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Blankenship

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[45] **Nov. 25, 1975**

[54] **CATALYST CONTAINER IN INCINERATOR TOILET**

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[73] Assignee: **Research Products/Incinolet Corporation,** Dallas, Tex.

[22] Filed: **July 1, 1974**

[21] Appl. No.: **484,953**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 460,924, April 15, 1974, abandoned, which is a continuation-in-part of Ser. No. 445,661, Feb. 25, 1974, abandoned.

[52] **U.S. Cl.** ..... **4/131;** 4/118; 110/9 E

[51] **Int. Cl.²** **A47K 11/02**

[58] **Field of Search** ..... 4/131, 118, 217, 213; 110/9 R, 9 E

[56] **References Cited**

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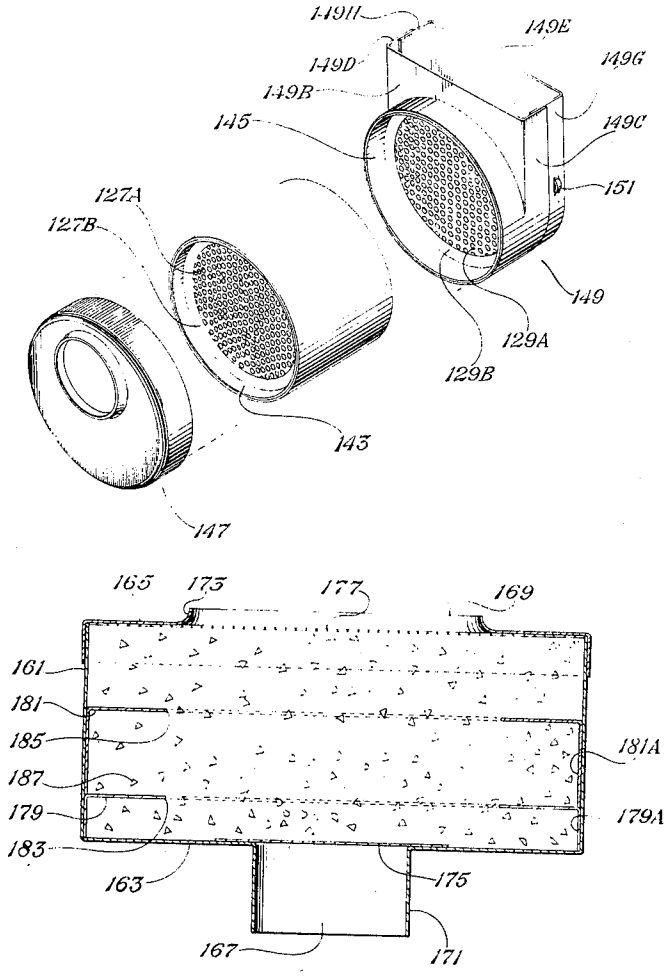
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Primary Examiner—Henry K. Artis

[57] **ABSTRACT**

The specification discloses a catalyst container for use in an incinerator toilet for reducing or eliminating odors during incineration and which comprises an inlet to be coupled to an exhaust vent extending from the incinerator chamber of the toilet, a diffusion chamber, a catalyst chamber section for holding a catalyst, a collection or diffusion chamber downstream of the catalyst chamber section leading to an outlet to be located in communication with a blower for drawing gases from the incinerator chamber and through the catalyst container by way of the catalyst located in the catalyst chamber section. In one embodiment the catalyst container is formed from five pieces which may be readily assembled and disassembled and which comprises a cylindrical housing; a front perforated plate and a rear perforated plate to be located within the housing for holding the catalyst; a front cap, having an inlet, to be fitted around the front end of the cylindrical housing; and a rear cap, having an outlet, to be fitted around the rear end of the cylindrical housing.

25 Claims, 9 Drawing Figures



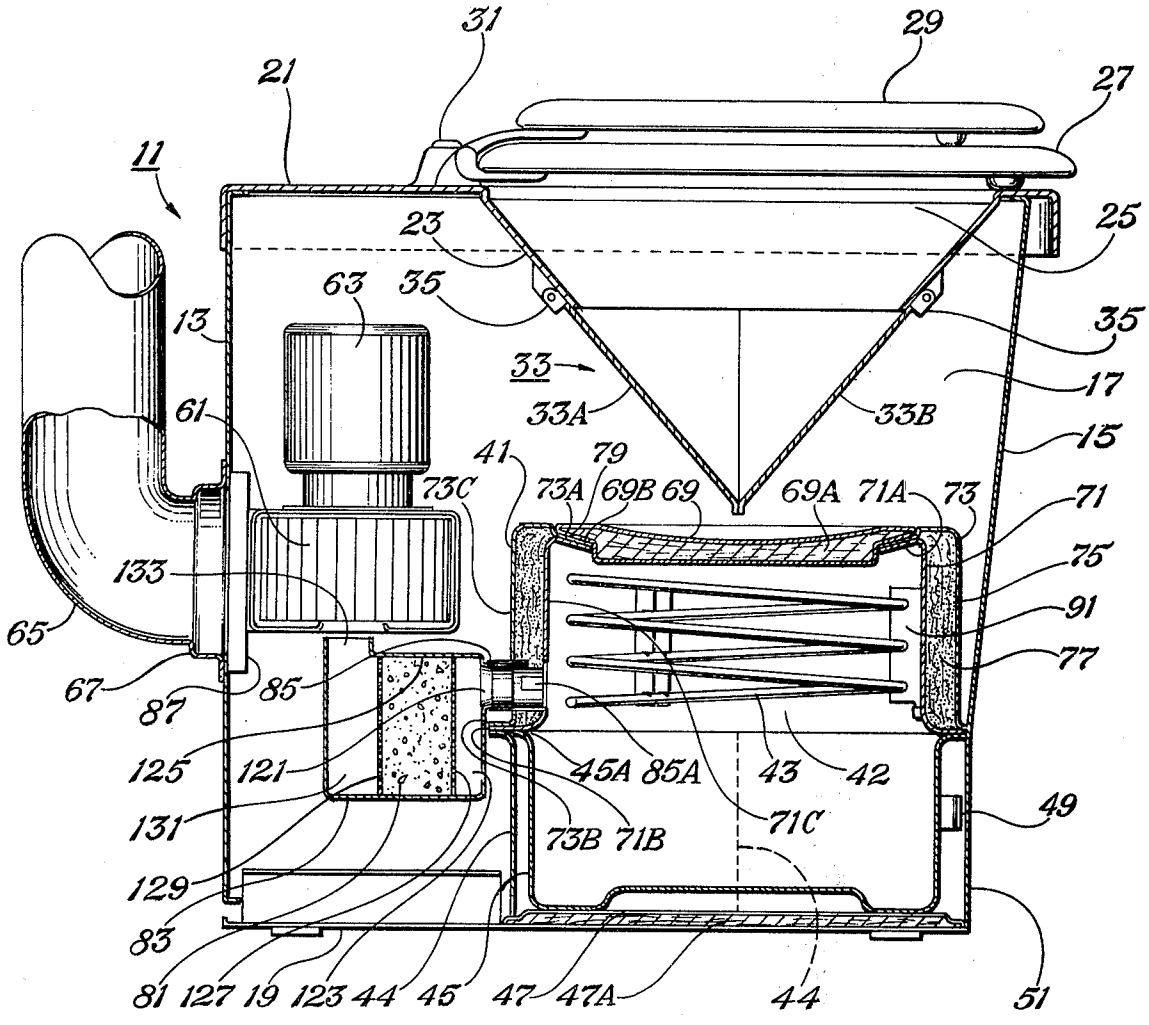

31
29
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63
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13
35
33
17
61
33A
33B
15
41
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73C
73A
69B
69
69A
71A
73
71
133
75
91
65
77
67
87
85
125
121
45A
85A
43
42
131
73B
71B
71C
49
129
83
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127
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123
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47A
44
51

Fig. 1

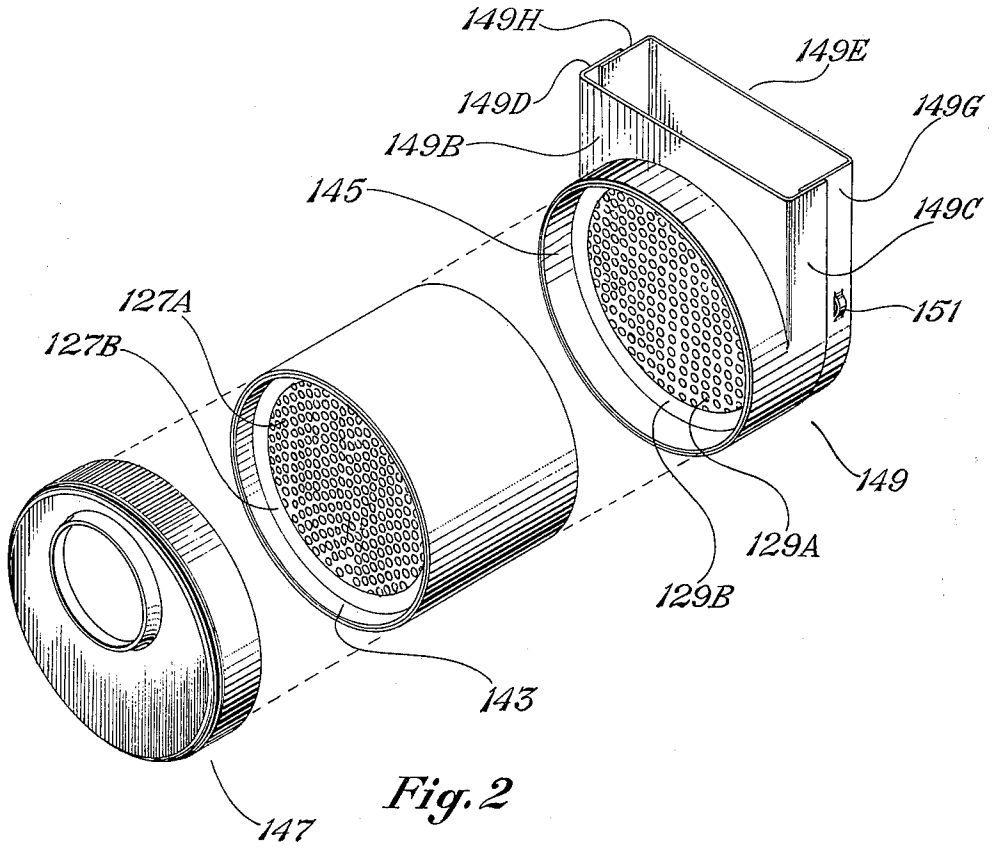

149H
149E
149D
149G
149B
145
149C
151
127A
127B
149
129A
129B
143
147

Fig. 2

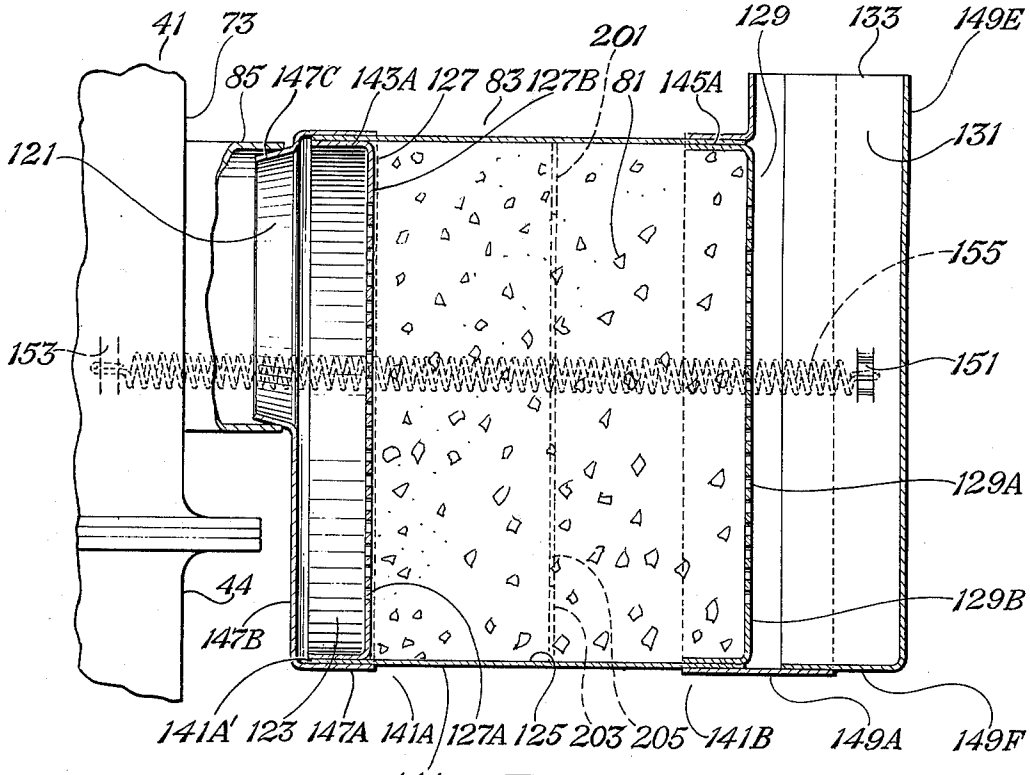

41
73
201
129
133
149E
85
147C
143A
127
83
127B
81
145A
121
131
155
153
151
129A
44
129B
147B
141A'
123
147A
141A
127A
125
203
205
141B
149A
149F
141

Fig. 3

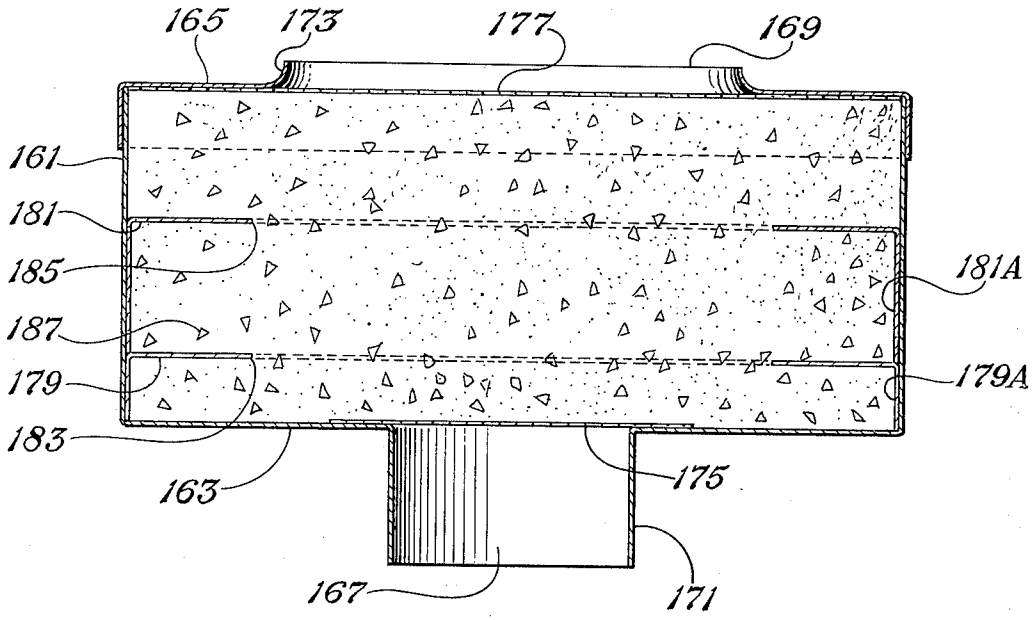


Fig.4

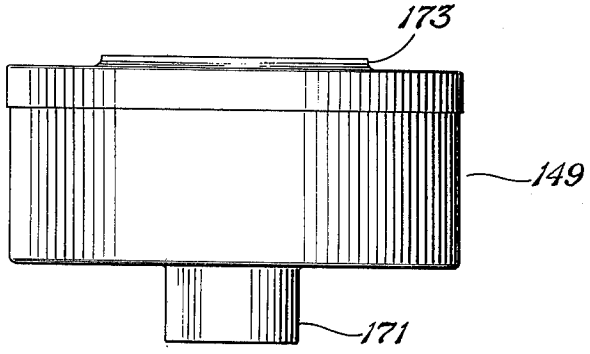


Fig.5

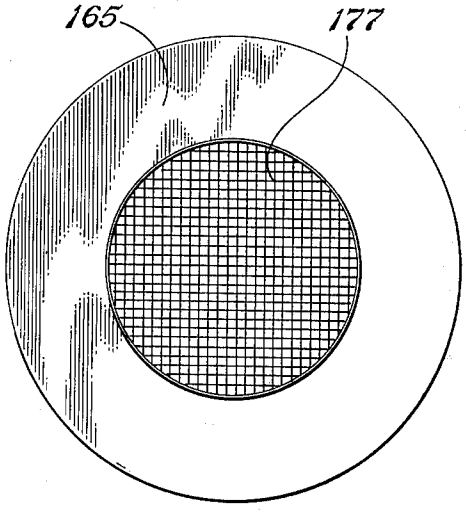


Fig.6

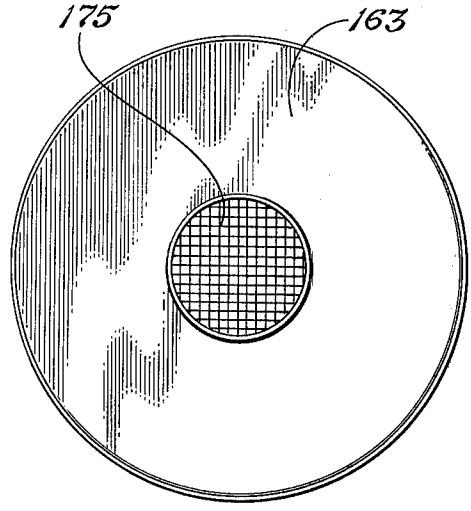


Fig.7

Fig.8

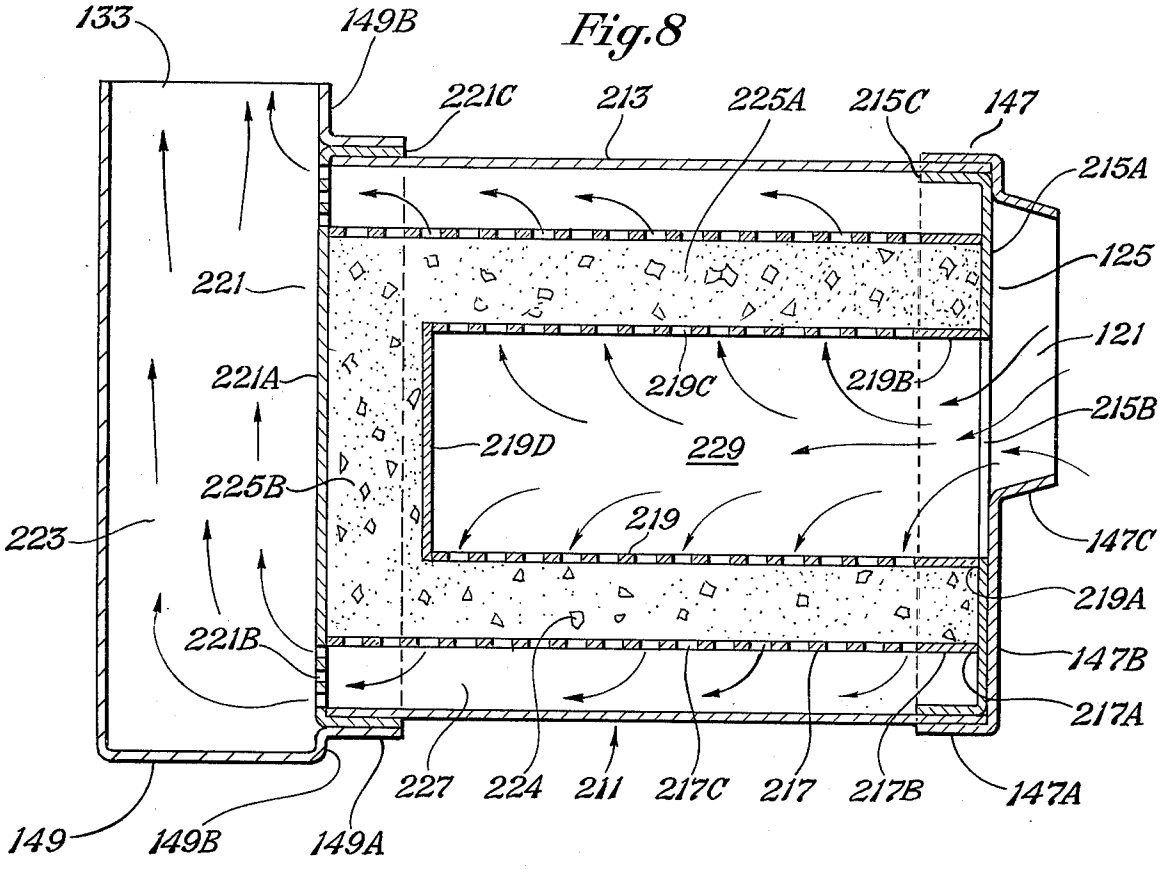
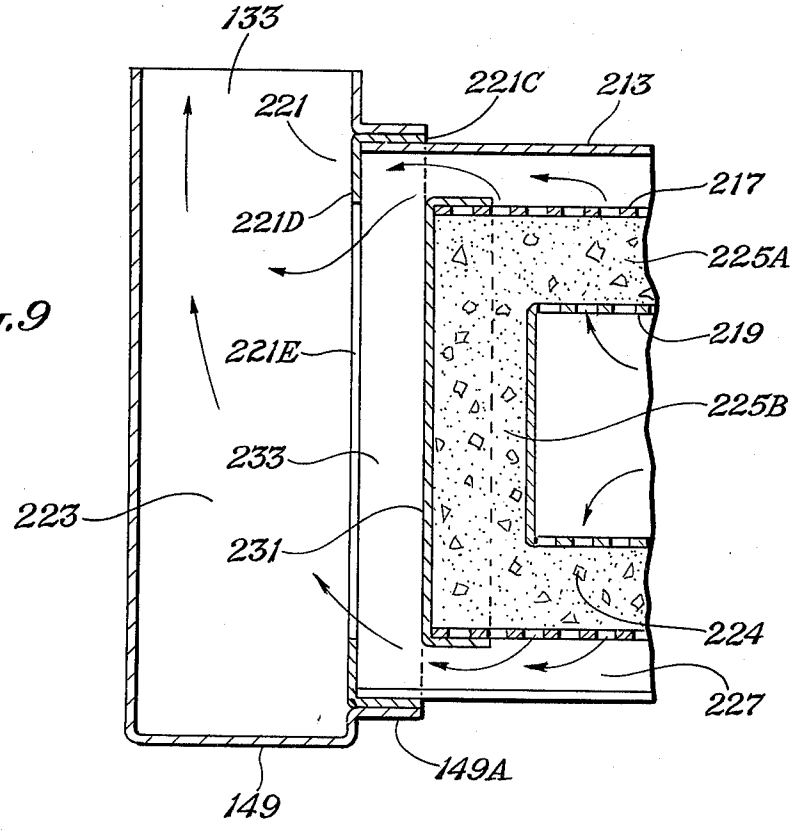

133
149B
221C
213
225A
215C
147
215A
125
121
215B
147C
219A
147B
217A
147A
221
221A
225B
223
221B
219C
219B
219D
229
219
227
224
211
217C
217
217B
149
149B
149A

Fig.9


133
221
221C
213
217
221D
225A
219
221E
225B
233
223
231
224
227
149A
149

CATALYST CONTAINER IN INCINERATOR TOILET

This application is a continuation-in-part of U.S. patent application Ser. No. 460,924, filed Apr. 15, 1974, now abandoned which is a continuation-in-part of U.S. patent application Ser. No. 445,661, filed Feb. 25, 1974, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to incinerator toilets and more particularly to a catalyst container to be located outside of an incinerator chamber employed in such toilets.

Incinerator toilets have been developed for use in facilities or locations where the water supply is limited or where sewer connections are not available. From a practical standpoint, these toilets must employ an odor control means for reducing or eliminating the odors generated during incineration. One effective type of odor control means in use comprises a catalyst such as aluminum oxide pellets. For proper operation, the catalyst normally must be elevated to a temperature appropriate for the necessary chemical reaction. Thus, the catalyst must be located in close proximity to a source of heat in order to reach the necesary temperature level for operation. In the case of the incinerator toilet, a logical source of heat is that from the incinerator chamber. Most catalysts require occasional replacement or replenishment, depending upon the type of catalyst and nature of the chemical reaction. Some catalysts are also quite expensive so that the volume of such catalysts needs to be minimized, consistent, of course, with the amount actually required for performance.

For a catalyst to be effective in the removal of odors, such odors must necessarily pass through or over the catalyst in sufficiently close proximity to assure proper chemical reaction. Equally obvious is the requirement that no odors bypass the catalyst and hence, enter the exhaust in the unaltered state, i. e., as odor. In the latter regard, only a trace amount of odor bypassing the catalyst is necessary to be clearly detectable as odor within the exhaust stack.

The design of the incinerator toilet is always affected by limited space requirements because of the types of facilities into which the toilet may be installed; because of human engineering requirements; and because of cost consideration. Lack of space within the toilet cabinet restricts the design of the catalyst container. Therefore, the catalyst container must be highly efficient in order that the catalyst do its job within the limited space.

Working against the restriction of space is the concept of "dwell time", i. e., the time required for the odor to dwell within the catalyst in order to undergo the necessary chemical reaction. Any time shorter than this would be insufficient for the job. The total effect calls, therefore, for a catalyst container that occupies a minimum of space yet is highly efficient, inexpensive, and easily removed for servicing.

Finally, if the toilet is force vented by a blower located within the toilet cabinet, the effect of the blower is to draw odors through any cracks or openings existing between parts of the incinerator chamber and, for example, the catalyst container. If this occurs, the odors will bypass the catalyst and remain odorous. Moreover, any connection between the catalyst container and the incinerator chamber must be reasonably tight and free of effect of vibration, yet, remain easily removable.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide a catalyst container for use in an incinerator toilet which is small in size, highly efficient, inexpensive, and yet may be rapidly assembled or disassembled for repair or for servicing.

It is a further object of the present invention to provide a catalyst container for positively directing the gases and odors through the catalyst, preventing any odors bypassing the catalyst, and which assures adequate dwell time of the odor molecules within the catalyst for effective odor reduction.

In one aspect, the catalyst container is adapted to be located to one side of the incinerator chamber of the toilet and comprises an inlet and an outlet, a catalyst chamber section located between the inlet and outlet for holding a heat activated catalyst for reducing odors, a diffusion chamber located between the inlet and the catalyst chamber section, and a gas collection chamber located between the catalyst chamber section and the outlet. The diffusion chamber and the catalyst chamber section are separated by front means having a plurality of small inlet apertures located within a given area for allowing the passage of gas from the diffusion chamber into the catalyst chamber section. The catalyst chamber section and the collection chamber are separated by rear means having a plurality of small outlet apertures within a given area for allowing the passage of gas from the catalyst chamber section to the collection chamber. In the preferred embodiment, the catalyst is in pellet form having a size greater than the size of the inlet and outlet apertures such that the catalyst is held within the catalyst chamber section.

In a further aspect, the front and rear means each comprise front and rear plates respectively. The inlet apertures are formed through the front plate within an area spaced inward from its outer edges such that the front plate has a solid wall surrounding the inlet apertures and which extends inward from the walls of the catalyst chamber section. The outlet apertures are formed through the rear plate within an area spaced inward from its outer edges such that the rear plate has a solid wall surrounding the outlet apertures and which also extends inward from the walls of the catalyst chamber section.

In one embodiment, the catalyst container comprises a cylindrical housing member; a front insert comprising a front circular plate and a rear insert comprising a rear circular plate which are adapted to be removably inserted within the front and rear ends of the cylindrical housing for forming the catalyst chamber section. A removable front cap having a front wall and extending cylindrical side walls is adapted to be fitted around the front end of the cylindrical housing member. The inlet is formed through the front cap and is adapted to be removably coupled to the vent conduit of the incinerator chamber. The diffusion chamber is formed between the front wall of the front cap and the front plate of the front insert when the front insert and front cap are located in place. A removable rear cap having a rear wall and extending cylindrical side walls is adapted to be fitted around the rear end of the housing member. The outlet is formed through the rear cap and is adapted to be in fluid communication with the gas removal means.

The collection chamber is formed between the rear plate of the rear insert and the rear wall of the rear cap when the insert and rear cap are located in place. The front plate and rear plate have a plurality of small inlet and outlet apertures formed therethrough within circular areas spaced inward from the outer edges of the front and rear plates respectively for holding the pellets within the catalyst chamber section and for allowing the passage of gas from the diffusion chamber to the collection chamber by way of the catalyst pellets located in the catalyst chamber section. The outer portions of the front and rear plates between the small inlet and outlet apertures and their outer edges are solid such that the front and rear plates have solid annular walls surrounding their inlet and outlet apertures and which extend inward from the walls of the housing member. The inlet has a cross sectional area less than the area of the front plate within which are located the outlet apertures.

In a further aspect, the inlet is formed through the front wall of the front cap and comprises an extending conduit adapted to be removably coupled to the vent conduit extending from the incinerator chamber. In addition, at least one tension spring is adapted to be secured to the rear cap and to the incinerator chamber for holding the catalyst container in place against the incinerator chamber with the inlet conduit coupled to the vent conduit of the incinerator chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a cross sectional side view of an incinerator toilet employing a catalyst container of the present invention;

FIG. 2 is an exploded perspective view of the catalyst container of FIG. 1;

FIG. 3 is a cross sectional side view of the catalyst container of FIG. 2;

FIG. 4 is a cross sectional side view of another embodiment of a catalyst container;

FIG. 5 is a side view of the container of FIG. 4;

FIG. 6 is a top or rear view of the catalyst container of FIGS. 4 and 5;

FIG. 7 is a front or lower view of the catalyst container of FIGS. 4 and 5;

FIG. 8 is a cross sectional side view of another embodiment of a catalyst container; and

FIG. 9 is a partial cross sectional view of the embodiment of FIG. 9 with certain modifications.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, the incinerator toilet comprises a housing 11 formed by a rear wall 13, an arcuate front wall 15, two side walls, one of which is identified at 17, a bottom wall 19 and a top 21. The front, rear, sides and bottom walls are preferably formed of stainless steel while the top 21 is a molded heat resistant plastic such as fiberglass. The forward portion of the top 21 includes a recessed upper bowl portion 23 forming an upper opening 25 which extends downward from the top 21. The top 21 and the bowl 23 are molded from fiberglass as one integral unit. Located above and around the bowl 23 is a hinged seat 27 adapted to be located in the position shown or moved to an upward position. A hinged lid 29 is adapted to fit over the seat 27. The lid 29 also may be moved to an upward position independently of the seat. Both the seat 27 and the lid 29 are hinged to the top 21 by way of a hinge arrangement illustrated at 31. A lower bowl portion 33 is located below the upper bowl portion 23 and is transversely divided into two halves 33*a* and 33*b* which are pivotally mounted on the outer surfaces of the upper bowl portion 23 by way of hinges 35. When the toilet is being used, the halves 33*a* and 33*b* will be in their closed position whereby a cone shaped paper insert may be located within the bowl formed by the upper portion 23 and the lower portion 33.

The incinerator toilet comprises an open ended incinerator chamber member 41 located below the bowl and which has a circular electrical heating coil 43 removably supported in its central opening 42 by brackets 91. The terminal ends of the coil 43 extend through the walls of the chamber 41 where they are connected to electrical leads and a switching arrangement for controlling the flow of current to the coil 43. The chamber 41 is mounted on a semi-circular metal support 44. An ash pan 45 is slidedly mounted on a metal step support 47 formed on the housing bottom 19 within the chamber support 44 and below the central opening of the chamber member 41. Heat insulation material 47*a* is located between support 47 and the bottom 19. The ash pan 45 has a handle 49 on its front side which is accessible by means of a removable panel 51 located beneath the arcuate front wall 15. A blower wheel 61 and a motor 63 are provided for drawing gases and odor from the interior of the chamber 41 and then blowing the odor and gases out of a rear vent 65 which is connected to the rear wall 13 of the housing 11 by way of a collar 67. An incinerator chamber lid 69, which fits into a recessed seat formed at the upper end of the chamber 41, is provided for closing the upper end of the chamber 41 while the heter 43 is being energized for disposing of the waste received in the pan 45. The outer walls of the lid 69 are formed of stainless steel with heat insulation material 69*a* located within the walls.

When the incinerator toilet is being used by a person, the lower bowl halves 33*a* and 33*b* will be located in their closed position as shown in FIG. 1 and a cone shaped paper insert located within the upper bowl portion 23 and lower bowl portion 33. When it is desired to deposit the waste in the paper cone within the pan 45, the chamber lid 69 will be raised upward and out of its recessed seat and then swung to the side and out of the way to allow the hinged halves 33*a* and 33*b* to swing open to allow the paper cone and waste to drop through the central opening 42 of the chamber 41 and into the pan 45. A linkage mechanism controlled by a foot pedal for allowing the bowl halves 33*a* and 33*b* and the chamber lid 69 to operate in this manner is disclosed and claimed in my co-pending application Ser. No. 87,413, filed Nov. 6, 1970 and entitled "Incinerator Toilet Having a Vertically Movable Incinerator Chamber Lid". After the paper cone and waste has been deposited in the pan 45, the foot pedal again will be actuated to return the chamber lid 69 to its closed position and to return the bowl halves 33*a* and 33*b*to their closed positions. A switch then may be actuated to complete a circuit to the electrical coil 43 and to the blower motor 63. Suitable electrical circuits for electrically controlling the coil 43 and the blower motor 63 are disclosed in my previously issued U.S. Pat. No. 3,020,559, dated Feb. 13, 1962 and U.S. Pat. No. 3,251,070, dated May 17, 1966.

The incinerator chamber 41 is formed by cylindrical inner and outer members 71 and 73. These members are single piece members drawn and shaped from stain-

less steel. As illustrated, inner and outer members **71** and **73** have inward extending flanges **71***a* and **73***a* located at their top ends and outwardly extending flanges **71***b* and **73***b* located at their lower ends. In assembly, the inner member **71** is inserted within the outer member **73** and inwardly extending flanges **71***a* and **73***a* are welded together while outward extending flanges **71***b* and **73***b* are welded together. Thus, only two primary seams are employed in forming the chamber thereby facilitating construction. Due to the shape of the two members **71** and **73**, the intermediate wall portions **71***c* and **73***c* between the upper and lower flanges will be spaced apart forming an enclosed annular insulating chamber **75**. During assembly of the inner and outer members **71** and **73**, a heat insulation material **77** will be located within this chamber **75** to provide insulation against the heat generated by the electrical heating coil **43**. In one embodiment, the heat insulation material **77** may be fibrous or hair-like material such as fiberglass. It is noted that the inwardly extending upper flanges **71***a* and **73***a* extend downwardly forming a recessed seat **79** for supporting the chamber lid **69**. Seat **79** mates with the annular bottom surface **69***b* of the lid **69** to prevent or minimize the leakage of gases or odor therebetween. The half cylindrical wall plate **44** is welded to the bottom flange **71***b* for providing the desired support for the incinerator chamber **41**. The upper end **45***a* of the pan **45** flanges outward forming a flat, annular surface which will be in contact with the bottom flange **71***b* of the chamber **41** to prevent or minimize the leakage of gas or odor therebetween.

During incineration by the coil **43**, gases and odor are drawn from the chamber **41** and through and across a heat activated odor reducing catalyst **81** located in a container **83** which is positioned outside of the walls of the incinerator chamber **41**. In the preferred embodiment the catalyst is in pellet form and which preferably are formed of aluminum oxide (Al_2O_3). It is to be understood however, that other types of heat activated catalysts may be used or mixed with the aluminum oxide. The gases are drawn through the catalyst **81** within the container **83** by way of a vent line or exhaust tube **85** and an exhaust fan or blower wheel **61** driven by the motor **63**. The inner and outer walls of the incinerator chamber have circular apertures formed therethrough and which are located to be in alignment when the inner and outer walls are assembled together. After assembly, the exhaust tube **85** is inserted through these apertures and welded to the inner and outer walls thereby providing a flow path from the interior of the chamber through the exhaust tube **85**. The other end of the exhaust tube **85** is in fluid communication with the interior of the container **83** through an inlet **121** which leads to a diffusion chamber **123**. The catalyst pellets **81** are located in a catalyst chamber section **125** formed between front and rear perforated plates **127** and **129**. Downstream of the rear plate **129** is a gas collection or diffusion chamber **131** which leads to an outlet **133**. The outlet **133** is in fluid communication with blower **61**. Vent **65** is coupled to blower **61** by way of a collar **67** and connection **87**. Thus, when the blower **61** is driven by motor **63**, odors and gases will be drawn from the interior of the chamber **41** through the exhaust line **85** into inlet **121** and diffusion chamber **123** and then through the perforations in plate **127** and through and across the catalyst pellets **81** located between perforated plates **127** and **129** for effective odor reduction. From the catalyst, the gases will be drawn through perforations in plate **129**, into diffusion chamber **131**, through outlet **133** and then forced by the blower **61** outward through the vent lines **65**. Since the catalyst is located outside of the walls **71** and **73** of the incinerator chamber **41**, differences in expansion and contraction of the incinerator chamber walls will not effect the catalyst thereby prolonging its effectiveness as an odor reducing means. It is noted further that vent line **85** has slots **85***a* formed in its forward end and which are located within the annular insulating chamber **75**. Thus, any gases or odors which may have leaked or passed into annular chamber **75** also will be drawn out through the exhaust line **85** and across the catalyst **81** in the container **83**.

The incinerator chamber **41** and an arrangement including removable brackets **91** for removably supporting the coil **43** in chamber **41** are disclosed in more detail and claimed in my co-pending U.S. patent application entitled "Incinerator Toilet," Ser. No. 445,662, filed Feb. 25, 1974.

Referring now to FIGS. **2** and **3**, there will be described in detail the catalyst container **83**. The container is formed by a cylindrical housing **141**; a front insert **143** comprising the front or upstream plate **127** adapted to be removably inserted into the front end **141***a* of the housing; and a rear insert **145** comprising the rear or downstream perforated plate **129** adapted to be removably inserted into the rear end **141***b* of the cylindrical housing forming the catalyst chamber section **125** between the front and rear perforated plates **127** and **129**. A front cap **147** through which is formed the inlet **121** is adapted to be fitted around the front of the cylindrical housing **141** while a rear cap **149** in which is formed the outlet **133** is adapted to be fitted around the rear end of the housing **141**.

The front insert **143** is a pan or cup-shaped member having cylindrical walls **143***a* extending from the front circular plate **127**. Formed through the plate **127** are a plurality of small apertures or perforations **127***a* located in a circular area spaced inward from the outer edges of the plate **127** thereby forming a solid, non-perforated annular wall **127***b* around the perforations **127***a*. The perforations **127***a* have a size smaller than the size of the pellets thereby holding the pellets in the chamber section **125** but allowing gases to pass inward. The rear insert **145** is a pan or cup-shaped insert having cylindrical walls **145***a* extending from the perforated circular plate **129**. Formed in the plate **129** are a plurality of small apertures or perforations **129***a* located in a circular area spaced inward from the outer edges thereof. Thus, the plate **129** has a solid non-perforated annular wall **129***b* which surrounds the inner perforations **129***a*. The perforations **129***a* have a size smaller than the catalyst pellets thereby holding the pellets within the chamber section **125** but allowing gas to pass outward through the perforations **129***a*. The outside diameters of the cylindrical walls **143***a* and **145***a* of the front and rear inserts are slightly less than the inside diameter of the cylindrical housing **141** whereby the inserts may be inserted into the cylindrical housing and removed therefrom.

The front cap **147** comprises cylindrical walls **147***a* extending from a front wall **147***b*. The front wall **147***b* has a short circular conduit **147***c* extending therefrom forming the inlet **121**. The inside diameter of the cylindrical walls **147***a* is slightly greater than the outside diameter of the cylindrical housing **141** such that the front cap may be fitted around the front end of the cy-

lindrical housing and removed therefrom. When fitted in place, the space between the front wall **147** and the front perforated plate **127** form the diffusion chamber **123.**

The rear cap **149** comprises forward cylindrical walls **149***a* having a front facing wall **149***b* and side walls **149***c* and **149***d* extending upward from the top portion thereof. A rear portion comprising a rear wall **149***e* having a circular bottom wall **149***f* and side walls **149***g* and **149***h* is welded to the inside of walls **149***a*, **149***c*, and **149***d* to form the complete rear cap having the outlet **133** located at the top. The inside diameter of cylindrical walls **149***a* is slightly greater than the outside diameter of cylindrical housing **141** such that the rear cap may be fitted around the rear end of the cylindrical housing and removed therefrom. When fitted in place, the space between the rear wall **149***e* and the rear perforated plate **129** form the collection or diffusion chamber **131.**

In assembly, the rear insert **145** may be inserted within the rear end of the cylindrical housing as shown. The housing **141** then may be turned to locate its front end upward and the chamber section **125** filled with the catalyst pellets. The front insert **143** then may be inserted as shown whereby the front plate **127** is spaced from the front edges **141***a* of the cylindrical housing to form the diffusion chamber **123.** The front and rear caps then may be fitted in place. After assembly, the inlet conduit **147***c* is inserted into the exhaust line **85** and two tension springs are employed for holding the container **83** in place against the chamber **41** with its outlet **133** directly under the inlet of the exhaust fan **61.** The tension springs are coupled to slots **151** formed at the rear of the rear cap on opposite sides and to slots **153** formed on the outside wall **73** of the chamber **41** on opposite sides of the exhaust line **85.** In FIG. **3,** a tension spring is illustrated in dotted line **155** coupled to slots **151** and **153** on the opposite side of the assembly shown. The tension springs will hold the container **83** in place with its inlet conduit **147***c* in exhaust line **85** in an effective air-tight relationship and moreover, will hold the removable component parts of the container **83** together in an effective air-tight relationship yet will allow the container **83** to be readily removed for disassembly and servicing when desired.

By forming the catalyst container from a cylindrical housing, the space occupied by the catalyst container is minimized. By use of the diffusion chambers **123** and **131,** the dwell time of the gases within the catalyst pellets is maintained sufficiently long for effective odor reduction even though the inlet **121** and outlet **133** are made relatively small which is desirable for efficient withdrawal of the gases using a given minimum size exhaust fan and motor. In this respect, the diffusion chamber **123** presents a relatively large entrance area for passage of the gases into the catalyst chamber section through perforations **127***a*. Similarly, the diffusion chamber **131** presents a relatively large exit area for passage of the gases out of the catalyst chamber section through perforations **129***a*. As the gases pass through the smaller inlet **121,** they will diffuse throughout the entire cross-sectional area of the diffusion chamber **123** thereby allowing the gases to pass or flow into essentially the entire cross-sectional area of the pellets **81.** Since the diffusion chamber **131** is as large in cross section as the chamber **123,** the gases will flow through essentially the entire cross-sectional areas of the pelets before passing into diffusion chamber **131.** Thus, the dwell time of the gases in the catalyst pellets is increased and moreover, effectively all of the pellets are able to contribute to odor reduction.

Since the annular walls **127***b* and **129***b* extend inward from the walls of the cylindrical chamber, the gas furthermore will be forced to pass through catalyst pellets located within the chamber section **125** even though there may be some settling or compacting of the catalyst pellets. In this respect, even though the catalyst chamber section will be filled completely with catalyst pellets during assembly, compaction or settling may occur, thereby resulting in a small void space at the top of the catalyst chamber section **125** next to the inside top wall portion of the cylindrical housing **141.** If even a small amount of gas were allowed to bypass the catalyst through the void space, undesirable odors would be allowed to pass through the outlet **133** and hence through the exterior vent **65.** The solid annular walls **127***b* and **129***b*, however, extend inward a distance sufficient to insure that their inward edges always will be lower than possible void spaces that may form in the catalyst chamber section next to the inside cylindrical walls. Thus, even though void spaces next to the inside cylindrical walls of the catalyst chamber section may form, all of the gas will be forced to pass through catalyst pellets upon entering and leaving the catalyst chamber section insuring that no odors bypass the catalyst and hence enter the exhaust **65** in the unaltered state.

From the above description, it can now be understood that the catalyst container can be readily assembled and disassembled for servicing; it provides an effective air-tight chamber for holding the catalyst pellets; it occupies a minimum of space yet is constructed to provide sufficient dwell time of the gases in the catalyst for effective odor reduction.

In one embodiment, the outside diameter of cylindrical housing **141** is 3½ inches and its length from end to end is 2½ inches. The diffusion chamber **123** has a depth of one half of an inch while the diffusion chamber **131** has a depth of about 1 inch. The diameters of the circular areas in plates **127** and **129** in which the perforations **127***a* and **129***a* are located are 2¾ inches whereby the annular walls **127***b* and **129***b* extend inward three-eighths of an inch. The forward minimum diameter of outlet conduit **147***c* is, 1¾ inches while the outlet **133** has dimensions of 1 inch by 3½ inches.

In a further embodiment, the front and rear plates **127** and **129** may have their inlet and outlet apertures **127***a* and **129***a* formed over essentially their entire diameters thereby eliminating the solid annular walls **127***b* and **129***b*. At least one intermediate annular plate, illustrated in dotted form at **201** may be welded or secured to the inside of the cylinder **141** between its ends at a position inward of the front and rear inserts **143** and **145.** The intermediate annular plate has a central circular opening **203** formed therethrough which may have a diameter of 2¾ inches whereby its solid annular wall **205** extends inward three eighths of an inch. This intermediate annular plate thus will perform the same function as annular walls **127***b* and **129***b* to insure that no gas bypasses the catalyst through void spaces which may form next to the inside wall of cylinder **141.**

FIGS. **4–7** disclose another embodiment of a catalyst container wherein the front and rear diffusion chambers of FIG. **2** are not employed. The catalyst container of FIGS. **4–7** is identified at **149** and comprises a cylindrical housing **161** having a front or lower wall **163** and

a removable rear cap **165** adapted to be fitted around the rear or top end of the housing **161.** The front wall **163** has an inlet **167** formed therethrough while the rear cap **165** has an outlet **169** formed therethrough. Inlet **167** is formed by a circular conduit **171** while outlet **169** is formed by a short circular conduit **173.** The inlet conduit **171** will be coupled to the exhaust line or vent of the incinerator chamber of a toilet or the like while the outlet conduit will be located to be in fluid communication with the blower or exhaust fan. Secured against the inside wall of the front wall **163** over the inlet **167** is a wire screen **175.** A wire screen **177** also is secured or located against the inside wall of the rear cap **165** over the outlet **169.** Two spaced apart annular deflector plates **179** and **181** are located within the housing **161** at positions spaced inward from the front wall **163** and rear cap **165.** These plates have central openings **183** and **185** formed therethrough and have their outer edges located adjacent and secured to the inside wall of the housing **161.** Thus, the plates **179** and **181** define annular walls which extend inward from the wall of the cylindrical housing **161.** The housing **161,** its front wall **163,** and rear cap **165** and wire screens **175** and **177** define a catalyst chamber which is filled with heat activated catalyst pellets **187.** It is noted that the pellets are located between the annular plates **179** and **181** as well as between plate **179** and front wall **163** and between plate **181** and the rear cap **165.** The screens **175** and **177** hold the pellets in the chamber but allow gas to flow from inlet **167** to outlet **169** by way of the pellets in the chamber.

The container of FIGS. **4–7** has advantages in that the gas must always pass through catalyst pellets upon entering and leaving the catalyst chamber. Moreover, the two annular plates **179** and **181** present an increased flow path for gases following the inside wall of the chamber thereby assuring sufficient contact of the gases with the catalyst pellets to effectively reduce odor. In addition, since the rear cap **165** is removable, the container may be readily disassembled and assembled for repair or servicing.

For use in the toilet of FIG. **1,** the exhaust line **85** may be "ell" shaped having its outward end pointed upward around which the inlet conduit **171** will be removably fitted. In this position, wall **163** and cap **165** will form the bottom and top respectively of the container **149.** The blower **61** and motor **63,** as well as the exhaust vent **65** will be raised whereby the inlet **171** may be fitted around the top end of the ell and the outlet **169** placed directly under the blower **61** to allow the blower or exhaust fan to draw odors and gases from the chamber, through the catalyst pellets in the container **149** for the reduction of odor and then out through the vent **65.** Since the container **149** will be resting on the vertical end of the ell, the springs **155** will not be needed or employed.

In one embodiment, the cylindrical housing **161** has a height of 2½ inches and an outside diameter of 6 inches. The inside diameter of the inlet **167** is 1¾ of an inch while the inside diameter of the outlet **169** is 3½ inches. The diameter of the apertures **183** and **185** formed through the plates **179** and **181** are 4 inches. As shown in FIG. **4,** the plates **181** and **179** have cylindrical flanges **181***a* and **179***a* respectively which fit within the cylindrical housing **161.** These flanges may be welded to the inside wall of the housing. Screen **175** also is welded to the wall **163** over the inlet **167.**

FIGS. **8** and **9** disclose other embodiments of a catalyst container which are similar to the embodiment of FIGS. **2** and **3** but have modified diffusion and collection chambers Referring first to FIG. **8,** the catalyst container is identified by reference numeral **211** and is formed by a cylindrical housing **213;** a removable front wall insert **215** to which are connected outer and inner perforated cylinders **217** and **219** respectively; a removable front cap **147;** a removable rear wall **221;** and a removable rear cap **149.** The front and rear caps **147** and **149** are similar to the front and rear caps of the embodiment of FIG. **2.** As illustrated cap **147** comprises an inlet **121** formed therethrough and is adapted to have its cylindrical wall **147A** fitted around the front of the cylindrical housing **213.** The front wall insert **215** comprises a front wall **215A** having a circular inlet aperture **215B** formed centrally therethrough and a rearward extending cylindrical wall **215C** which is adapted to be removably inserted into the cylindrical housing **213.** The outer perforated cylindrical member **217** has its front end **217A** welded to the inside of the wall **215A** at a position such that cylinder **217** is spaced radially inward from the cylindrical housing **213.** Member **217** has a cylindrical wall portion **217B** which extends rearward from wall **215A** a short distance with no perforations formed therein. Perforations **217C** are formed through member **217** rearward of the wall portion **217B.** The inner cylindrical member **219** has its front end **219A** welded to the front wall **215A** around the central aperture **215B** at a position spaced radially inward from the outer perforated cylinder **217.** Member **219** has a cylindrical wall portion **219B** extending rearward from wall **215A** a short distance with no perforations formed therein. Perforations **219C** are formed through the member **219** rearward of the wall portion **219B.** Connected to the rear of the perforated member **219** is a solid rear wall **219D.** The rear wall **221** comprises a central solid portion **221A** and an outer annular portion through which are formed a plurality of apertures **221B.** A cylindrical wall **221C** extends from the rear wall **221** and which is adapted to be removably fitted around the rear end of the cylindrical housing **213.** In this position, the front side of the solid wall portion **221A** will abut against the rear end of the outer perforated cylindrical member **217** as illustrated. The cylindrical wall **149A** of the rear cap **149** is adapted to be removably fitted around cylindrical walls **221C** of rear wall **221** to form an outlet chamber **223.**

When the components of the container are assembled as illustrated in FIG. **8,** there is formed an annular catalyst chamber portion **225A** between the inner and outer perforated cylindrical members **219** and **217** and a rear catalyst chamber portion **225B** between rear walls **219D** and **221** for holding heat activated catalyst pellets illustrated at **224.** Perforations **217C** and **219C** have a size smaller than the catalyst pellets thereby holding the pellets within the chamber **225A, 225B** but allowing gas to pass therethrough. In addition there is formed an open annular chamber **227** between outer perforated cylindrical member **217** and the cylindrical housing **213** defining a gas collection chamber which is in fluid communication with chamber **223** through apertures **221B.** The inlet diffusion chamber comprises the interior of the inner perforated cylindrical member **219** and is identified at **229.** As in the embodiment of FIGS. **2** and **3,** the inlet conduit **147C** is adapted to fit within the vent line **85** of an incinerator chamber while the outlet **133** is adapted to be located next to a blower

or suction fan as illustrated in FIG. 1. The flow path of effluent gas is illustrated by the arrows. In this respect the gas will flow through the inlets **121** and **215B** and into the diffusion chamber **229**. From the chamber **229** the gas will flow through perforations **219C**, through the heat activated catalyst **224** located in the chamber **225A, 225B**, through the perforations **217C** to the collection chamber **227**. From chamber **227** the gas will flow through the perforations **221B** into the outlet chamber **223** and then through the outlet **133**.

The embodiment of FIG. **8** has advantages over the embodiment of FIGS. **2** and **3** in that the cross-sectional area of the diffusion chamber to the flow of effluent gases is larger than that on the embodiment of FIGS. **2** and **3** even though the outside diameter of the cylindrical housing **213** is the same as that of housing **141**. With increased flow area, the rate of flow into and through the catalyst is decreased which increases the dwell time within the heat activated catalyst and hence optimizes the reduction of odor. Moreover the container of the embodiment of FIG. **8** has less resistance to flow of gas drawn therethrough which has advantages for example in the event the blower becomes dirty or inefficient.

In one embodiment, the outside diameter of the cylindrical housing **213** is 3½ inches and its length from end to end is 4½ inches. The diameter of the outer or downstream perforated cylindrical member **217** is about 2¾ inches while the diameter of the inner or upstream perforated cylindrical member **219** is about 1½ inches. The length of the inner perforated cylindrical member **219** is about 3¾ inches. Solid cylindrical wall portions **217B** and **219B** each has a length of about 7/16 of an inch. The end cap **149** is similar to that of FIGS. **2** and **3** as indicated above except the front facing wall **149B** extends completely around the end cap. When it is desired to replace the heat activated catalyst **224** the rear end cap **149** and the rear wall **221** may be removed to empty the used catalyst and to refill the chamber **225A, 225B** with fresh catalyst. Suitable means may be provided for holding the container in an operative position the incinerator toilet is illustrated in FIG. **1**.

Although rear walls **219D** and **221A** were described as being solid, they could be perforated if desired. In a further modification, cylinder **219** could extend rearward to solid wall **221A**, eliminating wall **219D** and allowing wall **221A** to form the rear end of cylinder **219** when the components of the container are assembled. In this modification catalyst chamber portion **225B** will be eliminated.

The catalyst container of FIG. **9** is similar to that of FIG. **8** except that the cylindrical housing **213** is longer and has a portion extending rearward of the rear end of the outer perforated cylindrical member **217**. In addition the rear wall **221** comprises a solid annular outer portion **221D** extending radially inward from the cylindrical wall **221C** defining a large central aperture **221E** formed through the rear wall **221**. The rear end of the outer perforated cylindrical member **217** has a removable cap **231** fitted thereover as illustrated. Since the rear end of the cylindrical housing **213** extends rearward of the cap **231** a space **233** is formed between the rear cap **231** and the rear wall **221** whereby the gases from the collection chamber **227** may flow through this space and through the aperture **221E** into the outlet chamber **223** and then up through the outlet **133**.

As mentioned above, the toilet disclosed employs a recessed seat **79** formed at the top of the incinerator chamber **41** to support the chamber lid **69**. The use of the recessed seat to support the lid has advantages in that it will allow liquid to drain inward and down into the pan **45** rather than on the floor of the toilet in the event that the paper insert leaks or the toilet is improperly used and moreover, results in a reduction of the height of the total toilet system. It is noted that U.S. Pat. No. 3,020,559 discloses two semi-circular chamber lid sections which may be moved by linkages and a foot pedal for opening and closing the two hinged halves of a conical shaped bowl. Although such an arrangement does not employ a recessed seat for its chamber lid and hence does not have the advantages mentioned above, the arrangement of U.S. Pat. No. 3.020,559 may be employed in the present toilet to control the opening and closing of the bowl halves **33***a* and **33***b*. In such an arrangement, the lid **69** will be formed in two sections which will seat on the top of the chamber **41**.

It is to be understood further that the lower bowl **33** may be a solid, conical shaped member with a lower aperture formed therethrough whereby the incinerator toilet will be used only as a urinal. In this embodiment, at least one of the flanges **71***a* or **73***a* will extend inward an amount further than that shown in FIG. **1** to form or define a much smaller central aperture through the flange. A top metal plate with a small central opening will be welded to the top of the chamber **41** and heat insulation material located between this top plate and the flange **71***a* or **73***a* defining the much smaller opening. A metal tube will extend from the lower aperture formed in the conical shaped bowl; through the aperture formed in the top plate; through the central openings formed in flanges **71***a* and **73***a;* and into chamber **41**.

The lid **69** will not be employed and the linkage mechanism and foot pedal for raising and lowering the lid and for controlling bowl halves will not be needed.

I claim:

1. In an incinerator toilet having an incinerator chamber; heating means for incinerating waste products; and a flow path extending from said incinerator chamber to a gas removal means for removing gases from said incinerator chamber, a catalyst container adapted to be located in said flow path between said incinerator chamber and said gas removable means and containing a heat activated catalyst for removing odors, said catalyst container being adapted to be located to one side of said incinerator chamber and comprising;

an inlet and an outlet,

a catalyst chamber section located between said inlet and outlet for holding a heat activated catalyst for reducing odors,

a diffusion chamber located between said inlet and said catalyst chamber section,

a gas collection chamber located between said catalyst chamber section and said outlet,

said diffusion chamber and said catalyst chamber section being separated by an upstream wall means having a plurality of small inlet apertures for allowing the passage of gas from said diffusion chamber into said catalyst chamber section and for holding said heat activated catalyst in said catalyst chamber section,

said catalyst chamber section and said collection chamber being separated by a downstream wall

means having a plurality of small outlet apertures for allowing the passage of gas from said catalyst chamber section to said collection chamber and for holding said heat activated catalyst in said catalyst chamber section.

2. The catalyst container of claim **1** wherein:

said inlet and outlet apertures are located wiithin given areas of said upstream and downstream wall means,

said catalyst chamber section from said upstream wall means to said downstream wall means has a cross-sectional area greater than said areas of said upstream wall means and said downstream wall means within which are located said inlet apertures and said outlet apertures respectively.

3. The catalyst container of claim **1** wherein:

said inlet and outlet apertures are located within given areas of said upstream and downstream wall means,

said area of said upstream wall means within which are located said inlet apertures is greater than the cross-sectional area of said inlet.

4. The catalyst container of claim **3** wherein:

said area of said downstream wall means within which are located said outlet apertures is greater than the cross-sectional area of said outlet.

5. The catalyst container of claim **2** wherein:

said area of said upstream wall means within which are located said inlet apertures is greater than the cross-sectional area of said inlet.

6. The catalyst container of claim **5** wherein:

the area of said downstream wall means within which are located said outlet apertures is greater than the cross-sectional area of said outlet.

7. The catalyst container of claim **1** wherein:

said upstream wall means and said downstream wall means comprise front and rear plates respectively,

said small inlet apertures being formed through said front plate within an area spaced inward from its outer edges thereof such that said front plate has a solid wall surrounding said inlet apertures and which extends inward from the walls of said catalyst chamber section,

said small outlet apertures being formed through said rear plate within an area spaced inward from its outer edges thereof such that said rear plate has a solid wall surrounding said outlet apertures and which extends inward from the walls of said catalyst chamber section.

8. The catalyst container of claim **7** wherein at least one of said plates is removable.

9. The catalyst container of claim **7** wherein:

said area of said front plate within which are located said inlet apertures is greater than the cross-sectional area of said inlet.

10. The catalyst container of claim **9** wherein:

said area of said rear plate within which are located said outlet apertures is greater than the cross-sectional area of said outlet.

11. The catalyst container of claim **10** wherein both of said front and rear plates are removable.

12. The catalyst container of claim **11** wherein:

said inlet comprises an inlet conduit adapted to be removably coupled to an exhaust conduit extending from said incinerator chamber.

13. The catalyst container of claim **12** wherein:

said catalyst chamber section is cylindrical in cross-section with the axis thereof extending through said inlet and outlet apertures.

14. In an incinerator toilet having an incinerator chamber; heating means for incinerating waste products; a vent conduit extending from said incinerator chamber; and a gas removal means for removing gases from said incinerator chamber by way of said vent conduit,the combination therewith of a catalyst container adapted to be located between said vent conduit and said gas removal means and containing a heat activated catalyst for removing odors from gases drawn through said vent conduit by said gas removal means, said catalyst container comprising:

a housing member having side walls and an opening, extending therethrough from a front end to a rear end,

a front insert comprising a front plate,

a rear insert comprising a rear plate,

said front and rear inserts being adapted to be removably inserted into front and rear ends of said member forming a catalyst chamber section between said front and rear plates for holding pellets of heat activated catalyst for reducing odor,

a removable front cap having a front wall and extending side walls adapted to be fitted around the front end of said housing member,

an inlet formed through said front cap and adapted to be removably coupled to said vent conduit of said incinerator chamber,

a diffusion chamber, in communication with said inlet and downstream thereof, being formed between the front wall of said front cap and said front plate of said front insert when said front insert and front cap are located in place,

a removable rear cap having a rear wall and extending side walls adapted to be fitted around the rear end of said housing member,

an outlet formed through said rear cap and adapted to be in fluid communication with said gas removal means,

a collection chamber, in communication with said outlet and upstream thereof, being formed between said rear plate of said rear insert and the rear wall of said rear cap when said rear insert and said rear cap are located in place,

said front plate and said rear plate having a plurality of small inlet and outlet apertures formed therethrough within areas spaced inward from the outer edges of said front and rear plates respectively for holding said pellets within said catalyst chamber section and for allowing the passage of gas from said diffusion chamber to said collection chamber by way of the catalyst pellets located in said catalyst chamber section,

the outer portions of said front and rear plates between their small inlet and outlet apertures and their outer edges being solid such that said front and rear plates have solid walls surrounding their inlet and outlet apertures and which extend inward from the walls of said housing member.

15. The catalyst container of claim **14** comprising at least one tension spring adapted to be secured to said rear cap and to said incinerator chamber for holding said catalyst container in place against said incinerator chamber with said inlet coupled to said vent conduit of said incinerator chamber.

16. The catalyst container of claim **14** wherein:

said housing member comprises a cylindrical housing member,

said front and rear inserts comprise circular plates,

said small inlet and outlet apertures being formed through said front and rear plates within circular area spaced inward from their outer edges such that said front and rear plates have solid annular walls surrounding their inlet and outlet apertures and which extend inward from the walls of said cylindrical housing member.

17. The catalyst container of claim **16** wherein:

said inlet has a cross sectional area less than the area of said front plate within which are located said inlet apertures,

said outlet has a cross-sectional area less than the area of said rear plate within which are located said outlet apertures.

18. The catalyst container of claim **17** wherein:

said front insert comprises said front circular plate having cylindrical side walls extending therefrom with an outside diameter less than the inside diameter of said cylindrical housing member,

said front insert being adapted to be inserted within the front end of said cylindrical member such that said front plate is spaced from the front end of said cylindrical member to define said diffusion chamber,

said rear insert comprising said rear circular plate having cylindrical side walls extending therefrom,

the cylindrical side walls of said rear insert having an outside diameter less than the inside diameter of said cylindrical housing member whereby said rear insert may be inserted in the rear end of said cylindrical housing member.

19. The catalyst container of claim **18** wherein:

said inlet is formed through the front wall of said front cap and comprises an extending conduit adapted to be removably coupled to the vent conduit extending from said incinerator chamber, and

at least one tension spring adapted to be secured to said rear cap and to said incinerator chamber for holding said catalyst container with said inlet conduit coupled to said vent conduit of said incinerator chamber.

20. The catalyst container of claim **1** comprising:

an intermediate plate located in said catalyst chamber section between said front and rear means,

said intermediate plate having an opening formed therethrough between its outer edges forming a solid wall surrounding its opening and which extends inward from the walls of said catalyst chamber section.

21. In an incinerator toilet having an incinerator chamber; heating means for incinerating waste products; and a flow path extending from said incinerator chamber to a gas removal means for removing gases from said incinerator chamber, a catalyst container adapted to be located in said flow path between said incinerator chamber and said gas removal means and containing a heat activated catalyst for removing odors, said catalyst container comprising:

an inlet and an outlet,

a catalyst chamber section located between said inlet and outlet for holding a heat activated catalyst for reducing odors,

said catalyst chamber being separated from said inlet and outlet by front and rear means having a plurality of small inlet and outlet apertures respectively for holding said heat activated catalyst in said catalyst chamber section and for allowing the flow of gas from said inlet to said outlet by way of the heat activated catalyst in said catalyst chamber section,

said inlet and outlet each having a cross sectional area less than the maximum cross sectional area of said catalyst chamber section,

at least one deflector plate means located in said catalyst chamber section at a position spaced inward from said front and rear means and having its outer edges in contact with the surrounding walls of said catalyst chamber section, and

an aperture formed through said plate means at a position spaced inward from its outer edges thereof such that said plate means has a solid wall surrounding its aperture and which wall extends inward from the walls of said catalyst chamber section.

22. The catalyst container of claim **21** which comprises:

a housing member having cylindrical side walls and a front wall,

said inlet being formed through said front wall and adapted to be removably coupled to a vent conduit extending from said incinerator chamber,

a removable rear cap having a rear wall and extending side walls adapted to be fitted around the rear end of said housing member,

said outlet being formed through said rear cap and adapted to be located in fluid communication with said gas removal means, and

two spaced apart deflector plate means located in said catalyst chamber section at a position spaced inward from said front and rear means and having their outer edges in contact with the surrounding walls of said catalyst chamber section, and

an aperture formed through each of said plate means at a position spaced inward from its outer edges thereof such that each of said plate means has a solid wall surrounding its aperture and which wall extends inward from the walls of said catalyst chamber section.

23. The apparatus of claim **1** wherein said catalyst container comprises:

a housing member having surrounding walls,

a front wall coupled to one end of said housing member and having an opening formed therethrough defining said inlet,

outer perforated surrounding walls located at a position spaced inward from said walls of housing member and having a front end connected to said front wall,

inner perforated surrounding walls located at a position spaced inward from said outer perforated walls and having a front end connected to said front wall around said opening,

rear wall means coupled to the rear ends of said outer and inner perforated walls,

the space between said inner perforated walls and said outer perforated walls defining a catalyst chamber section for holding a heat activated catalyst for reducing odors,

the interior of said inner perforated walls forming a diffusion chamber which is in fluid communication with said inlet,

the space between said outer perforated walls and said walls of housing member forming a gas collection chamber, and

an end cap coupled to the other end of said housing member forming said outlet and defining an outlet and with said collection chamber.

24. The apparatus of claim **23** wherein said rear wall means comprise separate rear walls coupled to the rear ends of said inner and outer perforated walls.

25. The apparatus of claim **23** wherein said rear wall means comprises a common rear wall coupled to the rear ends of said inner and outer perforated walls.

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