

[54] AIR PURIFIER AND HUMIDIFIER

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[58] **Field of Search**..... 55/234, 417, 467,
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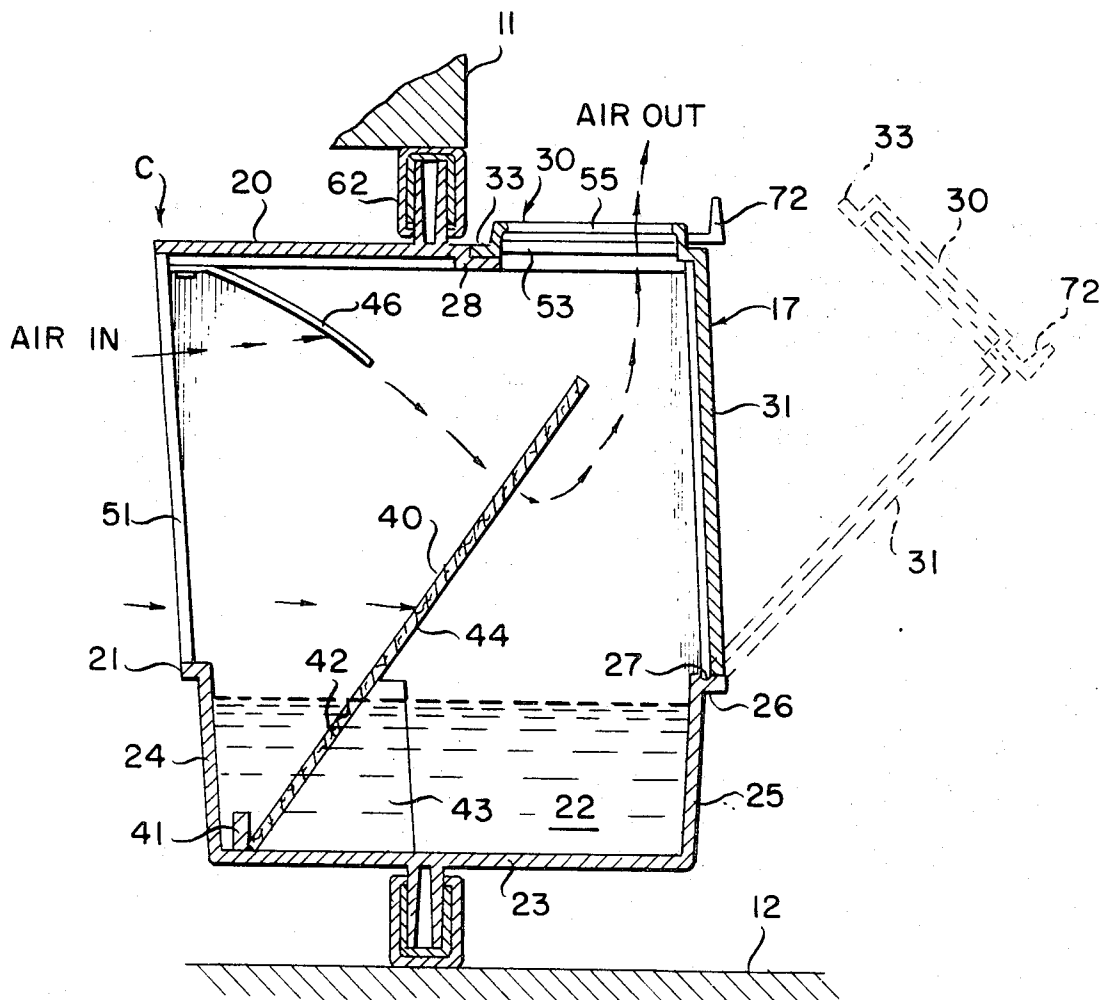
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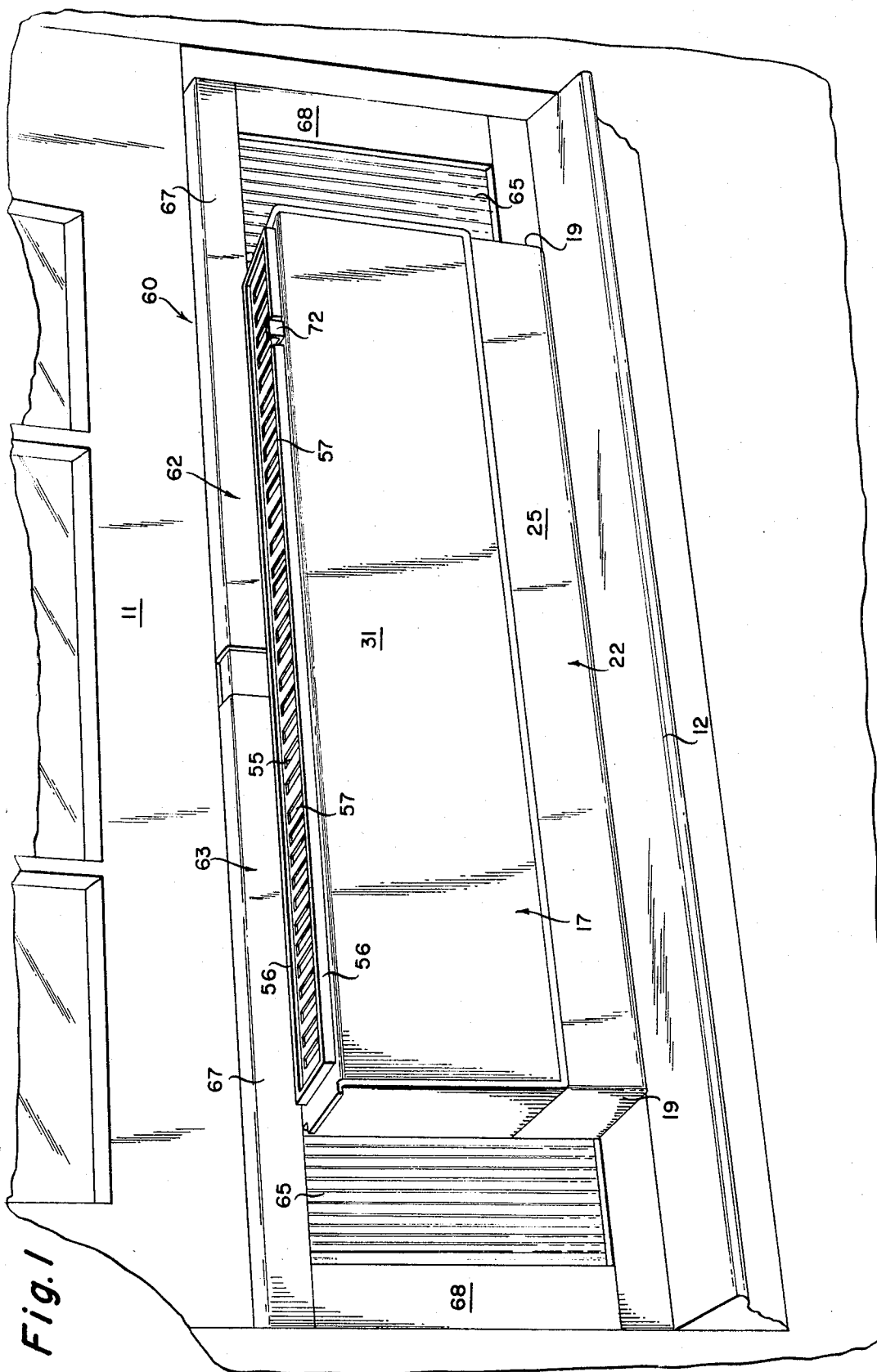
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ABSTRACT

A window-mounted air purifier and humidifier is provided, comprising a two-part casing or housing, one of which parts has a wall for inlet of external air and is formed at its lower end with a well portion for containing a supply of water and for holding a partially submerged air scrubber or wick. Desired paths of flow of air entering the device are facilitated by a depending vane directed toward the wick. The other part of the casing serves as a closure and constitutes a portion of the top wall and a portion of the front wall of the casing. Means are formed on the exterior of the casing to enable it to be mounted on the window sill in a position such that not more than about one-half of its depth protrudes into the interior of the room.

9 Claims, 7 Drawing Figures





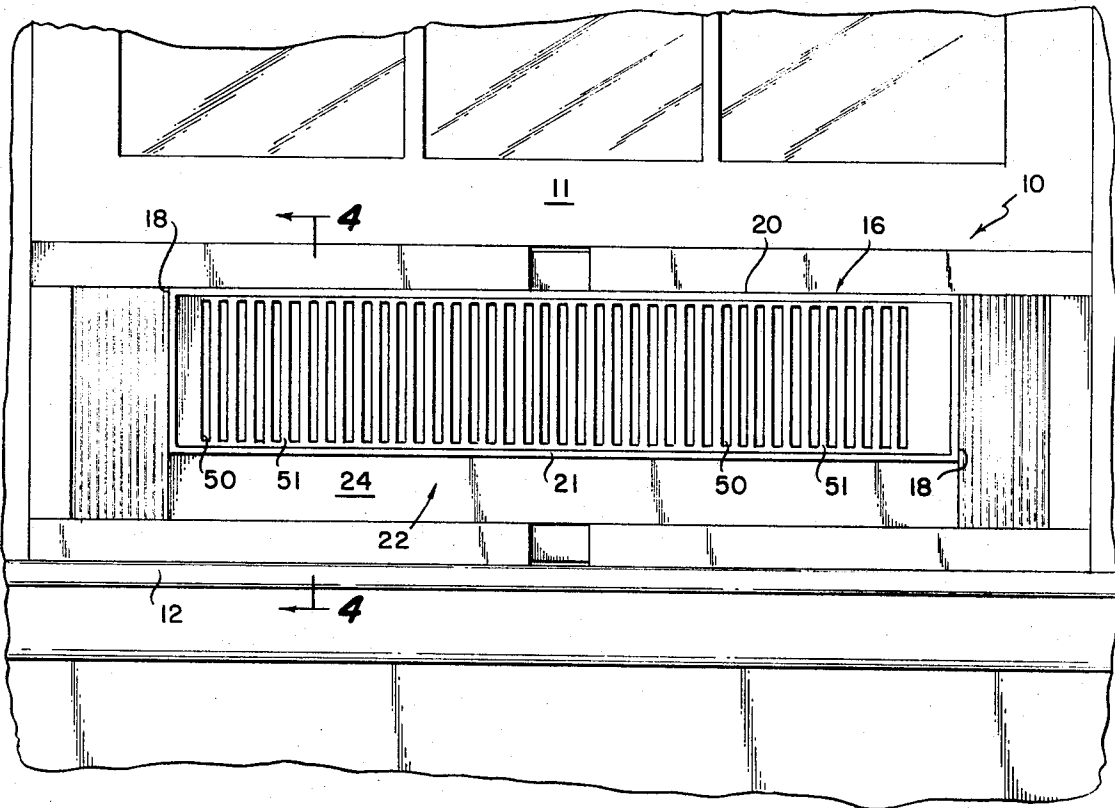


Fig. 2

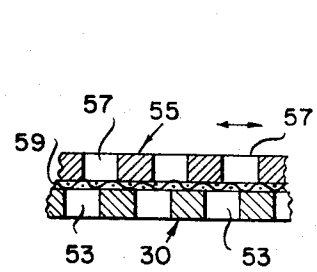
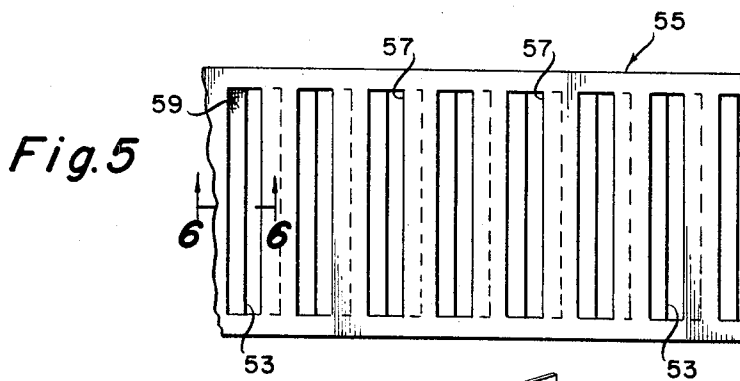


Fig. 6

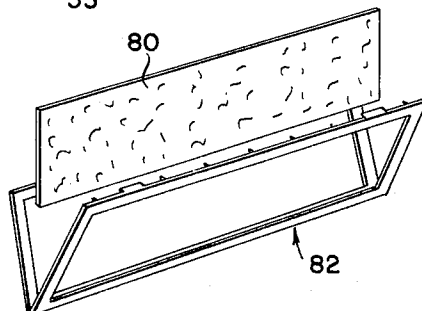
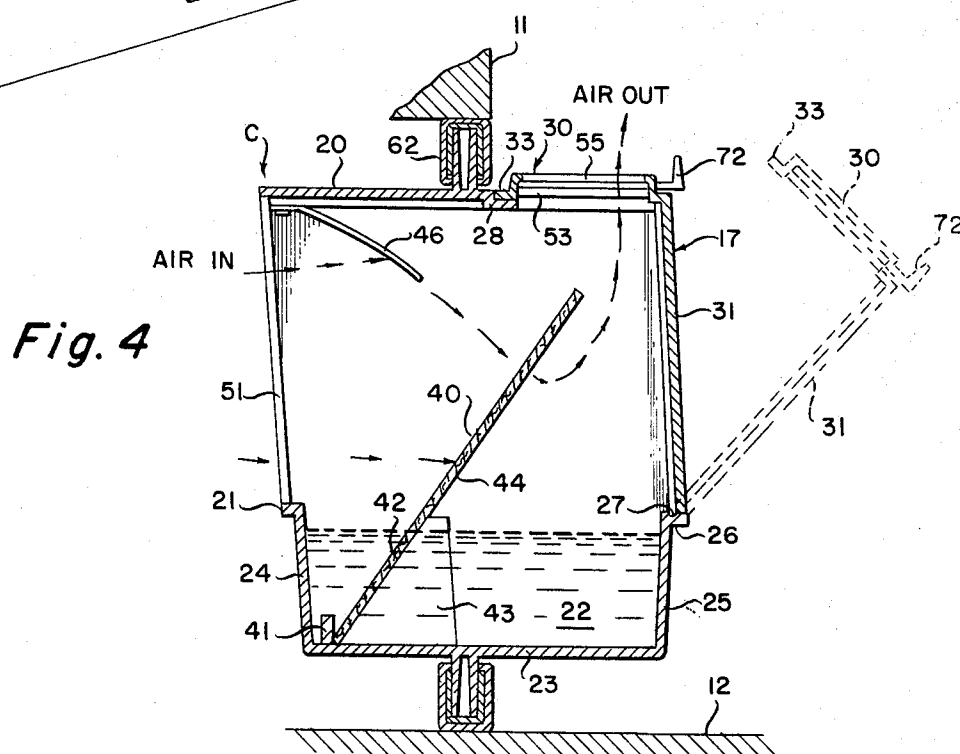
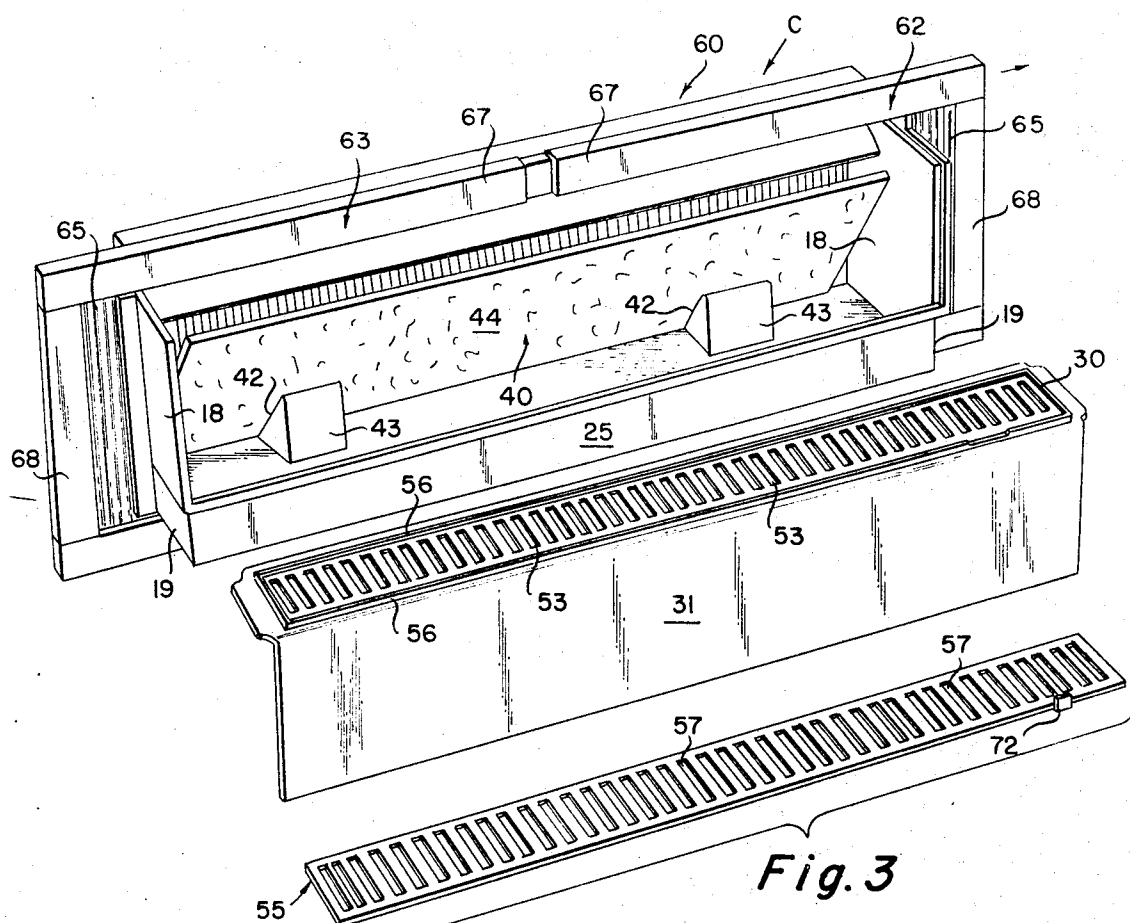


Fig. 7



AIR PURIFIER AND HUMIDIFIER

BACKGROUND

This invention relates to air purifiers and, more particularly, to window-mounted air purifiers which additionally serve to humidify the incoming air.

This application more particularly concerns a window-mounted apparatus of the character indicated, and embodies improvements upon the air purifier and humidifier structures shown in my prior U.S. Pats. No. 3,464,188, dated Sept. 2, 1969 and No. 3,621,834, dated Nov. 23, 1971.

As stated in my aforesaid patents, in urban and industrial areas, the air is heavily polluted with dust, and dirt. This not only is harmful to the health of people residing or frequenting such areas, but is also unpleasant because of the deposits of dirt inside of homes, schools, office buildings, and other inhabited structures located in such areas, caused by air entering from the outside and circulating within the interiors of such structures. Furthermore, in most areas, the air carries pollen to which many persons are allergic. Consequently, there is a great need for an inexpensive air purifier which removes the dirt, dust, and pollen from the air before it enters the inside of the building.

As also stated in my above-identified patents, it is well known to place filter elements of various types across the open portion of a window, in order to trap the foreign matter. These filter elements, however, rapidly become clogged with dirt and thus prevent adequate air flow into the building. Furthermore, when brisk or heavy winds prevail, it is common for the dirt trapped on or in such filter elements to be blown into the room, thus defeating the purpose of using such filter elements. Moreover, when such filter elements are employed, it is necessary to remove them in the winter-time, and this manifestly leaves the air unfiltered when the window is opened from time to time when fresh air is desired.

As further stated in my above-identified patents, another problem existing in homes and other buildings at the present time, more especially in those buildings which are heated by hot-air systems, is the dryness which prevails during the heating season. This is likewise unhealthy and uncomfortable to occupants and harmful to wood furniture, etc.

According to my above-mentioned patents, there is provided an apparatus that does not require any moving parts or electric current or other power for performing its function, and incorporates, instead, an inexpensive air filter which effectively purifies the air entering from the outside into the interior of a room, in an open-window of which the apparatus is mounted.

The apparatus according to my said prior patents, although effective for accomplishing its purpose of purifying and humidifying the air entering a room, exhibits several undesirable features from the standpoint of its structural characteristics as well as from the esthetic appearance it presents when in its operative position in a window.

The principal object of the present invention is to provide an improved construction embodying an inexpensive air purifier and humidifier which may be permanently mounted in an open window, and which utilizes substantially the same paths of flow for purifying and humidifying the air entering from the atmosphere into the room. As in the case of the structures of my

prior patents, the foregoing results are achieved without requiring the use of any moving parts.

BRIEF SUMMARY OF THE INVENTION

Briefly stated, this invention, in its present form, as in the forms shown in the above-mentioned patents, comprises an elongated housing having a front (viewed from the interior of the room) wall, a rear wall through which external air is admitted, and a top wall provided with an air outlet for entry of the filtered and humidified air from the interior of the apparatus into the room.

The apparatus of the present invention is constructed to be mounted in a window opening in a position to be supported by the window sill.

In the apparatus of my prior patents, the rear or air-admitting wall is disposed substantially in the plane of the window sash. As a consequence, substantially the entire depth of the apparatus extends or protrudes into the interior of the room. This is in many instances undesirable from a practical standpoint, and is also considered by many people as undesirable from an esthetic standpoint.

The apparatus of the present invention is constructed to eliminate the foregoing disadvantages. To that end, the apparatus of the present invention is provided with means enabling it to be mounted on a window sill in a position such that not more than substantially one-half of its depth extends or protrudes into the interior of the room, while the remainder of its depth extends or overhangs on the exterior of the window.

In conjunction with the above-mentioned means for enabling the apparatus to be disposed on the window sill in position such that it does not protrude over more than about one-half its depth into the interior of the room, the apparatus according to the present invention is provided with means to enable the apparatus to be utilized in windows of various widths.

In the air purifier and humidifier apparatus disclosed in my prior patents, the humidifying action is achieved by means of a wick member which serves also as a filter for dust and dirt. The wick member is partially submerged within a body of water in a removable container placed on the bottom wall of the casing or housing of the apparatus. Access to the container for the purpose of replenishing the water, or for cleaning or replacing the wick member was had by removing or withdrawing the cover for the opening in the top wall of the housing. This made awkward the access to the water-container for the above-mentioned purposes. In accordance with another object of the invention, humidification of the air entering from the outside is achieved by an air scrubber or wick member disposed at an angle and partially submerged within a body of water contained in a well-like portion formed as the lowermost portion of the housing. Access to the wick member and to the body of water is had, in accordance with another feature of the present invention, by means of a separate, readily removable closure member, comprising (1) a vertically extending portion which serves, when the closure member is properly positioned, as the upper portion of the front (inside) wall of the housing or casing, and (2) a horizontally extending portion integral with the vertical portion and serving as the portion of the top wall of the casing or housing which protrudes into the room and through which the purified and humidified air enters the room.

DESCRIPTION OF THE DRAWINGS

The above-stated and other objects and advantages of the invention will become more apparent from the description herebelow and from the drawings in which:

FIG. 1 is a view in perspective, with parts broken away, of the window of a room, showing the sash in open position and the apparatus of the present invention mounted in the window opening, as viewed from the interior of the room;

FIG. 2 is a view in elevation, showing the apparatus positioned in the window opening, as it appears from the outside of the room;

FIG. 3 is a partially exploded view, in perspective, of the apparatus of the present invention;

FIG. 4 is a view of the apparatus in transverse cross-section, taken along lines 4—4 of FIG. 2, looking in the direction of the arrows;

FIG. 5 is a fragmentary view, in plan, of the top wall of the apparatus;

FIG. 6 is a view in cross-section, taken along line 6—6 of FIG. 5, looking in the direction of the arrows; and

FIG. 7 is a view in perspective, on a reduced scale, of a modified form of one of the parts.

PREFERRED EMBODIMENT

Referring to the drawing, the air purifier and humidifier (referred to hereinafter, for the sake of brevity, as a purifier) is itself indicated as a whole by reference character C.

The humidifier comprises a two-part elongated casing 10 adapted to be mounted in an open sash window fragmentarily indicated at 11, the sill of the window being indicated by the numeral 12.

The two parts of the casing or housing 10 may be formed of metal or of high density thermoplastic resins, such as polyethylene or polypropylene.

In accordance with the invention, the part 16 of the casing comprises a top wall portion 20; a wall 21 depending at an angle of substantially 90° from the top wall portion 20 and constituting the rear or outside wall of the casing; a pair of end walls 18; and a well portion 22. The well 22 comprises a bottom 23, a side wall 24 integral with wall portion 21; an end wall 19 integral with each end wall 24 of part 16; and a side wall 25 opposite the side wall 24.

The upper end of the side wall 25 is formed with a flange portion 26, having a seating groove 27 formed in its upper surface and extending longitudinally thereof, preferably throughout the entire length of the side wall 25.

The portion 20 of the top wall is formed along its free outer margin with a downwardly offset ledge or lip 28 disposed preferably in a horizontal plane, and extending substantially throughout the length of the top wall.

The other part 17 of the housing or casing 10 comprises a horizontal portion 30 and a wall 31 depending therefrom at its outer longitudinal edge, preferably at an angle of approximately 90°, and constituting the front wall of the casing or housing.

At its lower longitudinal edge, the wall 31 is formed with a cross-sectional contour complementary to that of the seating groove 27 in the flange 26, so as to be readily seatable within, and removeable from the groove.

The horizontal portion 30 of the member 17 is formed at its rear or free longitudinal edge with a relatively narrow, outwardly extending offset flange 33, extending throughout the length of the portion 30, adapted to be received by the upper surface of the ledge 28 when the member 17 is in proper position in relation to the part 16, for closing the casing 10. Thus, with the lower edge of wall 31 seated in the groove 26, with the member 17 in the dotted position shown in FIG. 4, i.e., with the casing open, only a relatively short hinging movement to the full line position shown in FIG. 4, is required to close the casing. Alternatively, the casing may be closed by first engaging the flange 33 of part 17 with ledge 28 of part 16, and then swinging part 17 downwardly to engage its lower edge in the groove 27.

The lower or well portion 22 of the housing is adapted to contain a supply of water or other suitable liquid within which there may be partially submerged one or more removeable air scrubbers or wicks 40. The wicks are disposed so as to rest on the bottom wall 23 and extend upwardly therefrom at an inclination toward the top of the casing, to a point substantially above the upper surface of the liquid in the well 22. The lower edge of the wick or scrubber 40 is supported on the bottom 23 of the well, preferably at a slight distance inwardly of the wall 24. The wick is of a length to extend substantially throughout the length of the casing.

To support the wick or wicks at the desired inclination within the well, the latter may be formed with a relatively narrow strip or partition 41, extending vertically upward from the bottom 23 along a longitudinal line spaced slightly inward from the wall 24. The inner face 42 of the strip 41 is disposed at a slight distance from the outer inclined surface 42 of each of a pair of angle brackets or blocks 43, such that when the wick 40 is in position with its lower longitudinal edge disposed between the face 42 of the strip 41 and the lower end of the blocks 43, the wick will rest with the inner surface 44 thereof against the surface 45 of the blocks 43. The wick will thus be disposed at the proper angle to serve its function of removing dirt, dust, etc., from the incoming air.

The wicks 40 are very absorbent and provide a large, moist, rough surface area. One material that has been found suitable for this use is a material sold commercially under the name of "Vapoglas" by Skuttle Manufacturing Company, Milford, Michigan.

In lieu of wicks of the type of material and the supporting means therefor above-described, there may be employed a filter fabric 80 constituting a "disposable" wick element made of a material sold commercially under the trade name "Viskon" by Cgicopee Mills, Inc., this material being cut to size and packaged as a replacement item. In use, it may be held in place in the well 22 between the two leaves of re-useable two-part hinged frame 82 of suitable dimensions.

The depending rear outer wall 16 of the casing may be formed substantially throughout its length and height with a number of closely spaced, small openings or perforations (not shown) or in the form of a grille, composed of a number of relatively narrow, closely spaced slits or slots 50 and intervening slats or bars 51. The slits and intervening slats extend transversely substantially the full distance from the upper end of the well 22 to the well 22 to the upper end of wall 21, for

the admission of air from the atmosphere into the interior of the casing 10 to undergo the purification and humidification obtainable by means of the apparatus.

Admission or escape of the purified and humidified air from the interior of the casing into the inside of the room, in the open window of which the purifier is mounted, takes place through the horizontal portion 30 of the top wall of the housing. To that end, the portion 30 is preferably formed with a series of narrow, elongated slits, slots or other forms of openings 53 extending transversely of the top wall portion, at closely spaced intervals from one another.

The air outlets 53 may be partially or totally obturated in order to restrict the flow of air into the room, by means of a readily removeable panel 55, reciprocable longitudinally on the upper surface of the grille or perforated horizontal portion 30 of the top wall. The panel 55 fits and may be reciprocated between vertically upstanding flanges or abutments 56 formed adjacent each of the longitudinal and transverse marginal edges of the portion 30.

Transversely extending slits 57 are formed in panel 55 at locations such that they will each register with a slit 53 when the panel is at one end of its limit of reciprocal movement with respect to the portion 30, and will completely overlie one of the intervening slats 51 of the top wall portion when the panel is moved to the other end of its limit of reciprocable movement along portion 30. Thus, by a relatively slight longitudinal movement of the panel 55, along the upper surface of the top wall portion 30, the openings in the latter for admission of air into the room may be either totally or partially obturated. To facilitate the reciprocal adjustment of the panel 55, the latter may be provided with a handle 72 extending upwardly therefrom at any convenient point along its width.

A fine mesh wire screen or an air filter fabric 59 such as the above-mentioned "Viskon" material, is adhered to the underside of panel 55 to overlie the air outlet portion 30.

In conjunction with the air wick 40, disposed in an angular position within the casing or housing as described, there is connected to the top wall portion 20 of member 16 of the housing, an air flow guide means or vane 46, which extends downwardly from the lower surface of the top wall portion 20; preferably from adjacent the outer wall 21, toward the wick 40. The vane 46 has the inner or free longitudinal edge thereof terminating short of the wicks in order to permit ready flow of air past the wick 40 and the vane 46. The vane is oriented so as to form an acute angle with the top wall portion 20.

To enable the humidifier to be positioned in its operative position in a window opening so that not substantially more than one-half its depth protrudes into the interior of the room, the housing or casing is provided with means constructed to achieve that result, and also to enable the humidifier to be accommodated to window openings of various widths.

To these ends, there is attached to the exterior of the casing, at approximately midway of its depth, a longitudinally extending, rectangular frame member 60 comprised of a pair of U-shaped members 62, 63, longitudinally adjustable with respect to each other. The legs of each of the members 62, 63, are each of a length somewhat more than one-half the longitudinal dimension of the casing, and the bridging or connecting portion of

each of the U-shaped members is of a length substantially the same as the height of the casing. The legs of each of the members 62, 63, are of rectangular channel shape, the cross-sectional dimensions of the legs of one of the members 62, 63 being slightly less than the cross-sectional dimensions of the legs of the other of said members, to enable the legs of one of the members to be in sliding telescopic engagement with the legs of the other member. Thereby the frame 60 is longitudinally adjustable with respect to the casing C, and the latter may be utilized in windows of various widths within the limits of longitudinal adjustment of the members 62, 63 with respect to each other.

In order to enable the purifier to be operatively installed in windows of various widths, means are provided in conjunction with the frame 60 for obturating the space between each end of casing as positioned on the window sill 12, and the adjacent vertical surface of the window frame. To that end, a flexible, extensible member 65, preferably composed of a relatively heavy sheet of material such as Teflon, is disposed between the legs 67 and the bridging portion 68 of each of the frame members 62, 63. Each of the extensible members 65 is formed with alternately reverse flutes extending transversely of the frame 60. The outermost one of the flutes at each end of the frame is connected in any suitable manner to the inner edge of the adjacent portion 68, and the innermost one of the flutes at each end of the casing is similarly connected to the outer surface of the end wall 70 of the casing.

Thus, it will be seen that longitudinal adjustment of the frame members 62, 63 with respect to one another will serve to accommodate the apparatus to window openings of various widths, any space between the end walls 70 of the casing and the adjacent sides of the window frame being taken up by the fluted, extensible members 65.

As will be seen, particularly from the perspective view of FIG. 1, the apparatus may be installed in the window opening by inserting it therein so that the lowermost longitudinal edge of the frame 60 rests on the window sill 12, in a position such that the frame member 60 is in vertical alignment with the lower edge of the sash 11. The frame members 62, 63 may then be slidably adjusted with respect to each other, to bring the outer vertical edges of each end portion 68 of the frame 60 into contact with the respective adjacent vertical surface of the window frame. Thereupon, the window sash may be lowered until the lowermost surface thereof rests upon the uppermost edge of the frame 60, thus serving to retain the apparatus in fixed position in the window opening.

OPERATION OF THE PURIFIER

Air entering the purifier through the grille wall 21 will flow inwardly toward the wick 40 and impinge thereupon. The air entering the upper end of the wall 21 is guided by the vane 46 toward the wick 40 so that some of the air will impinge upon the surface of the wick facing the air inlet wall 21, while other air will pass behind the wick, i.e., on the forward side of the wick. Some of the air will flow over the forward surface of the wick, while the remainder of the air hits the wall 31, reverses its direction and impinges upon the surface of the wick facing the wall 31. The flow of air leaving the wick in a direction toward the top wall portion 30 and the air leaving the vane 46 intersect and cause tur-

bulent flow within the housing, resulting in sufficient interface of the air with the wicks to effectively remove a great proportion of the dust, dirt and pollen carried by the incoming air. Furthermore, the moisture on the wick also humidifies the air. The air then escapes through the filter element associated with the panel 55, whereby any remaining foreign particles and excess moisture are removed.

The reciprocal panel 55 when disposed so as to completely close the openings 50 in the top wall portion 30, prevents air from entering the room, enables the unit to be left in place on the sill of the window during all seasons, and provides means for controlling the quantity of air entering the room.

It will be seen from the drawing and from the description herein that among the important advantages of the air purifier and humidifier hereof is that it operates entirely without moving parts; it may readily be installed for operation in a window opening by unskilled labor; when installed; only about one-half its depth protrudes inside the room; and access to the water supply in the casing is readily had by simply separating part 17 of the casing from part 16 thereof.

What is claimed is:

1. An air purifier adapted to be mounted in an open window of a room, comprising:
 - a. a casing having substantially parallel side walls, one of said side walls constituting an air inlet wall on one of the sides of the casing, the opposite side wall being imperforate;
 - b. a top wall, said top wall being imperforate along a portion of its width and having a regulatable air outlet opening formed therein adjacent said imperforate side wall, and means to vary the size of said outlet opening;
 - c. means in the interior of the casing for causing air entering the casing to flow therethrough and to exit from said casing through said air outlet, said means including removeable wick means for separating dust, dirt and pollen from the air, said wick means being disposed to extend upwardly from adjacent the bottom of the casing and at an angle with respect to the plane of said air inlet wall;
 - d. a vane depending downwardly at an angle from said top wall adjacent the upper end of said first-named side wall and extending in a direction toward said wick means; and
 - e. means mounted on the exterior surface of the casing and extending longitudinally thereof substantially midway of its transverse dimension, said last-named means being constructed to enable the cas-

ing to be supported on the sill of an open window in a position such that said casing does not protrude into the interior of said room a distance greater than about one-half of said transverse dimension, said casing being constructed of two separate parts, one of said parts being separable from the other longitudinally of the casing substantially midway of said transverse dimension and along the ends of the casing, said regulatable air outlet opening being disposed on the portion of said top wall which is disposed adjacent said imperforate wall.

2. An air purifier as defined in claim 1, wherein said separable part includes a portion of said top wall, said portion comprising said regulatable air outlet, and wherein said air outlet comprises a series of openings formed in said portion of the top wall.

3. An air purifier as defined in claim 2, wherein said top wall portion is provided with a removeable panel having a series of openings formed therein, said panel being reciprocable longitudinally thereof between (1) a position in which said openings in said top wall portion are in full register with the openings in said panel, and (2) positions in which said openings in said top wall portion are fully or partially obturated.

4. An air purifier as defined in claim 1, wherein the other of said parts is formed at the lower end thereof in the form of a well-like portion for holding a supply of liquid.

5. An air purifier as defined in claim 4, wherein a sheet of air filtering material is positioned in said well-like portion of the casing and is disposed so as to be partially submerged in said liquid.

6. An air purifier as defined in claim 5, wherein said sheet of filtering material is a disposable sheet of fabric held between a hinged pair of rectangular frame members.

7. An air filter as defined in claim 1, wherein said means mounted on the exterior surface of the casing is adjustable longitudinally relative to the length of the casing.

8. An air purifier as defined in claim 7, wherein said adjustable means is provided with a fluted member at each of its opposite ends, each of said members being longitudinally extensible outwardly of the respective end walls of the casing.

9. An air purifier as defined in claim 7, wherein said adjustable means comprises a frame composed of a pair of U-shaped channel members, the legs of one of said members being telescopically engaged with the respective legs of the other of said members.

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