April 6, 1965 W. A. OMOHUNDRO 3,176,448

AIR PURIFIER CONSTRUCTION

Filed June 7, 1961 5 Sheets-Sheet 1

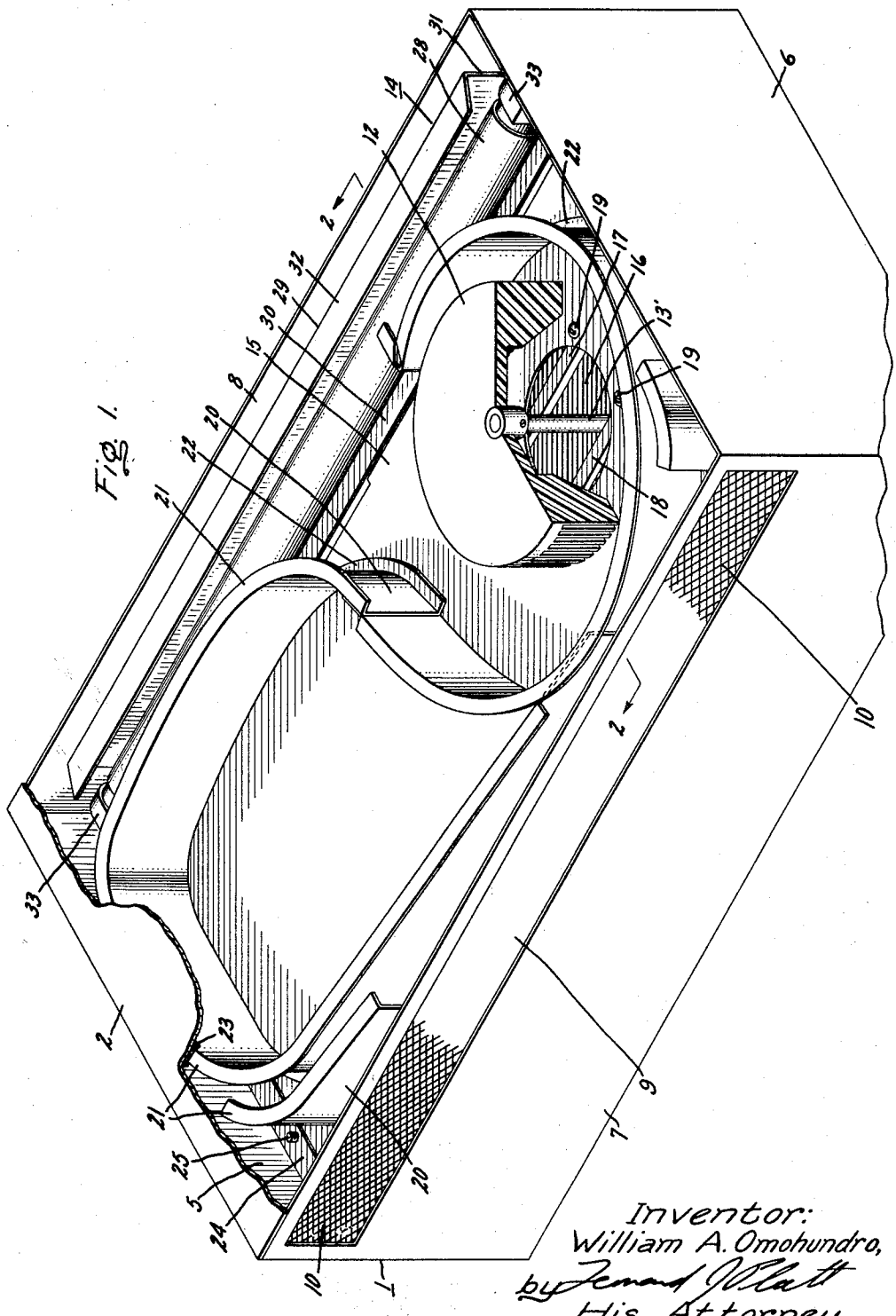

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Fig. 2.

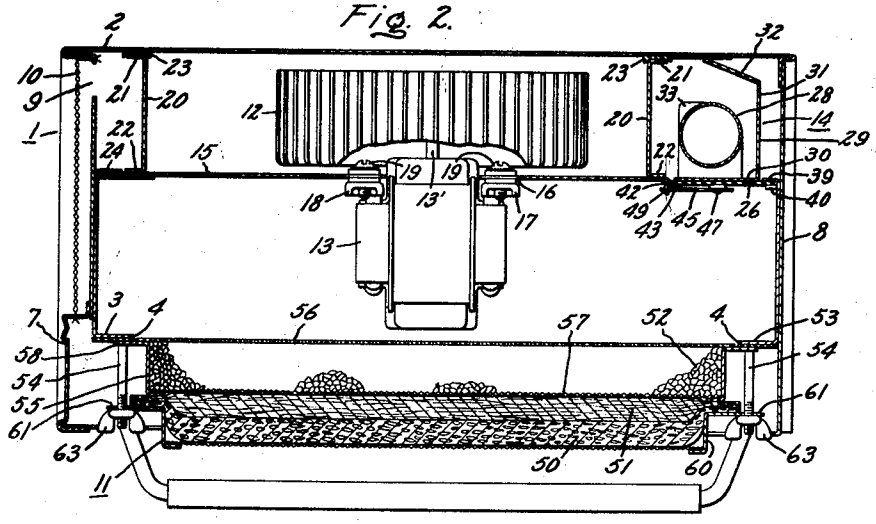
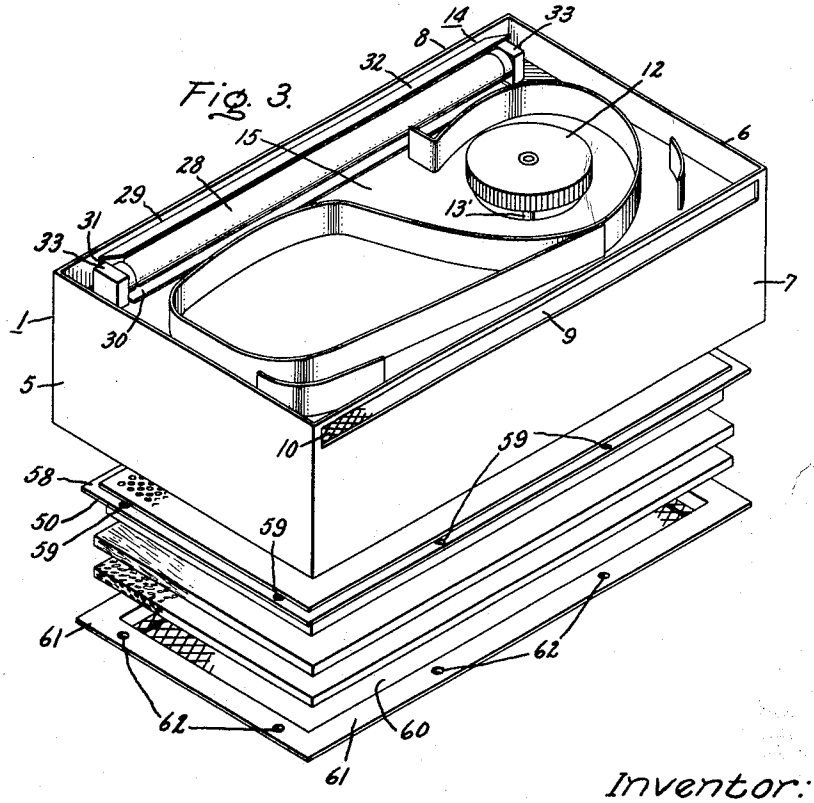


Fig. 3.



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AIR PURIFIER CONSTRUCTION

Filed June 7, 1961 5 Sheets-Sheet 3

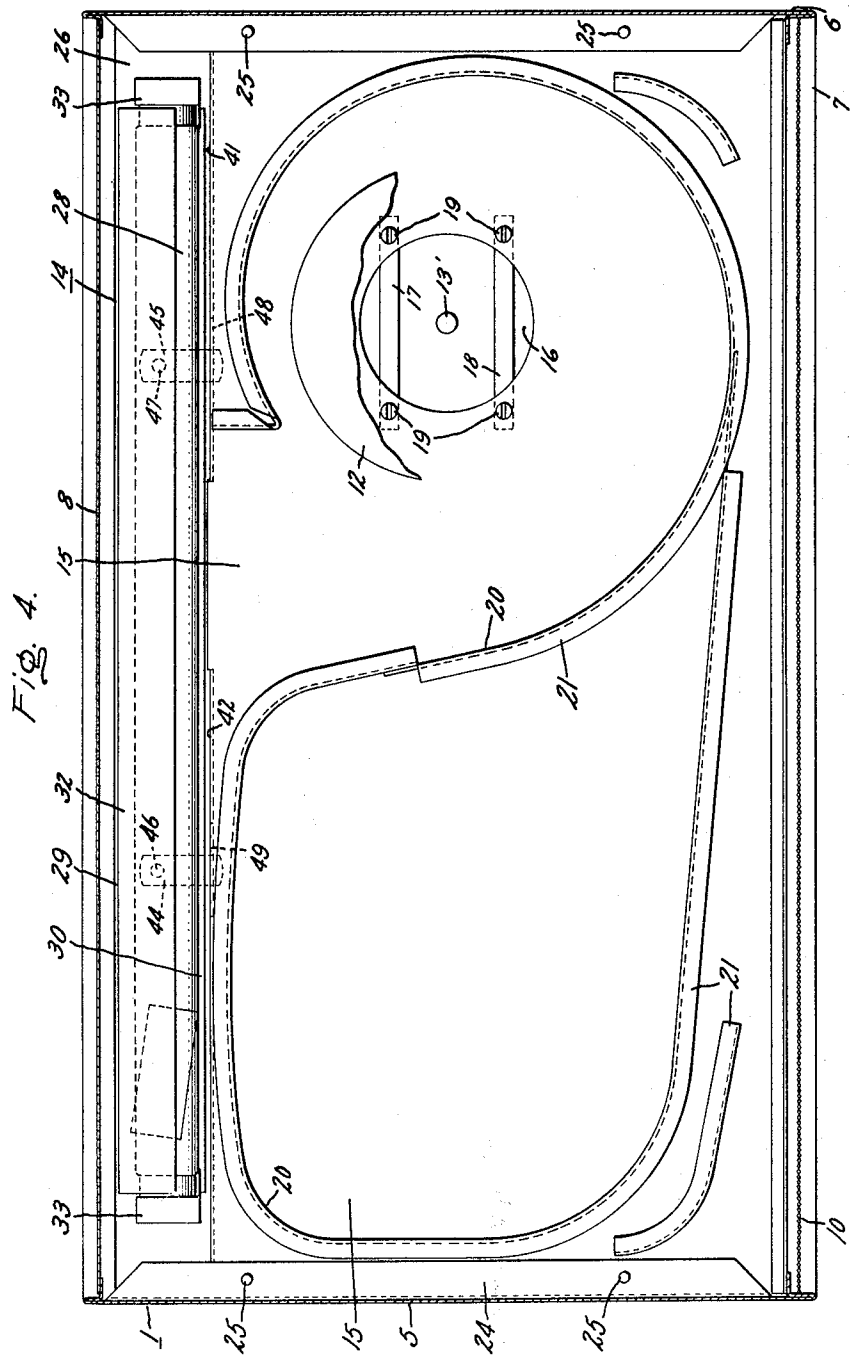

Fig. 4.

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AIR PURIFIER CONSTRUCTION

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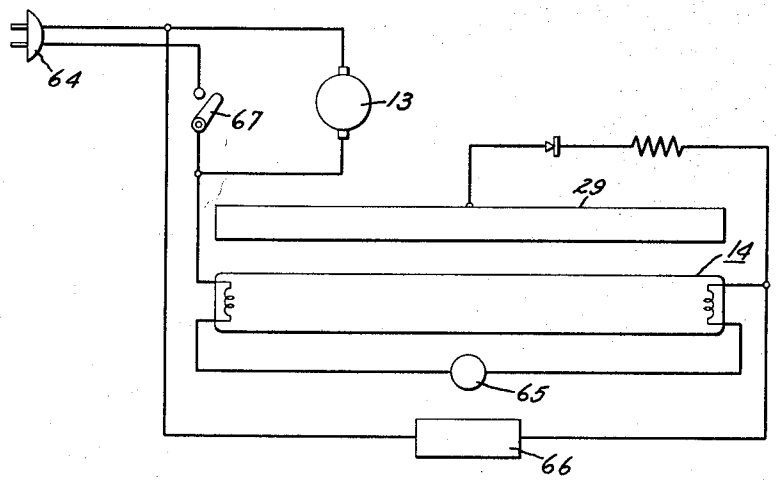
Fig. 5.



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AIR PURIFIER CONSTRUCTION

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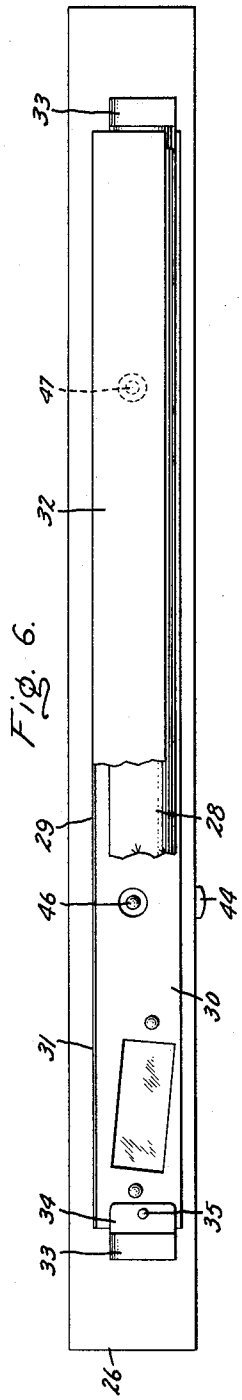

Fig. 6.

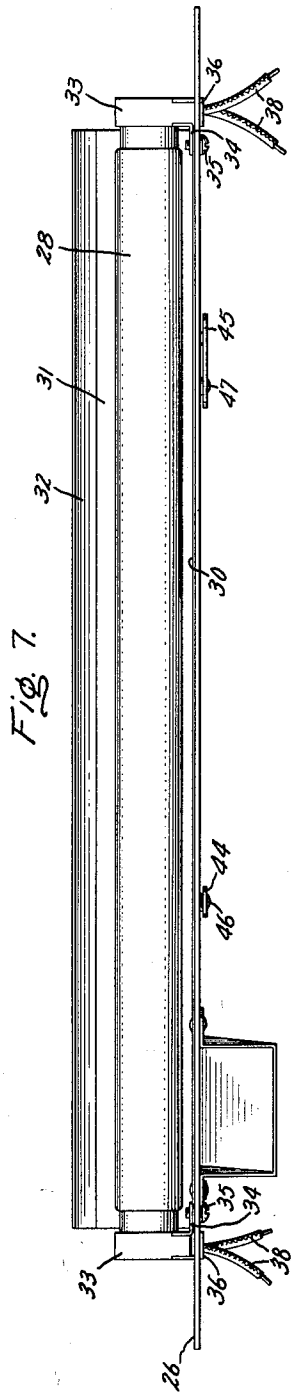

Fig. 7.

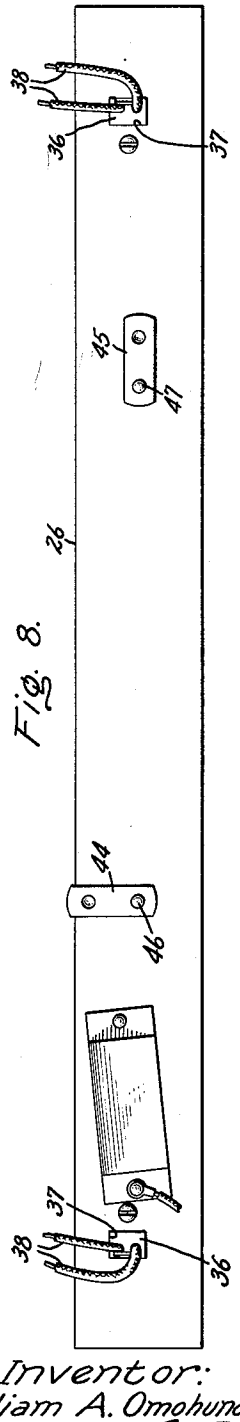

Fig. 8.

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AIR PURIFIER CONSTRUCTION

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Filed June 7, 1961, Ser. No. 115,351
8 Claims. (Cl. 55—279)

This invention relates to an air purifier and more particularly, to an improved compact easily manufactured construction arrangement for an air purifier.

In a co-pending application of Peter Kranz and William A. Omohundro, Serial No. 115,348, filed June 7, 1961, and assigned to the same assignee as the instant invention, there is disclosed an air purifier comprising an ultra-violet lamp ion generator, a fan, a fan motor, filters, and a casing. While these components could be manufactured in a number of different ways and a multiplicity of different arrangements could be provided for assembling the components in an air purifier casing, it is especially desirable that they be sturdily constructed and securely assembled in an air purifier casing. It is also desirable to provide an air purifier construction which may be manufactured at relatively low cost. It is most important therefore to reduce to a minimum the number of parts required, the number of manufacturing operations to be performed on each part, and the number of operations required to assemble the parts into a casing. It is also, of course, desirable to provide an air purifier which is constructed so that the ultra-violet lamp and the filters may be readily removed to permit easy replacement.

Accordingly, it is a primary object of this invention to provide an improved low cost construction assembly for an air purifier having a minimum number of parts which may be easily manufactured and assembled.

In accordance with one of the aspects of this invention, a casing having upstanding front, rear and side walls and generally parallel top and bottom walls is provided for supporting and enclosing the parts of a room air purifier. A barrier plate subassembly is provided for mounting the fan, fan motor and suitably shaped baffle walls. The baffle walls are fixed to the barrier plate and extend upwardly from the plate for contact with the inside surface of the top wall of the air purifier. With this arrangement, the barrier plate subassembly may be easily passed through an enlarged air inlet opening formed in the bottom wall of the casing and positioned so that the top portion of the baffle walls remain in air-tight contact with the top wall of the casing. Thus, a very simple, yet effective means for easily mounting the fan and fan motor and providing air passage means for the air purifier is achieved.

Other objects and attendant advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of the air purifier construction embodying the invention, partly broken away to show details of construction;

FIG. 2 is a sectional view of the air purifier taken substantially on the plane 2—2 of FIG. 1;

FIG. 3 is an exploded view of the improved air purifier;

FIG. 4 is a top view of the purifier with the top wall removed and the fan partly broken away;

FIG. 5 is a circuit diagram for the air purifier illustrated in FIG. 1;

FIG. 6 is a top plan view of the improved ion generator subassembly, with parts broken away to show details of construction;

FIG. 7 is a front elevational view of the improved ion generator subsassembly construction; and

FIG. 8 is a bottom plan view of the improved ion generator subassembly.

Referring now to FIGS. 1 and 2 of the drawings, there is illustrated an air purifier comprising a housing or casing 1 which suitably encloses the operative parts of the air purifier. The casing 1 is preferably made of sheet metal and includes a top wall 2 shown broken away for purposes of illustration, a bottom wall 3 having an enlarged opening 4 formed therein, side walls 5 and 6, a front wall 7, and a rear wall 8. The front wall 7 is formed with an air discharge opening 9 which may be provided with a suitable grille 10. Referring now to FIGS. 2 and 3 of the drawings, it can be seen that the air purifier also includes a plurality of filters generally indicated by reference numeral 11 for filtering the incoming air, a fan 12 and motor 13 for causing air to flow through the purifier, and an ultra-violet lamp ion generator generally indicated by reference numeral 14. The operation of the ion generator is more particularly described in the co-pending application of George Dickinson and William A. Omohundro, Serial No. 115,349, filed June 7, 1961, and assigned to the present assignee.

In accordance with the invention, a unique sub-assembly arrangement is provided for mounting the fan 12 and motor 13 and for affording air passage means through the air purifier. Referring now to FIG. 4, this arrangement includes a sheet metal barrier plate 15. The plate is generally rectangular and a circular air inlet opening 16 is provided in the right portion thereof. Thus, the fan motor 13 may be fixed to the bottom of the plate by brackets 17 and 18 and screws 19, or other suitable securing means. As shown, the fan blower wheel is located above the opening and is connected to the motor output shaft 13' which extends upwardly through opening 16.

In order to provide the desired air passage means from the air inlet opening 16 to the ion generator 14 and from the ion generator 14 to the air discharge opening 9, a unique baffle wall arrangement is subassembled to the barrier plate 15. As shown in FIG. 2, the baffle walls 20 extend generally perpendicular to the barrier plate 15 and the top wall 2 and are provided with upper and lower flanges 21 and 22, respectively. The lower flanges 22 are welded or otherwise permanently secured to the upper surface of the barrier plate 15 to thereby provide a readily formed subassembly which may be easily handled during manufacturing operations. A uniform strip of deformable foam rubber or other suitable material is glued or otherwise secured to the upper surface of upper flange means 21 to provide an air seal between the baffle walls and the top wall of the casing. As shown more particularly in FIGS. 1 and 2, inwardly extending flange means 24 is formed on the side and front walls of the casing. The flanges 24 are arranged generally parallel to the top wall 2 of the casing and their distance from the top wall of the casing is substantially the same as the height of the baffle walls 20. By this arrangement, the unique fan motor and baffle wall subassembly may be slipped through the enlarged opening 4 formed in the bottom wall 3 of the housing and positioned so that the end portions of the barrier plate are in contact with the flanges 24. Then, screws 25 or other suitable securing means may be used for connecting the plate 15 to flanges 24. The height of the baffle walls 20 and the thickness of the foam rubber 23 are so related to the distance of the flanges 24 below the top wall 2 that when the plate 15 is fixed to the flanges 24 the foam rubber strip is urged against the top wall 2 of the casing to provide an air tight seal between the baffle walls 20 and the top wall 2 of the casing. Thus, air passage means is simply and easily provided for the air purifier, thereby permitting elimination of additional sheet metal and connecting means which gen-

erally would be considered necessary for providing such air passage means.

A uniquely designed arrangement is also provided for removably mounting the ion generator and providing readily accessible terminal leads therefor. As best seen in FIGS. 6, 7 and 8, this arrangement comprises a flat rectangularly shaped sheet of insulating material 26 of such size as to fill the opening at the rear of the casing between barrier plate 15 and the rear wall 8. The ion generator includes a tubular ultra-violet lamp 28 and an elongated metal plate 29 for emitting electrons when it is bombarded by photons from the ultra-violet ray lamp 28. Referring now to FIGS. 2 and 3, the plate 29 is generally U-shaped in cross-section and includes a bottom wall 30, an upstanding side wall 31, and a top wall 32 for partially surrounding the ultra-violet lamp 28. Ceramic electrode supporting brackets 33 having bottom metal connecting flanges 34 are provided for holding the lamp 28 in a conventional manner. As shown more particularly in FIG. 7 two screws 35 may be provided for fixing the plate 29 and the electrode brackets 33 to the insulating plate 26. In order to achieve a more rigid structure and for providing a convenient lead opening to the brackets 33, bottom projections 36 are integrally formed on the ceramic brackets 33 for cooperation with complementary holes 37 which are formed in the plate 26. With this arrangement, a rigid support is achieved and the electrical leads 38 for the electrode brackets 33 may conveniently extend upwardly through the plate 26 to the conventional electrode connections within brackets 33.

The ultra-violet lamp and electron emitting plate subassembly may be readily removably positioned within the air purifier casing. As shown more particularly in FIG. 2, the rear wall 8 of the housing is provided with an inwardly extending flange 39. The flange extends generally parallel to the top wall 2 of the casing and a plurality of inwardly directed tabs 40 are provided on the rear wall 8 directly below the flange 39 for permitting the rearmost portion of the insulated plate to be positioned in the groove formed by flange 39 and tabs 40. Referring now to FIGS. 2 and 4, the rearmost portion of barrier plate 15 is provided with two downwardly extending flanges 41, 42 on the right and left sides thereof to thereby form a centrally located rearwardly extending horizontal tab portion 43. With this arrangement the lamp 14 and plate 26 subassembly may be inserted through the enlarged opening 4 formed in the bottom wall 3 of the casing and positioned in the upper rear portion of the housing with the rear portion of plate 26 located between flange 39 and tabs 40, the front portion of the plate resting against tab portion 43, and the front edge surface in abutting relationship with the rear walls of flanges 41 and 42. In order to removably secure the plate 26 to the rear portion of barrier plate 15, two latches 44 and 45, shown more particularly in FIGS. 2 and 8, are suitably pivoted to the bottom surface of insulating plate 26 by pivots 46 and 47, respectively, and two complementary slots 48 and 49 are formed in downwardly extending flanges 41 and 42, respectively, for receiving the ends of latches 44 and 45.

With this arrangement, the lamp 14 and plate 26 subassembly may be quickly removed from the air purifier casing by simply rotating latches 44 and 45 out of their complementary slots 48 and 49, lowering the forward portion of the plate 26 and pivoting the rear portion of plate 26 within the groove formed by flange 39 and tabs 40. Then the rear portion of the plate 26 may be removed from the groove formed by flange 39 and tabs 40 to thereby permit replacement of lamp 14. Accordingly, a readily removable subassembly is achieved.

The ultra-violet lamp and electron emitting plate subassembly is also uniquely related with respect to the air purifier casing so that a substantially air tight seal is effected between the upper portion 32 of the electron emitting plate and the top wall 2 of the air purifier casing. To

achieve this, as shown more particularly in FIG. 2, the distance from the top wall 2 of the casing to the flange 39 is so selected with respect to the height of electron emitting plate 29 that when the emitting plate is in the position shown in FIG. 2, the resiliency of the plate 29 urges the top portion thereof into air tight contact with the top wall 2 of the casing. Thus, an effective seal for providing an improved ion generator is achieved without the use of additional parts.

The improved air purifier is also constructed so that the filters may be quickly and easily removably connected to the purifier at the air inlet opening 4. The filters preferably include a coarse foam polyurethane filter pad 50, a superfine glass fiber filter pad 51 and a bed of activated charcoal 52. The operation of the filters is more particularly described in the co-pending application of Peter Kranz and William A. Omohundro, Serial No. 115,348, filed June 7, 1961, and assigned to the present assignee. Referring now to FIG. 2, inwardly extending flanges 53 are formed on the lower portions of the front, rear and side walls of the air purifier and a plurality of spaced downwardly extending threaded rods 54 are welded or otherwise secured to the flanges 53. A housing 55 having perforated top and bottom plates 56 and 57, respectively, is provided for suitably holding the activated charcoal. As shown in FIG. 3, the housing 55 also includes outwardly extending flanges 58 formed at the front, rear and sides thereof, and a plurality of openings 59 are formed in flanges 58. With this arrangement the charcoal housing may be quickly assembled to the air purifier by inserting the housing so that the threaded rods 54 extend through the complementary openings 59 and the flanges 58 of the charcoal housing abut the flanges 53 of the air purifier housing.

A metal grille member 60 is provided for holding the flexible pad filters against the lower perforated plate 57 of the charcoal housing. As shown, the grille 60 includes outwardly extending front, rear, and side flanges 61, and a plurality of openings 62 are formed in the flanges for cooperating with the threaded rods 54. Thus, the filters 50 and 51 may be conveniently sandwiched between the bottom perforated wall 57 of the charcoal housing and the grille 60 with the rods 54 extending through the openings 62 formed in the grille flanges. As shown, the flanges 61 of the grille extend somewhat upwardly from the bottom wall of the grille. With this arrangement, the edges of the pad filters 50 and 51 are compressed between flanges 58 and 61 to securely hold the filter pads. However, the central portions of the filters are held loosely between the bottom wall of the grille and the bottom wall of the charcoal housing in order to achieve full filter action. To complete the assembly, winged nuts 63 are provided for cooperation with the threaded rods 54 to urge the flanges of the grille upwardly. Accordingly, the filters may be readily removed from the air purifier housing by simply unthreading the winged nuts 63 from rods 54.

Referring now to the circuit diagram of FIG. 5, it is evident that the ultra-violet lamp 14 may be suitably connected to a standard 120 volt 60 cycle alternating current source by a conventional plug connector 64. A starter 65 and ballast 66 are also connected in the circuit in a conventional manner for properly energizing the ultra-violet lamp 14. As shown, the fan motor 13 is connected in parallel with the ultra-violet lamp 14 and a switch 67 is provided for simultaneously energizing the fan motor and the ultra-violet lamp. In accordance with this invention, all of the wiring for this circuit is suitably enclosed in the space between barrier plate 15 and the upper wall 56 of the charcoal filter housing.

From the foregoing description it will be appreciated that the improved air purifier construction includes a minimum number of relatively easily manufactured subassemblies. Accordingly, with the casing positioned in up-side-down relationship on an assembly line, the fan

motor and baffle wall subassembly may be passed through the enlarged bottom opening 4 and fixed to flanges 22. Then the ultra-violet lamp 14 and electron emitting plate 29 subassembly may be inserted and locked in position by latches 44 and 45. Following this, the various wiring connections may be made, and then the filters may be readily positioned and held in the desired locations by winged nuts 63. Thus, an exceedingly simple, yet effective air purifier construction is achieved.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the invention, and therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim is:

1. An air purifier comprising, a casing having upstanding front, rear and side walls, and generally parallel top and bottom walls, said bottom wall being formed with an enlarged air inlet opening, flange means formed on the inside of said front, rear and side walls arranged generally parallel to said top and bottom walls, a plurality of spaced downwardly extending rods fixed to said flange means, a generally flat sheet metal housing for holding activated charcoal extending across said opening and having perforated upper and lower walls, said housing being provided with outwardly extending flange means having a plurality of apertures formed therein, said housing being positioned with the threaded rods extending through said apertures, a sheet metal grille of approximately the same cross-section as said housing and extending beneath said housing, said grille being provided with outwardly extending flange means having apertures formed therein for receiving said threaded rods, filter pad means positioned between said housing and said grille, and means threaded onto said threaded rods compressing the edges of said filter pad means between the grille flange means and the housing.

2. An air purifier comprising, a casing having upstanding front, rear and side walls, and generally parallel top and bottom walls, said bottom wall being formed with an enlarged air inlet opening, flange means formed on the inside of said front, rear and side walls arranged generally parallel to said top and bottom walls, a plurality of spaced downwardly extending rods fixed to said flange means, a generally flat sheet metal housing for holding activated charcoal extending across said opening and having perforated upper and lower walls, said housing being provided with outwardly extending flange means having a plurality of apertures formed therein, said housing being positioned with the threaded rods extending through said apertures, a sheet metal grille having approximately the same cross-section as said housing and extending beneath said housing, said grille being provided with outwardly extending flange means having apertures formed therein for receiving said threaded rods, filter pad means positioned between said metal housing and said grille, said filter pad means including a relatively coarse foam pad and a superfine glass fiber filter pad located above the coarse foam pad, and means threaded onto said threaded rods against said grill flange means compressing the edges of said filter pad means between the grille flange means and the housing.

3. An air purifier comprising a casing having upstanding front, rear and side walls and generally parallel top and bottom walls, a barrier plate, means supporting said plate in spaced parallel relation with respect to said top and bottom walls, a motor mounted on said barrier plate, a fan driven by said motor positioned between said barrier plate and said top wall, baffle walls fixed to the upper surface of said barrier plate forming a scroll around said fan and extending upwardly in air sealed relation with the inside surface of the top wall of the air purifier, and an enlarged opening formed in said bottom wall having a larger cross-section than the barrier plate so that the plate with the fan, motor and baffle walls attached thereto may be readily passed through said opening as a unit.

4. The air purifier of claim 3 including resilient means fixed to the upper surface of said baffle walls to form the airtight seal between the baffle walls and the top wall of the purifier.

5. An air purifier comprising a casing having upstanding front, rear and side walls and generally parallel top and bottom walls, flange means formed on the inside of said front, rear and side walls, a barrier plate supported within said casing by said flange means in parallel relation to said top wall, a fan motor mounted on said barrier plate, a fan driven by said motor positioned between said barrier plate and said top wall, baffle walls fixed to the upper surface of said barrier plate extending upwardly therefrom in airtight relation with the inside surface of said top wall, and an enlarged opening formed in the bottom wall having a cross-section larger than said barrier plate so that the plate with the fan, motor and baffle walls fixed thereto may be readily passed through the opening as a unit and fixed to said flange means.

6. An air purifier comprising a casing having front, rear and side walls, inwardly extending flange means formed on each of said walls, a fan mounting barrier plate fixed to the flange means on said front wall and said side walls and being spaced from said rear wall, an insulating plate removably positioned between said barrier plate and said rear wall, lamp holder means connected to said insulating plate at opposite ends thereof, an elongated ultra-violet lamp extending between said lamp holders and being supported thereby, an electron emitting plate connected to said insulating plate and extending in spaced relation adjacent said lamp, said insulating plate having its rear edge supported by the flange means on said rear wall, a depending flange formed along the rear edge of said barrier plate, a latch member mounted on said insulating plate to pivot horizontally, and a horizontally extending slot formed in said barrier plate flange for receiving said latch member to support the front edge of the insulating plate.

7. An air purifier comprising a casing having upstanding front, rear and side walls and generally parallel top and bottom walls, a barrier plate extending between said side walls and along said front wall parallel to said top and bottom walls and spaced from said rear wall, a fan motor mounted on said barrier plate, a fan driven by said motor positioned between said barrier plate and said top wall, baffle walls fixed to the upper surface of said barrier plate in perpendicular relation thereto and extending upwardly therefrom in sealing relation with the inside surface of said top wall, said bottom wall being formed with an inlet opening which is larger than said barrier plate so that said barrier plate with the fan, motor and baffle walls attached thereto may be readily passed through said opening as a unit, an insulating plate positioned between said barrier plate and said rear wall in substantially the same plane as the barrier plate, lamp holder means connected to said insulating plate at opposite ends thereof, an elongated ultra-violet lamp extending between said lamp holders and being supported thereby, an electron emitting plate extending along and adjacent to said lamp, and means for removably holding the insulating plate in the aforementioned position including flange means formed on said rear wall for supporting the rear edge of said insulating plate and latch means pivotally mounted on the lower surface of said insulating plate for cooperating with said barrier plate to removably hold the front edge of said insulating plate in said casing.

8. An air purifier comprising a casing having upstanding front, rear and side walls and generally parallel top and bottom walls, inwardly extending flange means formed on said front, rear and side walls, a fan mounting barrier plate fixed to said flange means formed on said front wall and said side walls, said barrier plate being spaced

from said rear wall, an insulating plate extending between the rear edge of said barrier plate and said rear wall with the rear edge of the insulating plate being removably supported by the flange means formed on said rear wall, a depending flange formed on the rear edge of said barrier plate horizontally extending slot means formed in said barrier plate flange, latch means attached to the lower surface of said insulating plate to pivot in a horizontal plane and cooperate with said slot means to removably support the front edge of said insulating plate, lamp holder means connected to the upper surface of said insulating plate at opposite ends thereof, an ultra-violet lamp extending between said lamp holders and being supported thereby, and an electron emitting plate connected to said insulating plate between said lamp holders, said electron emitting plate including a vertically extending wall portion and an upper portion angularly extending from the upper edge of said vertical wall portion to the inner surface of said casing top wall, said emitting plate being formed of somewhat flexible material and

being dimensioned with respect to the space between said insulating plate and said casing top wall such that the emitting plate upper portion is self-urged into air sealing contact with said casing top wall.

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