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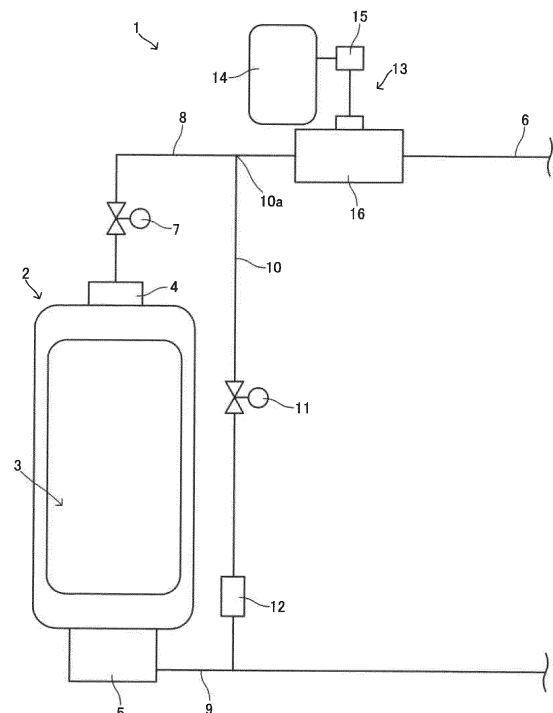
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(54) **TOILET CLEANING SYSTEM**

(57) A toilet cleaning system 1 including a water supply channel which supplies cleaning water to a toilet, a bypass water supply channel which is branched from the water supply channel and is connected to a drainage channel connected to a drainage portion of the toilet, and an air bubble mixing portion which bubbles air and mixes the bubbled air into the cleaning water supplied to the bypass water supply channel.



**Fig. 1**

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**Description**

## TECHNICAL FIELD

**[0001]** The disclosure relates to a toilet cleaning system which supplies cleaning water to a toilet.

## BACKGROUND ART

**[0002]** Conventionally, various toilet systems which supply cleaning water mixed with air bubbles to toilets have been known.

For example, Patent Document 1 mentioned below discloses a toilet device which is provided with a fine air bubble generator which supplies water together with fine air bubbles into a storage tank of a toilet and in which cleaning water containing fine air bubbles flows into the toilet when cleaning operation is executed.

## RELATED ART DOCUMENT

## PATENT DOCUMENT

**[0003]** PATENT DOCUMENT 1 : Japanese Unexamined Patent Application Publication No. 2008-274615

## DISCLOSURE OF THE INVENTION

## PROBLEMS TO BE SOLVED BY THE INVENTION

**[0004]** The toilet device disclosed in Patent Document 1 mentioned above is able to be cleaned by cleaning water containing fine air bubbles. However, the fine air bubbles contained in the cleaning water tend to decrease when the cleaning water flows down an inner surface of the toilet or flows on the way to a drainage channel such as a drainage trap, so that further improvement is desired in view of cleaning the drainage channel.

**[0005]** The present disclosure is proposed in view of the above circumstances, and an object thereof is to provide a toilet cleaning system capable of efficiently cleaning a drainage channel connected to a drainage portion of a toilet.

## MEANS OF SOLVING THE PROBLEMS

**[0006]** In order to achieve the above-mentioned object, a toilet cleaning system according to one aspect of the present invention includes a water supply channel which supplies cleaning water to a toilet, a bypass water supply channel which is branched from the water supply channel and is connected to a drainage channel connected to a drainage portion of the toilet, and an air bubble mixing portion which bubbles air and mixes the bubbled air into the cleaning water supplied to the bypass water supply channel.

## EFFECTS OF THE INVENTION

**[0007]** The toilet cleaning system of one aspect of the present invention as constructed above is able to effectively clean the drainage channel connected to the drainage portion of the toilet.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0008]**

Fig. 1 illustrates a schematic system configuration of one example of a toilet cleaning system of an embodiment of the present invention.

Fig. 2 illustrates a schematic system configuration of one example of a toilet cleaning system of another embodiment of the present invention.

## MODE FOR CARRYING OUT THE INVENTION

**[0009]** Embodiments of one aspect of the present invention are described below with reference to the attached drawings.

In the following embodiments, the directions such as up and down directions are explained under the condition that the toilet is installed.

Fig. 1 is a diagrammatic view of one example of a toilet cleaning system of the first embodiment.

**[0010]** As illustrated in Fig. 1, a toilet cleaning system 1 has a water supply channel 6, 8 which supplies cleaning water to a toilet 2. In this embodiment, the toilet cleaning system 1 is configured such that cleaning water is supplied to a single toilet 2. The toilet 2, which is a supply destination of cleaning water, is exemplified as a urinal for a standing user.

The toilet 2 has a bowl portion (bowl-like portion) 3, a water supply portion 4 connected to the water supply channel 6, 8, and a drainage portion 5 discharging urine and cleaning water.

**[0011]** The water supply portion 4 has a discharge portion such as a spreader which discharges cleaning water along an inner surface of the bowl portion 3.

The drainage portion 5 constitutes a trap portion in the shape of a bowl or in the shape of the letter P and is connected to a drainage channel 9. The toilet 2 can be a so-called floor-type and vertically-long urinal which is installed on the floor, or a wall-type urinal which is installed so as to be hooked on a wall surface. The toilet cleaning system 1 can include the toilet 2. In other words, the toilet device can be constructed with the toilet 2 and the toilet cleaning system 1.

**[0012]** The toilet cleaning system 1 has a bypass water supply channel 10 which is branched from the water supply channel 6, 8 and is connected to the drainage channel 9 connected to the drainage portion 5 of the toilet 2. In the following explanation, the water supply channel on the upstream side (on the water supply source side) of a branch portion 10a from which the bypass water supply

channel 10 is branched and connected is defined as an upstream side water supply channel 6, and the water supply channel on the downstream side (on the side of the toilet 2) of the branch portion 10a is defined as a downstream side water supply channel 8.

The bypass water supply channel 10 has a bypass valve 11 which opens or closes the bypass water supply channel 10 to supply or shut off cleaning water. The bypass water supply channel 10 has a backflow prevention portion 12 such as a backflow prevention valve (check valve) which prevents backflow of cleaning water to the upstream side. The backflow prevention portion 12 is provided on the downstream side (on the side of the drainage channel 9) of the bypass valve 11. An end portion on the downstream side of the bypass water supply channel 10 is connected to a region which is relatively close to the drainage portion 5 of the drainage channel 9 which is in the shape of a horizontally installed pipe. The end portion on the downstream side of the bypass water supply channel 10 can be connected to the end portion on an upstream side of a region of the drainage channel 9 provided so as to extend in the approximately horizontal direction.

**[0013]** In addition, the toilet cleaning system 1 has an air bubble mixing portion 13 which bubbles air and mixes the air bubbles into cleaning water supplied to the bypass water supply channel 10. In the embodiment, the air bubble mixing portion 13 is provided for the upstream side water supply channel 6 on the upstream side of the branch portion 10a from which the bypass water supply channel 10 is branched and connected and mixes the air bubble into cleaning water. The air bubble mixing portion 13 can be configured to mix fine air bubbles of both or one of millimeter order or micrometer order. The air bubble mixing portion 13 can be configured in such a manner that the void fraction (area rate of fine air bubbles contained per sectional area unit of fluid) of bubbled cleaning water mixed with fine air bubbles (cleaning water containing fine air bubbles) is from 5% to 40%, or more preferably from 10% to 30%.

**[0014]** In the embodiment, the air bubble mixing portion 13 has a gas-liquid mixing portion 16 in the shape of a venturi pipe provided for the upstream side water supply channel 6 as a sudden pressure change portion and an air introduction portion 14 introducing air into the gas-liquid mixing portion 16. The air introduction portion 14 can be constituted in such a manner that a tip end of a pipe is open to the atmosphere or that an on-off valve is provided in the middle of a pipe. In addition, the air introduction portion 14 can be constituted such that gas including functional gas such as carbon dioxide gas or ozone gas is introduced into air. In the embodiment, a flow rate adjustment portion 15 capable of adjusting the flow rate of the air supplied to the gas-liquid mixing portion 16 is provided on the downstream side of the air introduction portion 14. The void fraction mentioned above can be adjusted by controlling the flow rate adjustment portion 15.

**[0015]** The gas-liquid mixing portion 16 has a constricted portion formed in the shape of a nozzle and air is introduced from the air introduction portion 14 by the ejector effect by negative pressure action of cleaning water discharged through the constricted portion. The air bubbles are sheared and minutely divided by a sudden pressure change action when passing through a narrow diameter portion and a wide diameter portion of the gas-liquid mixing portion 16, and become fine air bubbles to be mixed in cleaning water. In such a configuration, when cleaning water flows into the upstream side water supply channel 6, air is taken in by the negative pressure and bubbled cleaning water is produced, so that chemical agent is not required to be filled and adverse effect on the environment caused by discharge of chemical agent hardly occurs.

**[0016]** The downstream side water supply channel 8 has a water supply valve 7 which opens and closes the downstream side water supply channel 8, and supplies and shuts off cleaning water. The water supply valve 7 is provided on the downstream side of the gas-liquid mixing portion 16. The upstream side water supply channel 6 can be communicated with a water pipe, which is a water supply source. Namely, the water supply method of the toilet cleaning system 1 can be a direct water pressure type. In place of the embodiment in which the water supply valve 7 and the bypass valve 11 are separately provided, a three-way switching valve which functions as the water supply valve 7 and the bypass valve 11 can be provided for the branch portion 10a.

In the toilet cleaning system 1 configured as mentioned above, with the water supply valve 7 is open with the bypass valve 11 closed, bubbled cleaning water mixed with fine air bubbles is produced when cleaning water passes through the gas-liquid mixing portion 16, and is supplied to the bowl portion 3 of the toilet 2 via the downstream side water supply channel 8. Such a cleaning operation can be performed by operating a cleaning operation portion provided for the toilet 2 or by a human body detection sensor which detects the movement of a human body.

**[0017]** In addition, when the bypass valve 11 is open with the water supply valve 7 closed, bubbled cleaning water produced as mentioned above when cleaning water passes through the gas-liquid mixing portion 16 is directly supplied to the drainage channel 9 via the bypass water supply channel 10.

For example, a drainage channel cleaning mode in which bubbled cleaning water is supplied to the bypass water supply channel 10 after the cleaning operation as mentioned above can be performed. Namely, when the cleaning operation is on, a drainage channel cleaning mode which supplies bubbled cleaning water to the drainage channel 9 can be executed after the toilet cleaning mode in which bubbled cleaning water is supplied to the bowl portion 3 of the toilet 2.

**[0018]** In addition, when the cleaning operation is not performed for a predetermined time set in advance, both

of or one of the toilet cleaning mode and the drainage channel cleaning mode can be executed. Namely, when the toilet is not used for a relatively long time, the cleaning mode can be performed.

Such a cleaning operation is performed by controlling each portion by a control unit which has a control circuit such as CPU and a storage unit and which is appropriately provided for the toilet cleaning system 1.

In the drainage channel cleaning mode, bubbled cleaning water can also be supplied to the bowl portion 3 of the toilet 2. Namely, when the water supply valve 7 and the bypass valve 11 are open, bubbled cleaning water is branched at the branch portion 10a to be supplied into the bowl portion 3 of the toilet 2 via the downstream side water supply channel 8 and the drainage channel 9 via the bypass water supply pipe 10.

**[0019]** In the toilet cleaning system 1 of the embodiment as mentioned above, the drainage channel 9 connected to the drainage portion 5 of the toilet 2 is effectively cleaned.

Namely, the toilet cleaning system 1 has the air bubble mixing portion 13 in which air is bubbled and mixed with cleaning water supplied to the bypass water supply channel 10. Therefore, bubbled cleaning water is directly supplied to the drainage channel 9 connected with the bypass water supply channel 10 without reaching the toilet 2. Namely, bubbled cleaning water is supplied to the drainage channel 9 without passing through the bowl portion 3 and the drainage portion 5. Thus, compared with the embodiment in which bubbled cleaning water is supplied to the drainage channel 9 via the bowl portion 3 and the drainage portion 5, air bubbles contained in the bubbled cleaning water reached the drainage channel 9 are inhibited from reducing. As a result, dirt such as urine stone (calcium ion and bacteria) adhering to the inner surface of the drainage channel 9 is absorbed by the air bubbles contained in the bubbled cleaning water and is effectively removed, thereby effectively inhibiting accumulation of urine stone.

**[0020]** In this embodiment, the air bubble mixing portion 13 is provided so as to mix air bubbles at the upstream side water supply channel 6 on the upstream side of the branch portion 10a from which the bypass water channel 10 is branched and connected. Therefore, bubbled cleaning water is also supplied to the toilet 2 and cleaning performance of the toilet 2 is improved.

In addition, this embodiment is constructed such that bubbled cleaning water is branched at the branch portion 10a and is simultaneously supplied to both of the toilet 2 and the bypass water supply channel 10. Therefore, compared with the embodiment in which bubbled cleaning water is selectively supplied to the toilet 2 and the bypass water supply channel 10, both of the bowl portion 3 of the toilet 2 and the drainage channel 9 are effectively cleaned.

**[0021]** Next, another embodiment is explained with reference to the drawings.

In the following embodiment, differences from the first

embodiment are mainly explained and the similar components are allotted with the same reference numerals and their explanations are omitted or briefly described. Fig. 2 illustrates a diagrammatic system configuration of one example of a toilet cleaning system of the second embodiment.

**[0022]** In a toilet cleaning system 1A of this embodiment, the downstream water supply channel 8 is branched into a plurality of channels (three channels in the figure) and cleaning water is supplied to a plurality of toilets 2, 2, 2. Branch pipes 8A, 8A, 8A of the downstream side water supply channel 8 are respectively connected to water supply portions 4, 4, 4 of the toilets 2, 2, 2. The water supply valves 7, 7, 7 as mentioned above are respectively provided for the branch pipes 8A, 8A, 8A.

The discharge portions 5, 5, 5 of the toilets 2, 2, 2 are respectively connected with drainage pipes 9A, 9A, 9A connected to the drainage channel 9 which is in the shape of a horizontally installed pipe. An end portion on the downstream side of the bypass water supply channel 10 is connected to a connection portion of the drainage channel 9 and the drainage pipe 9A connected to the toilet 2 on the most upstream side in the drainage direction of the drainage channel 9. Namely, the end portion on the downstream side of the bypass water supply channel 10 is connected to an end portion on the upstream side of a region of the drainage channel 9 provided so as to extend in the approximately horizontal direction.

The backflow prevention portion 12 as mentioned above is provided at a region on the downstream side of the bypass water supply channel 10. The bypass valve 11 as mentioned above is provided on the upstream side of the backflow prevention portion 12 of the bypass water supply channel 10.

**[0023]** Also in this embodiment, an air bubble mixing portion 13A is provided so as to mix air bubbles at an upstream side water supply channel 19 on the upstream side of the branch portion 10a from which the bypass water channel 10 is branched and connected. In this embodiment, an end portion on the upstream side of the upstream side water supply channel 19 is connected to a water storage portion 18. Namely, a water supply method of the toilet cleaning system 1A is a tank type (pump pressurization type), not a direct water pressure type.

Cleaning water is supplied to the water storage portion 18 from a water supply pipe 6A such as a water pipe. The water storage portion 18 has a suitable level meter so as to store cleaning water at a predetermined level.

**[0024]** In this embodiment, the air bubble mixing portion 13A is configured to generate bubbled cleaning water mixed with fine air bubbles in such a manner that cleaning water with air dissolved under pressure is depressurized. In such a configuration, compared with the embodiment in which fine air bubbles are mixed into cleaning water by shearing and breaking air bubbles by the pressurization of the sudden pressure change action as mentioned above, finer air bubbles are mixed into cleaning water.

**[0025]** The air bubble mixing portion 13A has an air

introduction pipe 14A which introduces air and a pump 15A which sucks air introduced from the air introduction pipe 14A and sucks cleaning water in the water storage portion 18. The air bubble mixing portion 13A has a dissolution tank 17 connected to a discharge side of the pump 15A, and the dissolution tank 17 has a gas-liquid mixing tank and a gas-liquid separation tank and dissolves air into cleaning water by pressurization of the pump 15A. The air bubble mixing portion 13A has a pressure release portion 16A in the shape of a venturi pipe for releasing pressure on the downstream side of the dissolution tank 17.

**[0026]** In the toilet cleaning system 1A configured as mentioned above, the pump 15A is activated with the bypass valve 11 closed and the water supply valve 7 of the toilet 2 after cleaning operation is open, then bubbled cleaning water mixed with fine air bubbles is supplied to the bowl portion 3 of the toilet 2.

In addition, when the pump 15A is activated and the bypass valve 11 is open, similar to the first embodiment mentioned above, bubbled cleaning water can be directly supplied to the drainage channel 9 via the bypass water supply pipe 10. In addition, when the pump 15A is activated and the bypass valve 11 is open with all of the water supply valves 7, 7, 7 closed, bubbled cleaning water can be supplied only to the bypass water supply channel 10. Similar to the above, bubbled cleaning water can be simultaneously supplied to both of at least the bowl portion 3 of the toilet 2 and the bypass water supply channel 10.

**[0027]** The toilet cleaning system 1A of the embodiment as mentioned above has the approximately same effect as the first embodiment. In addition, in this embodiment, the drainage channel 9 connected to the drainage portions 5, 5, 5 of the toilets 2, 2, 2 is effectively cleaned. Parts of the different configurations in the above-mentioned embodiments can be combined or exchanged with each other. The above-mentioned components of the toilet cleaning systems 1, 1A in each embodiment are only examples and various modifications are possible. In the above-mentioned embodiments, the toilet 2 to be cleaned in the toilet cleaning systems 1, 1A is exemplified as a urinal; however, a squat-type or seat-type toilet can be used.

#### DESCRIPTION OF THE REFERENCE NUMERAL

##### **[0028]**

1, 1A	toilet cleaning system	50
2	toilet	
5	drainage portion	
6, 19	upstream side water supply channel (water supply channel)	
8	downstream side water supply channel (water supply channel)	55
9	drainage channel	
10	bypass water supply channel	

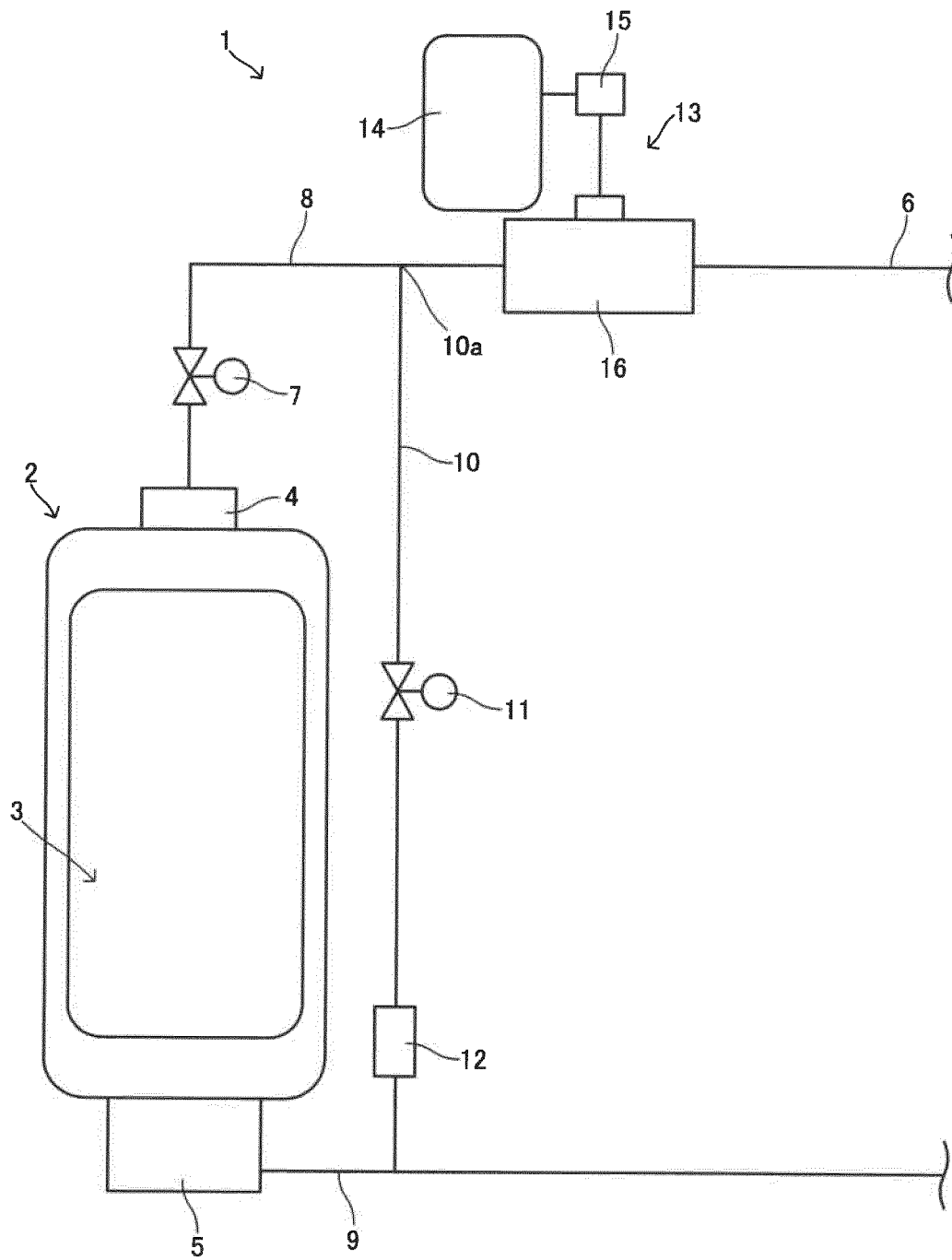
10a	branch portion
13, 13A	air bubble mixing portion

##### 5 **Claims**

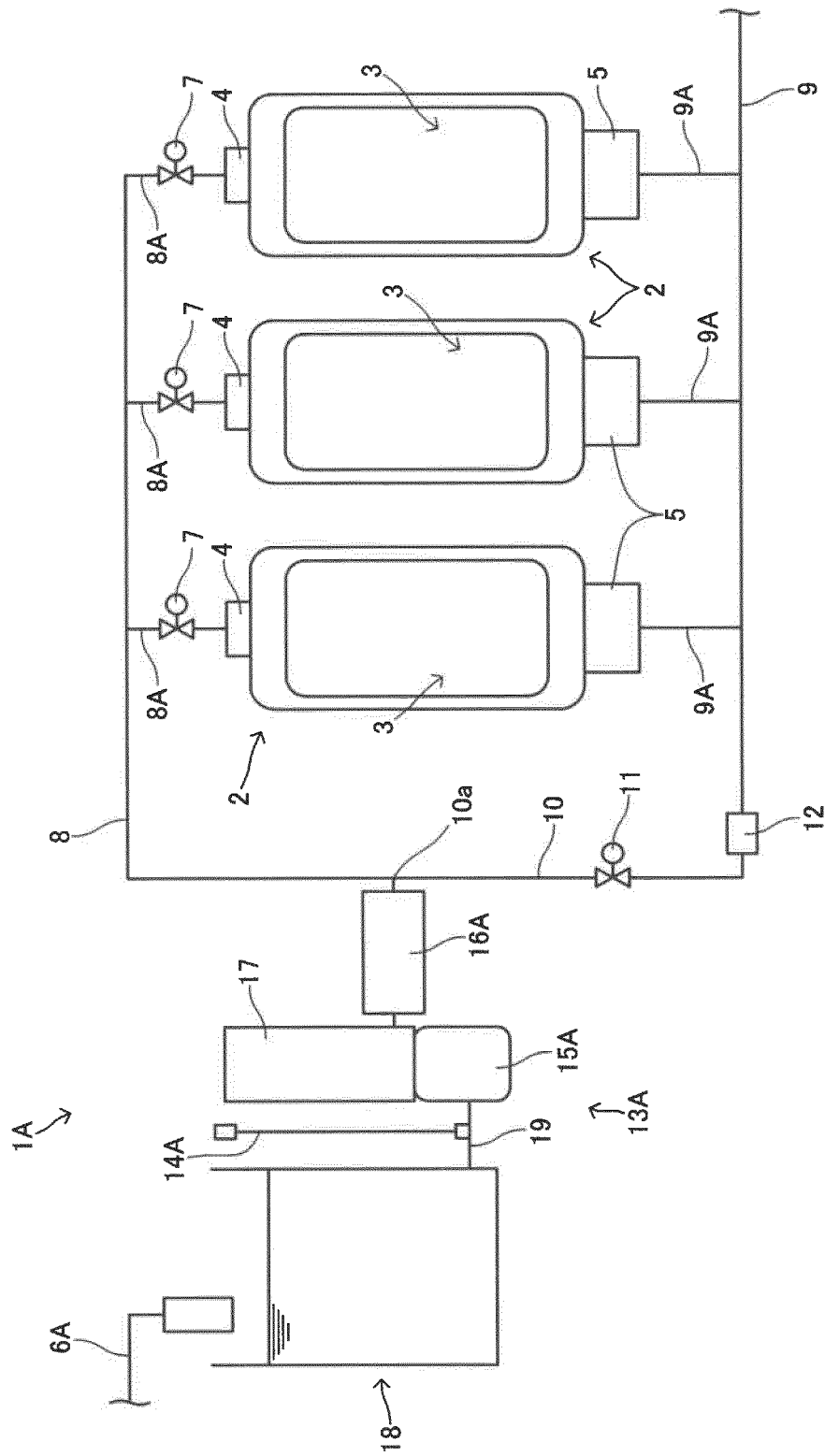
##### 1. A toilet cleaning system, comprising:

- 10 a water supply channel which supplies cleaning water to a toilet;  
 10 a bypass water supply channel which is branched from the water supply channel and is connected to a drainage channel connected to a drainage portion of the toilet; and  
 15 an air bubble mixing portion which bubbles air and mixes the bubbled air into the cleaning water supplied to the bypass water supply channel.

##### 2. The toilet cleaning system according to claim 1, wherein the air bubble mixing portion is provided so as to mix air bubbles at the water supply channel on an upstream side of a branch portion from which the bypass water supply channel is branched and connected.



**Fig. 1**



**Fig. 2**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/030976

5	A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. E03D5/00 (2006.01) i 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) Int.Cl. E03D5/00	
10	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2018 Registered utility model specifications of Japan 1996-2018 Published registered utility model applications of Japan 1994-2018	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)	
	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
	Category*	Citation of document, with indication, where appropriate, of the relevant passages
20	Y	JP 2007-77666 A (TOTO KIKI KABUSHIKI KAISHA) 29 March 2007, paragraph [0035], fig. 9 (Family: none)
25	Y	JP 2002-356898 A (TOTO KIKI KABUSHIKI KAISHA) 13 December 2002, paragraphs [0049]-[0055], [0074], fig. 16 & US 2003/0088910 A1, paragraphs [0176], [0217]-[0220], fig. 36 & CN 1432094 A
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40	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.	
45	* 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	
50	Date of the actual completion of the international search 23 October 2018 (23.10.2018)	Date of mailing of the international search report 06 November 2018 (06.11.2018)
55	Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer  Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2008274615 A [0003]