the reservoir and provides an increased and roughened surface area across which the incoming air flows. The housing and sleeves have baffles or air guides mounted therein to direct the incoming air toward the reservoir and wick.

Forced air exiting from the air temperature control system unit enters the air purifier through the bottom of the housing. The air flows upwardly around the reservoir and is directed toward the wick whereupon it impinges against the wick and the air and dirt particles become moisture laden. A great majority of the dirt particles adhere to the wick or fall into the reservoir and those particles not removed by the wick or reservoir are removed by the filter element through which the air flows as it leaves the purifier. The resultant air is effectively filtered and humidified.

The sleeves, being slidable within the housing, permit adjustment of the length of the purifier to correspond to the length of the existing air temperature control system exhaust unit. The reservoir is removed easily for refilling and the filter element and wick are removed easily for cleaning purposes.

Description of the drawings

The above discussed objectives and attendant advantages as well as others will become apparent from the description below and the drawings in which:

FIGURE 1 is an exploded, perspective view of an air purifier formed in accordance with a first embodiment of this invention,

FIGURE 2 is a longitudinal sectional view of the air purifier of FIGURE 1 shown in its expanded position,

FIGURE 3 is a perspective view of a water reservoir having wicks placed therein,

FIGURE 4 is a perspective view of a baffle for guiding the flow of air,

FIGURE 5 is a perspective view of a reservoir having rotary discs mounted therein,

FIGURE 6 is an exploded, perspective view of an air purifier formed in accordance with a second embodiment of this invention,

FIGURE 7 is a longitudinal sectional view of the air purifier of FIGURE 6 shown in its expanded position, and

FIGURE 8 is a sectional view taken along line 8—8 of FIGURE 7.

First embodiment (FIGURES 1-4)

With reference to the drawings, and specifically FIGURES 1 and 2, there is illustrated an air purifier and humidifier 10 (above and hereinafter referred to as a "purifier") of the type adapted to be placed on top of a standard exhaust unit (not shown). The purifier 10 comprises a primary housing 12 formed of an upper wall 14 and a pair of downwardly extending side walls 16, 17 formed with upwardly inwardly turned lower edges 18, 19 respectively which, in addition to providing rigidity to the housing 12, also form longitudinal glide channels 20, 22. Air outlets, two of which are shown at 24, 26, extend through the upper wall 14 and consume a majority of the surface of the upper wall. A conventional filter element 28 is removably mounted across each of the outlets 24, 26 to permit easy removal, cleaning, and replacement. The length of the housing 12 corresponds with the length of the smallest conventional air temperature control system exhaust unit outlet, which is approximately 24 inches long.

In order to provide for extension of the purifier 10 to a length corresponding to longer exhaust units a pair of sleeves 30, 32 are provided, one sleeve being slidably

inserted within each end of the primary housing 12. The sleeves are identical in structure and comprise a pair of side walls 34, 36 and an upper wall 38 forming a generally U-shaped member. The upper wall 38 has an air outlet 40 therethrough which consumes a majority of the upper wall's surface area and, as with the air outlets 24, 26 of the primary housing 12, an easily removable filter 42 is placed thereacross. The side walls 34, 36 extend straight downwardly and are received within the glide channels 20, 22 of the primary housing 12. One end wall 44 is attached to the outer end of each of the sleeves 30, 32 and has a handle-shaped louver 46 mounted thereon. An air exhaust port 48 extends through the end wall 44 and is aligned with the handle-shaped louver 46 so that the handle 46 serves as a louver, a deflector and a handle for facilitating sliding the sleeves 30, 32 relative to the housing 12.

Mounted within each of the sleeves 30, 32 is a floor 50 having a plurality of air passageways 52 extending there-through. The length of the floor is greater than the length of the sleeves 30, 32 so that when the sleeves 30, 32 are extended to the end of the housing 12 an extension portion 53 of the floor 50 projects into the housing 12 for reasons described below. The floor 50 is provided with upwardly turned flanges 54 on each side thereof to permit the floor to be spot welded to the side walls 34, 36 of the sleeves. The floor is mounted at a point intermediate the top wall 38 and the lower edge of the side walls 34, 36 and has four rubber grommets 56 mounted therein.

Adapted to be placed upon the floor 50 is a reservoir 58 in the form of a rectangular container. Extending downwardly from the bottom of the reservoir 58 are four legs 59 spaced apart and arranged to correspond to the rubber grommets 56 in the floor 50. The reservoir 58 is placed on the floor with the legs placed on the grommets which support the reservoir and dampen any vibrations caused by air flowing within the purifier 10. The legs 59 are long enough to provide a clearance between the reservoir 58 and floor 50 in order to allow the air to circulate around the reservoir.

Supported within the reservoir 58 are a plurality of wicks 60, which are illustrated clearly in FIGURE 3. The wicks 60 extend from the bottom of the reservoir to a point above the upper surface of the reservoir. The wicks are very absorbent and provide a large, wet, rough surface area. To increase the wick total surface area, the two outer wicks are aligned at an angle to the longitudinal axis of the reservoir. One material that has been found suitable for this use is a material sold commercially under the name "Vapoglas" by the Skuttle Manufacturing Co., Milford, Mich. Another suitable material is fused alumina sold commercially under the trademark "Alundum" by the Norton Company.

The sleeves 30, 32, having the reservoir 58 partially filled with water mounted therein, are inserted within the housing by placing the side walls 34, 36 within the glide channels 20, 22 and sliding the sleeves inwardly. Air enters the housing 12 from the bottom and, in order to prevent the air from flowing directly out through the openings 24, 26, a baffle 61, illustrated in FIGURE 4, is mounted near the bottom of the housing. The baffle 61 is formed with a central portion 62 having upwardly turned flanges 64 to facilitate spot welding the baffle to the side walls 16, 18 of the housing. The distance between the flanges 64 is equal to the inside dimension of the housing 12. Extending longitudinally in both directions from the central portion 62 are baffle plates 66 which are slightly oblique to a horizontal plane through the central portion 62. An angle of approximately 6° above the horizontal is satisfactory. The width of the baffle plates 66 is slightly less than the inside width of the sleeves 30, 32 to allow for the movement of the sleeves.

The baffle 61 is mounted within the housing in line with the top of the inwardly upwardly turned bottom of

the side walls 16, 18 so that the baffle plates 66 rise above the glide channels 20, 22 as they approach the ends of the housing 12. The floor 50 of the sleeves 30, 32 is located at a position spaced from the bottom of the sleeves' side walls 34, 36 so as to provide a clearance between the baffle plates 66 and the floor 50 in order to effect desired circulation of the air around the baffle plate 66 and upwardly through the air passageways 52 in the floor 50.

Operation of purifier

The purifier 10 is placed on an air temperature control system exhaust unit of the type having exhaust air flowing upwardly. This system provides relatively high pressure, fast flowing air which enters the housing through the bottom thereof. The air baffle 61 causes the air to flow toward the ends of the housing 12 and into the sleeves 30, 32. The air entering the sleeves flows upwardly through the air passageways 52 in the floor 50 and around the reservoir 58.

Because of the velocity and turbulent movement of the air, the air impinges upon the wicks 60 whereupon the dust and dirt particles become moisturized and adhere to the rough, wet surface of the wicks. The moisture on the wicks also humidifies the air. The air then escapes through the filter elements 28, 42 in the top wall of the housing 12 and sleeves 30 respectively whereby any remaining dirt and excess moisture is removed.

In order to prevent the air from flowing around the baffles and escaping through the openings in the top wall 14 of the housing 12 without becoming purified when the purifier is extended to its maximum length or, in other words, when the sleeves are moved outwardly to their furthest position, the floor extension portion 53 projects into the housing as may be seen in FIGURE 2. This extension directs the air flow into the sleeves 30, 32 and, consequently, around the reservoir 58. It should be noted that the extension is not mandatory because the louvers 46 in the sleeves' end wall 44 provide an air outlet at the end of the sleeves sufficient to cause the air to backflow into the sleeves even if the extension was not provided. However, the extension 53 improves the efficiency of operation of the purifier.

After the water 68 within the reservoirs is evaporated to a point where it needs to be replaced, the sleeves 30, 32 are removed from the housing 12 and the reservoirs 58 are removed from the sleeves 30 by merely lifting them slightly and pulling them out. The water is then easily replaced and the reservoirs are placed back into the sleeves and onto the grommets 56 in the floors 50. Alternatively, the reservoirs can be filled by removing the filter elements 42 and pouring the water directly into the reservoirs without removing them.

Modifications of first embodiment

Instead of using the wicks 60, or in combination with them, a plurality of air guide vanes 70 shown by dotted lines in FIGURES 1 and 2 are mounted on the inside of the side walls 34, 36 of the sleeves 30, 32 to direct the air toward the surface of the water 68 in the reservoirs 58. The air impinging upon the water is purified by a washing action and humidified by the entraining of water in the air. As described above, the air then escapes through the filter elements 28, 42 where any remaining dirt and excess moisture is removed. Another method of improving the efficiency of the system when wicks are not used is illustrated in FIGURE 5 wherein a plurality of discs 72 are rotatably supported in the reservoirs 58 by mounting them on shafts 74 supported on their ends by bearings 76 within the side walls 34, 36 of the reservoirs. The discs, which have a rough surface, can be provided with small grooves or blades (not shown) which serve as turbine buckets so that the air flowing past the discs causes them to rotate. The rotation of the discs 72, in addition to providing movement to the water, provides a wet surface against which the air impinges resulting in

humidifying and purifying the air by both washing and trapping the dust on the discs' rough surface. While not required, higher efficiency can be obtained by providing guide vanes inside the sleeves to direct the air toward the discs.

In addition to purifying and humidifying the air the purifier can serve to disinfect or impart a pleasant fragrance to the air merely by adding a disinfectant or perfume to the water in the reservoirs 58.

Second embodiment (FIGURES 6-8)

The second embodiment of this invention, which is the preferred embodiment, is less expensive to manufacture and easier to use than the first embodiment described above. The air purifier and humidifier 100 comprises a primary housing 102 formed with a top wall 104 and a pair of downwardly extending side walls 106, 108 forming a generally inverted U-shaped member. The side walls 106, 108 are provided with upwardly inwardly turned lower edges 110, 112 respectively which, in addition to providing rigidity to the housing 102, also form longitudinal glide channels 114, 116. The extreme ends of the side walls 106, 108 are also turned inwardly toward the center of the housing forming short horizontal platforms 118, 120. The housing 102 can be made of sheet metal or plastic and formed as an integral unit. A support plate 122 is mounted on the platforms 118, 120 and spans the width of the housing 102. The support plate is provided with a great number of large perforations 124 to permit the air exiting from an air temperature control system unit (not shown) to enter the housing 102.

An elongated air outlet 126 extends through the upper wall 104. A conventional filter element 128 is removably mounted across the opening 126 and is held in place by two rotatable clamp like members 130, 131.

A reservoir 132 in the form of a rectangular container having a size slightly smaller than the outlet 126 is adapted to be placed on the perforated support plate 122. Access to the reservoir is available through the outlet 126 to provide easy removal of the reservoir for cleaning and filling purposes. Supported within the reservoir 132 is an elongated rectangular wick 134 held vertically in place by a wick support 136. The wick 134 extends from the bottom of the reservoir 132 to a point above the upper surface of the reservoir and slightly below the upper wall 104.

At least two baffles 138, 140 are provided, one baffle being located on each side of the air outlet 126 and oriented obliquely with respect to the upper wall 104. As can be seen in FIGURE 8 the baffles project downwardly and toward the side wall adjacent each baffle. As the air rises through the perforated plate 122 and around the reservoir 132 it is directed down toward the wick 134 by the baffles 138, 140, thus providing more efficient and effective air impingement against the wick.

In order to increase the length of the purifier 100 to correspond to exhaust units having lengths longer than the housing 102 a pair of sleeves 142, 144 are provided, one sleeve being slidably inserted within each end of the housing 102. The sleeves are identical in structure and comprise a pair of side walls 146, 148, an upper wall 150 and a single end wall 152 mounted on the end of the sleeve remote from the center of the housing 102. The side walls 146, 148 of the sleeve extend straight downwardly and are received within the glide channels 114, 116 of the housing 102. A knob or suitable handle 154 is mounted on the end wall 152 to facilitate sliding the sleeves relative to the housing 102. Mounted within each sleeve is an air deflector 156 (see FIGURE 7) which extends generally diagonally across the sleeve. The air deflector is provided to direct the air passing into the sleeves back toward the reservoir 132 and wick 154.

Operation of the purifier 100 is similar to that of the aforescribed purifier 10 forming the first embodiment. That is, air leaving the air temperature control system

exhaust unit flows upwardly into the housing 102 and around the reservoir 132. The air is directed toward the wick 134 by the baffles 138, 140 depending from the upper wall 104 of the housing and the air deflectors 156 near the end wall of the sleeves 142, 144. The air impinging upon the wick becomes purified because the dust and dirt particles, which have become moisturized, adhere to the rough, wet surface of the wick, or because of the particles increased weight and the circulatory movement of the air, they fall into the reservoir. The air also becomes humidified. The air then escapes through the filter element 128 across the air outlet 126 whereby any remaining dirt and excess moisture is removed.

While the above descriptions are directed to auxiliary units adapted to be mounted upon an existing air temperature control system exhaust unit, it is clear that by modifying the mounting arrangement in any conventional manner, such as by providing suspension hangers, the purifier can be mounted within and be considered part of the exhaust unit. It can also be mounted in front of units which have louvers in their front walls; however, this will require a slight modification to allow for the horizontally directed incoming air. While the descriptions above are with respect to an air temperature control system of the type wherein the temperature of the air is centrally controlled and wherein the air is blown through an exhaust unit, it is also adapted for use with other types of temperature control systems such as a control system of the type wherein a coolant or heating fluid is passed through a finned heat exchanger located in a room and a fan, located within each individual room unit, causes air to flow over the finned heat exchanger and out through louvers in the heat exchangers enclosure. Furthermore, while the various embodiments have been described above as independent designs, it is clear that different features of the designs can be combined in any manner to produce a resultant unit having specific features which are desired for a particular use.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An air purifier comprising:

- (a) a housing having primary and secondary portions which are longitudinally moveable with respect to each other to enable adjustment of the length of the housing, at least one of said portions having a perforated floor and at least one of said portions having an air outlet therethrough,
- (b) a filter element removably mounted across said air outlet,
- (c) a liquid reservoir removably supported within said housing on said floor, said reservoir being accessible from outside said housing for replenishing with a liquid and being removable through said air outlet,
- (d) a liquid absorbent air scrubber removably supported by a removable bracket within said reservoir, said scrubber extending above the upper edge of said reservoir and being substantially impermeable to air and having a roughened surface such that air entering the housing through the perforated floor impinges upon and reflects off of the scrubber, and
- (e) air flow guide means within said housing directing the air entering the housing toward said scrubber.

2. An air purifier comprising:

- (a) a housing having an upper wall and two side walls depending therefrom, each of said side walls terminating at their lower end with an upwardly, inwardly turned portion forming glide channels remote from said upper wall, one of said walls having an air outlet therethrough throughout a majority of its surface and a filter element removably mounted across said outlet,
- (b) two sleeves, one sleeve being slidably mounted in each end of said housing, each of the sleeves comprising:
 - (i) two side walls and a top wall forming an inverted U-shaped member, an end wall attached

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thereto and a floor attached to said side walls at a position intermediate the top wall and the bottom of said side walls, said floor having an air inlet port therethrough, at least one of said walls having an air outlet therethrough and a filter element removably mounted across said outlet, the bottom of said side walls of each of said sleeves being slidably received within said channels,

- (c) two liquid reservoirs, one reservoir removably supported upon the floor of each of said sleeves, said reservoirs being accessible from outside said housing for replenishing with a liquid and being removable through said air outlet.
- (d) a liquid absorbent air scrubber removably supported by a removable bracket within each of said reservoirs, said scrubber extending above the upper edge of said reservoir and being substantially impermeable to air and having a roughened surface such that air entering the housing impinges upon and reflects off of the scrubber, and
- (e) means adjacent to said air inlets to guide the incoming air around the reservoirs effecting moistening of said air and the dirt particles entrained therein and effecting removal of said dirt and humidification of said air.

3. An air purifier as defined in claim 2 including a resilient support platform on each of said floors, the reservoirs resting upon the platforms which dampen vibrations of the reservoirs caused by air flow through the purifier.

4. An air purifier as defined in claim 2 including air deflectors within said secondary housing to direct the air to impinge upon the surface of the water to effect washing and humidifying said air.

5. An air purifier comprising:

- (a) a housing having two side walls, an upper wall and glide channels on said side walls remote from said upper wall, one of said walls having an air outlet therethrough throughout a majority of its surface and a filter element removably mounted across said outlet,

- (b) two sleeves, one sleeve slidably mounted in each end of said housing, each of said sleeves comprising two side walls and a top wall forming an inverted U-shaped member, an end wall attached thereto and a floor attached to said side walls at a position intermediate the top wall and the bottom of said side walls, said floor having an air inlet port therethrough, one of said walls having an air outlet therethrough and a filter element removably mounted across said outlet, the bottom of the side walls of each of said sleeves being slidably received within said glide channels,

- (c) two liquid reservoirs, one reservoir removably supported upon the floor of each of said sleeves, said reservoirs being accessible from outside said housing for replenishing with a liquid and being removable through said air outlet,

- (d) a liquid absorbent air scrubber removably supported by a removable bracket within each of said reservoirs, said scrubber extending above the upper edge of said reservoir and being substantially impermeable to air and having a roughened surface such that air entering the housing impinges upon and reflects off of the scrubber, and

- (e) air flow guide means comprising a baffle mounted within said housing adjacent the bottom thereof and including plates extending longitudinally toward the end of said housing, said plates spanning substantially across the width of said housing between said channels and providing a clearance between said plates and said channels forming air flow passageways.

6. An air purifier as defined in claim 5 wherein:

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- (a) said reservoir has a plurality of legs which rest on said floor of said secondary housing and provide a clearance between said floor and the bottom of said reservoir, and

- (b) said floor is spaced from said baffle when said sleeves are inserted in said housing.

7. An air purifier comprising:

- (a) a housing having two side walls and an upper wall, each of said side walls having an inwardly facing longitudinal glide channel at the bottom thereof,

- (b) an air outlet through at least one of said walls and a filter element removably mounted across said outlet,

- (c) a perforated support platform mounted within said housing and adjacent the bottom thereof,

- (d) a liquid reservoir removably supported on said platform, said reservoir being accessible from outside said housing for replenishing with water and being removable from said housing through said outlet,

- (e) a liquid absorbent air scrubber removably supported by a removable bracket within said reservoir, said scrubber extending above the upper edge of said reservoir and being substantially impermeable to air and having a roughened surface such that air entering the housing through the perforated support platform impinges upon and reflects off of the scrubber,

- (f) a sleeve comprising two side walls, an upper wall, and an end wall, the side walls being slidably received within said glide channels enabling relative sliding motion between said sleeve and said housing to permit adjustment of the length of the air purifier, and

- (g) air guide means within said purifier directing the air entering the purifier through the perforated support platform toward said scrubber.

8. An air purifier as defined in claim 7 wherein said air guide means includes a baffle mounted on opposite sides of said air outlet and extending downwardly and away from said air outlet and an air deflector adjacent to the end wall of said sleeve.

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DENNIS E. TALBERT, Jr., Assistant Examiner

U.S. Cl. X.R.

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