(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
20 September 2012 (20.09.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/125666 A1

(51) International Patent Classification:
B65F 1/00 (2006.01) *A61L 9/00* (2006.01)

(21) International Application Number:
PCT/US2012/028975

(22) International Filing Date:
14 March 2012 (14.03.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/049,993 17 March 2011 (17.03.2011) US

(72) Inventors; and
(71) Applicants : **HUGHES, Stephanie** [US/US]; 6563 Branch Hill Miamiville Road, Loveland, Ohio 45140 (US). **SCHNEIDER, David J.** [US/US]; 2409 Royal Castle Way, Union, Kentucky 41091 (US). **SCHNEIDER, Charles A.** [US/US]; 2545 ButterMilk Pike, Villa Hills, Kentucky 41017 (US). **HUGHES, Richard** [US/US]; 258 Longfellow Avenue, Worthington, Ohio 43085 (US).

(74) Agent: **KLEIN, Richard M.**; Fay Sharpe LLP, 1228 Euclid Avenue, Fifth Floor, Cleveland, Ohio 44115 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: WASTE CONTAINER WITH ODOR CONTROL

(57) Abstract: Waste containers which include a vessel body with an opening for receiving waste materials, a removable cover for operably enclosing said opening, and an odor control dispenser are disclosed. The odor control dispenser selectively dispenses an odor control agent into the vessel body when activated.

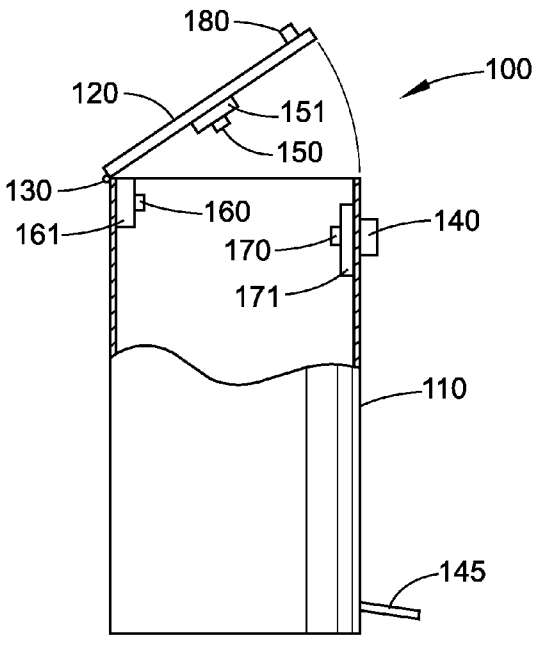


FIG. 1

WO 2012/125666 A1

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

WASTE CONTAINER WITH ODOR CONTROL

BACKGROUND

[0001] The present disclosure, in various embodiments, is directed to waste containers, such as pet waste receptacles, trash receptacles, diaper pails, compost containers, and medical waste containers, and the like, with odor control. The waste containers not only contain odors but also neutralize and reduce odors emitted waste materials contained therein.

[0002] Enclosed waste containers are frequently used to dispose of materials which emit generally continuous unpleasant and even noxious odors. Many people have a limited means to dispose of waste, i.e. once-weekly residential garbage pickup. To reduce costs associated with garbage bags, extra garbage pickups, etc., waste containers are typically used to receive many loads of waste prior to being emptied. Between depositions of each load, the already deposited contents tend to decay further, thus increasing the foulness of the odors emitted.

[0003] This problem is particularly bad for biological waste materials such as animal urine and feces, litter, diapers, medical waste, and meat. However, even materials which do not emit repugnant smells when first disposed of in a waste container tend to become increasingly odorous after disposal. Waste containers are often stored indoors where the smells are confined. Thus, the smells tend to linger even after the covers of the waste containers are closed and the people who dispose of the waste are not the only people who are exposed the odor.

[0004] Therefore, it would be desirable to develop a waste container which reduces or controls the odors emitted from the waste contents of the container.

BRIEF DESCRIPTION

[0005] The present application discloses, in various embodiments, waste containers. The waste containers comprise an enclosed waste holding receptacle and an odor control dispenser. The odor control dispenser releases an odor control composition comprising a specific odor control agent when activated. The odor control agent reacts

with odor-generating molecules of the waste material to neutralize and reduce odor produced thereby.

[0006] Disclosed in embodiments is a waste container comprising a vessel body, a cover, and an odor control dispenser. The vessel body includes an opening for receiving waste materials. The removable cover operably encloses said opening. The odor control dispenser selectively dispenses an odor control agent into the vessel body upon activation. In certain embodiments, the odor control dispenser may continuously release a vaporized odor control composition and/or may release an odor control composition when the cover is set in motion in relation to the vessel body.

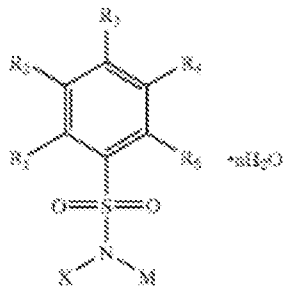
[0007] The odor control dispenser may also release an odor control composition upon activation of a trigger. In some embodiments, the odor control composition may be vaporized or atomized upon dispensing. The odor control composition reacts with the odor-causing molecules produced by the waste materials to reduce the odor.

[0008] In other embodiments, the waste container may further include a second or further additional odor control dispensers. For example, the second odor control dispenser may continuously release a vaporized or atomized odor control composition and/or may release an odor control composition when the cover is set in motion in relation to the vessel body.

[0009] The vessel body and cover may be pivotally connected by a hinge or may be slidably engaged.

[0010] The odor control dispenser contains a specific odor control composition. The odor control composition does not mask the odor produced by the waste material, but, instead reacts with the odor-generating molecules to neutralize or reduce the odor produced thereby.

[0011] The odor control agent may be a compound of Formula (II):



Formula (II)

wherein X is a halogen;

wherein R_3 is hydrogen, methyl, or COOM;

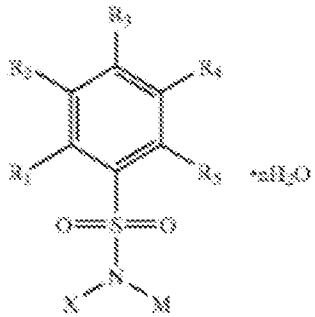
wherein R_1, R_2, R_4, R_5 are independently hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

wherein R is hydrogen or substituted or unsubstituted C_1-C_{12} alkyl;

wherein R_1, R_2, R_4 and R_5 are other than all hydrogen; and

wherein M is an alkali or alkaline earth metal.

[0012] The odor control agent may also be a compound of Formula (III):



Formula (III)

wherein, X is a halogen;

wherein R_1, R_2, R_4, R_5 are independently hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

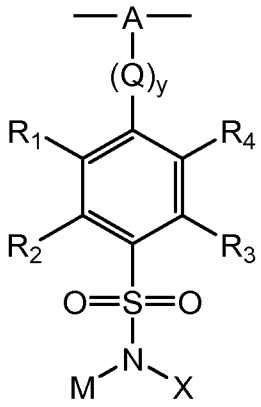
wherein R_3 is an organic derivatized COOH, such as an ester or alkylated amide, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_2 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

wherein R is hydrogen or substituted or unsubstituted C_1-C_{12} alkyl; and

wherein and M is an alkali or alkaline earth metal.

[0013] The odor control composition may comprise an odor control agent selected from chloramine T, chloramine B, N-chloro-4-carboxybenzenesulfonamide, and mixtures thereof. In some embodiments, the odor control agent is a mixture of chloramine T and N-chloro-4-carboxybenzenesulfonamide. In other embodiments, the odor control agent is a mixture of chloramine B and N-chloro-4-carboxybenzenesulfonamide. The odor control composition may further comprise a disinfectant.

[0014] In some embodiments, the odor control agent is a polymer of Formula (VI):



Formula (VI)

wherein A is a trivalent linkage;

wherein Q is a divalent linkage and y is 0 or 1;

wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight

or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen; and

wherein M is an alkali or alkaline earth metal.

[0015] In some embodiments, the waste container is a pet waste receptacle, a trash receptacle, a diaper pail, a compost container, or a medical waste container.

[0016] Also disclosed herein is a waste container comprising a vessel body with an opening for receiving waste materials, a cover connected to the vessel body for operably enclosing said opening, and an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation. The cover comprises a plurality of flexible flaps configured to allow the ingress of a waste material into the vessel body.

[0017] The odor control dispenser may continuously release an odor control composition. The odor control dispenser may also release an odor control composition upon activation of a trigger. The trigger may be activated when the flaps are flexed to receive the waste material.

[0018] Still further disclosed is a waste container comprising a vessel body with an opening for receiving waste materials, a hinged cover mounted on said vessel body for operably enclosing said opening, an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation, and a foot pedal operably connected to the hinged cover for opening and closing the cover and activating the dispenser.

[0019] Disclosed in other embodiments is a waste container comprising a vessel body with an opening for receiving waste materials, a cover pivotally connected to said vessel body for operably enclosing said opening, and an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation. Activation occurs when the cover is pivotally opened or closed.

[0020] Activation may occur mechanically when the cover is opened or closed. In embodiments, activation occurs mechanically when the cover engages or disengages a mechanical switch on the vessel body. Activation may also occur electronically via an electronic switch which is engaged when the cover is opened or closed. In other

embodiments, activation occurs when a light sensitive switch is engaged when the cover is opened or closed. A torsion spring may assist in the opening and closing of the cover.

[0021] The odor control dispenser may comprise a cartridge. The cartridge may be removable and/or refillable.

[0022] Also disclosed is a waste container comprising a vessel body with an opening for receiving waste materials, a cover connected to said vessel body for operably enclosing said opening, an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation. The cover comprises an attachment portion and a lid. The lid and the attachment portion are pivotally connected by a hinge. The attachment portion may snap onto the top of the vessel body.

[0023] Activation may occur when the lid is pressed down. A torsion spring may control the opening and closing of the lid.

[0024] Alternatively, activation may occur when a button is pressed. The button may be on top of the lid. The button may also be located on an inner lip of the attachment portion.

[0025] Activation may occur mechanically via opening and/or closing the lid. Activation may also occur electronically via an electronic switch attached to cover. In some embodiments, activated occurs when a light-sensitive switch is turned on.

[0026] These and other non-limiting characteristics of the disclosure are more particularly disclosed below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The following is a brief description of the drawings, which are presented for the purposes of illustrating the exemplary embodiments disclosed herein and not for the purposes of limiting the same.

[0028] **FIG. 1** is a side cutaway view of a first embodiment of a waste container of the present disclosure.

[0029] **FIG. 2** is a side cutaway view of a second embodiment of a waste container of the present disclosure.

[0030] **FIG. 3** is a top perspective view of a third embodiment of a waste container of the present disclosure.

[0031] **FIG. 4** is a side cutaway view of a fourth embodiment of a waste container of the present disclosure.

[0032] **FIG. 5** is a top perspective view of a fifth embodiment of a waste container of the present disclosure.

[0033] **FIG. 6** is a side perspective view of a sixth embodiment of a waste container of the present disclosure.

[0034] **FIG. 7A** is a top cutaway view of an upper portion of the waste container of **FIG. 6**.

[0035] **FIG. 7B** is a blow-up view of the hinge mechanism of the waste container of **FIGS. 6** and **7A**.

[0036] **FIG. 7C** is a blow-up view of the activation button of the waste container of **FIGS. 6**, **7A**, and **7B**.

[0037] **FIG. 8** is a side cutaway view of the upper portion of the waste container of **FIGS. 6** and **7**.

DETAILED DESCRIPTION

[0038] A more complete understanding of the components, processes, and apparatuses disclosed herein can be obtained by reference to the accompanying drawings. These figures are merely schematic representations based on convenience and the ease of demonstrating the present disclosure, and are, therefore, not intended to indicate relative size and dimensions of the devices or components thereof and/or to define or limit the scope of the exemplary embodiments.

[0039] Although specific terms are used in the following description for the sake of clarity, these terms are intended to refer only to the particular structure of the embodiments selected for illustration in the drawings, and are not intended to define or limit the scope of the disclosure. In the drawings and the following description below, it is to be understood that like numeric designations refer to components of like function.

[0040] The modifier “about” used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (for example, it includes at

least the degree of error associated with the measurement of the particular quantity). When used in the context of a range, the modifier "about" should also be considered as disclosing the range defined by the absolute values of the two endpoints. For example, the range of "from about 2 to about 10" also discloses the range "from 2 to 10."

[0041] As used herein, the term "odor control agent" or "odor control composition" refers to a chemical which reacts with odor-causing molecules to reduce or eliminate odor. Odor control agents are distinguished from deodorants and fragrances which mask the odor but do not react with the odor-causing molecules.

[0042] The disclosure relates to waste containers comprising a vessel body, a removable cover, and an odor control dispenser. The vessel body includes an opening for receiving waste materials. The cover operably encloses said opening. The odor control dispenser is configured to selectively dispense an odor control composition which comprises at least one odor control agent. Release of the odor control composition is generally performed by spraying the odor control composition out of the odor control dispenser. The composition is released as a vapor or spray or is vaporized or atomized after being sprayed. The waste containers of the present disclosure are useful for neutralizing offensive odors emitted by the waste.

[0043] **FIG. 1** shows a first embodiment of a waste container **100** of the present disclosure. The waste container **100** comprises a vessel body **110** and a cover **120**. A hinge **130** connects the cover **120** to the vessel body **110**. The waste container also comprises three odor control dispensers **150**, **160**, and **170**. Each dispenser draws an odor control composition from a different odor control reservoir **151**, **161**, and **171**. In the depicted embodiment, the first odor control dispenser **150** is attached to the cover **120**. This particular odor control dispenser **150** continuously releases the odor control composition contained in the reservoir **151**. The odor control dispenser which continuously releases the odor control composition may alternatively be attached the interior of the vessel body. The second odor control dispenser **160** draws an odor control composition from reservoir **161** and is configured to release a portion of the composition into the vessel body **110** when the cover **120** is set in motion in relation to the vessel body **110**, i.e. when the cover **120** is opened. The second odor control dispenser **160** may be configured to release the odor control composition when the

cover **120** makes any movement with respect to the vessel body **110** or alternatively may be configured to release the odor control composition when a threshold angle between the cover **120** and the top of the vessel body **110** is reached. In some embodiments, the amount of odor control composition released may be a function of the angle between the cover **120** and the top of the vessel body **110**. For example, the odor control dispenser **160** may release odor control composition at a higher rate when the cover is barely open and little or no odor control composition when the cover is fully open. The third odor control dispenser **170** draws an odor control composition from reservoir **171** and is configured to release the composition upon activation of a trigger. The trigger may for example be a button **140** or a foot pedal **145**. When the button **140** or the foot pedal **145** is pressed, the odor control dispenser releases a portion of the odor control composition. An optional meter **180** displays the amount of odor control composition remaining in each of the reservoirs **151**, **161**, and **171**. Further optionally, the meter may produce a signal when the amount of odor control composition falls below a predetermined level. The signal may be a visual signal or an auditory signal.

[0044] **FIG. 2** illustrates a second embodiment of a waste container **200** of the present disclosure. The waste container **200** comprises a vessel body **210** and a cover **220**. The cover **220** slides across the vessel body **210** via a rail **232**. The waste container **200** comprises an odor control dispenser **260** which draws an odor control composition from a reservoir **261** and releases a portion of the odor control composition when the cover **220** slides past a predetermined point with respect to the vessel body **210**. The depicted embodiment also includes a second odor control dispenser **270** which draws odor control composition from a second reservoir **271** and releases a portion of the odor control composition when a trigger is activated, e.g. when a button **240** or a foot pedal **245** is pressed. The waste container **200** also includes a meter **280**.

[0045] **FIG. 3** depicts a third embodiment of a waste container **300** of the present disclosure. The waste container **300** includes a vessel body **310** and a cover **320** defining a top portion of the waste container **300**. The cover **320** comprises a plurality of flexible flaps **390**. Waste may be placed in the vessel body **310** by pushing the waste through the flexible flaps **390** in the cover **320**. After the waste material is placed into the vessel body **310**, the flaps return to a closed position. The flaps **390** may be

comprised of rubber or any other material which is capable of forming a seal when the flaps **390** are in a first position, i.e. when there is no pressure on the flaps **390**, and forming an opening when pressure is applied to the flaps **390**. The waste container **300** further comprises a first odor control dispenser **360** which draws an odor control composition from a reservoir **361** and releases a portion of the odor control composition when a waste material is being disposed of in the vessel body **310**. Alternatively, the odor control dispenser **360** may be configured to continuously release the odor control composition. A second odor control dispenser **370** draws an odor control composition from reservoir **371** and releases a portion of the composition when a button **340** is pressed.

[0046] **FIG. 4** portrays a fourth embodiment of a waste container **400** of the present disclosure. The waste container **400** comprises a vessel body **410** and a cover **420** which are connected by a hinge **430**. The waste container **400** also comprises three odor control dispensers **450**, **460**, and **470**. The first odor control dispenser **450** continuously releases odor control composition. The second odor control dispenser **460** releases odor control composition when the cover **420** moves in relation to the vessel body **410**. The third odor control dispenser **470** releases odor control composition when a button **440** is pressed or if a different trigger is activated. All three of the odor control dispensers **450**, **460**, and **470** draw odor control composition from a common reservoir **490**. Odor control dispensers **450** and **470** are attached to the reservoir **490** while odor control reservoir **460** receives odor control composition through tubing **495**. The tubing may run within the sidewall of the vessel body **410**. Alternatively, all of the odor control dispensers may be directly attached to the reservoir or all of the odor control dispensers may receive odor control composition from the reservoir via tubes. Meter **480** displays the amount of odor control composition remaining with the reservoir **490** and optionally provides a signal when the amount falls below a predetermined level.

[0047] **FIG. 5** displays a fifth embodiment of a waste container **500** of the present disclosure. The waste container **500** comprises a vessel body **510** and a cover **520** which may be connected at a hinge (not shown). The waste container **500** also includes a foot pedal **545** which may be pressed to open the cover **520**. The cover **520** includes a cartridge holder **599** for receiving a cartridge **597**. The cartridge **597** includes

an internal reservoir (not shown) which holds an odor control composition. A button **580** atop the cartridge **597** acts as a trigger for the release of a portion of the odor control composition from the reservoir. The cartridge **597** may be replaceable and/or refillable. The combination of the button **580** and the foot pedal **545** allow a user to open the vessel body and distribute the odor control composition without using two hands. In other words, the user can carry a waste bag to be disposed of in one hand while operating the waste container **500**.

[0048] **FIGS. 6-8** present a sixth embodiment of a waste container **600** of the present disclosure. The waste container comprises a vessel body **610**, a cover **620**, and an odor control dispenser **650**. The waste container may have a height of about 30 inches. The cover **620** includes an attachment portion **622** and a lid portion **624**. The attachment portion **622** may have an outer diameter of about 15 inches. The lid portion **624** may have a diameter of about 5 inches. The lid portion **624** is pivotally connected to the attachment portion **622** by a hinge **625**. The hinge **625** may comprise a torsion spring to automatically open the lid **624**. The torsion spring may be configured to open the lid at a relatively slow rate to reduce the dispersal of odors. The attachment portion **622** may be connected to the vessel body **610** by snapping on. For example, the attachment portion **622** may comprise a receiving member **626** which receives an outer lip **613** of the vessel body **610**. A snapping configuration allows plastic bags to be easily inserted and removed from the waste container **600**. The odor control dispenser **650** can be a cartridge which can be attached to the cover **620**. The cartridge **650** may be removable and/or refillable. The cartridge may generally be any shape which fits in a corresponding waste container. Non-limiting examples include rectangular, circular, and ring-shaped cartridges. The cartridge may have a capacity of about ½ cup.

[0049] The cartridge **650** may be activated by a button **627** located on an inner lip **623** of the attachment portion **620**. Activation may occur when the lid **624** is pushed down. This may also cause the torsion spring to open the lid.

[0050] Some of the waste containers of the exemplary embodiments include multiple odor control dispensers. However, these waste containers may also include only one dispenser. When one dispenser is used, the dispenser may be triggered to release odor control composition by one or more triggers. For example, the single dispenser

may release the odor control composition when the cover is moved with respect to the vessel body and/or when a button or foot pedal is pressed.

[0051] The single dispenser may also be configured to continuously release a baseline amount of odor control composition in some embodiments. The activation of triggers then increases the rate at which the odor control composition is released.

[0052] In embodiments, pressing the button or foot pedal may also cause the cover to open. The waste container may be configured such that the opening of the cover and the release of odor control composition are not simultaneous. For example, after a user presses the button or foot pedal, the odor control composition may be released immediately. However, the opening of the cover may be delayed so that the odor control composition has more time to neutralize odors prior to the user being exposed to smells from inside the vessel body.

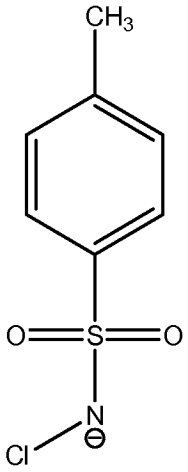
[0053] Release of the odor control composition may be actuated mechanically via opening and closing of the cover, electronically via an electronic switch on the cover, or by a light-sensitive which. During opening of the cover or lid, an increasing amount of light may reach the switch whereas a decreasing amount of light may reach the switch during closing.

[0054] When a single reservoir is used to feed multiple odor control dispensers, the composition released by each odor control dispenser will be the same. In some embodiments, wherein multiple odor control dispensers are used, the compositions released may differ between dispensers.

[0055] The odor control composition relates to specific chemicals which react with odor-causing molecules of the waste material. The composition may comprise from about 0.1 to about 5 wt% odor control agents.

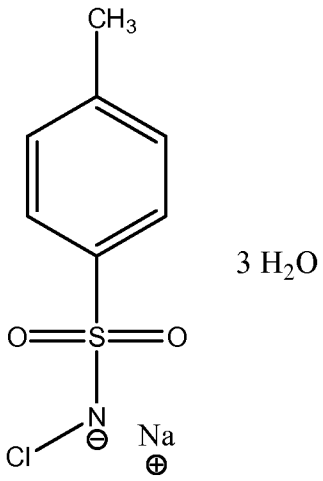
[0056] In more particular embodiments, the odor control agent is a chloramine. Chloramines are suitable odor control agents based on the ability to release an active Cl^+ ion when needed on demand, immediately after which, an active aromatic sulfo nitrene companion ion is generated. The Cl^+ ion starts the conversion process of the odor molecule and is immediately assisted by the companion aromatic sulfo nitrene which completes the conversion process. Specific chloramines include chloramine T, chloramine B, and CH-BENZ.

[0057] Chloramine T, illustrated below, is the common name for N-chloro-4-methylbenzenesulfonamide.



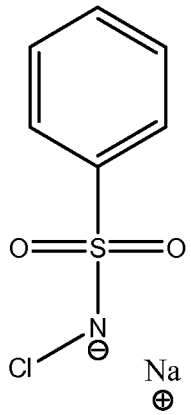
Chloramine T

Chloramine T as used herein may also refer to a salt, e.g. as a sodium salt. Chloramine T may also be hydrated. For example, the chloramine T may be a tri-hydrated sodium salt as shown in Formula (I)



Formula (I)

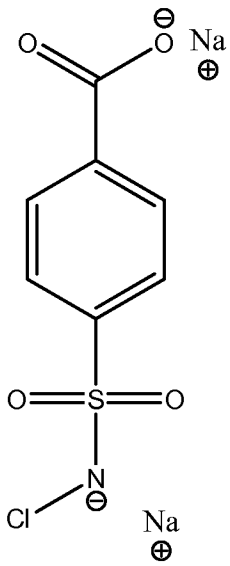
[0058] Chloramine B, illustrated below, is the common name for N-chlorobenzenesulfonamide sodium salt.



Chloramine B

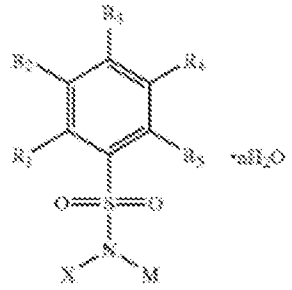
Chloramine B may also be hydrated.

[0059] CH-BENZ, illustrated below, refers to N-chloro-4-carboxybenzenesulfonamide.



CH-BENZ

[0060] More generally, the odor control agent may comprise a halo active aromatic sulfonamide organic compound. The halo active aromatic sulfonamide compounds are in the low to no toxicity range according to Environmental Protection Agency (EPA) standards. The low toxicity of the compounds makes the compounds attractive for use in human and animal environments. The halo active aromatic sulfonamide compounds are in accordance with the following Formulas (II) to (V).



Formula (II)

wherein X is a halogen,

R_3 is hydrogen, methyl, or COOM,

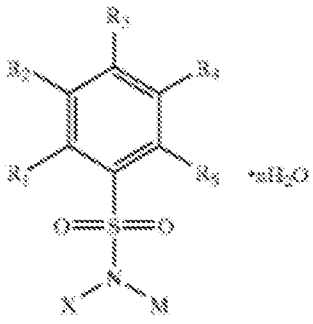
R_1, R_2, R_4, R_5 are independently hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens,

R_1, R_2, R_4 and R_5 are other than all hydrogen,

R is hydrogen or substituted or unsubstituted C_1-C_{12} alkyl,

and M is an alkali or alkaline earth metal.

[0061] Additional compounds which are useful odor control agents are in accordance with Formula (III):



Formula (III)

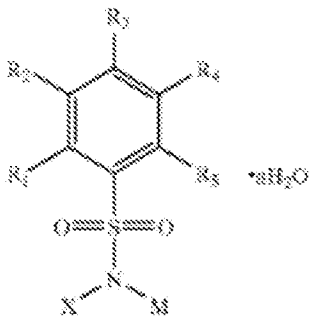
wherein X is a halogen,

R_1, R_2, R_4, R_5 are independently hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens,

R_3 is an organic derivatized COOH, an ester or alkylated amide, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_2 to C_{12}, wherein the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens,

and M is an alkali or alkaline earth metal.

[0062] Other compounds which are useful as odor control agents are as per Formula (IV):



Formula (IV)

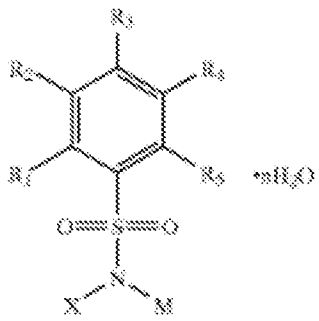
wherein X is a halogen,

R_1, R_2, R_4, R_5 are hydrogen,

R_3 is hydrogen, methyl, or COOM,

and M is either potassium, rubidium, cesium, lithium or an alkaline earth metal.

[0063] Other compounds which can be used as odor control agents are in accordance with Formula (V):



Formula (V)

wherein X is bromine, fluorine, or iodine,

R_1, R_2, R_4, R_5 are hydrogen,

R_3 is hydrogen, methyl, or COOM,

and M is an alkali or alkaline earth metal.

[0064] Compounds of Formulas (II)-(V) may or may not be hydrated (n H_2O), but are generally isolated as a trihydrate (where n=3).

[0065] The compounds of Formulas (II)-(V) are very soluble in water. This property allows for easy compounding of odor control compositions and allows high percentages of the compounds to be formulated into the useful solution products.

[0066] Further the compounds of Formulas (II)-(V) have minimal bleach odor. This property again is highly advantageous, because, formulations with strong bleach odor are undesirable in most applications.

[0067] The activity of the aromatic chlorosulfonamido group of the compounds of Formulas (II)-(V) is regulated by the selection of specific "R" groups. "R" groups adjacent to the chlorosulfonamido group (R_1 and R_5) can cause steric effects and therefore change activity and/or cause stability changes on the chlorosulfonamido group. In addition the various "R" groups can be effected differently. Specific increases or decreases in activity and, stability may be noted. The usefulness of specific aromatic chlorosulfonamido groups may be affected by their different and unique inductive or resonance effects.

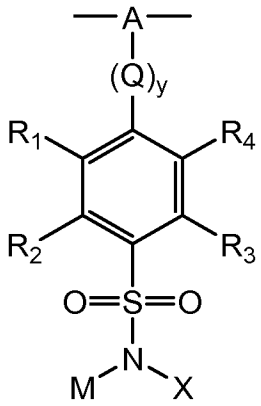
[0068] Bleach is commonly used as a source of Cl+ cations which are effective as deodorizers. The term "Cl+" refers to the fact that the chlorine atom has a +1 formal charge in a hypochlorite ion, ClO^-, which is the form taken by the chlorine atom when

dissociated from the sulfonamide compound. A chlorine atom is generally considered to have a charge of 1^-. Reference to the chlorine atom as having a +1 or 1^- charge may be used in this application interchangeably because this terminology has no effect on the compound itself or its use. Because of the problems associated with the use of bleach, i.e. the discoloration of the substrate, and its heavy non discrete oxidizing power, it is generally not suitable for use as a deodorizer. In addition the Cl+ cation which is produced by bleach is much more ionic and non discrete in its reactions when compared to the Cl+ cation produced by the compounds of Formulas (II)-(V). Further, as the compounds of Formulas (II-V) liberate the Cl+ ion, a companion ion an aromatic sulfo nitrene, is released which also is intimately involved in a reaction to convert the odorous molecule to a non-odorous state. That is when compared to the Cl+ cation produced by bleach, the Cl+ cation produced by the compounds of Formulas (II)-(V) is much more covalent and less ionic and therefore is very selective in its initial reaction as a deodorizer, hence, it will attack the odor source and not the substrate. As a result of this covalence the bleaching side effects resulting from the Cl+ cation produced by the compounds of Formulas (II)-(V) do not cause the bleaching problems produced by bleach. Therefore, the Cl+ cation produced by the compounds of Formulas (II)-(V) can be used to deodorize as they do not have side effects such as strong bleach smell etc. Generally it could be said that the compounds of Formulas (II)-(V) are more stable than bleach and have a higher selectivity as a Cl+ source as compared to the Cl+ cation produced by bleach. In addition, the N-halogenated aromatic sulfonamide when activated by an attack on an odorous molecule by its Cl+, further produces an active aromatic sulfo nitrene which also modifies the odor causing molecule in such a manner that it is no longer an odorous molecule.

[0069] In summary, compared to bleach the compounds of Formulas (II)-(V) are superior deodorizing agents because they are more selective, more covalent Cl+ and because the backbone companion ion, the aromatic sulfonitrene, remaining after the Cl+ cation is released from the compounds of Formulas (II)-(V), is itself very selective but very active and immediately contributes its odor controlling power. This backbone companion ion has the ability to further react with the odor containing molecule thereby permanently removing it as a potential source of odor. In contrast the chemical moiety

which remains after the Cl+ cation is removed from bleach has no ability to react with odor causing molecules.

[0070] The odor control agent may also comprise a polymer. Halo active aromatic sulfonamide polymers in particular exhibit little or no toxicity according to EPA standards. The polymer may be of Formula (VI):



Formula (VI)

wherein A is a trivalent linkage;

wherein Q is a divalent linkage and y is 0 or 1;

wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen; and

wherein M is an alkali or alkaline earth metal.

[0071] In a first specific embodiment of Formula (VI), R_1, R_2, R_3, and R_4 are hydrogen or alkyl; y is 0; X is chlorine, bromine, fluorine, or iodine; and M is an alkali or alkaline earth metal. In a further specific embodiment, X is chlorine and M is sodium or potassium.

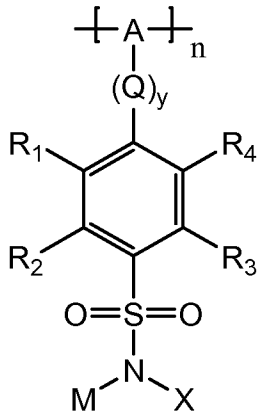
[0072] In a second specific embodiment of Formula (VI), R_1, R_2, R_3, and R_4 are hydrogen or alkyl; Q comprises an ester (-COO-) linkage where the ester carbon is attached to the benzene group and y is 1; X is chlorine, bromine, fluorine, or iodine; and

M is an alkali or alkaline earth metal. In a further specific embodiment, X is chlorine and M is sodium or potassium.

[0073] In other specific embodiments, A is $-CH_2-CH-$.

[0074] In other specific embodiments, Q is a methyl formate ($-COO-CH_2-$) linkage where the $-CH_2-$ is attached to A (not the benzene group) and y is 1.

[0075] In a further embodiment, the polymer of the present disclosure has the following Formula (VII):



Formula (VII)

wherein A is a trivalent linkage;

wherein Q is a divalent linkage and y is 0 or 1;

wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen;

wherein M is an alkali or alkaline earth metal; and

wherein n is the degree of polymerization.

[0076] In a first specific embodiment of Formula (VII), R_1, R_2, R_3, and R_4 are hydrogen or alkyl; y is 0; X is chlorine, bromine, fluorine, or iodine; and M is an alkali or alkaline earth metal. In a further specific embodiment, X is chlorine and M is sodium or potassium.

[0077] In a second specific embodiment of Formula (VII), R_1, R_2, R_3, and R_4 are hydrogen or alkyl; Q comprises an ester (-COO-) linkage where the ester carbon is attached to the benzene group and y is 1; X is chlorine, bromine, fluorine, or iodine; and M is an alkali or alkaline earth metal. In a further specific embodiment, X is chlorine and M is sodium or potassium.

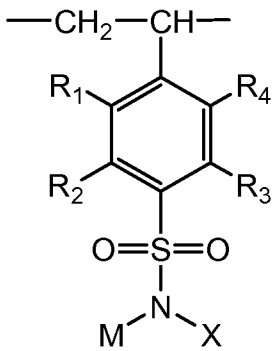
[0078] In other specific embodiments, A is $-CH_2-CH-$.

[0079] In other specific embodiments, Q is a methyl formate ($-COO-CH_2-$) linkage where the $-CH_2-$ is attached to A (not the benzene group) and y is 1.

[0080] The polymer may have any polymeric form. For example, the polymer may be a linear polymer, a nonlinear (branched) polymer, a crosslinked polymer, a copolymer, a graft copolymer, or a block copolymer. Similarly, the polymer may comprise only one monomer or several monomers. However, at least one monomer must allow attachment of or subsequent development of the aromatic N-sulfonamide moiety.

[0081] The backbone of the polymer comprises a monomer which allows attachment of or subsequent development of the aromatic N-sulfonamide moiety as a pendant group. The simplest backbone is a polyaliphatic backbone such as poly(ethylene), poly(vinyl alcohol), or poly(allyl alcohol). The backbone may also comprise other monomers which do not contain the aromatic N-sulfonamide moiety.

[0082] In specific embodiments, the polymer comprises a monomer of the following Formula (VIII):



Formula (VIII)

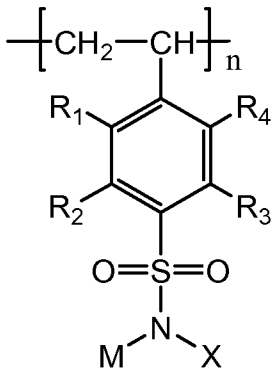
wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized

SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen; and

wherein M is an alkali or alkaline earth metal.

[0083] In further specific embodiments, the polymer is of the following Formula (IX):



Formula (IX)

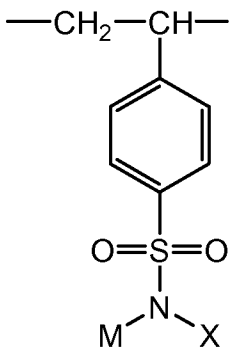
wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen;

wherein M is an alkali or alkaline earth metal; and

wherein n is the degree of polymerization.

[0084] In specific embodiments, the polymer comprises a monomer of the following Formula (X):



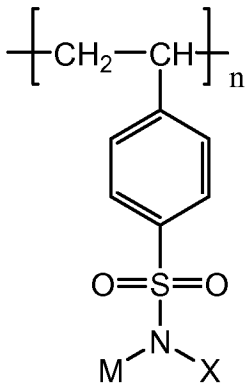
Formula (X)

wherein X is chlorine, bromine, fluorine, or iodine; and

M is an alkali or alkaline earth metal.

[0085] In a more specific embodiment of Formula (X), X is chlorine and M is sodium or potassium.

[0086] In specific embodiments, the polymer has the following Formula (XI):



Formula (XI)

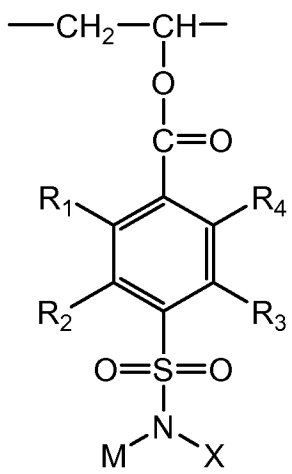
wherein X is chlorine, bromine, fluorine, or iodine;

M is an alkali or alkaline earth metal; and

wherein n is the degree of polymerization.

[0087] In a more specific embodiment of Formula (XI), X is chlorine and M is sodium or potassium.

[0088] In other specific embodiments, the polymer comprises a monomer of the following Formula (XII):



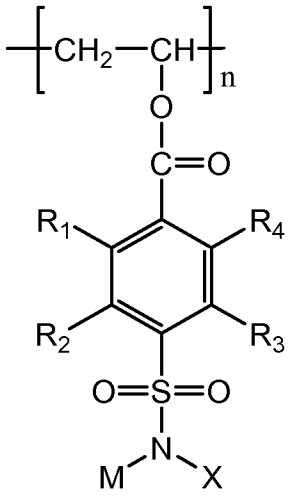
Formula (XII)

wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen; and

wherein M is an alkali or alkaline earth metal.

[0089] In further specific embodiments, the polymer is of the following Formula (XIII):



Formula (XIII)

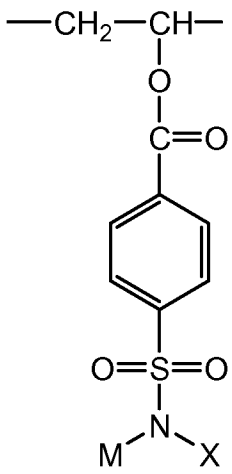
wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen;

wherein M is an alkali or alkaline earth metal; and

wherein n is the degree of polymerization.

[0090] In other specific embodiments, the polymer comprises a monomer of the following Formula (XIV):



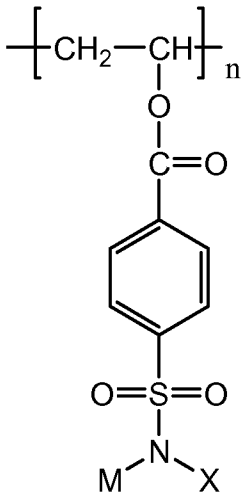
Formula (XIV)

wherein X is chlorine, bromine, fluorine, or iodine; and

M is an alkali or alkaline earth metal.

[0091] In a further specific embodiment of Formula (XIV), X is chlorine and M is sodium or potassium.

[0092] In specific embodiments, the polymer has the following Formula (X):



Formula (XV)

wherein X is chlorine, bromine, fluorine, or iodine; and

M is an alkali or alkaline earth metal.

[0093] In a further specific embodiment of Formula (XV), X is chlorine and M is sodium or potassium.

[0094] It should be clear that the monomers and polymers shown in Formulas (VIII) through (XV) are all specific embodiments of the monomer and polymer shown in Formulas (VI) and (VII).

[0095] In embodiments, the odor control agent itself may act as a disinfectant. The odor control composition may further comprise an additional disinfectant. The disinfectant may be present in an amount of from about 0.1 to about 5 wt% of the composition. Suitable disinfectants include, but are not limited to, chloramine T, chloramine B, and N-chloro-4-carboxybenzenesulfonamide.

[0096] In embodiments, a disinfectant composition separate from the odor control composition may also be utilized. In these embodiments, release of the disinfectant composition may be actuated by any of the same triggers used for releasing the odor control composition. This option allows a user to release disinfectant when a more hazardous material is being disposed of.

[0097] The odor control composition of the present disclosure may also further comprise one or more fragrances or deodorants. The fragrances and deodorants mask the smell of the contents of the waste container but do not react with odor-causing molecules.

[0098] The waste containers of the present disclosure have been described with reference to exemplary embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the present disclosure be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

CLAIMS:

1. A waste container comprising:
a vessel body with an opening for receiving waste materials;
a removable cover for operably enclosing said opening; and
an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation.

2. The waste container of claim 1, wherein the odor control dispenser continuously releases a vaporized odor control composition.

3. The waste container of claim 1, wherein the odor control dispenser releases a sprayed or atomized odor control composition.

4. The waste container of claim 1, wherein the odor control dispenser releases an odor control composition when the cover is set in motion in relation to the vessel body.

5. The waste container of claim 1, wherein the odor control dispenser releases an odor control composition upon activation of a trigger.

6. The waste container of claim 5, wherein the odor control composition is atomized or vaporized upon dispensing.

7. The waste container of claim 5, wherein the odor control composition reacts with odor-causing molecules produced by the waste materials to reduce the odor.

8. The waste container of claim 5, further comprising:
one or more additional odor control dispensers.

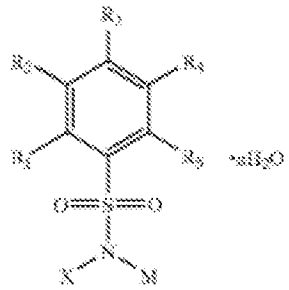
9. The waste container of claim 8, wherein the additional odor control dispensers continuously release a second odor control composition.

10. The waste container of claim 8, wherein the additional odor control dispensers release a second odor control composition when the cover is set in motion in relation to the vessel body.

11. The waste container of claim 1, wherein the vessel body and the cover are pivotally connected by a hinge.

12. The waste container of claim 1, wherein the vessel body and the cover are slidably engaged.

13. The waste container of claim 1, wherein the odor control agent is a compound of Formula (II):



Formula (II)

wherein X is a halogen;

wherein R_3 is hydrogen, methyl, or COOM;

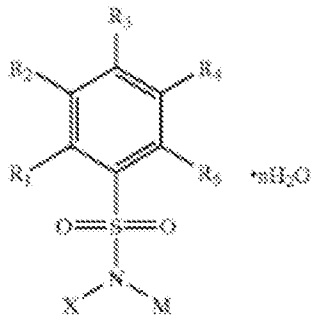
wherein R_1, R_2, R_4, R_5 are independently hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

wherein R is hydrogen or substituted or unsubstituted C_1-C_{12} alkyl;

wherein R_1, R_2, R_4 and R_5 are other than all hydrogen; and

wherein M is an alkali or alkaline earth metal.

14. The waste container of claim 1, wherein the odor control agent is a compound of Formula (III):



Formula (III)

wherein X is a halogen;

wherein R_1, R_2, R_4, R_5 are hydrogen, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_1 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

wherein R_3 is an organic derivatized COOH, such as an ester or alkylated amide, CN, NO_2, SO_3H or derivatized SO_3R, a halogen, a substituted or unsubstituted phenyl group, a sulfonamide, a halosulfonamide, a straight or branched aliphatic moiety from C_2 to C_{12}, wherein, the same straight or branched aliphatic moiety may contain substitution at one or more of the aliphatic hydrogens;

wherein R is hydrogen or substituted or unsubstituted C_1-C_{12} alkyl; and

wherein and M is an alkali or alkaline earth metal.

15. The waste container of claim 1, wherein the odor control agent is

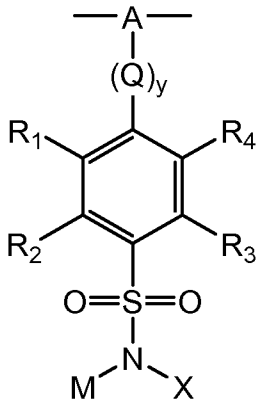
selected from chloramine T, chloramine B, N-chloro-4-carboxybenzenesulfonamide, and a mixture thereof.

16. The waste container of claim 15, wherein the odor control agent is a mixture of chloramine T and N-chloro-4-carboxybenzenesulfonamide.

17. The waste container of claim 15, wherein the odor control agent is a mixture of chloramine B and N-chloro-4-carboxybenzenesulfonamide.

18. The waste container of claim 15, wherein the odor control composition further comprises a disinfectant.

19. The waste container of claim 1, wherein the odor control agent is a polymer of Formula (VI):



Formula (VI)

wherein A is a trivalent linkage;

wherein Q is a divalent linkage and y is 0 or 1;

wherein R_1, R_2, R_3, and R_4 are independently selected from hydrogen, CF_3, COOH, derivatized COOH, an ester or alkylated amide, COOM, CN, NO_2, SO_3H or derivatized SO_3R, halogen, substituted or unsubstituted phenyl, sulfonamide, halosulfonamide, and linear or branched alkyl from C_1 to C_{12}, wherein the same straight or branched aliphatic moiety may be substituted at one or more of the aliphatic hydrogens;

wherein X is halogen; and

wherein M is an alkali or alkaline earth metal.

20. The waste container of claim 1, wherein the container is a pet waste receptacle.

21. The waste container of claim 1, wherein the container is a trash receptacle.

22. The waste container of claim 1, wherein the container is a diaper pail.

23. The waste container of claim 1, wherein the container is a compost container.

24. The waste container of claim 1, wherein the container is a medical waste container.

25. A waste container comprising:

a vessel body with an opening for receiving waste materials;

a cover connected to the vessel body for operably enclosing said opening; and

an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation;

wherein the cover comprises a plurality of flexible flaps configured to allow the ingress of a waste material through the opening and into the vessel body.

26. The waste container of claim 25, wherein the odor control agent dispenser continuously releases an odor control composition.

27. The waste container of claim 25, wherein the odor control agent dispenser releases an odor control agent upon activation of a trigger.

28. The waste container of claim 25, wherein the trigger is activated when

the flaps are flexed to receive the waste material.

29. A waste container comprising:

a vessel body with an opening for receiving waste materials;

a hinged cover mounted on said vessel body for operably enclosing said opening;

an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation; and

a foot pedal operably connected to the hinged cover for opening and closing the cover and activating the dispenser.

30. The waste container of claim 29, wherein the odor control agent is selected from chloramine T, chloramine B, N-chloro-4-carboxybenzenesulfonamide, or a mixture thereof.

31. A waste container comprising:

a vessel body with an opening for receiving waste materials;

a cover pivotally connected to said vessel body for operably enclosing said opening; and

an odor control dispenser for selectively dispensing an odor control agent into the vessel body upon activation;

wherein activation occurs when the cover is pivotally opened or closed.

32. The waste container of claim 31, wherein activation occurs mechanically when the cover is opened or closed.

33. The waste container of claim 31, wherein activation occurs electronically via an electronic switch which is engaged when the cover is opened or closed.

34. The waste container of claim 31, wherein activation occurs when a light sensitive switch is engaged when the cover is opened or closed.

35. The waste container of claim 32, wherein activation occurs when the cover engages or disengages a mechanical switch on the vessel body.

36. The waste container of claim 31, wherein a torsion spring assists in the opening or closing of the cover.

37. The waste container of claim 31, wherein the odor control dispenser comprises a removable cartridge.

38. The waste container of claim 31, wherein the odor control dispenser comprises a refillable cartridge.

39. The waste container of claim 31, wherein the odor control agent is selected from chloramine T, chloramine B, N-chloro-4-carboxybenzenesulfonamide, or a mixture thereof.

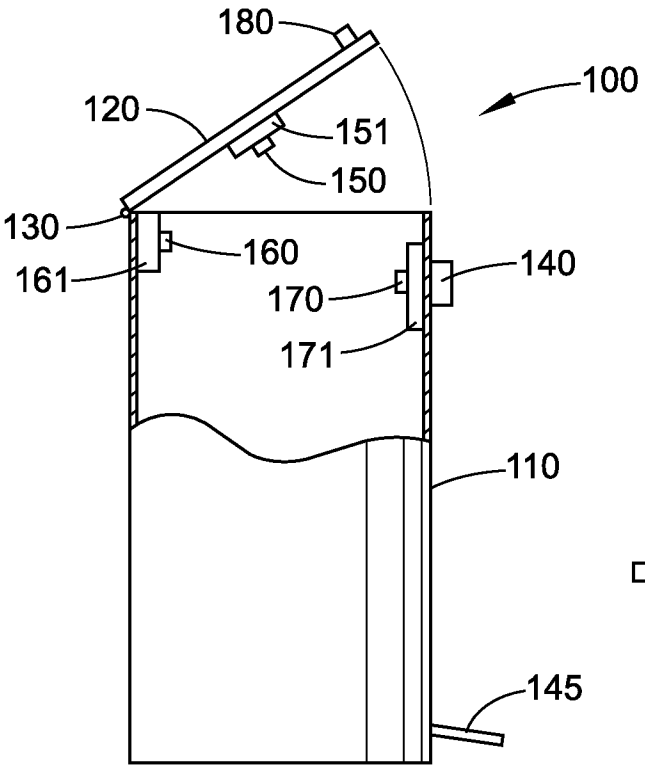


FIG. 1

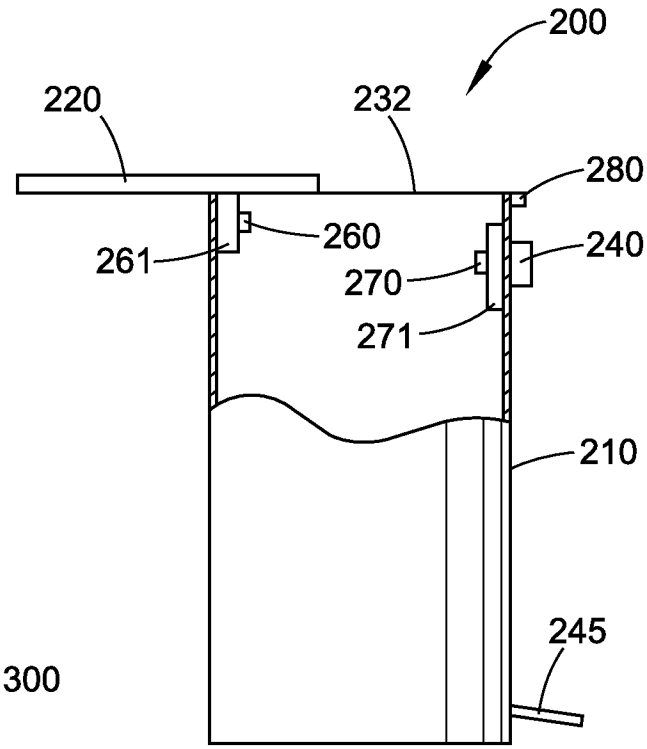


FIG. 2

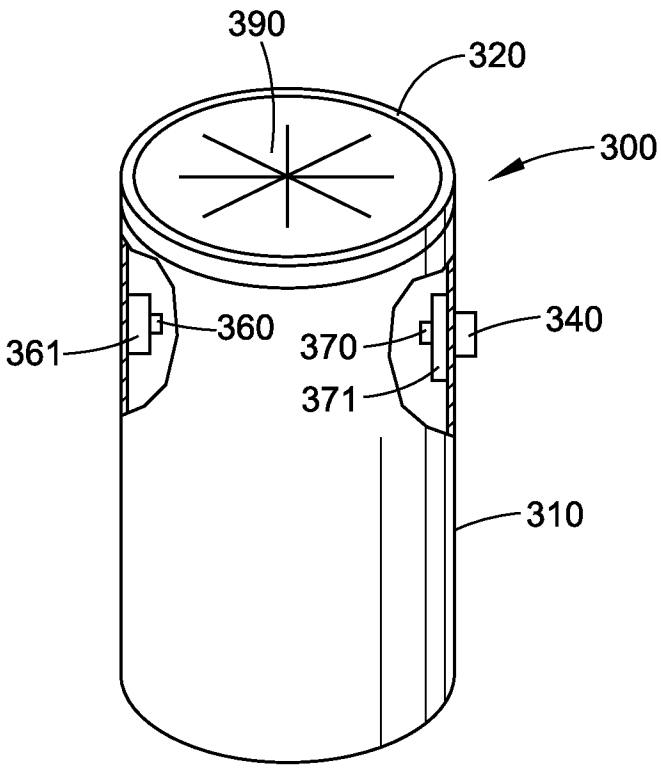


FIG. 3

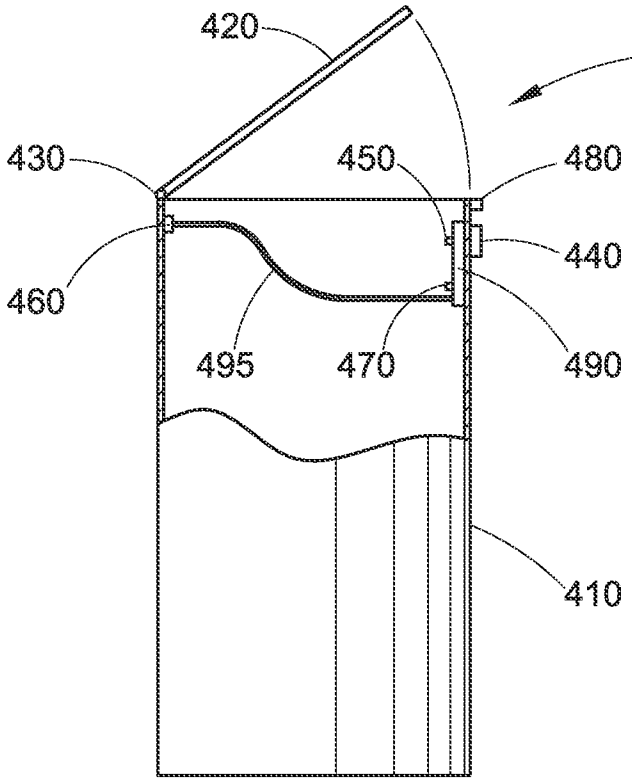

420
400
430
450
480
440
460
495
470
490
410

FIG. 4

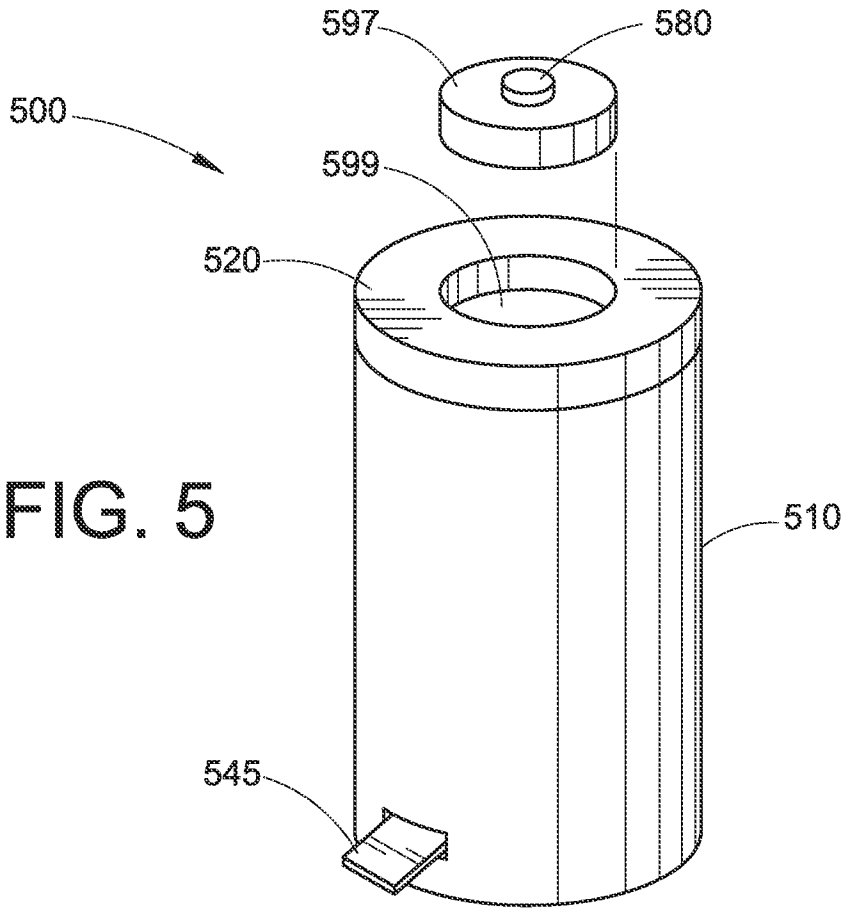
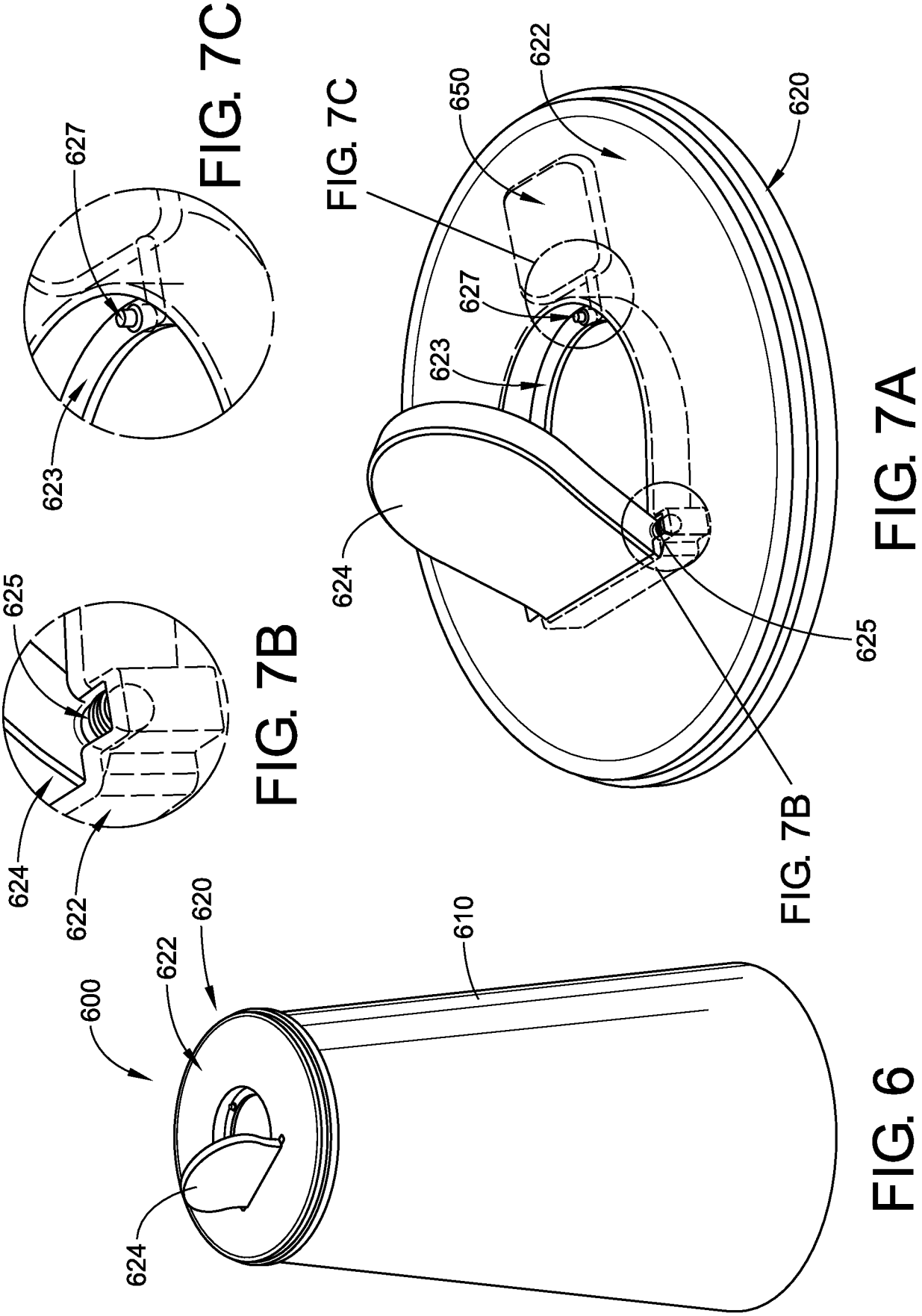

597
580
500
599
520
510
545

FIG. 5


600
622
620
610
624
FIG. 6
625
624
622
FIG. 7B
627
623
FIG. 7C
650
622
620
627
623
624
625
FIG. 7B
FIG. 7A

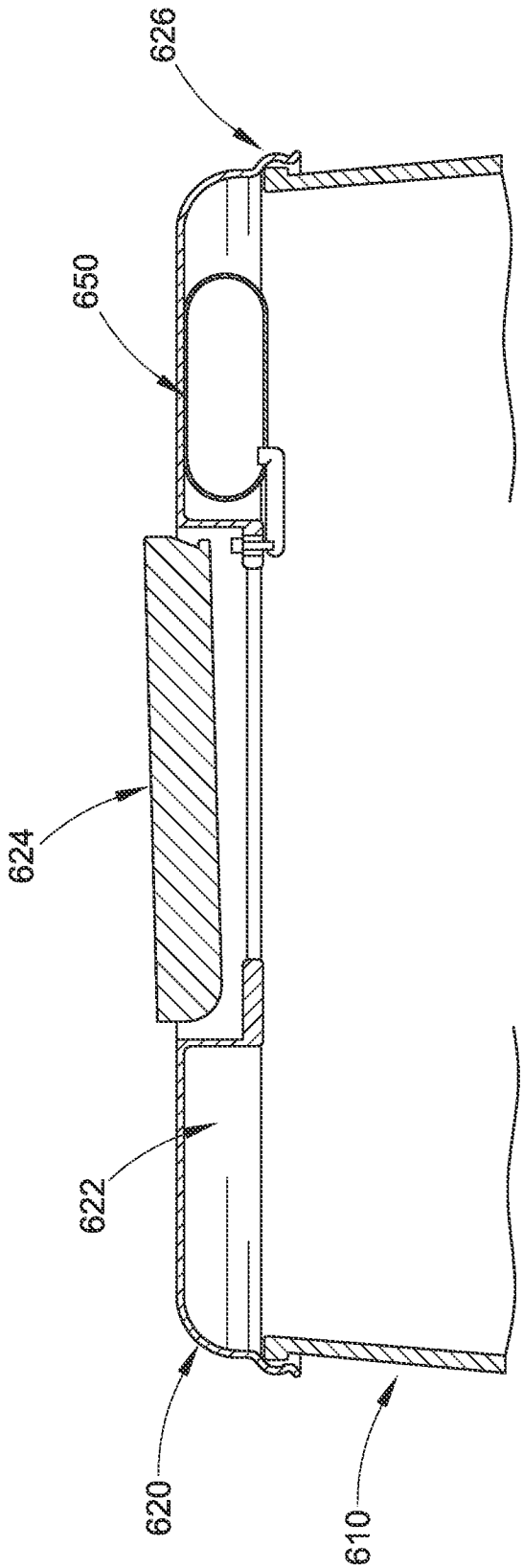


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US12/28975

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65F 1/00; A61L 9/00 (2012.01)
USPC - 220/908, 908.2; 424/76
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - B65F 1/00; A61L 9/00 (2012.01)
USPC - 220/908, 908.2; 424/76.1, 76.2, 76.21, 76.3, 76.5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP (bibliographic data only), DE-C, B, DE-A, DE-T, DE-U, GB-A, FR-A); DialogPro; Google; Google Scholar; trash, waste, garbage, refuse, recycling, compost, container, bin, receptacle, basket, vessel, bucket, pail, deodor, odor, smell, stench, malodor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 7878359 B1 (KO, W) February 1, 2011, abstract; figures 1, 3; column 2, lines 10-24; column 2, lines 59-67; column 3, lines 1-5; column 3, lines 19-44; column 3, lines 45-67; column 4, lines 1-3; column 4, lines 23-28	1, 3-5, 11, 21, 29, 31, 32, 35 ----- 2, 6-10, 12-20, 22-28, 30, 33, 34, 36-39
X	US 5988520 A (BITNER, A) November 23, 1999, abstract; figures 1-3; column 1, lines 5-10; column 3	1, 2, 4, 12, 21
Y	WO 2005/054087 A1 (TWINN, S) June 16, 2005, page 4, paragraph 10	25-28
Y	US 7371368 B2 (SCHNEIDER, D et al.) May 13, 2008, abstract; column 1, lines 28-31; column 1, lines 39-46; column 1, lines 65-67; column 2, lines 1-3; column 2, lines 8-15; column 2, lines 60-64; column 4, lines 12-25; column 6, lines 40-43; column 7, lines 45-52; column 8, lines 2-45; column 10, lines 3-4; Claim 1	7, 15-18, 20, 22, 30, 39
Y	US 7516865 B1 (PIERRE, R) April 13, 2009, figure 4; column 3, lines 1-33	33, 37, 38
Y	US 6164710 A (SHIBUYA, K) December 26, 2000, column 3, lines 36-40	36
Y	US 5845847 A (MARTIN, J et al.) December 8, 1998, column 1, lines 9-34	2, 8-10, 26
Y	US 2010/0150785 A1 to (WOOLMAN, D et al.) June 17, 2010, abstract; paragraphs [0007], [0011], [0065]-[0096]	6, 18
Y	US 2010/0041761 A1 (SCHNEIDER, DJ et al.) February 28, 2010, paragraphs [0015]-[0025]	13, 14

☒ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 June 2012 (19.06. 2012)	16 AUG 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US12/28975

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0160565 A1 (SCHNEIDER, CA. et al.) July 12, 2007, paragraphs [0003], [0004], [0007]	19
Y	US 6814249 B2 (LIN, T) November 9, 2004, figure 5; column 2; lines 52-54	23
Y	US 4902482 A to (FAUST, PA) February 20, 1990, abstract	24
Y	US 4733103 A (ITOH, H et al.) March 22, 1988, abstract	34
Y	US 5474201 A (LIU, CC) December 12, 1995, abstract; figure 2	12
E, Y	US 2011/0303664 A1 (NICHOLS, B) December 15, 2011, abstract; figures 1, 2; paragraphs [0011]-[0017]	1, 3, 21, 25, 29, 31
A	US 5398897 A (SVERDLIK, D) March 21, 1995, abstract; figure 1	1