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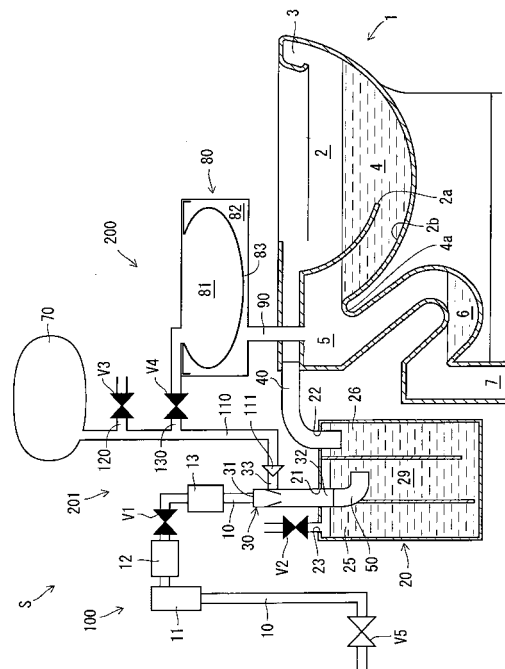
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(54) **AIR SUCTION DEVICE FOR TOILET DRAINAGE CHANNEL**

(57) An air suction device for a toilet drainage channel, capable of good and silent toilet flushing. The air suction device (200) for the toilet drainage channel (5) has air suction means for sucking air from the toilet drainage channel (5) connected to the downstream side of a water sealing part (4) of a toilet body (1). The air suction means has an ejector (30) serving as a negative pressure generator and also has a suction tank (80) connected between the ejector (30) and the toilet drainage channel (5). The air suction device (200) further has a control device (C) for controlling both execution of a suction stroke in which the suction tank (80) exhausts air into the toilet drainage channel (5). The control device (C) executes the air suction stroke after the start of the supply of flush water to the bowl (2) of the toilet body (1) and then executes the air exhaust stroke before the completion of the supply of the flush water to the bowl (2).

Fig. 1



Description

Technical Field

[0001] The present invention relates to an air suction device for toilet drainage channel.

Background Art

[0002] Patent Document 1 discloses one of conventional air suction devices for toilet drainage channel. The air suction device is provided with air suction means for sucking air from a toilet drainage channel connected to the downstream side of a water sealing part of a toilet body. A bypass pipe is connected to a water supply pipe which supplies flush water into a toilet bowl of the toilet body. The bypass pipe is provided with an ejector generating negative pressure. The air suction means has the ejector and a suction tank connected between the ejector and the toilet drainage channel. The suction tank has an interior partitioned into an outside of a bellows (a first chamber) and an inside of the bellows (a second chamber). The first chamber communicates with the ejector, and the second chamber communicates with the toilet drainage channel. A flush valve is provided on the water supply pipe located upstream of the bypass pipe.

[0003] Upon actuation of the flush valve in the air suction device, the flush water is caused to flow through the water supply pipe for a predetermined time thereby to be supplied into the toilet bowl. Since the flush water also flows through the bypass pipe into the ejector in this case, air in the first chamber of the suction tank is sucked by the ejector. As a result, the bellows in the suction tank is expanded. Air is sucked from the toilet drainage channel into the second chamber in the course of expansion of the bellows. An air suction step is thus carried out thereby to cause a siphon action.

[0004] Furthermore, the delivery of the flush water to the water supply pipe is stopped upon lapse of a predetermined time, whereby the supply of flush water to the toilet bowl is terminated. This allows the water supply pipe downstream of flush valve, the bypass pipe and the first chamber to be open to the atmosphere, whereupon the bellows in the suction tank is contracted. Air in the second chamber is discharged into the toilet drainage channel in the course of contraction of the bellows. An air discharge step is thus carried out.

[0005] No special control device is necessitated in the conventional air suction device for toilet drainage channel since air is sucked from the toilet drainage channel in synchronization with the flush water supply to the toilet bowl. Accordingly, the air suction device has a simple construction.

Patent Document 1: JP-A-H07-54388

Disclosure of the Invention

Problem to be Overcome by the Invention

[0006] However, the siphon action is caused under the condition where an amount of flush water supplied into the toilet bowl is small since the air suction step is carried out concurrently with the supply of flush water into the toilet bowl in the above-described conventional air suction device for toilet drainage channel. Accordingly, the siphon action is weaker than a siphon action caused with the use of potential energy obtained by supplying flush water into the toilet bowl so that a water level becomes sufficiently high in the toilet bowl. In this case, there is a possibility that sewage may insufficiently be discharged from the toilet bowl to the toilet drainage channel.

[0007] Furthermore, the siphon action caused by execution of the air suction step is terminated by discharging almost all flush water in the toilet bowl into the toilet drainage channel such that a water sealing part is broken. In this case, a breaking sound is produced.

[0008] The present invention was made in view of the foregoing conventional circumstances and the subject matter thereof is to provide an air suction device for a toilet drainage channel, which can perform good and silent toilet flushing.

[0009] The present invention provides an air suction device for a toilet drainage channel, provided with an air suction unit which sucks air from a toilet drainage channel connected to a downstream side of a water sealing part of a toilet body, the air suction unit having a negative pressure generator and a suction tank connected between the negative pressure generator and the toilet drainage channel, the air suction device comprising a control device which controls execution of an air suction step in which air is sucked from the toilet drainage channel by the suction tank and execution of an air discharge step in which the air is discharged into the toilet drainage channel by the suction tank, wherein the control device executes the air suction step after start of flush water supply to a toilet bowl of the toilet body and the air discharge step before termination of the flush water supply to the toilet bowl of the toilet body.

[0010] In the above-constructed air suction device for the toilet drainage channel according to the present invention, the air suction is executed in the state where a water level in the toilet bowl is sufficiently high after flush water supply to the toilet bowl, so that a siphon action is caused. Consequently, the siphon action is rendered stronger with the use of potential energy obtained by a rise of the water level in the toilet bowl, whereupon sewage can reliably be discharged into the toilet drainage channel.

[0011] Furthermore, when the air discharge step is executed before termination of the flush water supply to the toilet bowl, the discharge flow is broken as the result of increase in an amount of air in the toilet drainage channel such that the siphon action can be terminated. In this

case, no breaking sound is produced since the water sealing part is not broken.

[0012] Consequently, the air suction device for the toilet drainage channel according to the invention can perform good and silent toilet flushing.

[0013] In the air suction device according to the invention, it is preferable that the control device executes the air discharge step while a discharge flow due to a siphon action is continuous in the toilet drainage channel after supply of the flush water into the toilet bowl. In this case, the siphon action can reliably be terminated by the execution of the air discharge step.

[0014] In the air suction device according to the invention, it is preferable that the control device executes the air drainage step after the flush water supply to the toilet bowl has been interrupted and before the flush water supply to the toilet bowl is re-started for formation of a water sealing part. In this case, since the siphon action is reliably terminated, a water sealing part with a predetermined water level can be formed.

[0015] In the air suction device according to the invention, it is preferable that the suction tank has an interior partitioned into a first chamber and a second chamber by a diaphragm movable in an upward and/or a downward direction defined during installation of the suction tank, and that the first chamber is connected to the negative pressure generator and the second chamber is connected to the toilet drainage channel.

[0016] In this case, the siphon action can stably be caused since a predetermined amount of air is sucked from the toilet drainage channel according to an interior volume of the suction tank. Furthermore, the interior of the suction tank is divided into the first and second chambers by the diaphragm, and only the second chamber communicates with the toilet drainage channel, whereby the flush water containing sewage, air containing a foul odor and the like are reliably prevented from flowing into the negative pressure generator side.

[0017] Various negative pressure generators can be used only if these generators can generate negative pressure. For example, a mechanical pump or the like may be used other than the ejector which generates negative pressure by supplying flush water.

Brief Description of the Drawings

[0018]

FIG. 1 is a view showing a frame format of a western flushing toilet provided with an air suction device for a toilet drainage channel, in accordance with embodiments 1 and 2;

FIG. 2 is a schematic block diagram showing a control device of the air suction device of embodiments 1 and 2;

FIG. 3 is a timing chart explaining actuation of the flushing toilet in embodiment 1; and

FIG. 4 is a timing chart explaining actuation of the

flushing toilet in embodiment 2.

Explanation of Reference Symbols

5 **[0019]**

1 ... toilet body

2 ... toilet bowl

4 ... water sealing part

10 5 ... toilet drainage channel

30 ... ejector (negative pressure generator)

80 ... suction tank

200 ... air suction device

C ... control device

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Best Mode for Carrying Out the Invention

[0020] Embodiments 1 and 2 of a western flushing toilet will be described with reference to the drawings. The air suction device for the toilet drainage channel in accordance with the present invention is applied to the flushing toilet.

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Embodiment 1

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[0021] The western flushing toilet of embodiment 1 comprises a toilet body 1 and a toilet flushing device S as shown in FIG. 1. A toilet seat and a toilet lid are eliminated in the drawings.

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[0022] The toilet body 1 has a rim 3 formed along an upper inner periphery of a toilet bowl 2. The toilet body 1 is formed with an upward flow path 2b extending upward from a lower end of the toilet bowl 2 and with a water sealing part 4 located in a lower interior of the toilet bowl 2. The upward flow path 2b of the toilet body 1 is connected to a connecting pipe, in which a toilet drainage channel 5, a dwell part 6 and a drain outlet 7 are defined.

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[0023] The toilet flushing device S comprises a flush water supplying device 100 and an air suction device 200 for the toilet drainage channel 5.

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[0024] The flush water supplying device 100 comprises a water conduit 10 connected to a water pipe and a first on-off valve V1 opening and closing the water conduit 10.

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[0025] The water conduit 10 communicates with a water shutoff valve V5 of a water pipe drawn out of a floor or wall surface of a toilet room in which the toilet body 1 is installed. Furthermore, a strainer device 11 incorporated with a water stop valve and a strainer and a constant flow rate valve 12 are provided upstream of the first on-off valve V1, and a vacuum breaker 13 is provided downstream of the first on-off valve V1.

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[0026] An ejector 30 serving as a negative pressure generator has an inlet 31 connected to a part of the water conduit 10 located downstream of the vacuum breaker 13. The ejector 30 has an outlet 32 to which an inlet 21 of a tank 20 is connected, so that flush water stored in the tank 20 can be caused to flow through an outlet 22.

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[0027] The tank 20 has an inflow chamber 25 communicating with the inlet 21 and an outflow chamber 26 which has a bottom communicating with the inflow chamber 25 and communicates with the outlet 22. The inflow chamber 25 is provided with an atmospheric port 23 to which the second on-off valve V2 is connected. The inflow chamber 25 includes a swirl chamber 29 into which flush water is discharged from a nozzle 50 communicating with the outlet 32 of the ejector 30 such that a swirl flow is formed. To the outlet 22 is connected a delivery pipe 40 which extends to the rim 3 of the toilet body 1.

[0028] The ejector 30 has a suction port 33 communicating with the outside. The suction port 33 draws flush water from the outlet 32 thereby to suck air thereinto.

[0029] The air suction device 200 of the toilet drainage channel 5 has a negative pressure storage tank 70, a suction tank 80 and the like as will be described below.

[0030] The suction port 33 of the ejector 30 communicates, via a first connecting pipe 110 provided with a check valve 111, with the negative pressure storage tank 70 storing the negative pressure. Accordingly, the ejector 30 constituting a water supply unit of the flush water supplying device 100 is also used for the air suction device 200.

[0031] A second connecting pipe 120 is branched from the first connecting pipe 110 located nearer to the negative pressure storage tank 70 than the check valve 111 is. The second connecting pipe 120 is provided with a third on-off valve V3 located midway therethrough and communicates with the outside. A third connecting pipe 130 is also branched from the first connecting pipe 110 and provided with a fourth on-off valve V4 located midway therethrough. The third connecting pipe 130 communicates with the suction tank 80 which sucks air from the toilet drainage channel 5.

[0032] The suction tank 80 has an interior partitioned into a first chamber 81 and a second chamber 82 by a diaphragm 83 which is movable in an upward and/or a downward direction defined during installation thereof. The first chamber 81 communicates with the third connecting pipe 130, and the second chamber 82 communicates with the toilet drainage channel 5 via a suction pipe 90.

[0033] As shown in FIG. 2, the on-off timing and the on-off period of each of the first, second, third and fourth on-off valves V1, V2, V3 and V4 are controlled by a control device C. Since the second, third and fourth on-off valves V2, V3 and V4 are for use with air, the valves V2, V3 and V4 are not subjected to a large pressure, whereupon these valves can be rendered smaller than on-off valves for use with water and is designed so as to be opened and closed with a smaller force.

[0034] In the above-described western flushing toilet, the suction device 200 of the toilet drainage channel 5 comprises the ejector 30, the first connecting pipe 110, the check valve 111, the negative pressure storage tank 70, the second connecting pipe 120, the third on-off valve V3, the third connecting pipe 130, the fourth on-off valve

V4, the suction tank 80, the suction pipe 90 and the control device C. The flush water supplying device comprises the water conduit 10, the strainer device 11, the constant flow rate valve 12, the first on-off valve V1, the vacuum breaker 13, the ejector 30, the nozzle 50, the tank 20, the second on-off valve V2, the delivery pipe 40, the first connecting pipe 110, the second connecting pipe 120, the third on-off valve V3 and the control device C.

[0035] Next, the operation of the toilet flushing device S incorporated with the suction device 200 of embodiment 1 will now be described on the basis of the construction as shown in FIG. 1.

[Non-flushing]

[0036] In FIG. 3, the first, second, third and fourth on-off valves V1, V2, V3 and V4 are closed during non-flushing before time t1. In this state, flush water is stored in the tank 20. The diaphragm 83 in the suction tank 80 is in abutment with a lower inner wall surface of the suction tank 80.

[Toilet bowl flushing step and negative pressure storing step]

[0037] When the user operates a flushing switch for delivering a toilet flush start signal to the control device C at time t1 in FIG. 3 after having gone to stool, the first on-off valve V1 is opened by the control device C.

[0038] As a result, flush water flowing through the connecting pipe 10 further flows through the ejector 30 into the swirl chamber 29. When the flush water flows into the ejector 30, the ejector 30 sucks air in the negative pressure storage tank 70 through the first connecting pipe 110 and the check valve 111. The sucked air flows into the swirl chamber 29 together with flush water. Since the flush water is swirled in the swirl chamber 29, air contained in the flush water is separated successfully thereby to be stored in an upper interior of the inflow chamber 25. As a result, negative pressure is gradually stored in the negative pressure storage tank 70, and the water level in the inflow chamber 25 is gradually lowered by an amount corresponding to the air sucked from the negative pressure storage tank 70.

[0039] Furthermore, the flush water supplied from the water conduit 10 and the flush water stored in the tank 20 whose amount corresponds to the amount of air sucked from the negative pressure storage tank 70 are supplied through the delivery pipe 40 into the rim 3. The flush water supplied into the rim 3 flows downward while swirling along an inner surface of the toilet bowl 2, thereby forming a swirl flow. Sewage is collected by the swirl flow to a central part of the toilet bowl 2. Toilet paper is unhardened and fitted with flush water, being dispersed into the flush water.

[Air suction step]

[0040] The fourth on-off valve V4 is opened at time t2 in FIG. 3 by the control device C. As a result, the negative pressure in the negative pressure storage tank 70 is transmitted through the first connecting pipe 110, the third connecting pipe 130 and the fourth on-off valve V4 to the first chamber 81 of the suction tank 80, whereupon the pressure in the first chamber 81 becomes negative. Furthermore, since flush water is continuously supplied into the ejector 30, air in the first chamber 81 is also sucked by the ejector 30. Consequently, the diaphragm 83 in the suction tank 80 is rapidly lifted upward by the negative pressure in the negative pressure storage tank 70 in the beginning of the opening of the fourth on-off valve V4. Thereafter, since the air suction by the negative pressure storage tank 70 is terminated, the diaphragm 83 is slowly lifted upward only by the ejector 30 until the diaphragm 83 abuts against the upper inner wall surface of the suction tank 80. When air in the toilet drainage channel 5 is to be sucked into the second chamber 82 by the suction tank 80, the water level in the toilet bowl 2 is rendered sufficiently high by the flush water having been supplied into the toilet bowl 2 at the toilet bowl flushing step, whereupon the water head difference between the water level in the toilet bowl 2 and a highest portion 4a of the water sealing part 4 is sufficiently large. As a result, the potential energy of the flush water due to the water head difference and air suction from the toilet drainage channel 5 cause the flush water in the toilet bowl 2 to rush into the toilet drainage channel 5, whereby the toilet drainage channel 5 is filled with the flush water promptly such that a strong siphon action is produced. Accordingly, a discharge flow can promptly be formed by a smaller amount of flush water. The filled state of the toilet drainage channel 5 to cause the siphon action is achieved not only by the state of the toilet drainage channel 5 completely filled with flush water but also a state where pressure balance is maintained between the upstream side and the downstream side of the toilet drainage channel 5 and the discharge flow is caused, and the filled state of the toilet drainage channel 5 includes the case where air remains in the toilet drainage channel 5.

[0041] In this case, sewage centrally collected in the toilet bowl 2 by the swirl flow formed in the toilet bowl 2 is reliably discharged to the toilet drainage channel 5 with the flush water discharged to the toilet drainage channel 5 by the siphon action.

[0042] Furthermore, the toilet drainage channel 5 is disconnected from the downstream side by the retaining portion 6 such that the toilet drainage channel 5 is a closed space existing between the water sealing 4 and the retaining portion 6. Accordingly, since a predetermined amount of air can reliably be sucked from the toilet drainage channel 5, the siphon action can be caused.

[0043] Furthermore, the interior of the suction tank 80 is divided by the diaphragm 83 into the first and second chambers 81 and 82, and only the second chamber 82

communicates with the toilet drainage channel 5. Accordingly, the flush water containing sewage, the air containing foul odor and the like are reliably prevented from entering the negative pressure storage tank 70 or the ejector 30.

[Flush water increasing step]

[0044] The water level in the toilet bowl 2 is reduced to the height near the lowest level 2a of the rear of the toilet bowl 2 at time t3 in FIG. 3. In this instant of time, the third on-off valve V3 is opened and the fourth on-off valve V4 is closed by the control device C.

[0045] In this case, since the flush water is still being supplied into the ejector 30, a large amount of external air flows into the swirl chamber 29 through the third on-off valve V3, the second connecting pipe 120 and the first connecting pipe 110. Accordingly, the flush water in the inflow chamber 25 is forced via the outflow chamber 26 and the delivery pipe 40 into the rim 3 by the entered external air. As a result, the water level in the inflow chamber 25 is rapidly reduced to a large degree.

[0046] An amount of flush water supplied into the rim 3 is increased before air flows from the toilet bowl 2 into the toilet drainage channel 5 and the siphon action is terminated, that is, before the water level in the toilet bowl 2 become lower than the lowest water level portion 2a in the rear of the toilet bowl 2. In other words, the flush water supplied from the rim 3 is an addition of the flush water supplied from the water conduit 10 and the flush water stored in the tank 20. Accordingly, since an amount of flush water supplied to the toilet bowl 2 per predetermined time is increased, the water sealing part 4 is not broken, the flush water in the toilet bowl 2 is swirled, and the siphon action is continued. Furthermore, the swirl flow in the toilet bowl 2 is intensified, and the flow of flush water is increased. Consequently, sewage remaining in the toilet bowl 2 is discharged so as to be forced out into the toilet drainage channel 5, and lightweight sewage floating in the flush water can be discharged into the toilet drainage channel 5.

[Air discharge step]

[0047] The flush water supplied into the toilet bowl 2 by the flush water increasing step is still swirled at time t4 in FIG. 3, and the water sealing part 4 is not broken. In other words, the discharge flow due to the siphon action is continuous. At this time t4, the first on-off valve V1 is closed and the fourth on-off valve V4 is opened by the control device C. As a result, the atmospheric pressure is introduced into the first chamber 81 such that the diaphragm 83 is lowered, since the first chamber 81 of the suction tank 80 communicates with the outside through the fourth on-off valve V4, the third connecting pipe 130, the first connecting pipe 110, the second connecting pipe 120 and the third on-off valve V3. Accordingly, since air is discharged from the second chamber 82 into the toilet

drainage channel 5, an amount of air is increased in the toilet drainage channel 5. For this reason, the toilet drainage channel 5 cannot be retained in a state completely filled with the flush water, whereby the siphon action is terminated. That the toilet drainage channel 5 cannot be retained in the state completely filled with the flush water includes the case where the upstream side and the downstream side of the toilet drainage channel 5 are kept balanced in pressure even in the state where air remains in the toilet drainage channel 5 such that the state where the discharge flow is being caused cannot be maintained. In this case, no noise due to the braking of the water sealing part 4 is produced.

[Restoring step]

[0048] The first and second on-off valves V1 and V2 are opened and the fourth on-off valve V4 is closed by the control device C at time t5 in FIG. 3. As a result, the flush water flows into the swirl chamber 29 while the ejector 30 is sucking air from the outside. Air contained in the flush water is successfully separated in the swirl chamber 29 to be discharged through the atmospheric port 23 and the second on-off valve V2 to the outside. Accordingly, the flush water is stored in the tank 20 until the predetermined water level before start of the flushing is reached. Furthermore, the siphon action has been completely terminated, and flush water is supplied from the outflow chamber 26 through the delivery pipe 40 to the rim 3, whereby the water sealing part 4 with a predetermined water level is formed in the toilet bowl 2 such that the toilet is restored to the initial state.

[Opening step]

[0049] The first on-off valve V1 is closed and the fourth on-off valve V4 is opened by the control device C at time t6 in FIG. 3. As a result, the first chamber 81 of the suction tank 80 communicates with the outside via the fourth on-off valve V4, the third connecting pipe 130, the first connecting pipe 110, the second connecting pipe 120 and the third on-off valve V3, whereupon the diaphragm 83 is lowered until the diaphragm 83 abuts against the lower inner wall surface of the suction tank 80. Consequently, since the diaphragm 83 is returned to the predetermined position before flushing, the subsequent flushing can stably be executed. Thereafter, the second, third and fourth on-off valves V2, V3 and V4 are closed by the control device C at time t7 in FIG. 3.

[0050] Accordingly, the air suction device 200 for the toilet drainage channel 5 in accordance with embodiment 1 carries out toilet flushing successfully and silently.

Embodiment 2

[0051] The western flushing toilet of embodiment 2 has the same construction as embodiment 1 and differs from the western flushing toilet of embodiment 1 only in the

operation of the toilet flushing device S.

[0052] The difference regarding the operation of the toilet flushing device S will be described.

[0053] As shown in FIG. 4, the first on-off valve V1 is closed and the fourth on-off valve V4 is opened by the control device C at time t4 a predetermined time after time t3' at which the flush water increasing step has been terminated. As a result, the first chamber 81 of the suction tank 80 communicates with the outside through the fourth on-off valve V4, the third connecting pipe 130, the first connecting pipe 110, the second connecting pipe 120 and the third on-off valve V3, whereupon the atmospheric pressure is introduced into the first chamber 81 such that the diaphragm 83 is lowered. At time t4 a predetermined time after completion of the flush water increasing step, the flush water supplied into the toilet bowl 2 by the flush water increasing step is also discharged into the toilet drainage channel 5 by the siphon action, whereupon an amount of flush water in the toilet bowl 2 is reduced. Accordingly, when air is rushed from the second chamber 82 into the toilet drainage channel 5, the discharge flow established by the siphon action is intermitted, whereby the siphon action can be terminated immediately and reliably. Furthermore, since the water sealing 4 is not broken in this case, too, no noise due to the breaking of the water sealing part 4 is produced. Since the other operation of embodiment 2 is the same as that in embodiment 1, detailed description of the other operation will be eliminated.

[0054] Consequently, the air suction device 200 for the toilet drainage channel in accordance with embodiment 2 can achieve the same effect of the invention in the same manner as in embodiment 1.

[0055] Although the invention has been described as embodiments 1 and 2, the invention should not be limited to the embodiments. It is not regardless to say that the invention can be changed suitably without departing from the gist thereof.

40 Industrial applicability

[0056] The present invention is utilizable as water flushing toilet.

45 Claims

1. An air suction device for a toilet drainage channel, provided with an air suction unit which sucks air from a toilet drainage channel connected to a downstream side of a water sealing part of a toilet body, the air suction unit having a negative pressure generator and a suction tank connected between the negative pressure generator and the toilet drainage channel, the air suction device comprising a control device which controls execution of an air suction step in which air is sucked from the toilet drainage channel by the suction tank and execution of an air discharge

step in which the air is discharged into the toilet drainage channel by the suction tank, wherein the control device executes the air suction step after start of flush water supply to a toilet bowl of the toilet body and the air discharge step before termination of the flush water supply to the toilet bowl of the toilet body. 5

2. The air suction device for the toilet drainage channel according to claim 1, wherein the control device executes the air discharge step while a discharge flow due to a siphon action is continuous in the toilet drainage channel after supply of the flush water into the toilet bowl. 10
3. The air suction device for the toilet drainage channel according to claim 1, wherein the control device executes the air drainage step after the flush water supply to the toilet bowl has been interrupted and before the flush water supply to the toilet is re-started for formation of a water sealing part. 15 20
4. The air suction device for the toilet drainage channel according to any one of claims 1 to 3, wherein the suction tank has an interior partitioned into a first chamber and a second chamber by a diaphragm movable in an upward and/or a downward direction defined during installation of the suction tank, and the first chamber communicates with the negative pressure generator and the second chamber communicates with the toilet drainage channel. 25 30

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Fig. 2

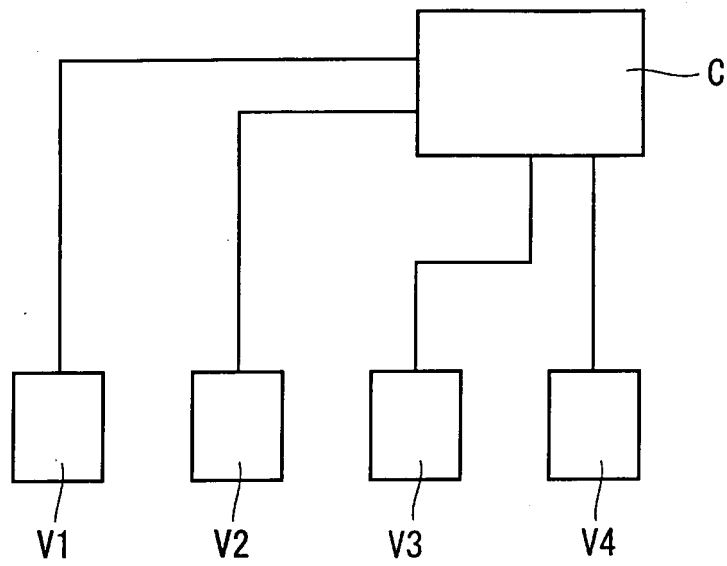


Fig. 3

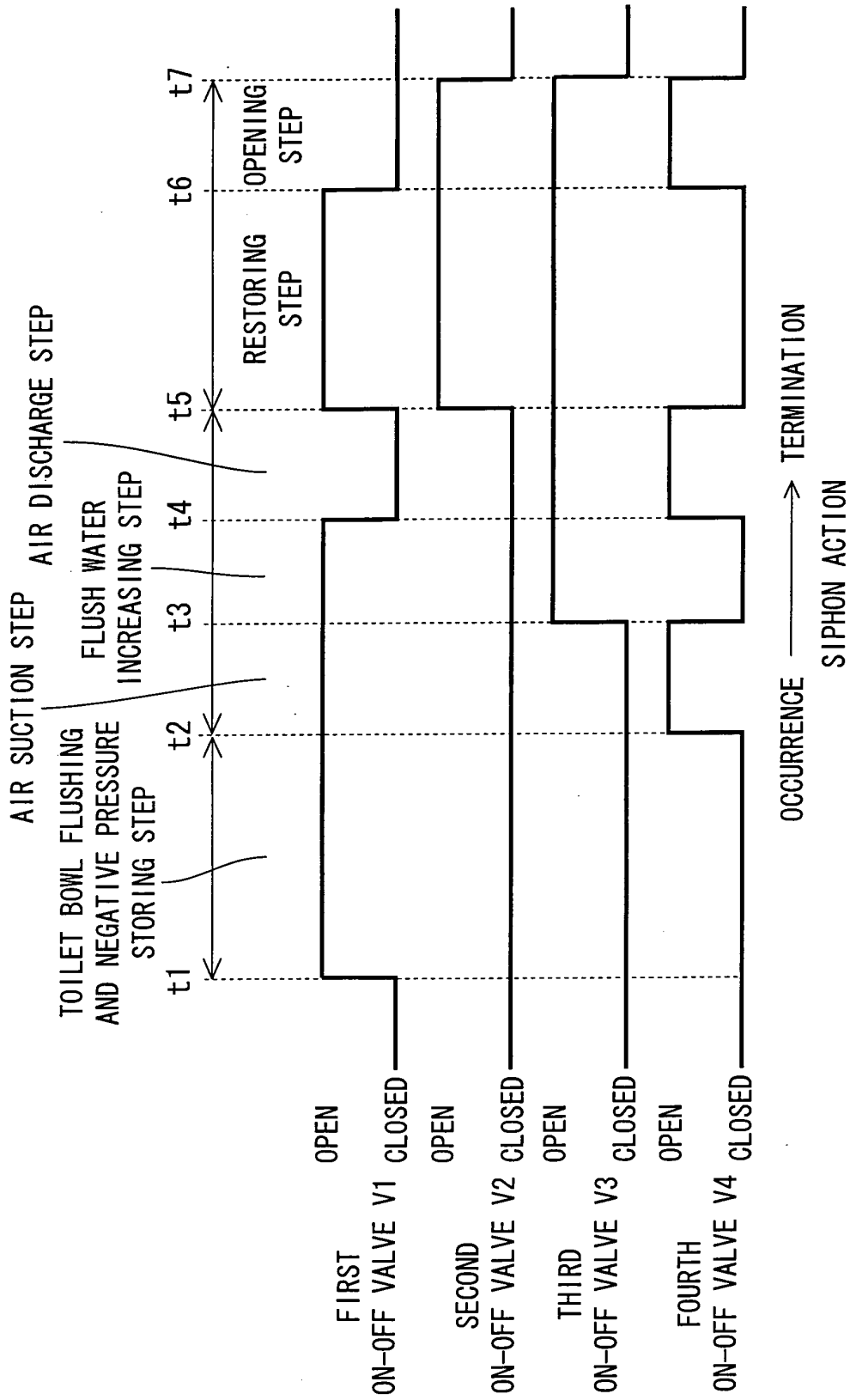
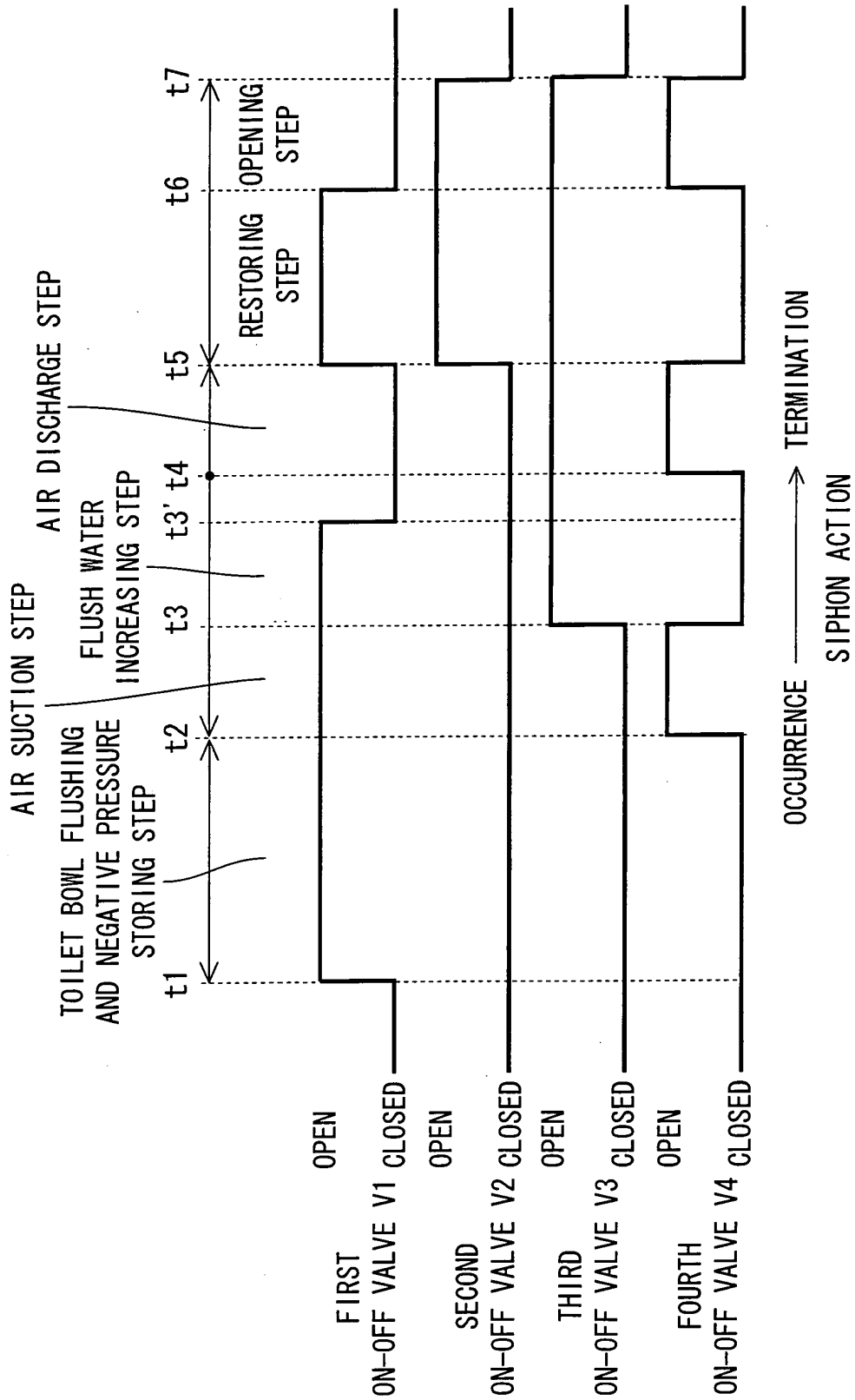


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2008/055493

A. CLASSIFICATION OF SUBJECT MATTER E03D11/02(2006.01) i, E03D11/18(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) E03D11/02, E03D11/18		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2008 Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008		
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	Relevant to claim No.
A	JP 7-54388 A (Toto Ltd.), 28 February, 1995 (28.02.95), Par. Nos. [0024] to [0064]; Figs. 1, 2 (Family: none)	1-4
A	JP 2007-63980 A (Inax Corp.), 15 March, 2007 (15.03.07), Par. Nos. [0057] to [0064]; all drawings & WO 2007/015403 A1 & WO 2007/015405 A1	1-4
A	JP 2004-143717 A (Toto Ltd.), 20 May, 2004 (20.05.04), Par. Nos. [0002], [0019]; Fig. 1 (Family: none)	1-4
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* 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 09 May, 2008 (09.05.08)		Date of mailing of the international search report 20 May, 2008 (20.05.08)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2008/055493
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-112056 A (Inax Corp.), 27 April, 2006 (27.04.06), Par. Nos. [0023] to [0051]; Figs. 1, 4 (Family: none)	1-4

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H0754388 A [0005]