Sept. 22, 1964 R. M. STUNKARD 3,149,552

AIR FILTER SYSTEM

Filed Nov. 24, 1961 4 Sheets-Sheet 1

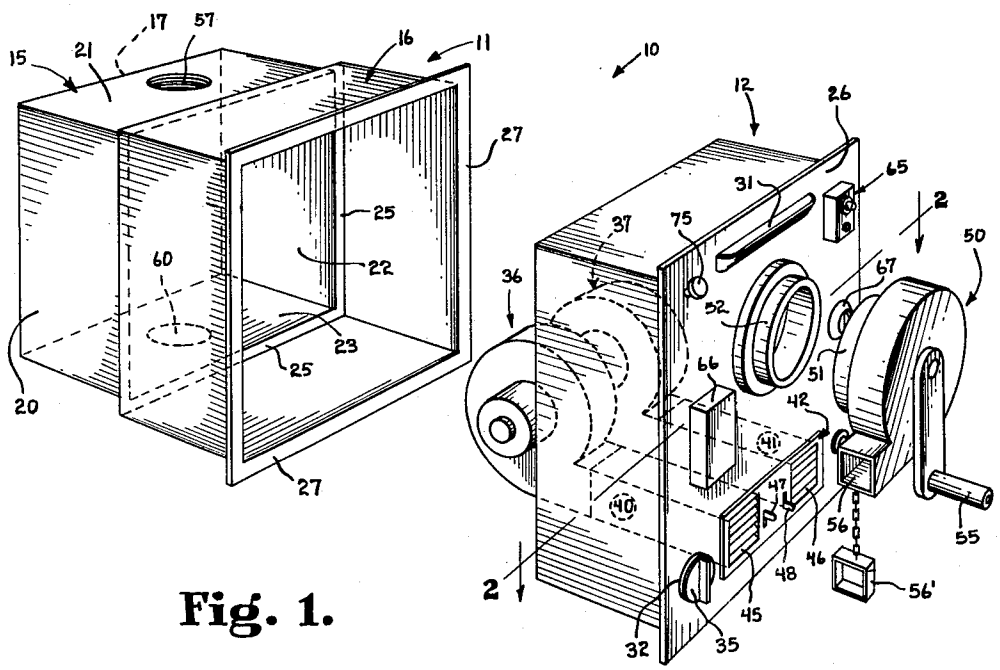


Fig. 1.

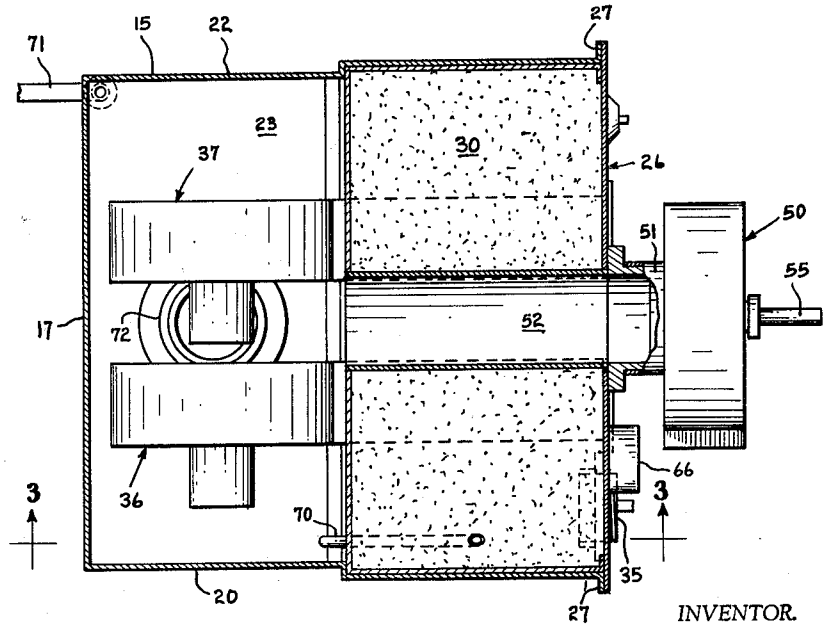


Fig. 2.

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AIR FILTER SYSTEM

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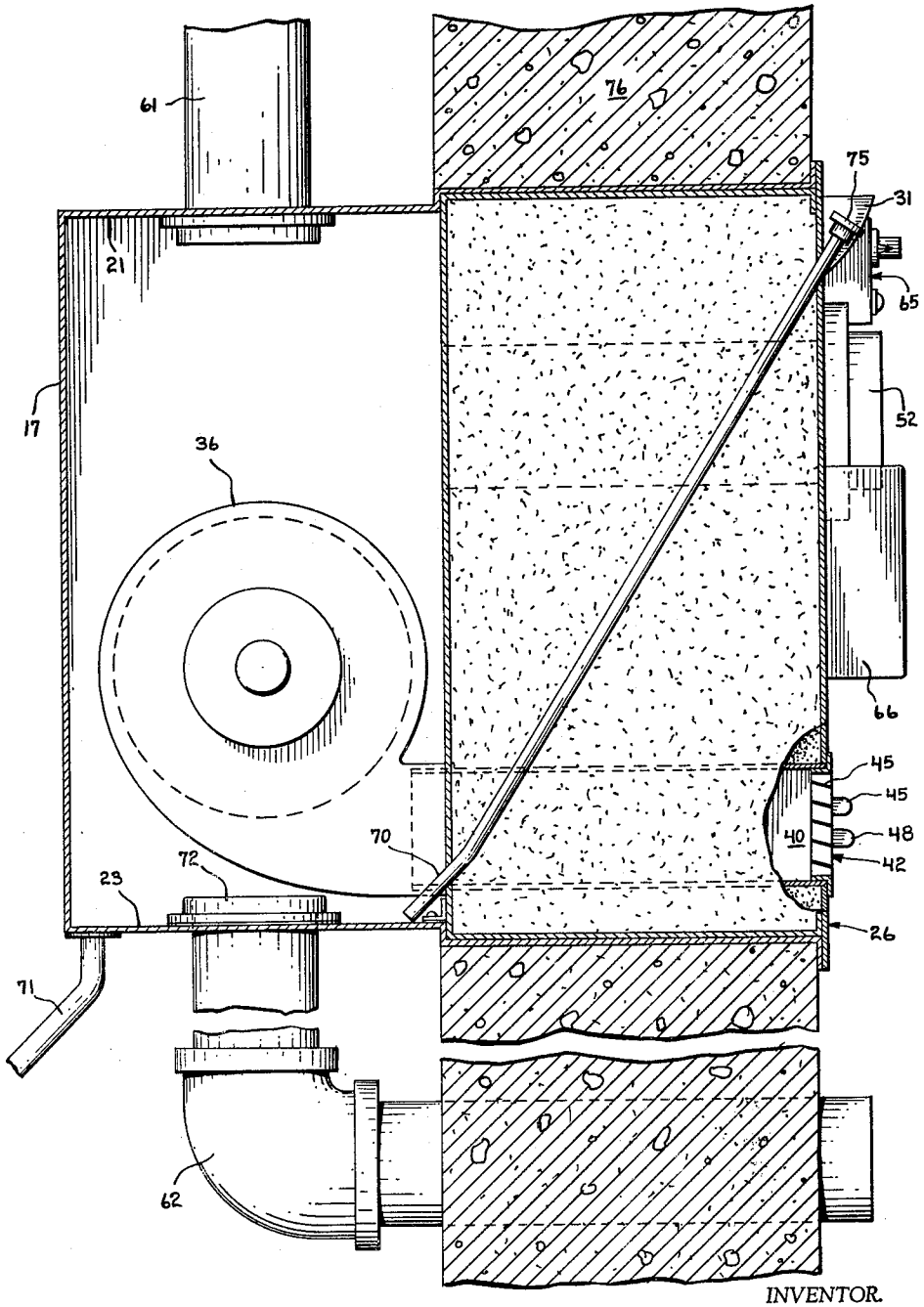


Fig. 3.

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AIR FILTER SYSTEM

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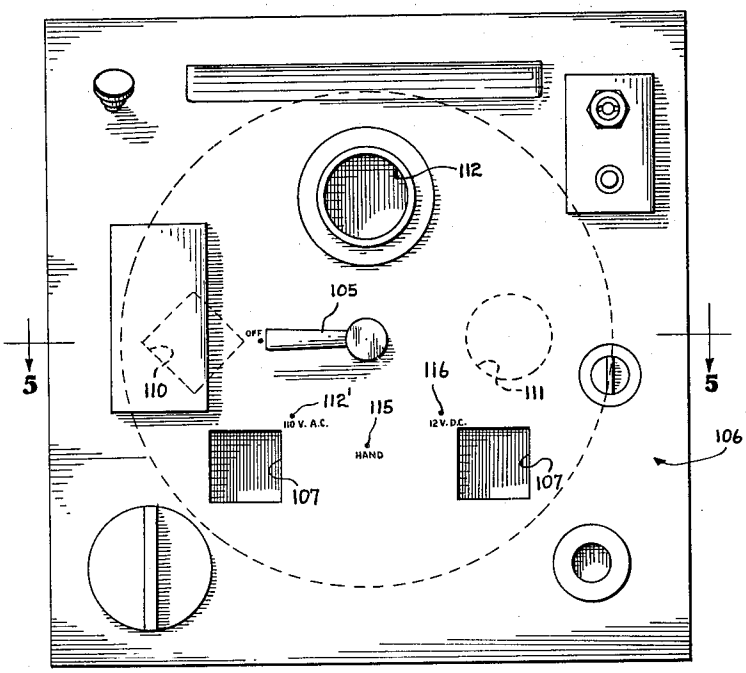


Fig. 4.

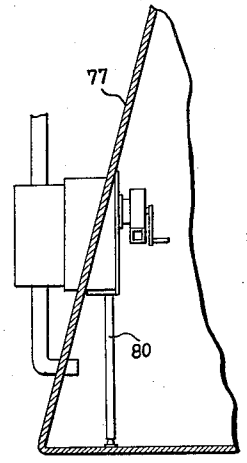


Fig. 7.

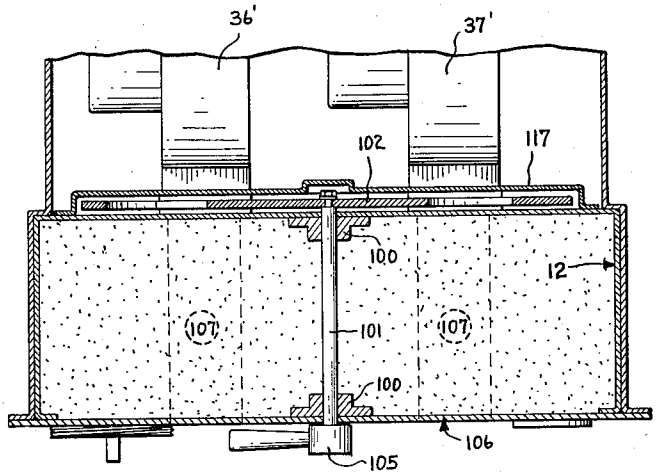


Fig. 5.

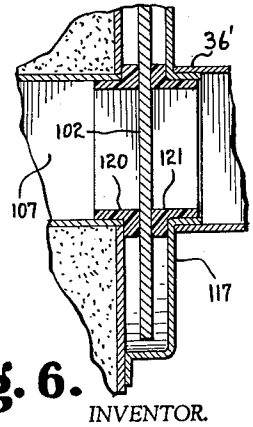


Fig. 6.

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AIR FILTER SYSTEM

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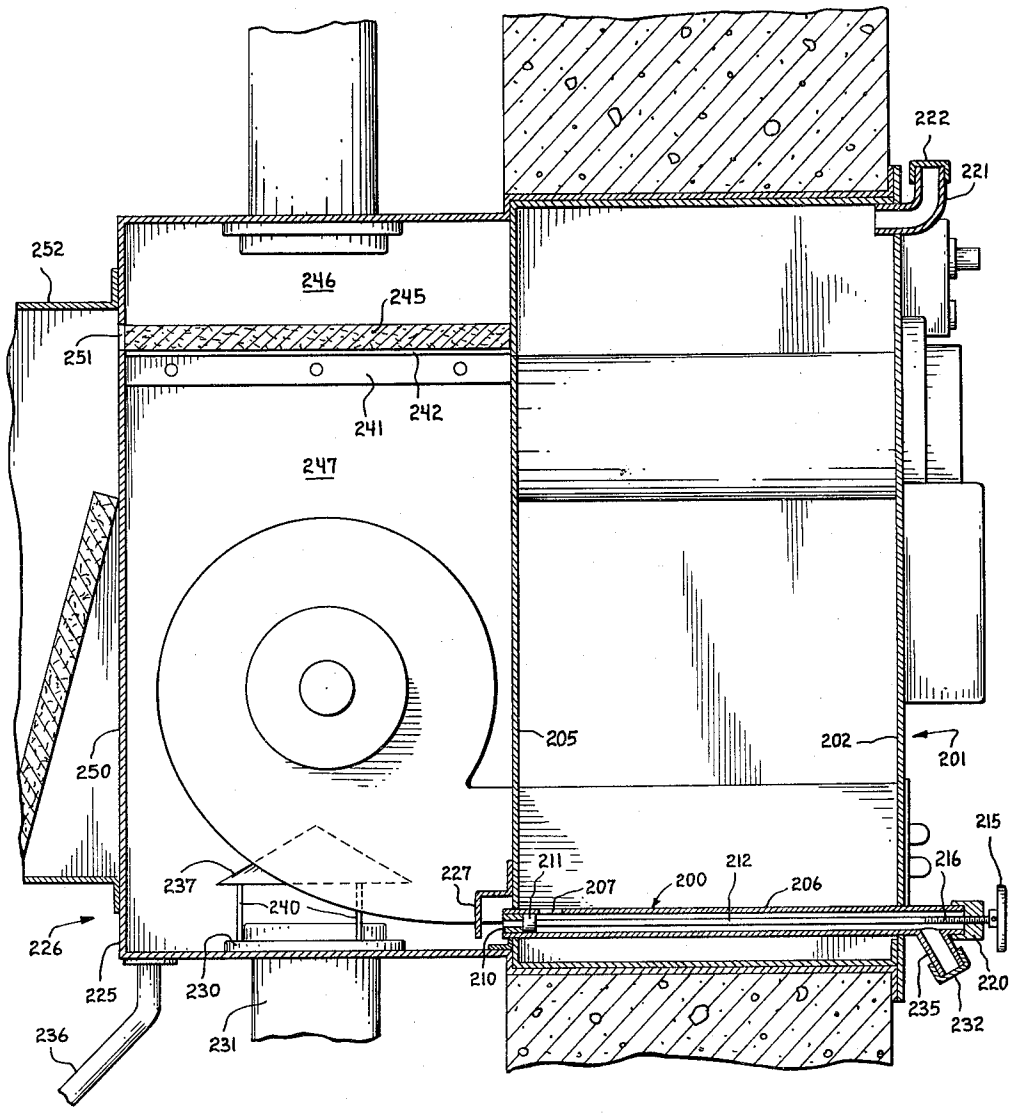


Fig. 8.

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United States Patent Office 3,149,552 Patented Sept. 22, 1964

3,149,552

AIR FILTER SYSTEM

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Filed Nov. 24, 1961, Ser. No. 154,425
5 Claims. (Cl. 98—39)

The present invention relates to a ventilating system finding an important utility in a fallout shelter.

One of the critical problems in the construction of a fallout shelter is the provision of proper ventilating means. The presently approved method of ventilating a fallout shelter includes the use of a hand powered crank-type blower. An intake an an exhaust pipe are provided for the shelter preferably at opposite ends thereof and with at least one elbow or bend in the intake pipe to prevent radiation from entering the shelter. The air is pumped into the shelter by locating the hand powered blower at the shelter end of the intake pipe. It has been found that such arrangement is not completely satisfactory, at least in part, because of the limited amount of air pumped. Thus, the number of occupants of the shelter may be limited and/or the occupants of the shelter must operate the blower at or near full capacity either continuously or for long periods of time.

Consequently, one object of the present invention is to provide an improved ventilating system particularly useful in a fallout shelter.

Another object of the present invention is to provide a ventilating system supplementing and/or reducing the necessity of hand operation.

Still another object of the invention is to provide a ventilating system capable of pumping a greater amount of air than presently known ventilating systems.

Related objects and advantages will become apparent as the description proceeds.

Briefly described, the ventilating system of the present invention includes an outer housing having a rearward portion and a forward portion, said housing being adapted for use with a fallout shelter. An inner housing is received within the forward portion and has a forward face. The outer housing is open at its forward end to expose the forward face of the inner housing. Two powered blowers are mounted on the rear wall of the inner housing with their outlet conduits extending through the inner housing and with their inlet conduits located within the rearward portion of the outer housing. A hand operated blower is mounted on the forward face of the inner housing whereby air may be pumped through a conduit mounted within the inner housing and leading from the rearward portion to the hand operated blower. The rearward portion has an air inlet in its upper surface which may be connected to atmosphere.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is an exploded perspective view of the ventilating system of the present invention.

FIG. 2 is a horizontal section taken along the line 2—2 of FIG.1 in the direction of the arrows.

FIG. 3 is an enlarged vertical section taken along the line 3—3 of FIG. 2 in the direction of the arrows.

FIG. 4 is a front elevation of an alternative embodiment of the invention with certain portions thereof broken away to indicate the differences between this embodiment and the embodiment of FIGS. 1–3.

FIG. 5 is a horizontal section taken along the line 5–5 of FIG. 4 in the direction of the arrows with portions thereof broken away for clarity.

FIG. 6 is a view similar to FIG. 5 but enlarged and fragmentary in nature.

FIG. 7 is a vertical section of a fallout shelter with walls other than 90° to the floor and showing an example of the ventilating system of the present invention and further showing the means for supporting the housing of the system in the wall of the shelter.

FIG. 8 is a view similar to FIG. 3 of a further alternative embodiment of the invention.

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawing and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now more particularly to the drawings, there is illustrated a ventilating system **10** including an outer housing **11** and an inner housing **12**. The outer housing **11** includes a rearward portion **15** and a somewhat larger forward portion **16**, both of which are rectangular in shape. The rearward portion **15** includes a base **17** and four sidewalls **20–23**. The rearward portion is joined to the forward portion by four outwardly projecting shoulders **25** extending from the sidewalls **20–23** and against which the inner housing **12** is supported.

The inner housing **12** is also rectangular in shape and has a forward face plate **26** which may be fixed to a flange **27** extending around the forward portion **16** of the outer housing for securing the inner housing within the outer housing. This fixing may be accomplished in any desired manner but preferably in a detachable manner to permit disassembly for repair. The inner housing **12** is hollow in nature and formed of sheet material whereby it may be filled with sand **30** through a chute **31** mounted on the forward face **26** adjacent the upper edge thereof. This sand may be drained from the inner housing by means of sand drain opening **32** which is normally closed by a threaded plug **35**.

A pair of centrifugal air blowers **36** and **37** are mounted upon the inner housing with their outlet conduits **40** and **41** extending completely through the inner housing to a louver plate **42**. This louver plate has two sets of louvers **45** and **46** pivotally mounted thereon whereby the conduits may be closed and opened by operating handles **47** and **48**. Since the louvers and louver plate are conventional in nature, they will not be further described. The blowers **36** and **37** are also conventional in nature but are different in that the blower **36** is operable by 110 volt household current while the blower **37** is operable by 12 volt current such as supplied by an automobile battery. The blowers **36** and **37** may be, for example, Shaded Pole Blowers manufactured by the Dayton Electric Manufacturing Company of Chicago, Illinois, Model No. 2–C–647 and 2–C–646, respectively. The battery for operating the blower **37** is located adjacent to the exhaust pipe of the shelter to insure that the fumes thereof are exhausted.

A further blower **50** of the hand operated variety is mounted upon the face plate **26** and may, for example, be Shelt-A-Vent type blower manufactured by The Lau Blower Company of Dayton, Ohio, Model No. SAV–2. This blower is mounted by means of its inlet defining portion **51** upon a conduit **52** which communicates between the rearward portion **15** of the outer housing and the forward face **26** of the inner housing, the conduit **52** being fixedly mounted upon the inner housing. The blower **50** is operated by a hand crank **55** to pump air from the rearward portion **15** of the outer housing through the conduit **52** and out of the outlet **56** of the hand operated

blower. The blower 50 is provided with a cap 56' which may be used for closing off the outlet of the blower.

The rearward portion 15 of the outer housing is provided with two openings 57 and 60 which are coupled respectively to an air intake pipe 61 and to a recirculating duct 62. The air intake pipe 61 is provided with suitable air filters (not shown). These filters may be conventional dust filters for preventing contaminated particles from entering the rearward portion 15 of the outer housing.

On the face plate 26 of the inner housing, there is mounted a three-way switch 65 which in one position operates the 110 volt blower 36, in another position operates the 12 volt blower 37 and in its third position, shuts off both of these blowers. A humidistat 66 is also mounted on the forward face of the inner housing and is arranged in series with the switch 65 and couples the blower 36 to the 110 volt source. The humidistat is also provided with a shunt switch whereby the circuit through the humidistat may be retained closed during shelter occupancy. The purpose of the humidistat is to maintain the fallout shelter dry before the attack occurs and also after the attack occurs if the 110 volt source is still available. The humidistat 66 is conventional in nature and operates to turn on the blower 36 when the inside of the shelter becomes humid. If desired, a suitable mechanical timer 67 may also be provided for operating either of the blowers 36 or 37 at desired times in the future.

A flush tube 70 is fixedly mounted upon the inner housing 12 and communicates between the forward face 26 and the rearward portion 15 of the outer housing 11. The flush tube 70 exhausts just adjacent the bottom sidewall 23 of the rearward portion. Also mounted upon the bottom sidewall 23 is a flush tube 71 which permits draining of the rearward portion away from the fallout shelter. The recirculation duct 62 is provided with an annular flange 72 surrounding the opening in the bottom sidewall whereby water flowing into the rearward portion through the flush tube 70 will not overflow and re-enter the fallout shelter through the recirculation duct. It should be noted that the flush tube is suitably inclined to facilitate the water flow but has a relatively small diameter to prevent too great an amount of water entering the rearward portion in a relatively short interval, thus preventing overflow into the duct 62. A cap 75 is provided for closing off the flush tube 70. Flushing of the rearward portion becomes necessary when radioactive particles enter into the rearward portion 15 through the air intake 61.

Referring to FIG. 3, it will be clear that the outer housing 11 is mounted within a fallout shelter including concrete or cement walls 76. In such a case, it is not necessary to provide additional support for the outer housing.

Referring to FIG. 7, if the outer housing is mounted in the wall of a fallout shelter which is, for example, formed of relatively thin sheet steel 77 or similar material, it may be necessary to provide a leg or legs 80 to support the outer housing.

Referring to FIGS. 4–6, an alternative embodiment of the present invention is illustrated which is identical to the above described embodiment except as follows. This embodiment includes a different means for closing off the outlet conduits of the power-operated blowers and also for closing off the inlet conduit of the hand-operated blower. Rotatably mounted within bearings 100 is a shaft 101 having a disc 102 fixed thereto at one outboard and a handle 105 fixed thereto at the other outboard end. The bearings 100 are fixed to the inside surfaces of the inner housing 12 and make possible rotation of the disc 102 by means of the handle 105 which is positioned forwardly of the face plate 106.

Similarly to the above described embodiment, the present embodiment includes blower outlet conduits 107 which communicate between the blowers and the forward face of the inner housing. The disc 102 has formed therein a rectangular opening 110 of the same size as the conduits 107 and also a circular opening 111 of the same size as the conduit 112 for the hand operated blower. In the position shown in FIG. 4, all of the conduits 107 and 112 are closed off. By rotating the handle 105 to point to the positions 112, 115 and 116, the blower 36', the blower 37' and the hand operated blower may be conditioned for operation, respectively, by opening their respective conduits.

Referring to FIGS. 5 and 6, it can be seen that the disc 102 is covered by a housing 117 which is fixed to the rearward face of the inner housing and has openings in registry with the outlet conduits of the blowers 36' and 37' and the conduit 112. Annular nylon bushings 120 and 121 are mounted within each of the conduits 107 and within the openings in the housing 117 and on opposite sides of the disc 102 to seal off any leakage between the conduits of one blower and the conduits of another blower and also to provide a relatively low friction support for the disc 102 whereby it may be smoothly rotated.

Referring to FIG. 8, there is illustrated a further alternative embodiment of the invention. This embodiment is identical to the above described embodiment of FIG. 3 with the following exceptions. The flush tube 70 is replaced by a horizontal conduit 200 which is mounted upon the inner housing 201 and more particularly upon the forward and rearward faces 202 and 205. The horizontal conduit 200 includes a tube 206 which has an opening 207 therethrough communicating between the inside of the tube and the inside of the inner housing 201. Received within one end of the tube is a stop member 210 against which abuts a valve member 211 in one operating position of the device. The valve member 211 may be withdrawn from the stop member 210 by rotation of a shaft 212 upon which the valve member is mounted. The shaft 212 has a handle 215 mounted at the other end thereof and has a threaded portion 216 threadedly received within a member 220 sealingly secured to the extending end of the tube 206.

Water or other liquid such as antifreeze may be placed in the inner housing 201 through an inlet conduit 221 mounted on the forward face 202 of the inner housing 201 and leading into the inner housing. The inlet conduit 221 may be closed off by a cap 222 if desired. It should be mentioned that it has been found that five inch thickness of water provides equivalent shielding against radioactive fallout to approximately three feet of earth. Thus, the filling of the inner housing 201 with water provides shielding to the occupants of the fallout shelter.

It will be noted that the handle 215 is located on the inside of the fallout shelter and thus may be easily manipulated by the occupants thereof. In order to flush the rearward portion 225 of the outer housing 226, the handle 215 is rotated whereby the threads 216 cause the valve 211 to move rightwardly as viewed in FIG. 8 past the opening 207 permitting a certain portion of the water within the inner housing to flow through the opening and through the stop 210 into the rearward portion 225. A deflector 227 is mounted upon the rearward face 205 of the inner housing and functions to prevent the water from flowing directly over the annular flange 230 surrounding the recirculation duct 231. If it is desired to drain the inner housing, this may be accomplished by the removal of a cap 232 closing off an outlet duct 235 communicating with the tube 206. Similar to the above described device, the present embodiment includes a flush drain 236.

The present embodiment also includes a conical cover element 237 which is supported upon three vertical members 240 secured to the flange 230 surrounding the recirculation duct opening. The conical cover 237 functions to prevent any radioactive particles from entering the recirculation duct 231.

The present embodiment also includes a pair of angles

241 fixed to the opposite sides of the rearward portion 225 of the outer housing and having legs 242 which project toward one another and which are adapted to support a filter 245 in a horizontal position so as to completely close off the upper section 246 from the lower section 247 of the rearward portion 225 of the outer housing 226. The filter 245 might be, for example, a Fram Permachem-Treated Air Filter which has a rectangular shape and is manufactured by the Fram Air Filter Manufacturing Company of Providence, Rhode Island.

The rearward face 250 of the outer housing has a slot 251 formed therein which leads into a used filter receptacle 252 fixed to the rearward face 250. In order to replace the filter 245, it is only necessary to remove the inner housing 201 and to force against the used filter with a new filter. The used filter will move through the slot 251 and drop into the receptacle 252, it being understood that the occupants of the shelter need not touch the used filter. The inner housing would then be replaced after the new filter was properly positioned upon the angles 241.

It should be understood that it may not always be necessary to have both the filter 245 and the conical cover 237 and that one or the other might be used.

Various other modifications might be made in the present device. For example, a heating or cooling or dehumidifying device might be mounted upon the rearward face 205 of the inner housing in order to heat, cool or dehumidify the inlet air. One example of a suitable heating coil might be a Straight Glocoil, Model 415, manufactured by the Eagle Electric Manufacturing Co., Inc., Long Island City, New York. By the use of such structure, the air entering the filter can be heated, cooled or dehumidified. Such a heating, cooling or air conditioning device would be wired in parallel to the 110 volt blower and would be controlled by a separate switch whereby manual control could be effected when heating, cooling or air conditioning is not desired in the shelter by the occupants thereof.

From the above description, it will be clear that the present invention provides an improved ventilating system particularly useful in a fallout shelter. It will also be clear that the present invention provides a ventilating system supplementing and/or reducing the necessity of hand operation. It has been found that a 12 volt battery can provide sufficient electrical power to operate the blower 37 intermittently for approximately twelve and one-half days. The battery for the 12 volt blower could be used to also power such appliances as a baby bottle warmer, a cigarette lighter, an emergency light and a space heater. It will also be clear from the above description that the above invention provides a ventilating system capable of pumping a greater amount of air than the conventional hand operated blower.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired to be protected.

The invention claimed is:

1. A ventilating system for an enclosure comprising an outer housing including a rectangular rearward portion and a relatively larger rectangular forward portion, said housing being adapted for mounting in the wall of the enclosure, said rearward portion including a base and four sidewalls and being joined to said forward portion by four shoulders extending outwardly from the respective sidewalls, an inner housing seated on said shoulders and received within said forward portion and having a forward face, said inner housing being received in sealing relationship within said outer housing, sand filling said inner housing, said outer housing being open at its forward end to

expose said forward face of said inner housing, a pair of centrifugal blowers mounted on said inner housing with their outlets at said forward face and their inlets located within said rearward portion, one of said blowers being adapted for operation by 110 volt house current, the other of said blowers being adapted for operation by 12 volt battery current, a hand operated blower mounted on the forward face of said inner housing, a conduit mounted within said inner housing and leading from said rearward portion to the inlet of said hand operated blower, said rearward portion having an air inlet in its upper sidewall and a recirculation opening in its lower sidewall.

2. A ventilating system for an enclosure comprising an outer housing including a rectangular rearward portion and a relatively larger rectangular forward portion, said housing being adapted for mounting in the wall of the enclosure, said rearward portion including a base and four sidewalls and being joined to said outer portion by four shoulders extending outwardly from the respective sidewalls, two of said sidewalls being an upper and a lower sidewall, an inner housing seated on said shoulders and received within said forward portion and having a forward face, said inner housing being received in sealing relationship within said outer housing said outer housing being open at its forward end to expose said forward face of said inner housing, a pair of centrifugal blowers mounted on said inner housing with their outlets at said forward face and their inlets located within said rearward portion, one of said blowers being adapted for operation by 110 volt house current, the other of said blowers being adapted for operation by 12 volt battery current, a hand operated blower mounted on the forward face of said inner housing, a conduit mounted within said inner housing and leading from said rearward portion to the inlet of said hand operated blower, said rearward portion having an air inlet in its upper sidewall and a recirculation opening in its lower sidewall, a chute mounted on the forward face of said inner housing adjacent the upper end thereof and leading into said inner housing whereby sand can be poured into said housing, a closable sand drain at the lower end of the forward face of said inner housing, a flush tube mounted in said inner housing with an inlet end at said forward face and an outlet end adjacent the lower sidewall of said rearward portion, said flush tube being inclined downwardly from said inlet end to said outlet end, a flush drain leading downwardly away from said lower sidewall, and an annular flange fixed to said lower sidewall and surrounding said recirculation opening, said flush tube being of sufficiently small size to prevent overflow of water into said recirculation opening.

3. A ventilating system for an enclosure comprising an outer housing including a rectangular rearward portion and a relatively larger rectangular forward portion, said housing being adapted for mounting in the wall of the enclosure, said rearward portion including a base and four sidewalls and being joined to said forward portion by four shoulders extending outwardly from the respective sidewalls, two of said sidewalls being an upper and a lower sidewall, an inner housing seated on said shoulders and received within said forward portion, said inner housing having a rearward face and a forward face, said outer housing being open at its forward end to expose said forward face of said inner housing, a pair of centrifugal blowers mounted on said inner housing with their outlets at said forward face and their inlets located within said rearward portion, said blowers being adapted for operation by different voltage current, a hand operated blower mounted on the forward face of said inner housing, a conduit mounted within said inner housing and leading from said rearward portion to the inlet of said hand operated blower, said rearward portion having an air inlet in its upper sidewall and a recirculation opening in its lower sidewall, a disc rotatably mounted on said inner housing at the rearward face thereof, said disc having a plurality

of openings therethrough which by rotation of the disc, may be moved alternatively into and out of registry with said outlet conduits and the conduit of said hand operated blower for controlling flow therethrough, and a handle in front of said forward face and coupled to said disc for the rotation thereof.

4. A ventilating system comprising an outer housing including a rearward portion and a forward portion, an inner housing received within said forward portion and having a forward face, said inner housing being received in sealing relationship within said outer housing, said outer housing being open at its forward end to expose said forward face of said inner housing, blower means mounted on said inner housing with its outlet at said forward face and its inlet located within said rearward portion, said rearward portion having an air inlet in its upper surface and a recirculation opening in its lower sidewall, a used filter receptacle fixed to the rear of said outer housing, a pair of inwardly extending projections extending toward one another from the inside surfaces of said rearward portion, said projections being adapted to support a filter element below said air inlet, said outer housing having a slot in the rear thereof opening into said used filter receptacle and having a width as great as said filter said slot having a height equal to the thickness of said filter, said slot terminating at the elevation of said projections and extending thereabove, whereby used filters can be disposed of by means of new filters.

5. A ventilating system for an enclosure comprising an outer housing including a rectangular rearward portion and a relatively larger rectangular forward portion, said housing being adapted for mounting in the wall of the enclosure, said rearward portion including a base and four sidewalls and being joined to said outer portion by four shoulders extending outwardly from the respective sidewalls, a water tight inner housing seated on said

shoulders and received within said forward portion and having a forward face, said inner and outer housings being sealed to one another along the lower intersection of the inner and outer housings to prevent liquid flow, liquid filling said inner housing, said outer housing being open at its forward end to expose said forward face of said inner housing, a pair of centrifugal blowers mounted on said inner housing with their outlet at said forward face and their inlets located within said rearward portion, one of said blowers being adapted for operation by 110 volt house current, the other of said blowers being adapted for operation by 12 volt battery current, a hand operated blower mounted on the forward face of said inner housing, a conduit mounted within said inner housing and leading from said rearward portion to the inlet of said hand operated blower, said rearward portion having an air inlet in its upper sidewall and a recirculation opening in its lower sidewall, a flush conduit leading from said inner housing and opening into the rearward portion of said outer housing, a valve controlling flow through said conduit and operable on said forward face, a flush drain leading downwardly away from said lower sidewall, an annular flange fixed to said lower sidewall and surrounding said recirculation opening, a cone shaped deflector mounted within said rearward portion of said outer housing over and covering said recirculation opening.

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