

[54] **ELECTROSTATIC AIR CLEANER**
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 147, 148, 149, 150, 151, 154

[57] **ABSTRACT**

An electronic air cleaner in which parallel collector plates are slidably and removably received by a frame member. An ionizing wire is strung in a generally zig-zag configuration to overlie and underlie each of the collector plates and the collector plates are engaged with a snug fit by electrical contact means which provide all of the collector plates with the same potential.

3 Claims, 9 Drawing Figures

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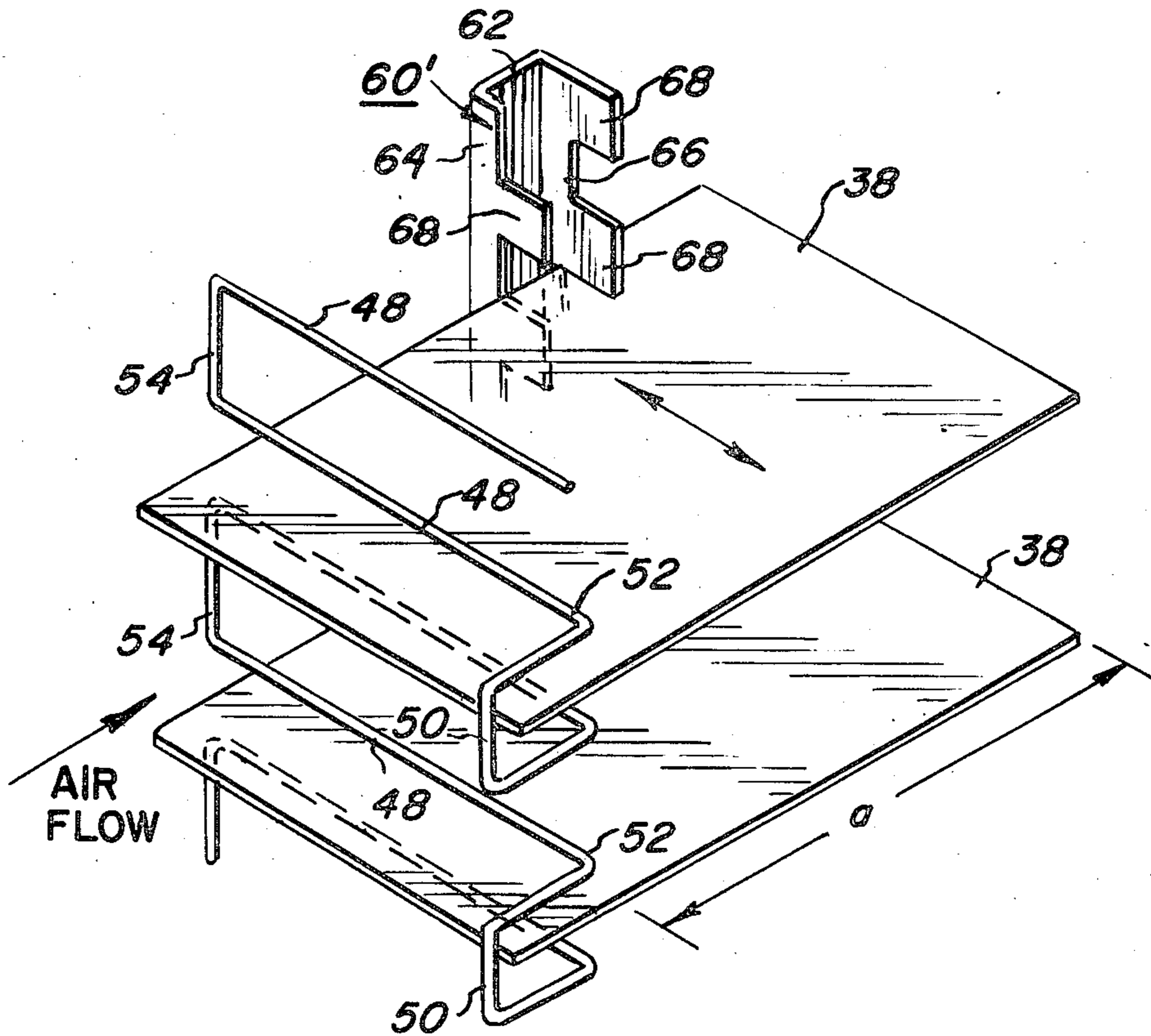


FIG. 1

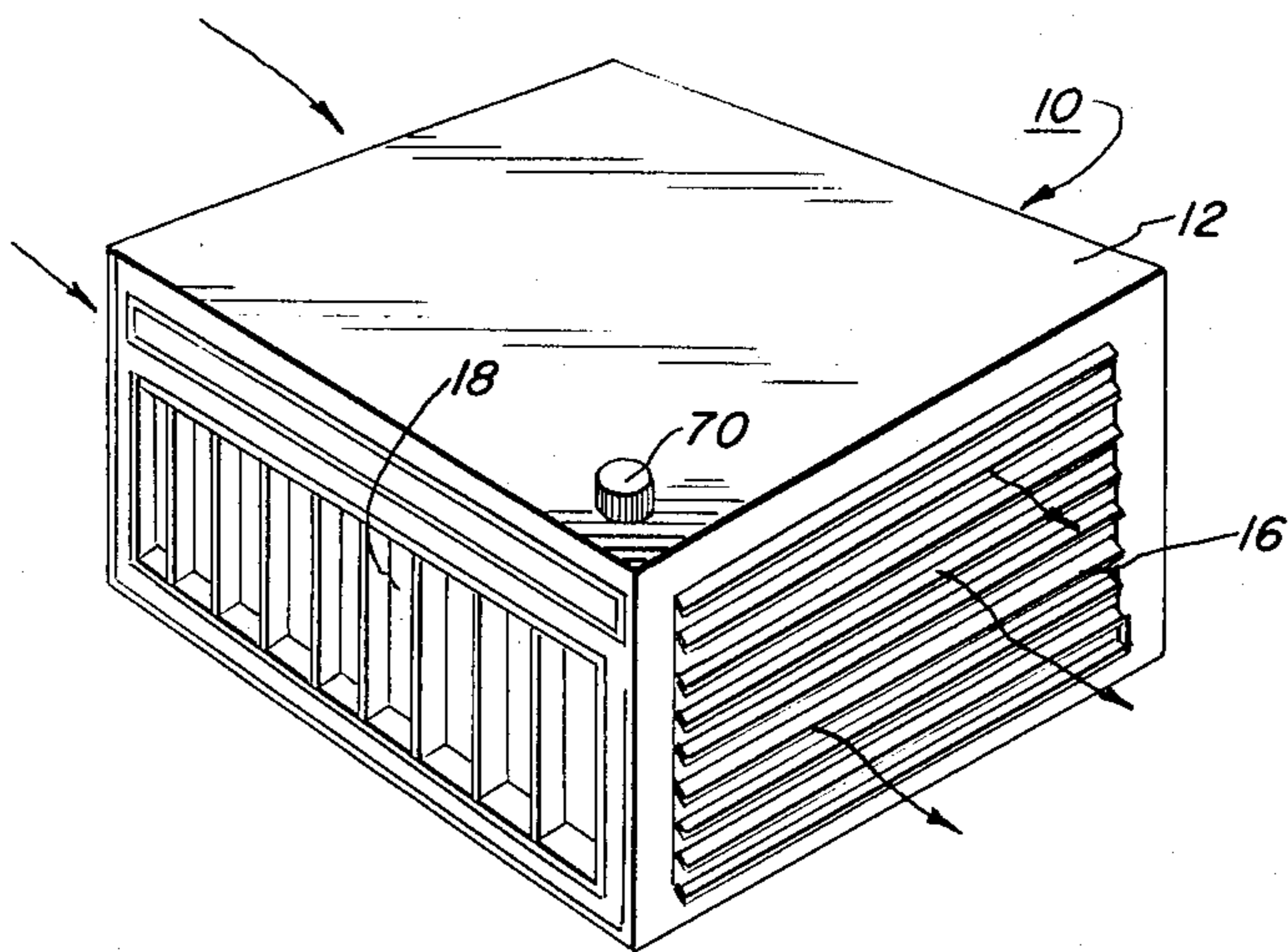
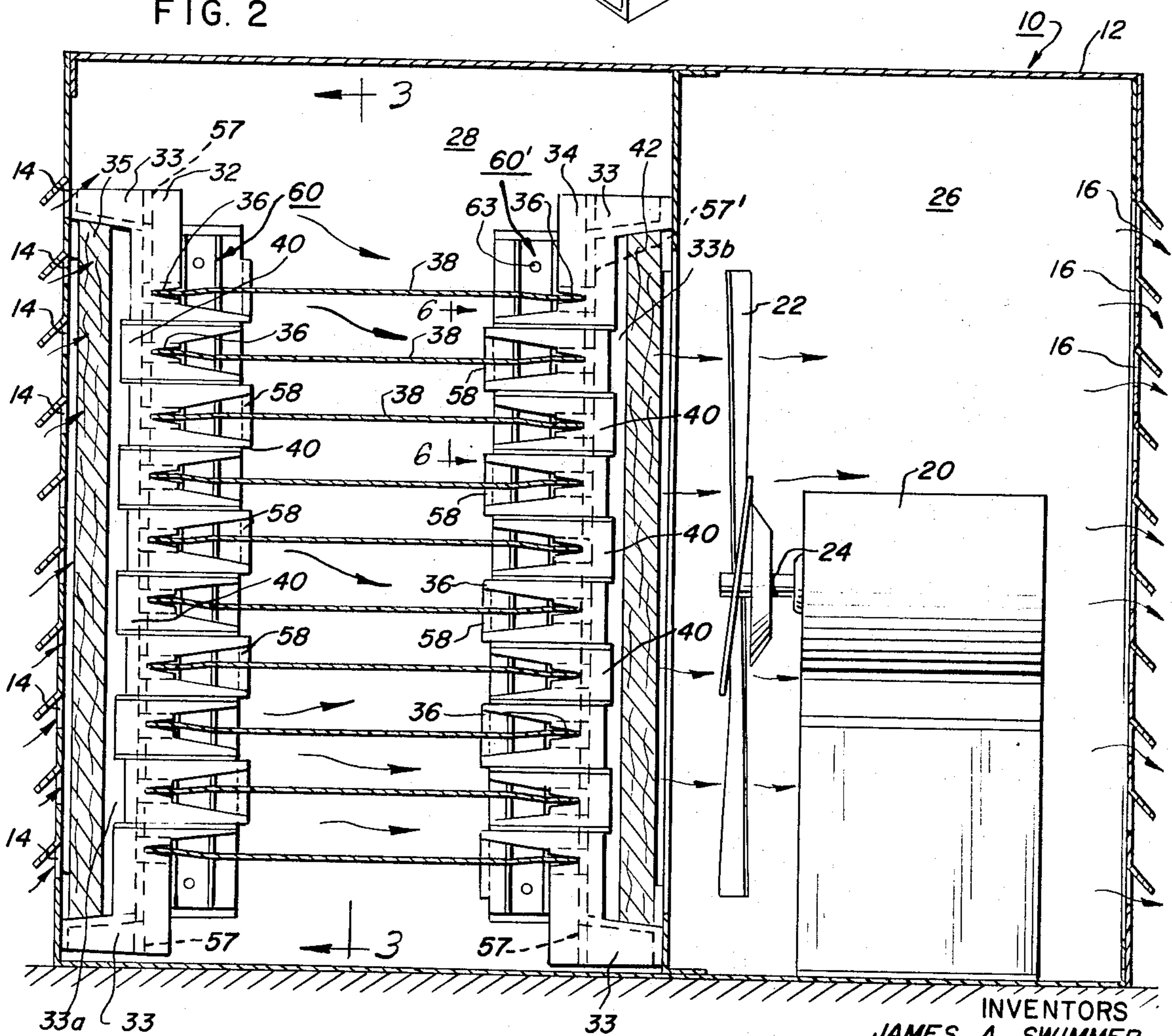
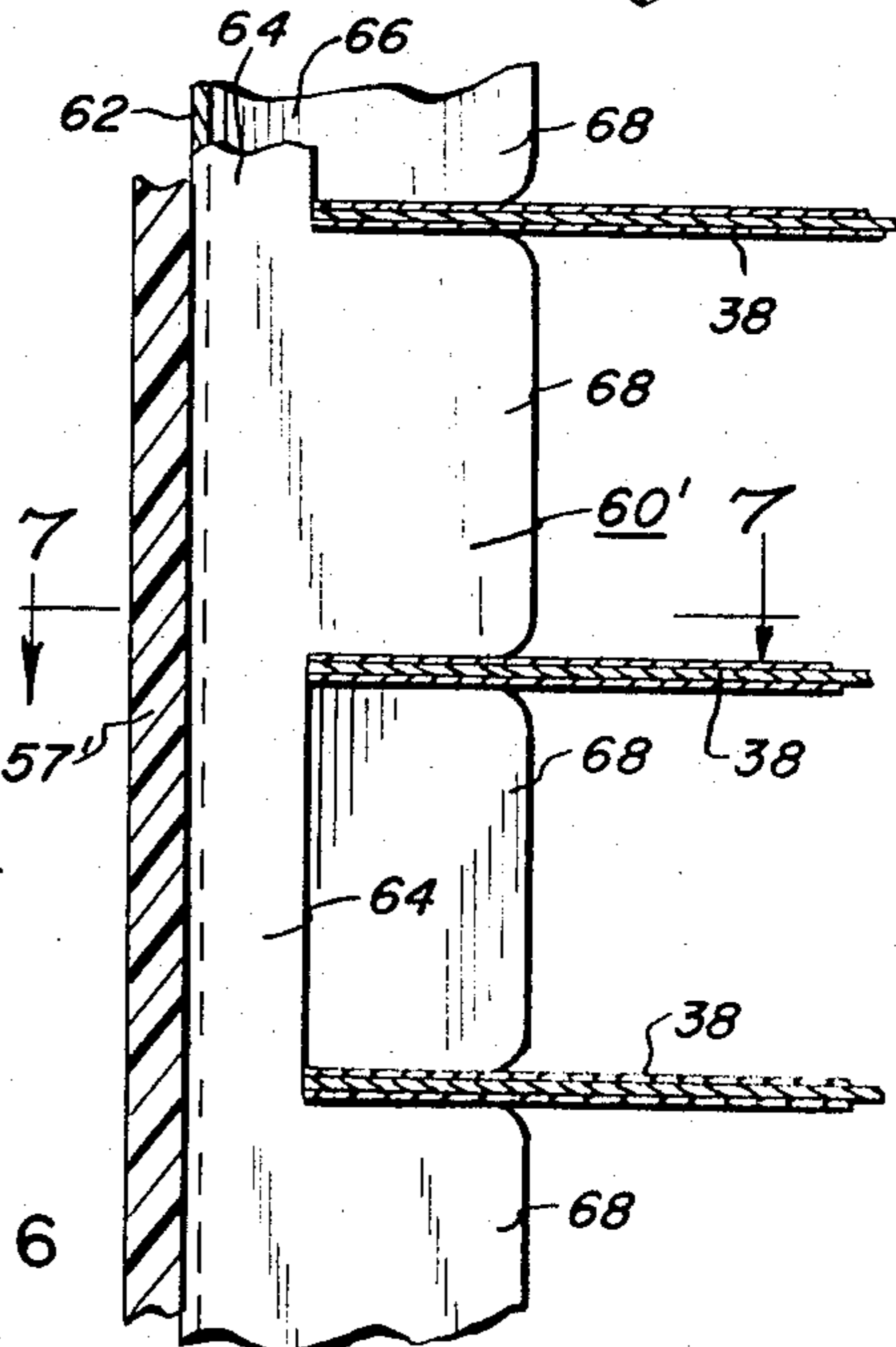
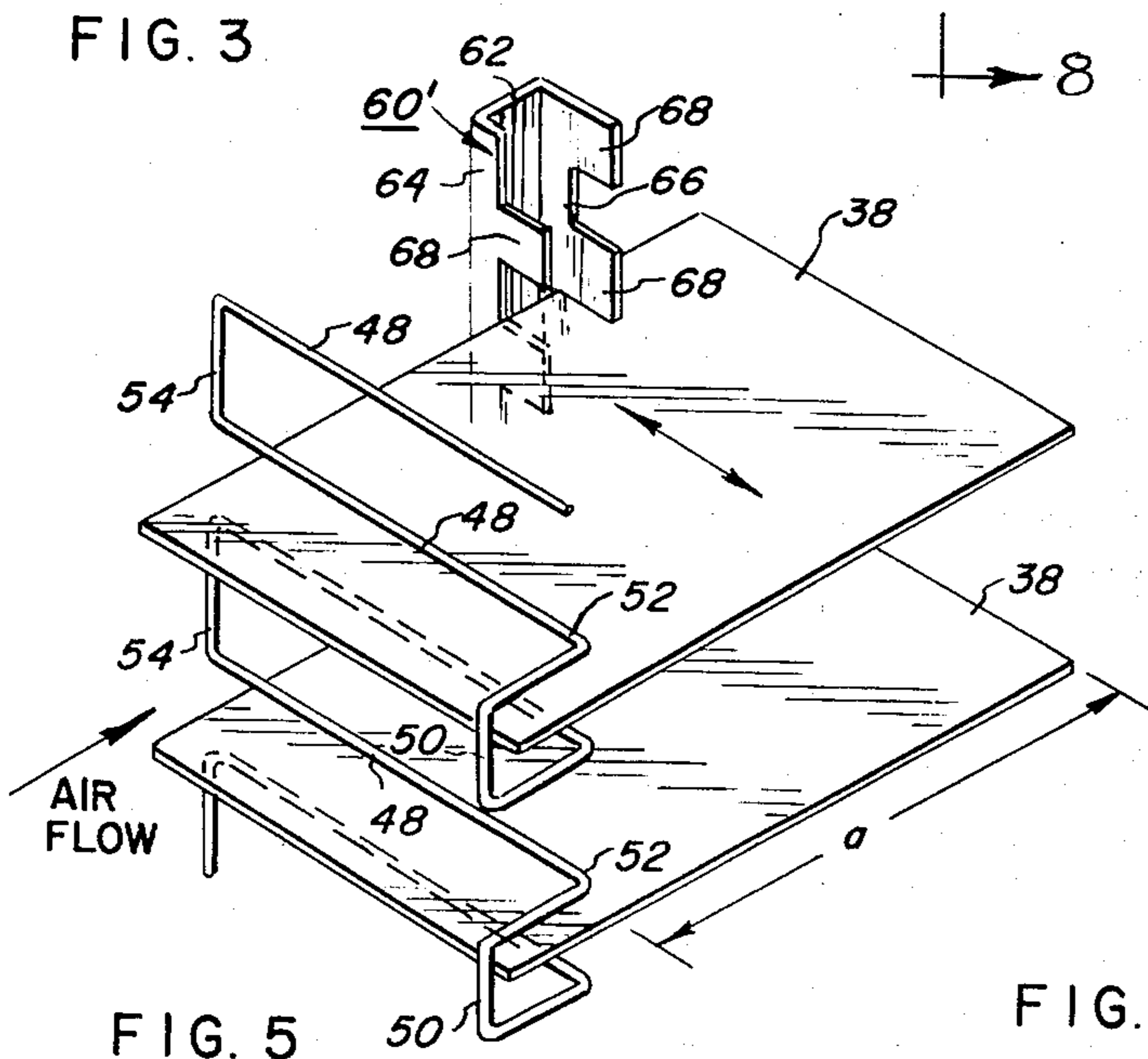
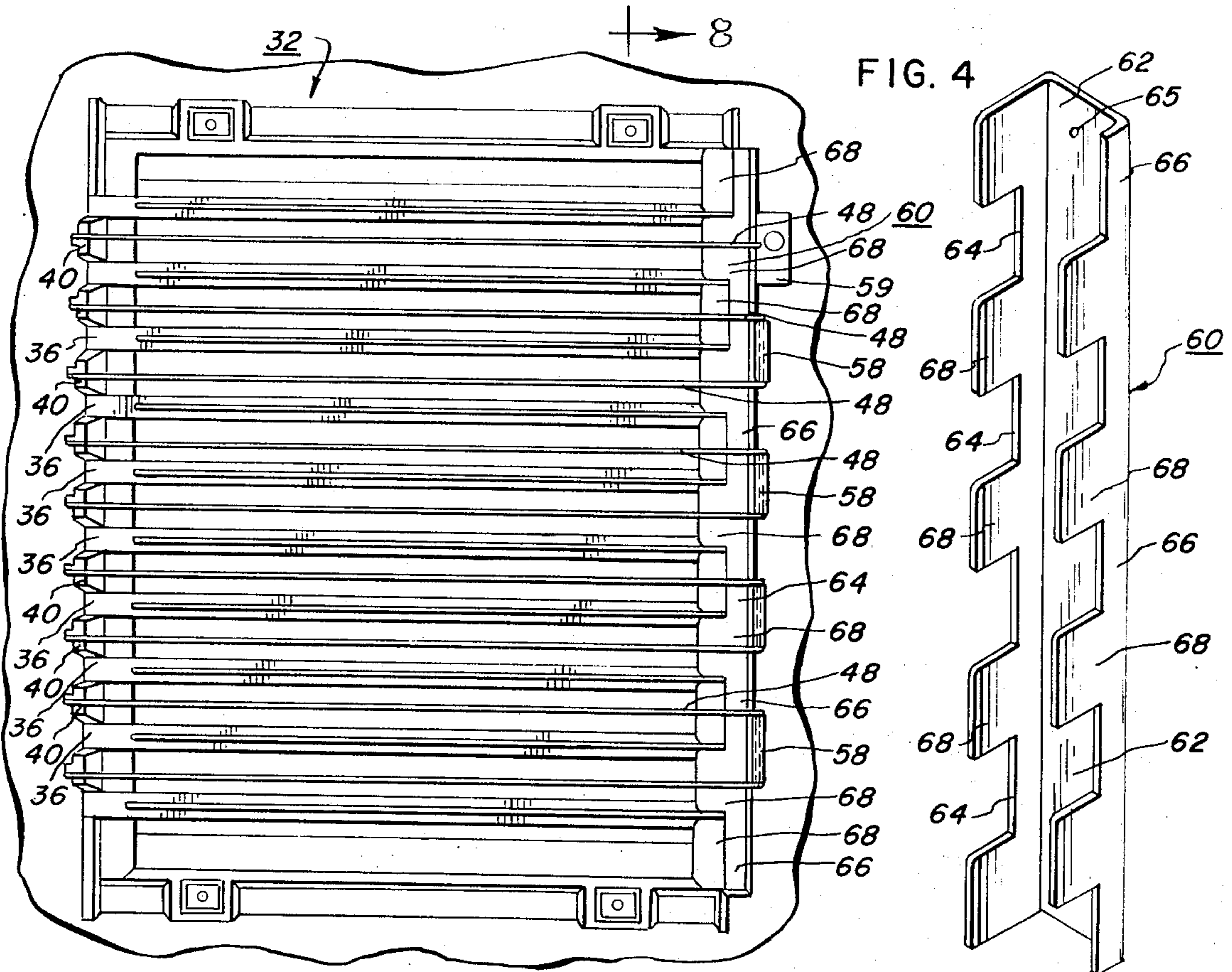


FIG. 2



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ELECTROSTATIC AIR CLEANER

BACKGROUND OF THE INVENTION

This invention relates to a novel electrostatic air cleaner for removing impurities from the air which is drawn into the housing and discharged therefrom.

Conventional electrostatic air cleaners include a housing with an air inlet and an air outlet and have a fan for drawing an air stream through the housing. The air stream passes an ionizing wire causing impurities in the air stream to be electrically charged. The charged impurities are attracted to the surface of collection plates where they remain while the purified air is discharged from the housing.

An object of the present invention is to provide an electrostatic cleaner which is simple in construction, inexpensive to manufacture and operates efficiently to collect impurities from the air.

Another object is to provide an electrostatic air cleaner having an ionizing wire that is strung in a manner which enables the simple and rapid construction of a relatively compact unit, yet provides an efficient means for charging particles in the air drawn into the air cleaner housing.

Another object is to provide an electrostatic air cleaner having collector plates which are slidably and removably received by a frame member, to enable the air cleaner unit to be cleaned rapidly and efficiently.

A still further object is to provide an electrostatic air cleaner having electrically conductive contact means for providing all of the collector plates with the same potential and for holding the collector plates in place in the unit with a snug fit, by requiring distortion of the collector plates in order for them to be properly aligned with the frame member of the unit.

Other objects and advantages of the present invention will become apparent from the following description, claims and by referring to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an electrostatic air cleaner constructed in accordance with the principles of the present invention;

FIG. 2 is a front elevational view thereof, with the front panel removed;

FIG. 3 is a cross-sectional elevation thereof, taken along the line 3—3 of FIG. 2;

FIG. 4 is a perspective view of an electrical contact strip constructed in accordance with the principles of the present invention;

FIG. 5 is a diagrammatic view of the electrical connections of the electrostatic air cleaner of FIG. 1;

FIG. 6 is a fragmentary enlarged sectional elevation, taken along the line 6—6 of FIG. 2, showing the connection of the collector plates with an electrical contact strip;

FIG. 7 is a fragmentary cross-section view taken along the line 7—7 of FIG. 6;

FIG. 8 is a fragmentary enlarged sectional elevation of a portion of the electrostatic air cleaner of FIG. 2; and

FIG. 9 is a fragmentary cross-sectional view taken along the line 9—9 of FIG. 8.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Referring to the drawings, an electronic air purifier

10 is shown including a metal housing 12. Air inlet openings 14 are provided on one side of the housing and air outlet openings 16 are provided on the opposite side of the housing. Housing 12 has a front panel 18 which, when removed, enables the unit to be efficiently serviced and cleaned, as will be described in more detail below.

Appropriately positioned within housing 12 are an electrical motor 20 and a bladed fan 22 carried on a shaft 24 that is driven, directly or indirectly, by the motor 20. Motor 20 and fan 22 are positioned in a chamber 26 of the housing and are operable to draw air through air inlet openings 14 and over electrostatic means and to then discharge a stream or flow of purified air through air outlet openings.

Positioned within chamber 28 of housing 12 is a frame member comprising two vertical uprights 32, 34, each being formed of a unitary molded plastic electrically-insulative material and defining horizontally extending slots 36 into which collector plates 38 extend to become aligned, in parallel spaced arrangement as shown most clearly in FIGS. 2 and 8. Uprights 32 and 34 are spaced from the opposite ends of chamber 28 by means of laterally extending flanges 33 to form recesses 33a and 33b. These recesses provide access for, respectively, a conventional prefilter 35 for trapping relatively large particles and a conventional charcoal filter 42 which is typically formed of a charcoal impregnated paper as is well known in the art. Prefilter 35 and filter 42 can simply be slid into the recesses 33a and 33b.

Uprights 32 and 34 have protuberances 40 which extend outwardly towards the front of the uprights, to retain an ionizing wire 48 (see FIG. 5) in position. Although ionizing wire 48 is used only with upright 32, uprights 32 and 34 are identical in construction for efficiency in manufacture. Protuberances 40 are designed to provide suitable tension on the ionizing wire so as to preclude the necessity of using additional hardware to provide such tension.

Ionizing wire is strung in a generally zig-zag configuration, as shown most clearly in FIGS. 3 and 5, to overlie and underlie each of the collector plates 38. The ionizing wire 48 is connected to upright 32 with bight portions 50 of the zig-zag wire having a perpendicular bend at 52 to offset the bight portion thereby enabling insertion and simple removal of the collector plates 38 into and from the configuration formed by the wire. The spacing is such that the collector plates are equidistant between the overlying and underlying wires.

Bight portions 50 of wire 48 are located around the edges of protuberances 40 for retention of the ionizing wire 48 on the front side of upright 32. Bight portions 54 (FIG. 5) of wire 48 are positioned around lips 58 (FIGS. 2, 3 and 9) carried by and molded intergrally with plastic frame structure 57. The ends of wire 48 are suitably fastened to a projection 59. (FIG. 3).

When collector plates 38 are slid into the horizontally extending slots 36 defined by uprights 32 and 34, they are engaged by generally U-shaped channel strips 60 and 60' connected at the rear of each of the uprights. Channel strip 60 is formed of electrically non-conductive material, such as plastic, while channel strip 60' is formed of electrically conductive material. Except for the materials of which strips 60 and 60' are formed, channel strips 60 and 60' are identical and each comprises a rear portion 62 with parallel, inwardly extending arms 64, 66. Rear portion 62 is fas-

tened to the housing by suitable fastening means 63 (FIGS. 2, 7 and 8) which extend through aperture 65 (FIG. 4). As shown in FIG. 7, bolt 63 connects metal housing 12 to channel strip 60' thereby grounding the channel strip 60'. Plastic frame structure 57' to which channel strip 60' is fastened, has an integral stud 67' through which bolt 63 extends, to space structure 57' from housing 12. A wing nut 69' is used to retain the structure in place as shown in FIG. 7 and to allow frame structure 57' to be easily removed for cleaning.

Each of the arms 64, 66 of the contact strip has alternating extending projections 68 with the bottom of each of the projections of one arm being aligned in a single horizontal plane with the top of a projection of the other arm. In this manner, because of the thickness of collector plates 38, the collector plates will become distorted (as shown most clearly in FIGS. 2 and 8) when they are placed into engagement with channel strips 60 and 60' thereby providing a snug fit. Such snug fit is particularly important with contact strip 60' because strip 60' serves to couple the collector plates to ground (or to a source of negative potential if desired). Strip 60 serves to provide symmetrical support for the plates. Arms 64 and 66 give rigidity to the structure to prevent undesirable flexing of projections 68.

In the illustrative embodiment, the collector plates 38 are formed of electrically conductive foil-coated cardboard, with the foil coating present on both sides of the plates. Hence the plates, when soiled, can be disposed of and new collector plates can be substituted therefor. Alternately, permanent (washable) solid aluminum collectors may be used.

It can be seen that the illustrative embodiment of the present invention essentially comprises substantially identical uprights 32, 34, channel strips 60 and 60' connected to each of the uprights, an ionizing wire 48 strung in a generally zig-zag configuration on upright 32, removable filters 40 and 42, and removable and disposable collector plates 38. Channel strip 60' is connected to ground (neutral) while ionizing wire 48 has a positive potential. If desired, channel strip 60' could be connected to a source of negative potential d.c. instead of being connected to ground. In this manner, all of the collector plates have the same potential in contrast to prior art units in which the collector plates are alternately charged. Utilizing the construction described above, with an ionizing wire having a positive potential and collector plates all being grounded or having identical negative potentials, a very efficient and effective electrostatic air purifier is provided.

Upon actuation of switch 70 (FIG. 1) motor 20 will be energized to drive fan blade 22 thereby drawing the air through the unit as described above. Since the illustrative embodiment does not use alternately charged collector plates, the ionized particles in the illustrative embodiment will move along a path which describes an arc of larger radius than the arc that would be described if the plates were alternately charged. It has been found that in order to collect the particles properly, the ratio of collector plate depth to the space between the collector plates should be in excess of the ratio 3.5 to 1. In other words, if the collector plates are one inch apart vertically, the depth of the plate (dimension *a* of FIG. 5) should be at least 3.5 inches in order to collect all of the ionized particles.

Although an illustrative embodiment of the invention has been shown and described, it is to be understood

that various modifications and substitutions may be made by those skilled in the art without departing from the spirit of the invention.

We claim:

1. In an electrostatic air cleaner of the type having a housing with an air inlet and an air outlet, motor driven fan means for drawing the air through the housing, means for ionizing particles drawn into the housing and means for collecting the ionized particles, the improvement comprising, in combination: an electrically insulative frame member for supporting a plurality of electrically conductive collector plates in parallel alignment, said frame member comprising a pair of spaced members defining parallel extending slots for slidably and removably receiving said collector plates and holding the plates substantially parallel when in position on the frame member; electrical contact means for engaging said collector plates with a snug fit to frictionally retain said plates in position in the frame member; and means connecting said electrical contact means to a d.c. voltage source, said electrical contact means comprising a generally U-shaped contact strip with the arms of the U extending toward the open face of the frame member which receives the collector plates, each of the arms of the U having alternating extending projections one lateral edge of each of which is substantially coplanar with another lateral edge of a projection of the other arm and is also substantially coplanar with a slot of the frame member whereby an inserted collector plate will be contacted by one lateral edge of one projection on one arm of the U and the other lateral edge of one projection on the other arm, causing the plate to be slightly distorted and thereby providing a snug contact.

2. In an electrostatic air cleaner of the type having a housing with an air inlet and an air outlet, motor driven fan means for drawing the air through the housing, means for ionizing particles drawn into the housing and means for collecting the ionized particles, the improvement comprising, in combination: an electrically insulative frame member for supporting a plurality of electrically conductive collector plates in parallel alignment, said frame member comprising a pair of electrically insulative spaced members defining parallel extending slots for slidably and removably receiving opposed edges of said collector plates and holding the plates substantially parallel when in position on the frame member; electrical contact means other than the frame member and positioned to engage said collector plates at an edge thereof other than the said pair of opposed edges with a snug fit, to frictionally retain said plates in the frame member, said ionizing means comprising a wire connected to the electrically insulative frame member and strung in a generally zig-zag configuration for disposition adjacent both surfaces of each of said collector plates with the length of the zig-zag portions extending transverse the air inlet, said wire and said collector plates being operatively constructed and arranged for removal of said collector plates without disturbing said ionizing wire.

3. In an electrostatic air cleaner of the type having a housing with an air inlet and an air outlet, motor driven fan means for drawing the air through the housing, means for ionizing particles drawn into the housing and means for collecting the ionized particles, the improvement comprising, in combination: electrically non-conductive frame means for supporting a plurality of

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electrically conductive collector plates in parallel alignment; said frame member providing opposed portions defining means for slidably receiving opposite ends of said collector plates; electrically conductive contact means other than said frame means and positioned to be releasably electrically engaged by portions of the collector plates when the collector plates are properly positioned on the frame members, said electrically conductive contact means being spaced between the opposed portions of the frame member that slidably receive the ends of the collector plates to receive the col-

lector plates with a snug fit, said electrically conductive means providing all of the collector plates with the same potential; said ionizing means comprising an electrically conductive wire strung in a generally zig-zag configuration for disposition adjacent both surfaces of each of said collector plates with the length of the zig-zag portions extending transverse the air inlet; said wire and said collector plates being operatively constructed and arranged for removal of said collector plates without disturbing said ionizing wire.

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