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(54) **SELF-REGULATED CLEANING SYSTEM FOR TOILET ARRANGEMENT**

(57) Described herein is a self-regulated cleaning system [104] for toilet arrangement [102], which includes a hydrogen peroxide generator [122] and a control system [124]. The hydrogen peroxide generator [122] generates and releases hydrogen peroxide in a storage tank [110]. The control system [124] includes a flush counter [126] and a control unit [132]. The flush counter [126] determines count of number of flush actions performed on a face plate [116]. The control unit [132] actuates the hydrogen peroxide generator [122] as the count of the number of flush actions reaches beyond threshold value for releasing hydrogen peroxide therein, perform first actuation of the flush valve [114] for release of mixture of hydrogen peroxide and water to a toilet bowl, and then perform second actuation of the flush valve [114] after a predefined time for release of water in the toilet bowl [106].

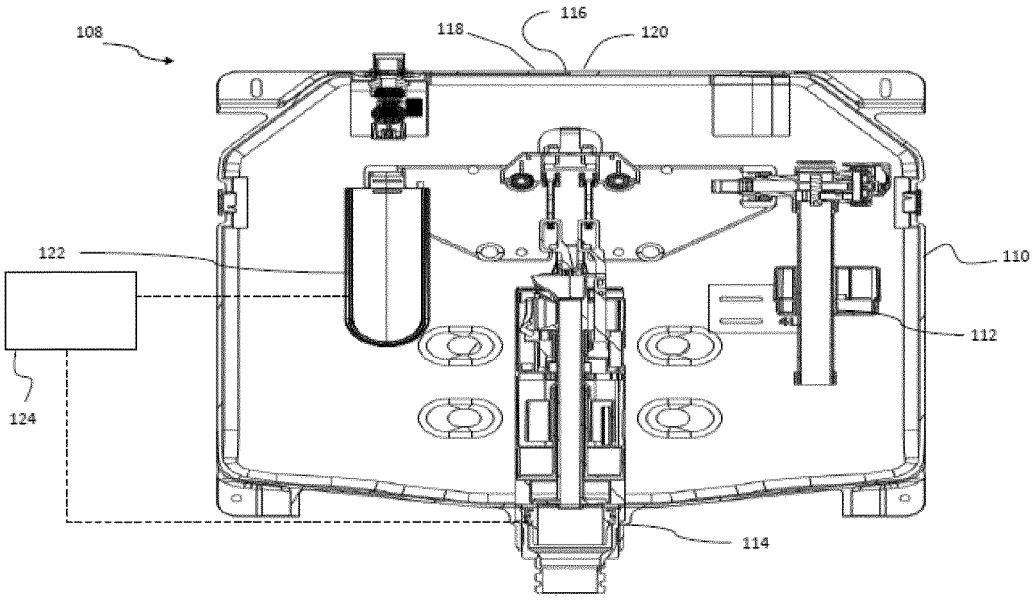

FIG. 2

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Description

TECHNICAL FIELD

[0001] The present disclosure generally relates to cleaning of toilet arrangements. More particularly, the present disclosure relates to a self-regulated cleaning system and a self-regulated cleaning method for cleaning a toilet arrangement.

BACKGROUND

[0002] Toilet arrangements are commonly known in sanitation industry, to enable persons to defecate in good sanitary conditions. A typical toilet arrangement comprises of a toilet bowl and a flush tank. The toilet bowl is provided to receive the users' defecate, while the user performs defecation. The toilet bowl is fluidly connected to the flush tank. Water is transferred from the flush tank to the toilet bowl for removing the defecate therefrom, when required. The flush tank comprises of a storage tank, a face plate, a fill valve, and a flush valve. The face plate is connected to the flush valve, such that the flush valve is opened corresponding to pressing of the face plate. When required, a user may press the face plate to open the flush valve, such that water is transferred from the storage tank to the toilet bowl for removing the defecate therefrom.

[0003] With prolonged usage, dirt and germs get build up over the toilet bowl of the toilet arrangement. Thus, the toilet bowl is required to be periodically cleaned. Typically, the toilet bowl is cleaned manually by spraying bleached chlorine solution (a mixture of bleached chlorine and acidic compound), allowing it to settle for a predefined time, and then cleaning it off by flowing water in the toilet bowl. However, bleached chlorine is not environment-friendly. Bleached chlorine solution produces dioxin, which is known to be degrading the environment. Further, when bleached chlorine is mixed with an acid compound to form the bleached chlorine solution, chlorine gas is given off that is toxic in nature. Particularly, exposure to chlorine gas may cause, irritation to the mucous membrane, coughing and breathing problems, burning watery eyes, and the like. Several other cleaning agents for toilet arrangements like sodium hypochlorite and hydrochloric acid are also toxic and non-environment friendly similar to bleached chlorine. Also, such manual cleaning requires employing of a cleaning staff, to perform the manual cleaning operation. This increases maintenance cost of the toilet arrangement. Moreover, such manual cleaning is relatively less efficient, and thus the cleaning schedule may not be followed appropriately.

[0004] Accordingly, in light of the aforementioned drawbacks in conventional manual cleaning of the toilet arrangement and several other inherent in the existing arts, there is a well felt need to provide self-regulated cleaning system for toilet arrangement.

SUMMARY

[0005] One object of the present invention relates to a self-regulated cleaning system for a toilet arrangement. The self-regulated cleaning system facilitates automatic cleaning of the toilet arrangement, at regular intervals. Thereby, reducing maintenance cost of the toilet arrangement.

[0006] Another object of the invention relates to a self-regulated cleaning system for a toilet arrangement, which relatively increases life cycle of the toilet arrangement by improving cleaning efficiency.

[0007] Yet another object of the invention relates to a self-regulated cleaning system for a toilet arrangement, which uses hydrogen peroxide as a cleaning agent. Hydrogen peroxide is environment friendly, which produces oxygen and water molecules on degradation. Thus, usage of hydrogen peroxide is environment friendly in nature. Also, Hydrogen peroxide is a safe antimicrobial agent as per USFDA (United States Food and Drug Administration).

[0008] Yet another object of the invention relates to a self-regulated cleaning system for a toilet arrangement, which has a safety control for deactivating the self-regulated cleaning system during improper operation conditions. For example, the self-regulated cleaning system is deactivated in events, such as but not limited to, during non-functioning of an electrolytic cell of a hydrogen peroxide generator, no/ improper electric supply, during usage of toilet arrangement by a user, no/improper supply of water to a flush tank.

[0009] Yet another object of the invention relates to a self-regulated cleaning system for a toilet arrangement, which includes a hydrogen peroxide generator and a control system. The hydrogen peroxide generator is positioned within the flush tank, and is adapted to generate and release a predefined amount of hydrogen peroxide in water stored in the flush tank, upon actuation of the hydrogen peroxide generator. The control system includes a flush counter and a control unit. The flush counter is adapted to determine a count of number of flush actions performed on the face plate of the flush tank. The control unit is operably connected to the flush counter, the hydrogen peroxide generator, and the flush valve. Further, the control unit is adapted to actuate the hydrogen peroxide generator as the count of the number of flush actions determined by the flush counter reaches beyond a threshold value, for release of hydrogen peroxide in water stored in the flush tank. Thereafter, the control unit performs a first actuation of the flush valve for release of a mixture of hydrogen peroxide and water to the toilet bowl of the toilet arrangement. Finally, the control unit performs a second actuation of the flush valve after predefined time of the first actuation for release of water in the toilet bowl of the toilet arrangement.

[0010] Yet another object of the invention relates to a self-regulated cleaning method for cleaning a toilet bowl of a toilet arrangement. The self-regulated cleaning

method initiates with continuously determining, with use of a flush counter, a count of flush actions performed on the face plate. Thereafter, the method compares, with use of the control unit, the count of flush actions performed on the face plate with a threshold value. Further, in case the count of flush actions performed on the face plate reaches beyond the threshold value, the control unit actuates the hydrogen peroxide generator for generation and release of a predetermined amount of hydrogen peroxide within water stored in the flush tank. Thereafter, the control unit performs a first actuation of the flush valve, with use of the control unit, for release of the mixture of hydrogen peroxide and water to the toilet bowl of the toilet arrangement. Finally, the method includes performing a second actuation of the flush valve after a predetermined time from the first actuation, with use of the control unit, for release of the water to the toilet bowl of the toilet arrangement.

BRIEF DESCRIPTION OF DRAWINGS

[0011] The present invention, both as to its organization and manner of operation, together with further objects and advantages, may best be understood by reference to the following description, taken in connection with the accompanying drawings. These and other details of the present invention will be described in connection with the accompanying drawings, which are furnished only by way of illustration and not in limitation of the invention, and in which drawings:

Figure. 1. Illustrates a schematic of a toilet system, employing a toilet arrangement and a self-regulated cleaning system, in accordance with the concepts of the present disclosure.

Figure. 2. Illustrates a sectional view of a flush tank of the toilet arrangement, in accordance with the concepts of the present disclosure.

Figure. 3. Illustrates a block diagram of a control system of the self-regulated cleaning system, illustrating various components of the control system of the self-regulated cleaning system, in accordance with the concepts of the present disclosure.

Figure. 4. Illustrates a flowchart of a cleaning process employed by the self-regulated cleaning system, in accordance with the concepts of the present disclosure.

DETAILED DESCRIPTION

[0012] In the following description, for the purposes of explanation, various specific details are set forth in order to provide a thorough understanding of embodiments of the present invention. It will be apparent, however, that embodiments of the present invention may be practiced without these specific details. Several features described hereafter can each be used independently of one another or with any combination of other features. An individual feature may not address any of the problems discussed above or might address only one of the problems discussed above. Some of the problems discussed above might not be fully addressed by any of the features described herein. Example embodiments of the present invention are described below, as illustrated in various drawings in which like reference numerals refer to the same parts throughout the different drawings.

[0013] Figure 1 shows a schematic of a toilet system [100]. Figure 2 illustrates a sectional view of a flush tank [108] of a toilet arrangement [102] of the toilet system [100]. Figure 1 and Figure 2 should be referred in conjunction, in order to clearly understand a scope of the present disclosure. The toilet system [100] includes the toilet arrangement [102] and a self-regulated cleaning system [104]. The self-regulated cleaning system [104] is provided to perform automatic cleaning of the toilet arrangement [102], at regular intervals. Structure and arrangement of the toilet arrangement [102] will be discussed hereinafter.

[0014] The toilet arrangement [102] is a typical toilet facility provided to allow users to defecate in good sanitary condition. The toilet arrangement [102] includes a toilet bowl [106] and the flush tank [108]. The toilet bowl [106] is an open-top vessel, which is provided to receive users' defecate, as the user performs defecation thereon. The flush tank [108] is provided to store water, which may be supplied to the toilet bowl [106] for removing defecate (termed as flushing action) therefrom. The flush tank [108] includes a storage tank [110], a fill valve [112], a flush valve [114], and a face plate [116].

[0015] The storage tank [110] is adapted to store water therein. The storage tank [110] is fluidly connected to a water source via the fill valve [112], to receive water therein. Moreover, the storage tank [110] is fluidly connected to the toilet bowl [106] via the flush valve [114], to allow exit of water therefrom. In particular, water stored in the storage tank [110] is transferred to the toilet bowl [106] via the flush valve [114], for enabling flushing action thereon. Notably, the storage tank [110] supports the fill valve [112], the flush valve [114], and the face plate [116], which in conjunction with each other facilitates filling and emptying of the storage tank [110] when required.

[0016] The fill valve [112] is provided between a fluid connection of the storage tank [110] with the water source, and enables filling of the storage tank [110] upon actuation. Particularly, the fill valve [112] is automatically actuated when a water level in the storage tank [110] reaches below a lower threshold level, to allow filling of the storage tank [110] with fresh water received from the water source. Moreover, the fill valve [112] is deactivated when water level in the storage tank [110] reaches above an upper threshold value, to stop filling of the storage tank [110].

[0017] Further, the flush valve [114] and the face plate

[116], in conjunction, allows exit of water from the storage tank [110] to the toilet bowl [106] upon users demand. The flush valve [114] is provided between a fluid connection of the storage tank [110] with the toilet bowl [106], and enables transfer of water therebetween upon actuation. Particularly, when actuated (opened), the flush valve [114] transfers water from the storage tank [110] to the toilet bowl [106], for performing flushing action. Moreover, when deactivated (closed), the flush valve [114] restricts transfer of water from the storage tank [110] to the toilet bowl [106], for stopping flushing action. Actuation and deactivation of the flush valve [114] is manually enabled with use of the face plate [116]. For such purpose, the face plate [116] is operably connected to the flush valve [114], such that the flush valve [114] is actuated when at least a button on the face plate [116] is pressed. The face plate [116] includes a full flush button [118] and a half flush button [120], for enabling a full flush action and a half flush action. The full flush button [118] is operably connected to the flush valve [114], such that pressing of the full flush button [118] corresponds to transfer of substantially entire water stored in the storage tank [110] to the toilet bowl [106]. Therefore, pressing of the full flush button [118] corresponds to one (1) flush action (also termed as "full flush action") performed on the face plate [116]. The half flush button [120] is operably connected to the flush valve [114], such that pressing of the half flush button [120] corresponds to transfer of substantially half of water stored in the storage tank [110] to the toilet bowl [106]. Therefore, pressing of the half flush button [120] corresponds to half (0.5) flush action (also termed as "half flush action") performed on the face plate [116]. A connection means between the full flush button [118] and the half flush button [120] with that of the flush valve [114] includes, but is not limited to, a clutch wire connection mechanism, a pneumatic connection mechanism, a linkage connection mechanism, an electric arrangement, and the like. In a preferred embodiment, as shown and described in the present disclosure, the face plate [116] is positioned on an outer surface of the flush tank [108], to be accessible to a user. Although, in the preferred embodiment the face plate [116] is shown and described as provided on the outer surface of the flush tank [108], however, in an alternate embodiment, the face plate [116] may be positioned remote to the flush tank [108]. Positioning of the face plate [116] relative to the flush tank [108] does not limit the scope of the invention. In the alternate embodiment, when the face plate [116] is positioned remote to the flush tank [108], the face plate [116] is pneumatically connected to the flush valve [114], which enable the exit of the fluid from the storage tank [110] upon pressing of the face plate [116].

[0018] The self-regulated cleaning system [104] is provided to perform automatic cleaning of the toilet bowl [106] of the toilet arrangement [100] based on a predefined self-regulated cleaning method/process, at regular intervals. The self-regulated cleaning system [104] comprises of a hydrogen peroxide generator [122] and a control system [124].

[0019] The hydrogen peroxide generator [122] is an electrolytic cell, positioned within the storage tank [110]. When actuated, the hydrogen peroxide generator [122] releases a predefined volume of hydrogen peroxide in the storage tank [110] of the flush tank [108]. In particular, the hydrogen peroxide generator [122] is adapted to release hydrogen peroxide within a predefined range of 2 - 30% volume of the storage tank [110], preferably between 3-6 % volume of the storage tank [110]. Notably, the hydrogen peroxide generator [122] generates the hydrogen peroxide by way of an electrolytic chemical reaction. As the hydrogen peroxide generator [122] is positioned within the storage tank [110], the hydrogen peroxide so generated is released in water stored in the storage tank [110] of the flush tank [108]. Furthermore, when deactivated, the hydrogen peroxide generator [122] stops generation of the hydrogen peroxide.

[0020] Figure 3 shows a block diagram of the control system [124] of the self-regulated cleaning system [104]. The control system [124] is provided to controllably actuate the hydrogen peroxide generator [122], to allow self-regulated production of hydrogen peroxide in the storage tank [110] of the flush tank [108]. The control system [124] includes a flush counter [126], a display unit [128], a safety unit [130], a control unit [132], and a printed circuit board [134]. The display unit [128] is positioned remote to the printed circuit board [134], and is in connection with the control unit [132]. The safety unit [130] and the control unit [132] are fabricated on the printed circuit board [134]. The safety unit [130] is in electric connection with the control unit [132]. Further, the control unit [132] is in electrical connection with the flush counter [126] and the hydrogen peroxide generator [122]. Although, the present disclosure describes the safety unit [130] and the control unit [132], are described as positioned on a single printed circuit board [134], it may be obvious to a person ordinarily skilled in the art that the that each of the safety unit [130] and the control unit [132], may be positioned and fabricated remote to the printed circuit board [134]. Similarly, although the display unit [128] is described as positioned remote to the printed circuit board [134], it may be obvious to a person ordinarily skilled in the art that the that each of the display unit [128] may be positioned and fabricated on the printed circuit board [134].

[0021] The flush counter [126] is adapted to determine a count of number of flush actions performed on the face plate [116] of the flush tank [106]. The flush counter [126] is a combination of two float switches [136, 138] and a storage unit [140]. The float switches [136, 138] are water level sensors, adapted to detect actuation of the face plate [116] for either of half flush and full flush, based on water levels in the storage tank [110] before and after the flush. Particularly, the float switches [136, 138] include a first float switch [136] (interchangeably referred to as the full float switch [136]) and a second float switch [138] (interchangeably referred to as the half float switch

[138]). The first float switch [136] generates a first signal, upon pressing of the full flush button [118] on the face plate [116] for full flush action. The second float switch [138] generates a second signal, upon pressing of the half flush button [120] on the face plate [116] for half flush action.

[0022] The storage unit [140] refers to a non-transitory media that stores data and/or instructions that cause a machine to operate in a specific manner. In a preferred embodiment, the storage unit [140] is an EPROM memory provided in electrical communication to each of the half float switch [138] and the full float switch [136]. The storage unit [140] is adapted to receive the first signal and the second signal from each of full float switch [136] and the half float switch [138], and correspondingly count the number of flushes actions performed. The storage unit [140] comprises of a counter that is incremented upon receipt of signals from each of full float switch [136] and the half float switch [138]. Notably, the storage unit [140] increments the counter by one (1), upon receipt of the first signal from the first float switch [136]. Further, the storage unit [140] increments the counter by half (0.5), upon receipt of the second signal from the second float switch [138]. In addition to the count of the number of flush actions, the storage unit [140] also records date and time of previous pressing of the face plate [116], for flushing. Further, as the storage unit [140] is an EPROM memory, the data in the counter can be erased, when required by the control unit [132]. Although, the storage unit [140] is described as the EPROM memory, various other types of memory as the storage unit [140] may also be contemplated

[0023] The display unit [128], which is a user-interactive LED based touch screen, is in communication with the storage unit [140] of the flush counter [126], via the control unit [132]. Particularly, the control unit retrieves a number of parameters from the storage unit [140] of the flush counter [126], and transmit it to the display unit [128]. The display unit [128] displays the number of parameters of the toilet arrangement [102], by obtaining data from the storage unit [140] of the flush counter [126] via the control unit [132]. For example, the display unit [128] displays date, time, number of flushes, cleaning mode, duration of cleaning, number of cleaning cycle, life of cleaning solution and water in the flush tank [108]. As the present disclosure relates to the count of the number of flush actions primarily, concepts of the present disclosure will be described in accordance to receipt and display of the count of the number of flush actions only. The display unit [128] retrieves the count of the number of flush actions stored in the storage unit [140] of the flush counter [126] via the control unit [132], and thus display the count of the number of flush actions. To display the content, any of the Liquid crystals display (LCD) and LED (Light emitting diode) technology may be used.

[0024] In a preferred embodiment, the safety unit [130] is provided for enabling safe operation of the self-regulated cleaning system [104]. The safety control unit comprises of a number of motion sensors that detects uneven operational parameters of the toilet arrangement [102] and the self-regulated cleaning system [104]. Uneven operational parameters of the toilet arrangement [102] includes, but is not limited to, improper operation of the toilet arrangement [102], a low water supply in the flush tank [108], a blockage in the drain pipe of the toilet arrangement [102], and/or failure of any of the components of the self-regulated cleaning system [104]. In such cases, the safety unit [130] guides the control unit [132] to halt/ stop/ not initiate execution of the self-regulated cleaning method/process, for cleaning the toilet arrangement [102].

[0025] The control unit [132] is electrically connected to each of the hydrogen peroxide generator [122], the storage unit [140] of the flush counter [126], and the safety unit [130]. Further, the control unit is operably connected to the flush valve [114]. With such arrangement, the control unit [132] enables cleaning of the toilet bowl [106] based on the predefined self-regulated cleaning method/ process [142]. Particularly, the control unit [132] is pre-programmed to follow certain steps of performing the self-regulated cleaning method/ process [142]. Notably, the control unit [132] is electrically connected to the storage unit [140] of the flush counter, to obtain the data for the count of the number of flush actions performed in the face plate [116]. Further, the control unit [132] is electrically connected to the hydrogen peroxide generator [122], for enabling controlled actuation and deactivation of the hydrogen peroxide generator [122] thereof. Moreover, the control unit [132] is operably connected to the flush valve [114], for enabling controlled actuation and deactivation of the flush valve [114] thereof. Notably, the control unit [132] performs the aforementioned actions, to execute the predefined self-actuating cleaning method/ process [142] on the toilet bowl [106] of the toilet arrangement [102]. The self-regulated cleaning method/ process [142] is as defined in the below description.

[0026] Figure 4. shows a flowchart of the self-regulated cleaning method/process [142] performed by the self-regulated cleaning system [104]. The self-regulated cleaning method/process [142] initiates at step [144]. At step [144], the flush counter [126] continuously determines/records the count of the number of flush actions performed on the face plate [116] of the flush tank [108] of the toilet arrangement [100]. Particularly, at step [144], the float switches [136, 138] detect actuation of the face plate [116], corresponding to which the count of number of flushes are stored in the counter of the storage unit [140]. As is already mentioned, the float switches [136, 138] detect actuation of the face plate [116] for either of the half flush action and the full flush action, based on the water remaining in the storage tank [110] after performing the flush action. Corresponding to either of the first signal from the first float switch [136] and the second signal from the second float switch [138[, the counter of the storage unit [140] is incremented. Thus, the storage unit [140] of the flush counter [126] stores the count of

number of flush actions performed on the face plate [116] of the flush tank [108]. Thereafter, the self-regulated cleaning method/ process [142] proceeds to step [146].

[0027] At step [146], the control unit [132] retrieves the flush data, i.e. the count of the number of flush actions performed on the face plate [116] from the storage unit [140] of the flush counter [126], and compares the count of the number of flush actions with a predefined threshold value. In case, the count of the number of flush actions is smaller than the predefined threshold value, no action is taken. Particularly, the method moves back to step [144], in case the count of the number of flush actions is smaller than the predefined threshold value. In case, the count of the number of flush actions reaches beyond (is larger than) the predefined threshold value, the self-regulated cleaning method/ process proceeds to step [148].

[0028] At step [148], the control unit [132] activates the hydrogen peroxide generator [122] for a small period. Particularly, at step [148], the hydrogen peroxide generator [122] generates and releases hydrogen peroxide at a controlled flow rate and volume percentage (preferably 3~6 % volume of the storage tank [110]) in the storage tank [110] of the flush tank [108]. After generation and release of the predefined volume of the hydrogen peroxide, the hydrogen peroxide generator [122] is deactivated. Thereafter, the self-regulated cleaning method/ process [142] proceeds to step [150]. With release of the hydrogen peroxide within water stored in the storage tank [110], the released hydrogen peroxide is then allowed to get mixed in the water stored in the storage tank [110] of the flush tank [108]. Thereafter, the cleaning process proceeds to step [152].

[0029] At step [152], the control unit [132] performs a first actuation of the flush valve [114] of the flush tank [108], for automatic flushing of the mixture of the hydrogen peroxide and water to the toilet bowl [106] of the toilet arrangement [102]. With such action, the mixture of the hydrogen peroxide and water is sprayed onto the dirt on the toilet bowl [106] of the toilet arrangement [102]. The hydrogen peroxide mixed water is allowed to settle on the toilet bowl, and thus act on dirt for a predefined time period. The predefined time period in the preferred embodiment is preferably 20 minutes. Thereafter, the self-regulated cleaning method/ process [142] proceeds to the step [154].

[0030] At step [154], the storage tank [110] of the flush tank [108] is filled with fresh water through the fill valve [112]. After the predefined time period of 20 minutes, the control unit [132] performs a second actuation of the flush valve [114] for flushing of the fresh water in the toilet bowl [106], for removal of dirt and hydrogen peroxide from the toilet bowl [106] of the toilet arrangement [102]. Thus, the automatic cleaning of the toilet bowl [106] of the toilet arrangement [102] is performed. It may be noted that after performing one cycle of the aforementioned steps of the self-regulated cleaning method/ process [142], the control unit [132] clears the counter of the storage unit [140] of the flush counter [126], to zero the count of the number of flush actions. Thereby, the self-regulated cleaning method/ process [142] restarts the count of the number of flush actions for next cycle of the steps of the self-regulated cleaning method/ process [142].

[0031] With such arrangement of the self-regulated cleaning system [104] and the self-regulated cleaning method/ process [142], an automatic cleaning of the toilet bowl [106] of the toilet arrangement [102] is enabled. Particularly, the self-regulated cleaning system [104] performs automatic cleaning of the toilet bowl [106] of the toilet arrangement [102] by following the self-regulated cleaning method/ process [142], as the count of the number of flush actions performed on the face plate [116] reaches beyond the threshold value. Thereby, the self-regulated cleaning system [104] performs automatic cleaning of the toilet bowl [106] of the toilet arrangement [102] by the self-regulated cleaning method/ process [142] after (10) flush actions.

[0032] In accordance with the above mentioned description of the self-regulated cleaning system [104] and the self-regulated cleaning method/ process [142], there are various advantages as cited herein. As the self-regulated cleaning system [104] by following the self-regulated cleaning method/ process [142] enables automatic cleaning of the toilet bowl [106] of the toilet arrangement [102], a need for separate maintenance staff is avoided and thus the maintenance cost is substantially reduced. Also, timely and scheduled cleaning of the toilet bowl [106] of the toilet arrangement [102] enables increased life cycle of the toilet bowl [106] of the toilet arrangement [102].

[0033] Moreover, as the hydrogen peroxide generator [122] is positioned within the storage tank [110], it has a protective shield of the storage tank [110]. Such protection of the hydrogen peroxide generator [122] within the storage tank [110] restricts exposure of the hydrogen peroxide generator [122] to external environment, thereby preventing degradation of electrodes contained therein by reacting with ambient air. This improves work life of the hydrogen peroxide generator [122]. In addition to this, hydrogen peroxide is environment-friendly. Particularly, upon degradation of hydrogen peroxide, oxygen and water molecules are produced. Thus, usage of hydrogen peroxide is environment friendly in nature. Therefore, Hydrogen peroxide is a safe antimicrobial agent as per US-FDA (United States Food and Drug Administration).

[0034] While the preferred embodiments of the present invention have been described hereinabove, it should be understood that various changes, adaptations, and modifications may be made therein without departing from the spirit of the invention and the scope of the appended claims. It will be obvious to a person skilled in the art that the present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.

List of Components:

[0035]

100- Toilet System
102 - Toilet arrangement
104- Self-Regulated Cleaning System
106 - Toilet Bowl
108- Flush Tank
110 - Storage tank of 108
112- Fill valve of 108
114- Flush valve of 108
116- Face plate of 108
118-Full Flush Button of 116
120 - Half Flush Button of 116
122- Hydrogen peroxide generator of 104
124 - Control System of 104
126 - Flush Counter of 124
128 - Display unit of 124
130-Safety Unit of 124
132 - Control Unit of 124
134- Printed circuit board of 124
136 - First Float Switch of 126
138 - Second Float Switch of 126
140 - Storage Unit of 126
142 - Self- Regulated cleaning method/ process
144- Step 1 of 142
146- Step 2 of 142
148- Step 3 of 142
150- Step 4 of 142
152- Step 5 of 142
154 - Step 6 of 142

Claims

1. A self-regulated cleaning system [104] for a toilet arrangement [102], the toilet arrangement [102] including a toilet bowl [106] and a flush tank [108], the flush tank [108] having a storage tank [110], a face plate [116], and a flush valve [114], the self-regulated cleaning system [104] comprising:

- a hydrogen peroxide generator [122] positioned within the storage tank [110] of the flush tank [108], and adapted to generate and release a predefined amount of hydrogen peroxide in water stored in the storage tank [110], upon actuation of the hydrogen peroxide generator [122]; and
- a control system [124], comprising:

a flush counter [126] adapted to determine a count of number of flush actions performed on the face plate [116] of the flush tank [108]; and
a control unit [132] operably connected to the flush counter [126], the hydrogen peroxide generator [122], and the flush valve [114], the control unit [132] being adapted to:

actuate the hydrogen peroxide generator [122] as the count of the number of flush actions determined by the flush counter [126] reaches beyond a threshold value, for release of hydrogen peroxide in water stored in the storage tank [110],
perform a first actuation of the flush valve [114] for release of a mixture of hydrogen peroxide and water to the toilet bowl [106] of the toilet arrangement [102], and
perform a second actuation of the flush valve [114] after predefined time of the first actuation for release of water in the toilet bowl [106] of the toilet arrangement [102].

2. The self-regulated cleaning system [104] as claimed in claim 1, wherein the hydrogen peroxide generator [122] is an in-situ electrolytic cell, which generates the predefined amount of hydrogen peroxide within the storage tank [110] by way of electrolytic chemical reaction.

3. The self-regulated cleaning system [104] as claimed in claim 1, wherein the predefined amount of hydrogen peroxide generated by the hydrogen peroxide generator [122] is within a range of 2% - 30% volume of a storage tank capacity, particularly within a range of 3% - 6% volume of the storage tank capacity.

4. The self-regulated cleaning system [104] as claimed in claim 1, wherein the flush counter [126] of the control system [124] includes:

at least one float switch [136, 138] adapted to generate a signal upon a flush action performed on the face plate [116]; and
a storage unit [140] having a counter, which is incremented upon receipt of the signal from the at least one float switch [136, 138], such that a counter value corresponds to the count of the flush actions performed on the face plate [116].

5. The self-regulated cleaning system [104] as claimed in claim 4, wherein the at least one float switch [136, 138] is a water level sensor that generates the signal based on a water level of the storage tank [110].

6. The self-regulated cleaning system [104] as claimed in claim 4, wherein the at least one float switch [136, 138] includes a half float switch [138] and a full float switch [136], such that the counter of the storage unit

[140] is incremented by one (1) upon receipt of the signal from the full float switch [136], while the counter value of the counter is incremented by half (0.5) upon receipt of the signal from the half float switch [138].

7. The self-regulated cleaning system [104] as claimed in claim 1, wherein the control system [124] further includes a display unit [128] connected to the control unit [132], to display the count of number of flush actions as determined by the flush counter [126].

8. The self-regulated cleaning system [104] as claimed in claim 7, wherein the display unit [128] further displays a date, time, a cleaning mode, a duration of cycle, and a life of cleaning solution and water left in the storage tank [110].

9. The self-regulated cleaning system [104] as claimed in claim 1, wherein the control unit [132] is further adapted to:

continuously receive the count of the number of flush actions performed on the face plate [116],
compare the count of the number of flush actions with the threshold value, and
actuate the hydrogen peroxide generator [122] as the count of the number of flush actions reaches beyond the threshold value.

10. The self-regulated cleaning system [104] as claimed in claim 1, wherein the predefined time between performing the first actuation of the flush valve [114] and the second actuation of the flush valve [114] is 20 minutes.

11. The self-regulated cleaning system [104] as claimed in claim 1, further includes a safety unit [130] that either halts or stops an operation of the control system [124], upon detection of a fault in either of the toilet arrangement [102] and the self-regulated cleaning system [104].

12. A self-regulated cleaning method [142] for cleaning a toilet bowl [106] of a toilet arrangement [102], the toilet arrangement [102] including a flush tank [108] with a storage tank [110], a face plate [116], and a flush valve [114], the self-regulated cleaning method [142] comprising:

- continuously determining, with use of a flush counter [126], a count of flush actions performed on the face plate [116];
- comparing, with use of a control unit [132], the count of flush actions performed on the face plate [116] with a threshold value;
- actuating, with use of the control unit [132], the hydrogen peroxide generator for generation and release of a predetermined amount of hydrogen peroxide within water stored in the storage tank [110], in case the count of flush actions performed on the face plate [116] reaches beyond the threshold value;
- performing a first actuation, with use of the control unit [132], of the flush valve [114] for release of the mixture of hydrogen peroxide and water to the toilet bowl [106] of the toilet arrangement [102]; and
- performing a second actuation, with use of the control unit [132], of the flush valve [114] after a predetermined time from the first actuation, for release of the water to the toilet bowl [106] of the toilet arrangement [102].

13. The self-regulated cleaning method [142] as claimed in claim 12, further includes a step of allowing refilling of the storage tank [110] with water after performing the first actuation and before performing the second actuation.

14. The self-regulated cleaning method [142] as claimed in claim 12, further includes resetting the counter of the storage unit [140] after each cycle of steps of actuating the hydrogen peroxide generator [122], performing first actuation of the flush valve [114], and performing second actuation of the flush valve [114].

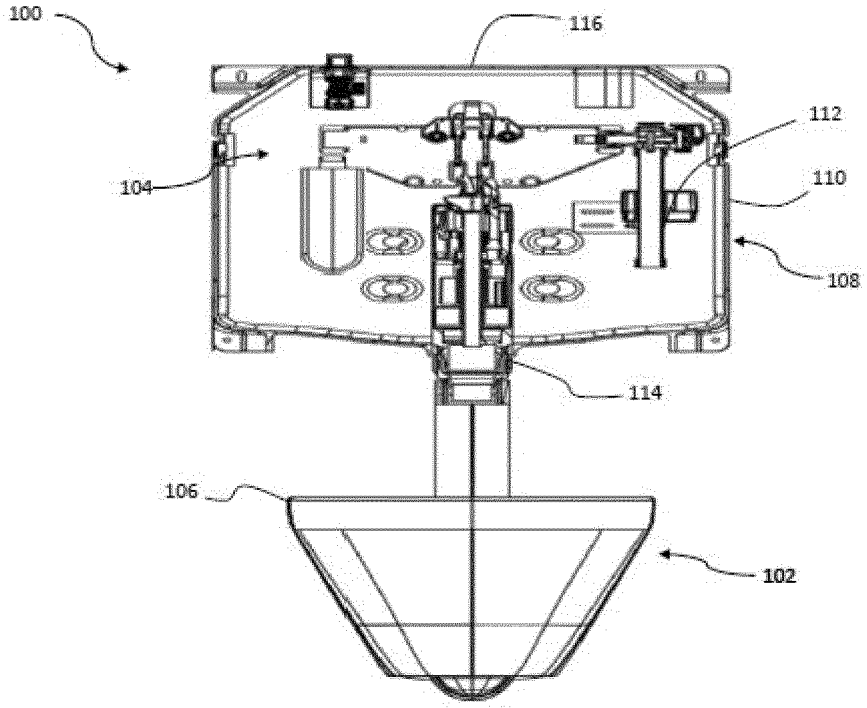

FIG. 1

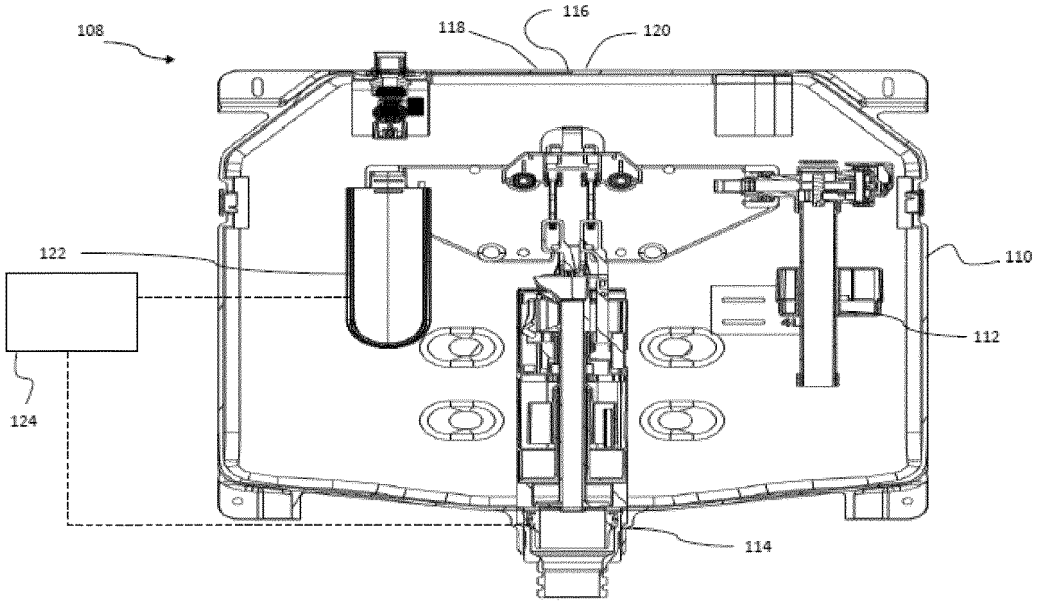

FIG. 2

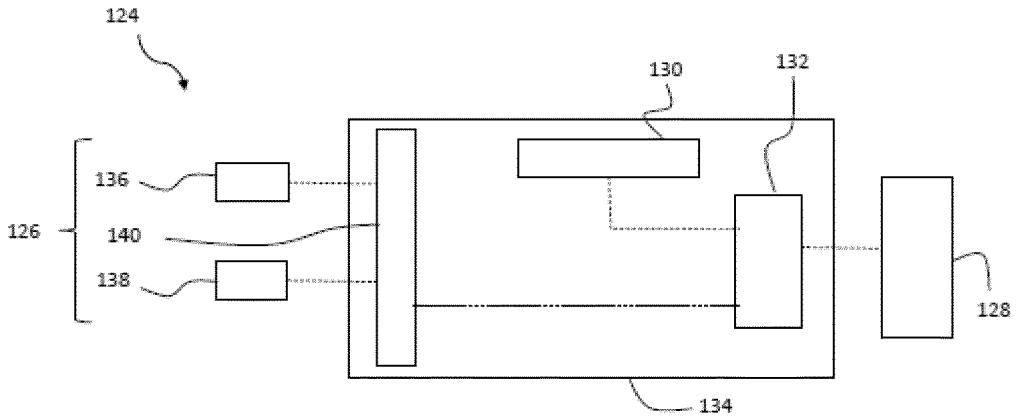

FIG. 3

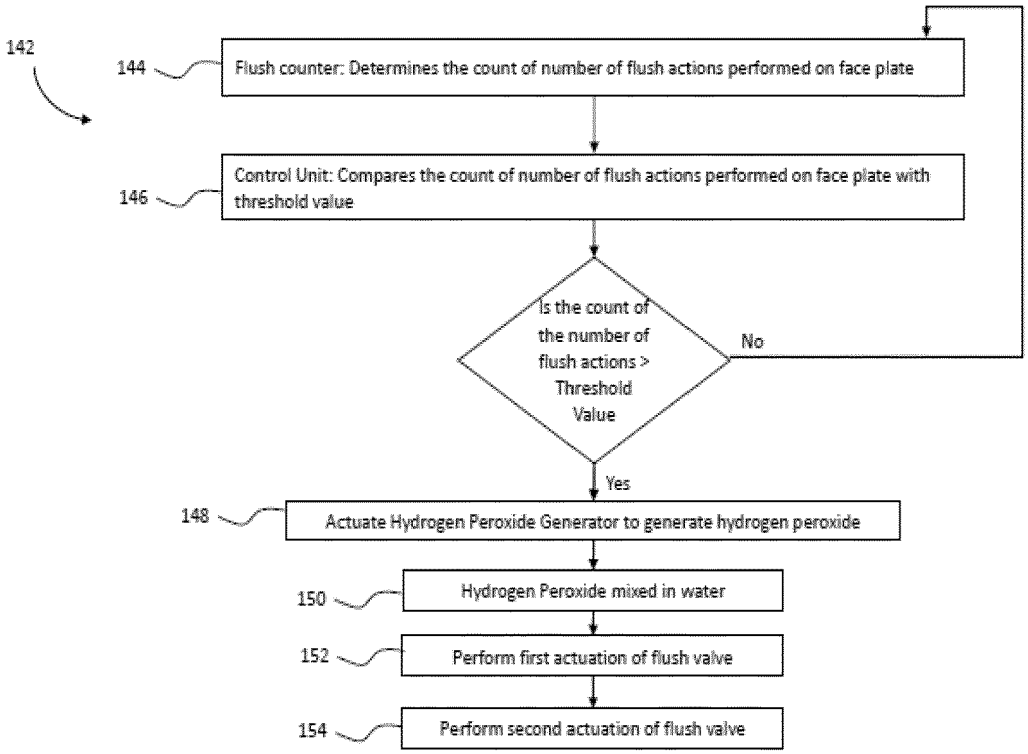
142
144
Flush counter: Determines the count of number of flush actions performed on face plate
146
Control Unit: Compares the count of number of flush actions performed on face plate with threshold value
Is the count of the number of flush actions > Threshold Value
No
Yes
148
Actuate Hydrogen Peroxide Generator to generate hydrogen peroxide
150
Hydrogen Peroxide mixed in water
152
Perform first actuation of flush valve
154
Perform second actuation of flush valve

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 8730

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 September 2020	Posavec, Daniel

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