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Water closet flushing apparatus.


 A water closet flushing apparatus for supplying flushing water via separate flushing water supply means (22, 23) to a bowl portion (11) and to a trap discharge passage (12) formed in the vicinity of a bottom portion of the bowl portion, in the shape of substantially an inverted letter "U" and provided with a top bend portion (12b) midway along the length of the trap discharge passage, characterized in that a flushing water spray is disposed at a position above the trap discharge passage for spraying flushing water in the direction of said trap discharge passage on the downstream side of the top bend, a first opening and closing means (20) communicated to the bowl portion for opening and/or closing the first supply means, a second opening and closing means (21) communicated to the flushing water spray for opening and/or closing the second supply means, and a control means (30) being provided to send opening and/or closing signals to the first and second opening and closing means, respectively.

Flushing water is supplied to the bowl portion to

flush it and flushing water is sprayed to the trap discharge passage to create a siphon action to discharge the flushing water along with excreta, etc.

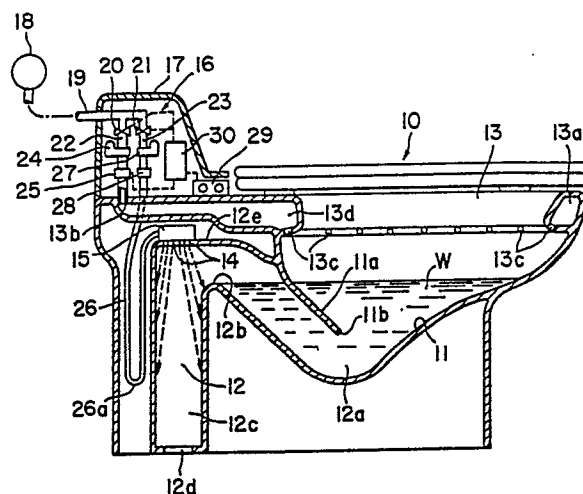


FIG. 1

WATER CLOSET FLUSHING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a water closet flushing apparatus and more particularly to a water closet flushing apparatus capable of efficiently supplying flushing water to a bowl of a water closet and also to a trap discharge passage which is disposed adjacent to the bottom of the water closet bowl and which can produce a siphon action.

A water closet comprises a bowl which receives human excreta and a trap discharge passage substantially in the form of an inverted U-shaped and communicated with the bottom of the water closet bowl.

In order that the amount of flushing water supplied to the water closet bowl can be decreased and in order there to be the definite generation in the trap discharge passage of the siphon action necessary for the flushing operation, there has recently been proposed a method in which flushing water is fed through independent flushing water lines to the water closet bowl and the trap discharge passage.

For example, in the case of the water closet flushing apparatus disclosed in Japanese Patent Publication No. 30092/1980, a flushing water pipe and an independent flushing water pipe are respectively communicated with a water closet bowl and a trap discharge passage so that they are both independently charged with flushing water. In a water closet flushing apparatus of the type described above, the flushing water that is supplied to the water closet bowl is supplied from a plural number of supply holes piercing the rim portion of the water closet bowl. In addition, the flushing water that is supplied to the trap discharge passage is supplied via a flushing water supply system separate from the water closet bowl flushing water supply system, and which supplies the flushing water to an opening provided in the portion of the trap discharge passage that communicates with the bottom of the water closet bowl. In addition, in a water closet flushing apparatus of the type described above, solenoid controlled valves are inserted into the two flushing water pipes and a timer is used to send signals to open and close the solenoid valves.

In the water closet flushing apparatus of the type described above, the solenoid controlled valves are controlled so that flushing water is first supplied to the trap discharge passage to produce the siphon action whereby the excreta and the flushing water are discharged. After this, flushing water is supplied to the water closet bowl to clean

the bowl. Therefore, when compared with conventional water closet flushing apparatus of the type in which flushing water is supplied to only the water closet bowl, there is the effect of causing the trap discharge passage to function as a siphon and consequently of requiring less flushing water.

However, in the case of conventional flushing apparatus of the type described above, the solenoid controlled valves are controlled to open or close in response to a time interval set by the timer so that there is the problem that when there are variations in the pressure of the flushing water in the flushing water supply line, there is also a variation in the flow rate so that an optimum flushing effect cannot be obtained. In particular, there is the problem that excreta remains in the water closet bowl when the pressure of the flushing water drops.

Moreover, the flushing water supply holes in the trap discharge passage are provided in the vicinity of the entrance to the trap discharge passage, and the flushing water has to be made to flow up from the lower end of the trap discharge passage to spill over the bend at the upper end of the trap discharge passage. Because of this, the trap discharge passage has to be filled with water from the bend at the upper end of the trap discharge passage to the lower end of the trap discharge passage and so the amount of water that is required to create a definite siphon effect in the entire trap discharge passage is much larger than would be otherwise expected.

In addition, there is an additional problem in that the cleaning of the bowl is performed after the excreta has been flushed out of the trap discharge passage and so excreta that has not been completely flushed out of the trap discharge passage by the siphon action falls back to remain in the bowl.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a water closet flushing apparatus that is capable of effectively cleaning the water closet bowl using only a small amount of flushing water.

The water closet flushing apparatus of the present invention is provided with a bowl portion and a trap discharge passage in the shape of an inverted letter "U" and formed in the vicinity of the bowl portion and having a top bend along its length, a water supply source for the supply of the flushing water, a first supply means communicating

the water supply source and the water closet bowl and for the supply of flushing water to the water closet bowl, a flushing water spray provided at the top portion of the trap discharge passage to spray flushing water from the top bend portion of the trap discharge passage and in the direction of the trap discharge passage on the downstream side, a second supply means to supply water to the shower, a first opening and closing means provided for the bowl water supply passage, a second opening and closing means provided for the trap discharge passage flushing water supply passage, and a control means to send command signals for the opening and/or closing action of the first opening and closing means and the second opening and closing means.

According to the present invention, the flushing water is supplied to the water closet bowl portion and the trap discharge passage in the following procedure.

- a. A predetermined quantity of flushing water is supplied to the bowl portion, thereby cleaning it.
- b. Water is sprayed into the discharge passage of the trap discharge passage to create a siphon action in the trap discharge passage and thereby discharge the water in the bowl portion.
- c. The flushing water is supplied at a predetermined flow rate to the bowl portion, thereby providing a water seal for the bowl portion.

BRIEF EXPLANATION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view indicating a first preferred embodiment of a water closet flushing apparatus in accordance with the present invention.

FIG. 2 is a block diagram indicating the configuration of a control apparatus for the water closet flushing apparatus indicating in FIG. 1.

FIG. 3 is a flow chart indicating the flushing process for the water closet flushing apparatus in accordance with the present invention.

FIG. 4 is a time chart of one example of the operation of the water closet flushing apparatus in accordance with the present invention.

FIG. 5 through FIG. 7 are time charts of other examples of the operation of the water closet flushing apparatus in accordance with the present invention.

FIG. 8 is a longitudinal sectional view indicating a second preferred embodiment of a water closet flushing apparatus in accordance with the present invention.

FIG. 9 is a longitudinal sectional view taken along section line IX-IX of the water closet flushing apparatus in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 and FIG. 2 indicate a first embodiment of the water closet flushing apparatus according to the present invention. A flushing bowl 10 is provided with a bowl portion 11 in which the excreta is collected, this bowl portion 11 being divided into two portions by a partition wall 11a, a trap discharge passage 12 communicating the two portions at the bottom portion of the bowl portion 11 and in the shape of an inverted letter "U", and a rim 13 formed in a substantially cylindrical shape around an upper edge of the bowl portion 11. The rim 13 is hollow and forms a flow path 13a for the flushing water. One portion of the flow path 13a is enlarged to form a water supply chamber 13d and a water supply inlet 13b opens into this water supply chamber 13d. Moreover, the rim 13 has a plural number of substantially circular-shaped flushing water supply holes 13c opened in it and communicating with the flow path 13a. These flushing water supply holes 13c are opened at an angle in the inner wall of the bowl portion 11. For example, the flushing water supply holes 13c are opened at an angle so that the direction of the water supplied through them is approximately 45° to the horizontal and in the downwards direction. By this, the flushing water discharged into the bowl creates a vortex in the bowl portion 11.

The trap discharge passage 12 has a flow inlet 12a formed between the bottom end 11b of the partition wall 11a and the bottom portion of the bowl portion 11. In addition, the trap discharge passage 12 with its substantially inverted letter "U" shape is provided with a top bend portion 12b and the flushing water W is discharged so as to flow over this top bend portion 12b. A discharge passage 12c downstream from the trap discharge passage 12 is formed as a straight pipe which is substantially vertical, and a discharge outlet 12d is provided at its lower end.

The top portion of the trap discharge passage 12 is formed so as to be flat, and is provided with a plural number of spray holes 14 that are opened through it and directly above the discharge passage 12c. These spray holes 14 are opened so as to have a slight inclination so that they spray water onto the walls of the discharge passage 12c of the trap discharge passage 12. In addition, the spray holes 14 are opened radially at substantially equal gaps so that the water is dispersed as it is sprayed. To the top portion of the spray holes 14 is mounted a cover 15 that covers all of the spray holes 14.

To the upper side of a water supply chamber 13d of the flushing bowl 10 is provided a cover 17

comprising an equipment housing chamber 16 that houses the flushing water supply control apparatus. To the equipment housing chamber 16 is inserted a flushing water supply pipe 19 that pierces the cover 17 and which is connected to a flushing water supply source 18. This flushing water supply pipe 19 branches into two midway along its length, with the branches being connected to a bowl water supply pipe 22 and a trap discharge passage water supply pipe 23. The bowl water supply pipe 22 is connected to a water supply inlet 13b that opens into the water supply chamber 13d, and along its length are provided in order, a solenoid opening and closing valve 20 for the bowl portion, a vacuum braker 24 which is open to the atmosphere and a flow sensor 25. In addition, the trap discharge passage water supply pipe 23 is communicated with the space inside the cover 15 of the spray holes 14 via a rubber hose, along the length of which are provided in order, a solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion, a vacuum braker 27 which is open to the atmosphere, and a flow sensor 28. A rubber hose 26 is provided in substantially the shape of a letter "U" and the bend portion 26a is disposed so that it is at a position lower than the position of the top bend portion 12b of the trap discharge passage 12.

A control apparatus 30 is provided inside the equipment housing chamber 16 and this control apparatus 30 is connected by signal lines to the solenoid opening and closing valve 20 for the bowl portion, the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion, the flow sensor 25 and the flow sensor 28. In addition, the control apparatus 30 is connected to a start input portion 29 provided with various types of switches for the operation of the flushing water supply apparatus or sensors for generating operation start signals, and this start input portion 29 is also provided inside the equipment housing chamber 16.

As indicated in FIG. 2, the control apparatus 30 is provided with a microprocessor (MPU) 31, a memory 32, an input interface circuit 33 and an output interface circuit 34. The microprocessor 31 is provided with a water amount comparison means 31b that compares the total flushing water amount on the basis of calculations by a flushing water amount calculation means 31a and flushing water amount calculation means 31a on the basis of flow signals from the flow sensor 25 and flow sensor 28 respectively, with the set value for a predetermined flushing water amount. The set value for a predetermined flushing water amount is stored beforehand in the memory 32. In addition, the memory 32 also stores the command process for the signals that command the opening and closing operation of

the solenoid opening and closing valve 20 for the bowl portion. In the microprocessor 31 is set a timer 31c for timing control of the opening and closing operation command signals for the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve (water spray valves 21 for the trap discharge passage portion.

Signal line 23a and signal line 28a connect the input interface circuit 33 of the control apparatus 30 to the flow sensor 25 provided for the bowl water supply pipe 22 and the flow sensor 28 provided for the trap discharge passage water supply pipe 23, respectively. In addition, signal line 20a and signal line 21a connect the output interface circuit 34 of the control apparatus 30 to the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion, respectively, so that opening and closing operation command signals are sent to the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion.

The following is a description of the procedure for the operation of the water closet flushing apparatus according to the present invention, and with respect to FIG. 3 and FIG. 4.

A manual switch, a switch activated by getting off the toilet seat after use of the water closet, a photosensor or the like is used to switch on a start switch 29b and start the operation of the water closet flushing apparatus. A start signal from the start input portion 29 is sent to the control apparatus 30 and then the microprocessor 31 sends an open bowl command signal to the solenoid opening and closing valve 20 for the bowl portion. By the opening of the solenoid opening and closing valve 20 for the bowl portion, flushing water from the flushing water supply source 18 is supplied to the water supply inlet 13b via a bowl water supply pipe 22. The flushing water that flows from the water supply inlet 13b and into the flow path 13a of the rim 13 is sprayed out from flushing water supply holes 13c and flows down into the bowl portion 11 while forming a vortex. This action cleans the inside of the bowl portion 11 (Step S1).

The amount of flushing water that flows to the bowl portion 11 is detected by the flow sensor 25 and the flow signal for that amount is sent to the flushing water amount calculation means 31a of the control apparatus 30 and the amount of water is calculated (Step S2). The water amount comparison means 31b compares the calculated amount of water with the predetermined value (Step S3). When the amount of water that has flowed into the bowl portion 11 reaches a predetermined value, a close valve command signal is sent to the solenoid

opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve 20 for the bowl portion is closed (Step S4). This completes the flushing action for the inside of the bowl portion 11.

The start signal from the start input portion 29 is also sent to the timer 31c of the control apparatus 30 and starts the timer countdown by the timer 31c (Step S5). When the count time has exceeded a predetermined value, a valve release command signal is sent from the control apparatus 30 to the solenoid opening and closing valve (water spray valve) 21 provided on the trap discharge passage water supply pipe 23 (Step S6). The solenoid opening and closing valve (water spray valve) 21 then opens and water from the flushing water supply source 18 is supplied to the rubber hose 26 via the trap discharge passage water supply pipe 23 and flows into the cover 15. The water that has flown into the cover 15 is radially sprayed from the spray holes 14 in the direction of the inner wall of the discharge passage 12c of the trap discharge passage 12 and is supplied to the inside of the discharge passage 12c of the trap discharge passage 12. By this, the inside of the discharge passage 12c of the trap discharge passage 12 is filled with flushing water and the air which is mixed with it and flows from the discharge outlet 12d. The flowing action of this air and water mix creates a negative pressure inside the discharge passage 12c and this creates a siphon action in the trap discharge passage 12 so that the flushing water and the excreta that has collected in the bowl portion 11 rises over the top bend portion 12b and is flushed along the discharge passage 12c of the trap discharge passage 12. The amount of flushing water necessary to create the siphon action is determined by the optimum value according to the shape of the trap discharge passage 12 and other factors, and the control of this amount of flushing water is performed using the flow sensor 28. This is to say that as in the same way for the control of the flow amount to the bowl portion 11, the flow amount is detected by the flow sensor 28 and is calculated by the flushing water amount calculation means 31a and this value is compared by the water amount comparison means 31b with a predetermined value (Steps S7, S8). When a predetermined amount of flushing water has been sprayed from the spray holes 14, the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion is closed (Step S9).

The timing for the opening of the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion is as shown in FIG. 4, can be made for when the solenoid opening and closing valve 20 for the bowl portion is open. In this case, as shown in FIG. 4, the time T1

is when flushing water is supplied to both the bowl portion 11 and the rubber hose 26. By this, the air inside the rubber hose 26 can be discharged beforehand from the spray holes 14 so that it is possible to effectively perform the flushing water spray action to then create the siphon action.

When the spraying of the amount of flushing water necessary to create the siphon action has been completed, the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion is closed and the siphon action causes the excreta and the contaminated water in the bowl portion 11 to be flushed away but the time that this flushing action continues is controlled by the timer 31c. This is to say that the time count by the timer 31c begins when the solenoid opening and closing valve 20 for the bowl portion closes (Step 10). After a predetermined time T2 has elapsed (Refer to FIG. 4), the open command signal is sent to the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve 20 for the bowl portion opens once again. By this, flushing water is supplied to inside the bowl portion 11 but the supply amount is detected using the flow sensor 25 in the same manner as has been previously described and is calculated by the microprocessor 31 (Step S12). The water amount comparison means 31b compares whether or not a predetermined flow amount has been reached (Step S13) and the solenoid opening and closing valve 20 for the bowl portion closes when a predetermined amount has been reached (Step S14). By this, the bowl is water sealed (i.e. the water level rises) for up to a predetermined level inside the bowl portion 11. Then, the closing of the solenoid opening and closing valve 20 for the bowl portion completes the series of processes for the water closet flushing apparatus.

In this manner, the flushing water sprayed from the spray holes 14 provided at the top of the trap discharge passage 12 to the inside of the discharge passage 12c of the trap discharge passage 12 allows the discharge passage 12c to be easily filled with flushing water so that a siphon action is efficiently created using only a small amount of flushing water. In addition, the amount of flushing water sprayed to the trap discharge passage 12 is detected and controlled by the flow sensor 28 so that the optimum control can be performed for the amount of water necessary for the siphon action. Moreover, the closing command signals for the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion are controlled on the basis of the results of calculation of the supply amounts detected by the flow sensor 25 and the flow sensor

28 and so even if a pressure fluctuation is created in the flushing water supply source 18 or the flushing water supply pipe 19, it is always possible for a predetermined amount of flushing water to be supplied so that no problems are caused due to there being insufficient water. In addition, when the flushing of the bowl portion 11 has been completed, the use of a flushing process to discharge excreta from the trap discharge passage 12 means that a favorable flushing effect can always be obtained even when there is a large amount of excreta in the bowl portion 11.

In addition, the bend portion 26a of the rubber hose 26 for supplying flushing water to the spray holes 14 is provided so that there is always flushing water inside the rubber hose 26. This means that odors inside the trap discharge passage 12 do not pass through the rubber hose 26 and the trap discharge passage water supply pipe 23 to leak into the room.

In the above described embodiment of the present invention as shown in FIG. 4, the solenoid opening and closing valve 20 for the bowl portion opens and then the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion opens so that the flushing of the bowl portion 11 and the spraying of flushing water to the trap discharge passage 12 are performed simultaneously.

However, as is shown in FIG. 5, the opening action of the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion can be performed after the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion has opened. In this case, the opening operation command signal for the solenoid opening and closing valve 20 for the bowl portion need not use the timer 31c of the control apparatus 30 and only the closing signal for the solenoid opening and closing valve 20 for the bowl portion need be used. Such water supply operation can be performed using a two-way automatic switching valve instead of the solenoid opening and closing valve 20 for the bowl portion and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion.

In addition, as is indicated in the flow chart of FIG. 6, it is also possible for the solenoid opening and closing valve 20 for the bowl portion to open while the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion is open, and for the creation of the water seal to commence. If this is done, then the flushing water sprayed from the spray holes 14 creates a siphon and then water is discharged to the bowl portion 11 while the water inside the bowl portion 11 is being flushed. Accordingly, the bowl portion

11 becomes empty due to the siphon action and the absence of any water connecting the bowl portion 11 and the trap discharge passage 12 is prevented. By this, the entry of odors from the trap discharge passage 12 to the bowl portion 11 is prevented and noise from the flushing water spray at the spray holes 14 can also be shut out.

In addition, as is shown in the time chart in FIG. 7, it is possible to continually perform the spraying of flushing water to the trap discharge passage 12 at a predetermined time gap. This is to say that when the initial flushing water supply action to the trap discharge passage 12 has been completed, the timer 31c counts the time and after a predetermined time T3 has elapsed, the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion opens and flushing water is again supplied from the spray holes 14 to the trap discharge passage 12. By this, siphon action inside the trap discharge passage 12 can be made to continue for a long time and the performance in flushing away any floating excreta in the bowl portion 11 can be increased.

Furthermore, instead of the flow sensor 25 and the flow sensor 28, it is possible to use a vane wheel that rotates in proportion to the flow and which outputs electrical signals in accordance with that rotation. In addition, a pressure gauge can be provided along the supply pipes as another type of flow control means so that the operating time of the timer is controlled on the basis of the detected value for the pressure, and thereby control the opening operation time of the solenoid opening and closing valves.

FIG. 8 illustrates a second embodiment of the water closet flushing apparatus according to the present invention.

In this embodiment, a water seal generation mechanism is communicated with the lower end of the trap discharge passage 12 and a supply source of the flushing water sprayed to the trap discharge passage 12 is different from the supply source for the flushing water supplied to the bowl portion 11. The other portions of this embodiment are the same as those described for the first embodiment, are indicated in the figure with the same numbers and the corresponding explanation for them is omitted.

In the embodiment illustrated in FIG. 8, the downstream side of the discharge passage 12c of the trap discharge passage 12 is formed in approximately straight from the top bend portion 12b. This lower end of the discharge passage 12c has a cylindrically shaped water seal mechanism 40 fixed and so as to communicate with it. The water seal mechanism 40 is cylindrical in shape and is made of synthetic resin, has an enlarged diameter portion 41 where the diameter enlarges from the middle

portion to the bottom portion, and an excreta guide cylinder 42 disposed so as to be housed inside this enlarged diameter portion 41. The lower end of the enlarged diameter portion 41 is formed with a flange portion 41a facing towards the inside, and a flow outlet 43 is provided with a reduced diameter portion. To the top of the enlarged diameter portion 41 is provided a communicated cylindrical portion 41b which engages with the downstream end of the discharge passage 12c using adhesive or the like so that a leakproof state is maintained.

The enlarged diameter portion 41 and the excreta guide cylinder 42 are communicated by a communicating portion 44 as shown in FIG. 9. Between the inner circumferential surface of the enlarged diameter portion 41 and the outer circumferential surface of the excreta guide cylinder 42, and between the lower end of the excreta guide cylinder 42 and the upper surface of the flange portion 41a are respectively provided gaps 45 and 46 as respectively shown in FIG. 8 and FIG. 9. In addition, between the inner wall of the enlarged diameter portion 41 and the upper end of the excreta guide cylinder 42 is provided a gap 47.

Furthermore, in this embodiment of the present invention, water that has already been processed and stored in the processed water tank 50 is used as the flushing water that is sprayed to the discharge passage 12c of the trap discharge passage 12. The flushing water that includes excreta and which has been discharged along the trap discharge passage 12 is sent via a discharge pipe (not indicated in the figure) to the processed water tank 50 where it undergoes processing such as sedimentation separation and chemical treatment.

The processed water tank 50 and the spray holes 14 to the trap discharge passage 12 are connected by a trap discharge passage supply pipe 51 and a rubber hose 26. The trap discharge passage supply pipe 51 which passes through the cover 17 and which is connected to the processed water tank 50 is provided along its length with, in order from the upstream side, a water supply pump 52, a flow sensor 28 and a solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion. In addition, the water supply pump 52, the flow sensor 28 and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion are each connected to a control apparatus 30 by respective signal lines.

In this embodiment of the present invention, the flushing water supply pipe 19 connected to a flushing water supply source 18 such as a waterworks differs from that of the first embodiment in that it is connected to the bowl water supply pipe 22 without branching into two along its length.

In addition, in this embodiment of the present

invention, the spray holes 14 for spraying flushing water to the trap discharge passage 12 are different from those of the first embodiment in that they are positioned slightly downstream from the top of the trap discharge passage 12. Accordingly, the water sprayed from the spray holes 14 is sprayed as shown in FIG. 8, at a slight angle with respect to the inner wall of the discharge passage 12c of the trap discharge passage 12.

The process of the flushing operation of a water closet flushing apparatus having such a configuration is basically the same as that of the first embodiment and will be omitted here, and only the particular features of this embodiment will be described.

In this embodiment of the present invention, after the solenoid opening and closing valve 20 for the bowl portion opens and the bowl portion 11 is supplied with flushing water, flushing water is supplied to create a siphon action in the trap discharge passage 12 but this is performed in the following manner. This is to say that the flushing water command signal output from the control apparatus 30 to spray the trap discharge passage 12 with water is sent to the water supply pump 52 and to the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion so that the water supply pump 52 operates and the solenoid opening and closing valve (water spray valve) 21 for the trap discharge passage portion opens. The water supply pump 52 sends treated water that has been stored in the processed water tank 50, to the spray holes 14 via the trap discharge passage supply pipe 51 and the rubber hose 26, and water is sprayed from the spray holes 14 to the inner wall of the discharge passage 12c. By this, a siphon action is created in the trap discharge passage 12 in the same manner as has already been described.

In addition, in this embodiment of the present invention, a water seal mechanism 40 is provided at the lower end of the trap discharge passage 12. This is to say that the one portion of the flushing water that flows through the downstream side discharge passage 12c of the trap discharge passage 12 flows through the gaps 45, 46 and 47 between the enlarged diameter portion 41 and the excreta guide cylinder 42 and is discharged from the flow outlet 43. In this case, the flange portion 41a forms a restricted diameter portion and so the flushing water that passes the gap 46 between the lower end of the excreta guide cylinder 42 and the upper surface of the flange portion 41a and flows radially inwards creates a water seal for the 43. This water seal blocks off the inside of the trap discharge passage 12 from the atmosphere and the flushing water is discharged definitely and promptly from the flow outlet 43 when flushing water is filled on

the side upstream from the water seal. By this, the generation of a complete siphon inside the trap discharge passage 12 is facilitated.

In this manner as has been described above for the second embodiment, treated water that has been stored in the processed water tank 50 is used as the flushing water that is supplied to the trap discharge passage 12 and so the effective utilization of the flushing water is promoted. In addition, the treated water that flows inside the trap discharge passage 12 is not seen by the user of the water closet and so there is no discomfort to the user even if this water is discolored, for example. Furthermore, by having a water seal mechanism 40 provided, the generation of the siphon action is facilitated and it becomes possible to reduce the amount of flushing water used.

As has been described above, according to the present invention, it is possible to perform efficient flushing using relatively little flushing water. Reducing the amount of water used for flushing means a reduction in the amount of noise generated by flushing and also that the various pipes and equipment and the treated water tank itself can be made more compact.

While the presently preferred embodiments of the present invention have been shown and described, it will be understood that the disclosure is for the purposes of illustration and that various changes and modifications may be made without departing from the spirit or the essential character of the invention. For example, it is possible to apply the water seal mechanism to the first embodiment. In addition, in the embodiments, the control method for the flow used a calculation means for the measurement and calculation of the flow but it is also possible to perform control of the flow by using an instantaneous flow measurement means and a timer. In addition, one portion of the trap discharge passage water supply passage to the trap discharge passage used a rubber hose but a hose of various other types of material may be used instead of a rubber hose.

Claims

1. A water closet flushing apparatus for supplying flushing water via separate flushing water supply means to a bowl portion and to a trap discharge passage formed in the vicinity of a bottom portion of the bowl portion, in the shape of substantially an inverted letter "U" and provided with a top bend portion midway along the length of the trap discharge passage, characterized in that a flushing water spray is disposed at a position above said trap discharge passage for spraying flushing water in the direction of said trap dis-

charge passage on the downstream side of said top bend, a first opening and closing means communicated to said bowl portion for opening and/or closing said first supply means, a second opening and closing means communicated to said flushing water spray for opening and/or closing said second supply means, and a control means being provided to send opening and/or closing signals to said first and second opening and closing means, respectively.

2. The water closet flushing apparatus of claim 1, wherein a flushing water spray portion is provided with a flushing water dispersal means to disperse and spray flushing water.

3. The water closet flushing apparatus of claim 2, wherein said flushing water dispersal means is formed from a plural number of spray holes.

4. The water closet flushing apparatus of claim 3, wherein said spray holes are opened radially so as to face the inner wall of the side of the trap discharge passage on the downstream side from said top bend.

5. The water closet flushing apparatus of any one of claims 1 to 4, wherein said first supply means and said second supply means are respectively connected to separate flushing water supply sources.

6. The water closet flushing apparatus of any one of claims 1 to 5, wherein said flushing water supply sources are provided with a water treatment tank to treat the flushing water, said second supply means being connected to said water treatment tank.

7. The water closet flushing apparatus of claim 6, wherein said second supply means is provided with a pump apparatus.

8. The water closet flushing apparatus of any one of claims 1 to 7, wherein the downstream side of said trap discharge passage is provided with a restricted portion having a smaller diameter.

9. The water closet flushing apparatus of any one of claims 1 to 8, wherein the first supply means and the second supply means are respectively provided with flow amount detection means.

10. The water closet flushing apparatus of claim 9, additionally provided with a control means comprising a flushing water amount calculation means to calculate an amount of flushing water supplied on the basis of flow signals from said flow detection means, and a flushing water amount comparison means to compare said amount of flushing water calculated by said flushing water amount calculation means and a predetermined value set for the flushing water supply amount.

11. The water closet flushing apparatus of any one of claims 1 to 10, wherein said control means is provided with a memory means to store a command process for said opening and/or closing sig-

nals.

12. The water closet flushing apparatus of any one of claims 1 to 11, wherein said control means is provided with a timer means to control the timing of said opening and/or closing signals.

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13. The water closet flushing apparatus of any one of claims 1 to 12, wherein said trap discharge passage flushing water supply passage has a bend substantially in the form of a letter "U".

14. A flushing water supply method for a water closet provided with a bowl portion and a trap discharge passage and comprising the steps of:

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a. supplying a predetermined quantity of flushing water to the bowl portion to thereby flush it,

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b. spraying water into the discharge passage of the trap discharge passage to create a siphon action in the trap discharge passage and thereby discharge the water in the bowl portion, and

c. supplying the flushing water at a predetermined flow rate to the bowl portion, and thereby provide a water seal for the bowl portion.

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15. The flushing water supply method of claim 14, wherein the spraying of the flushing water to the trap discharge passage is performed after the flushing water supply to the bowl portion has been completed.

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16. The flushing water supply method of claim 14, wherein the spraying of flushing water to said trap discharge passage is performed while flushing water supply to the bowl portion is being performed.

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17. The flushing water supply method of claim 16, wherein the water sealing of said bowl portion is performed while flushing water is being supplied to said trap discharge passage.

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18. The flushing water supply method of any one of claims 14 to 17, wherein the spraying of flushing water to said trap discharge passage is continuously performed for a predetermined time.

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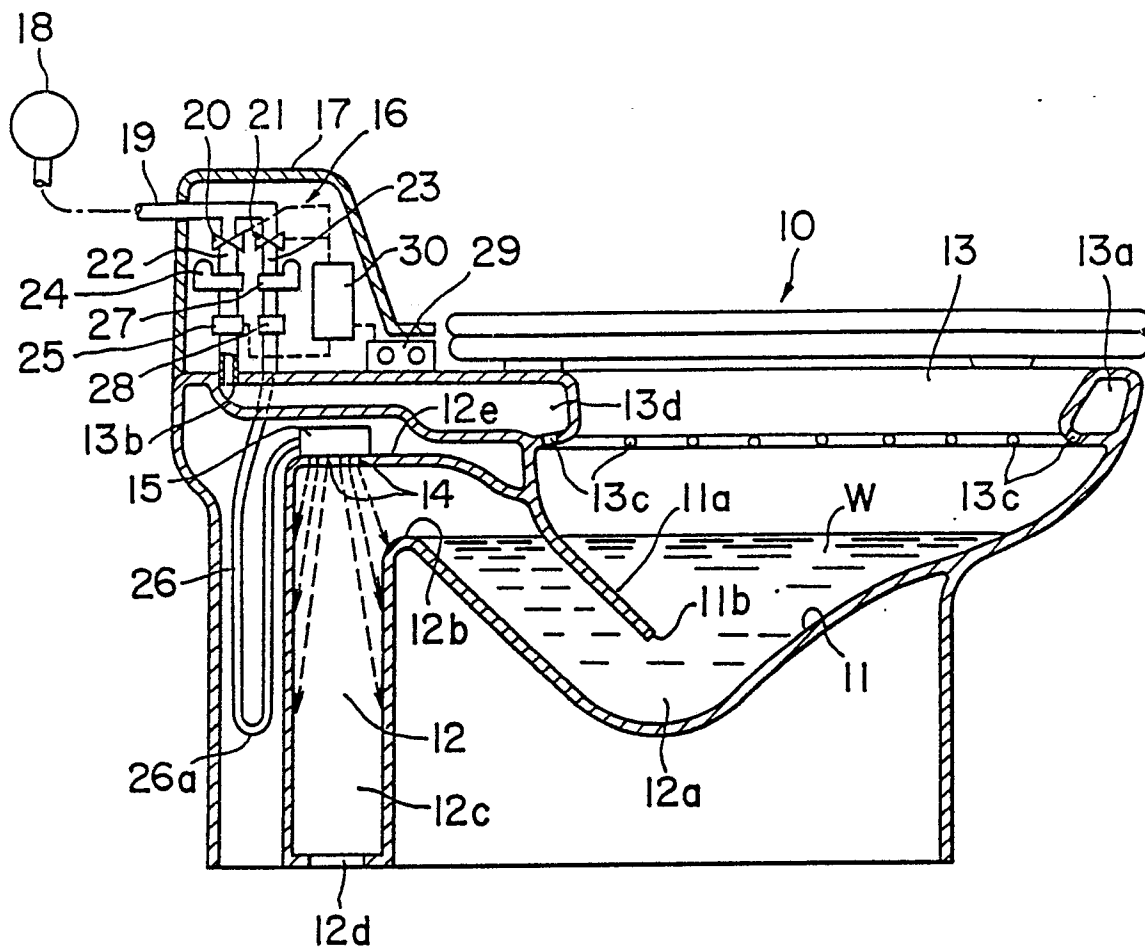


FIG. 1

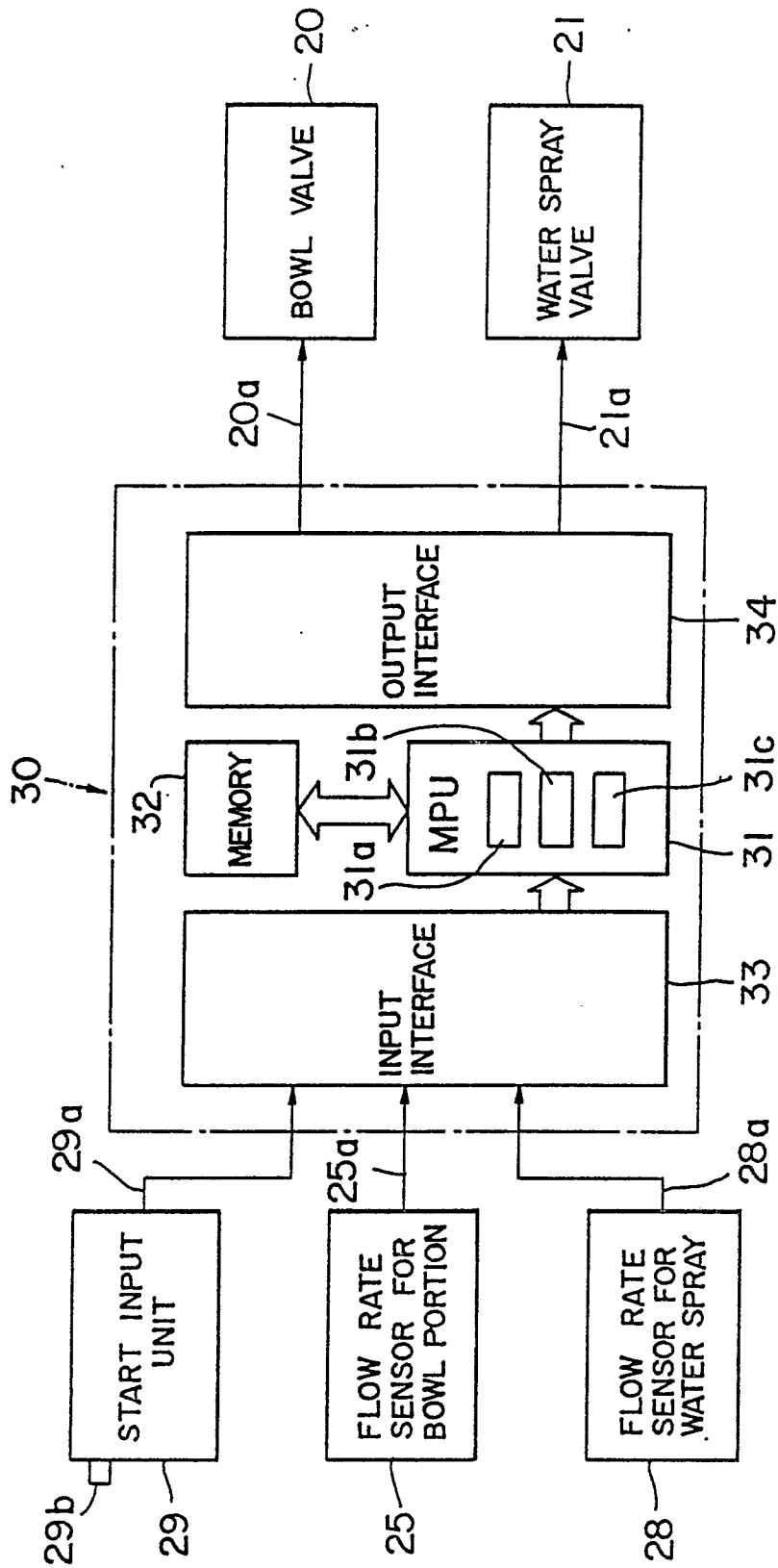


FIG. 2

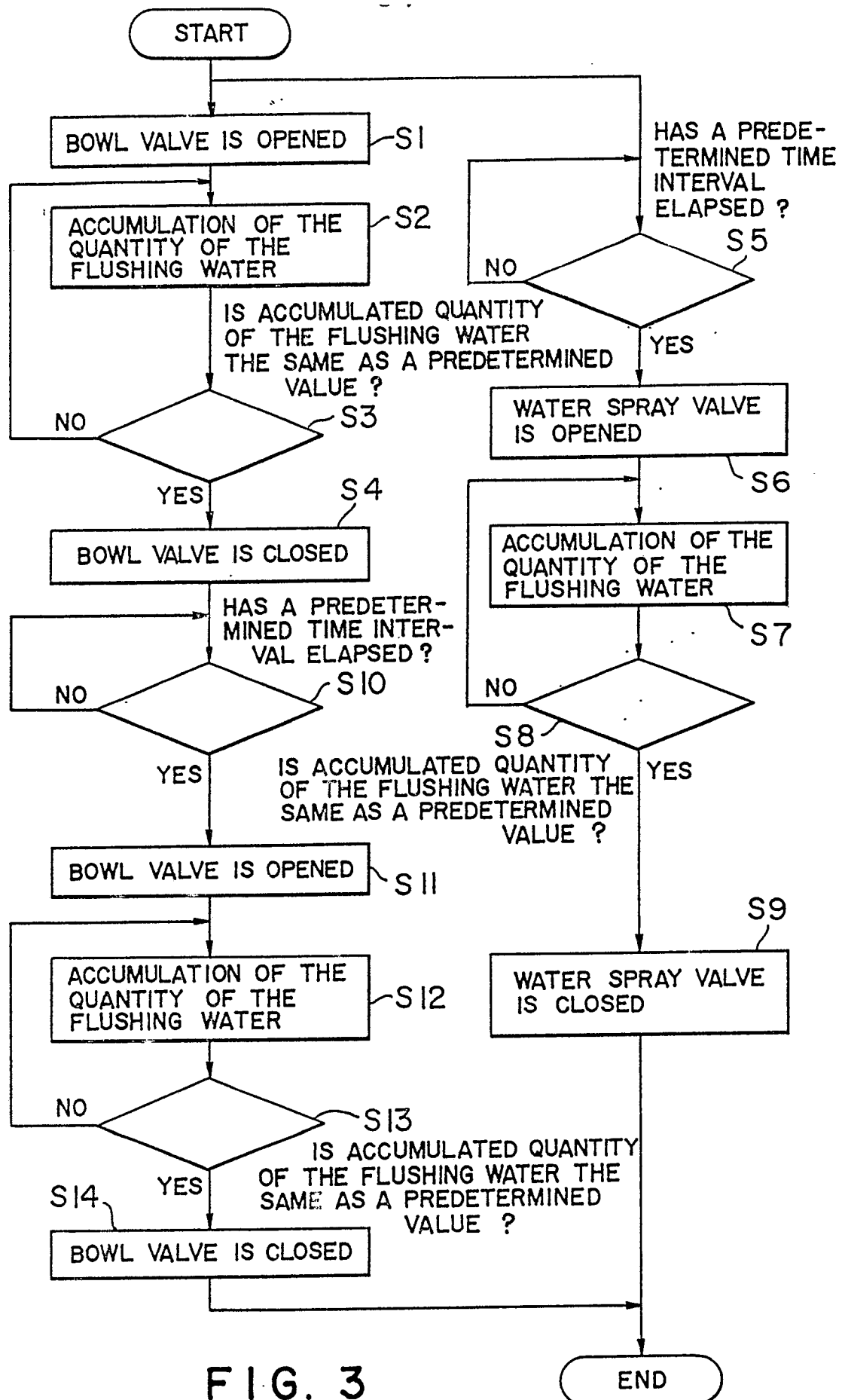


FIG. 3

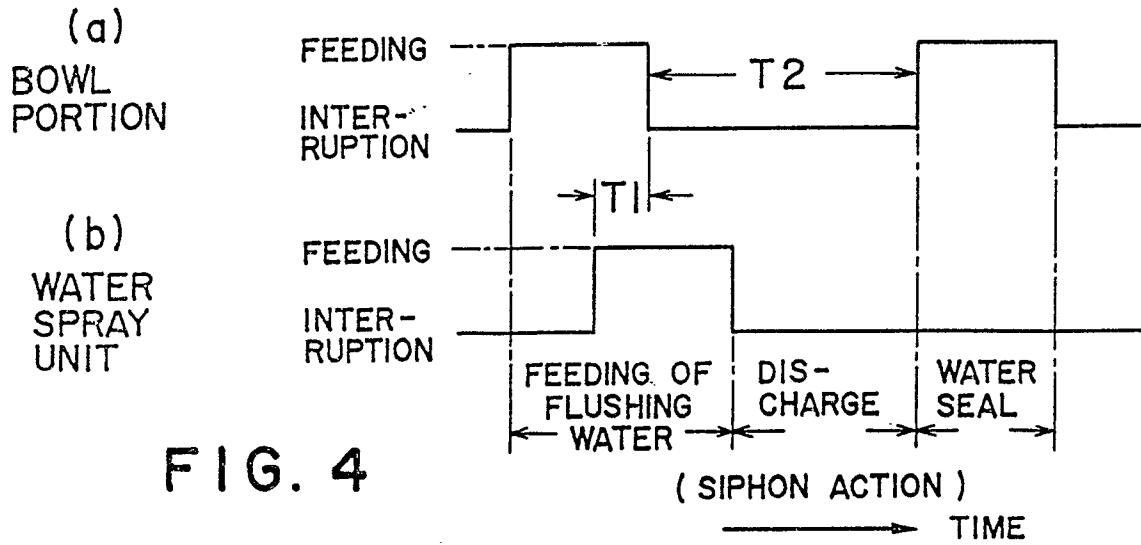


FIG. 4

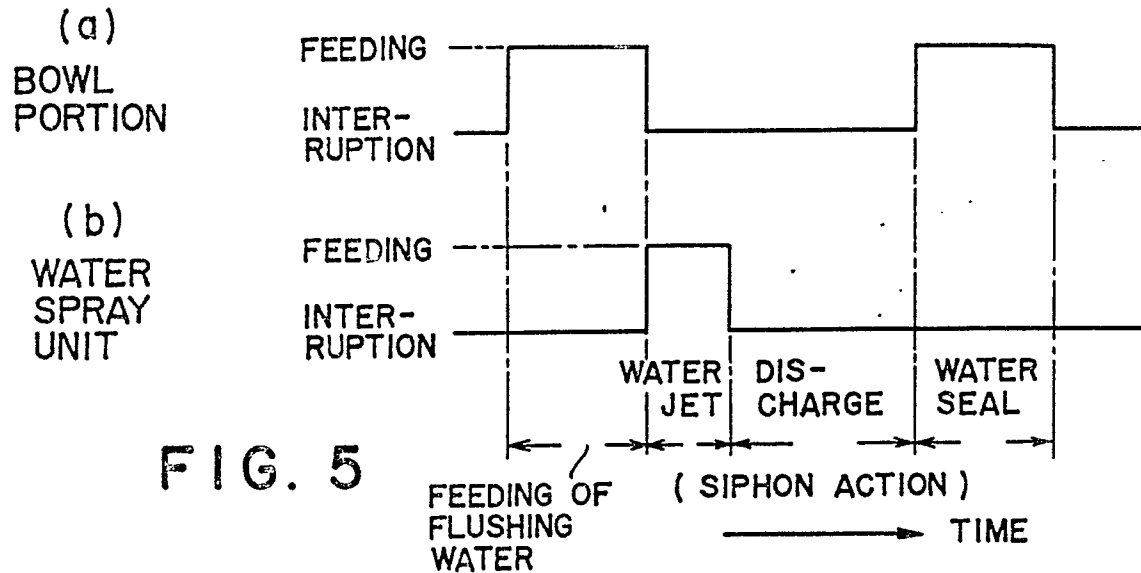


FIG. 5

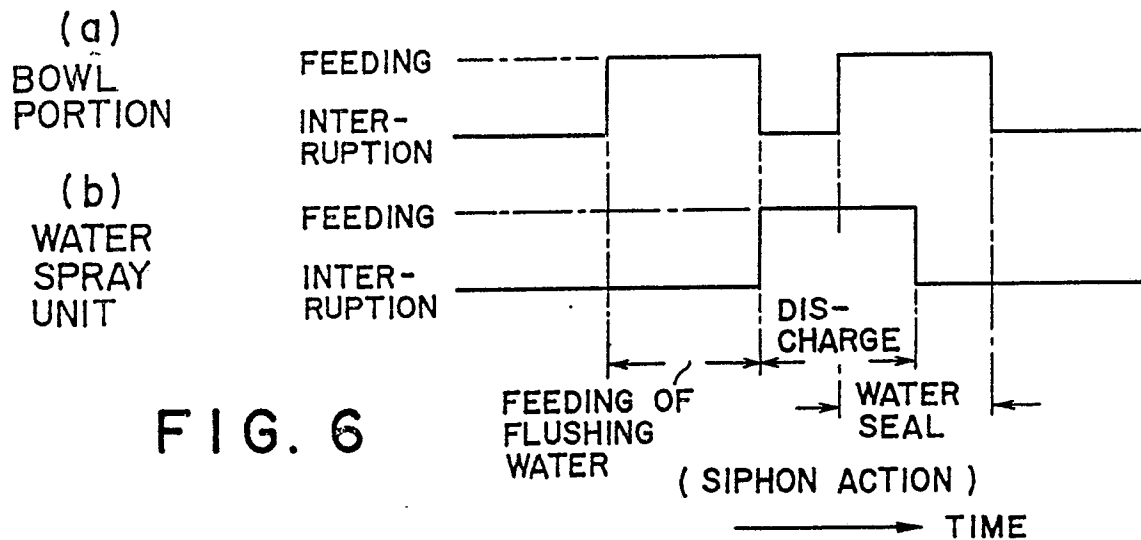


FIG. 6

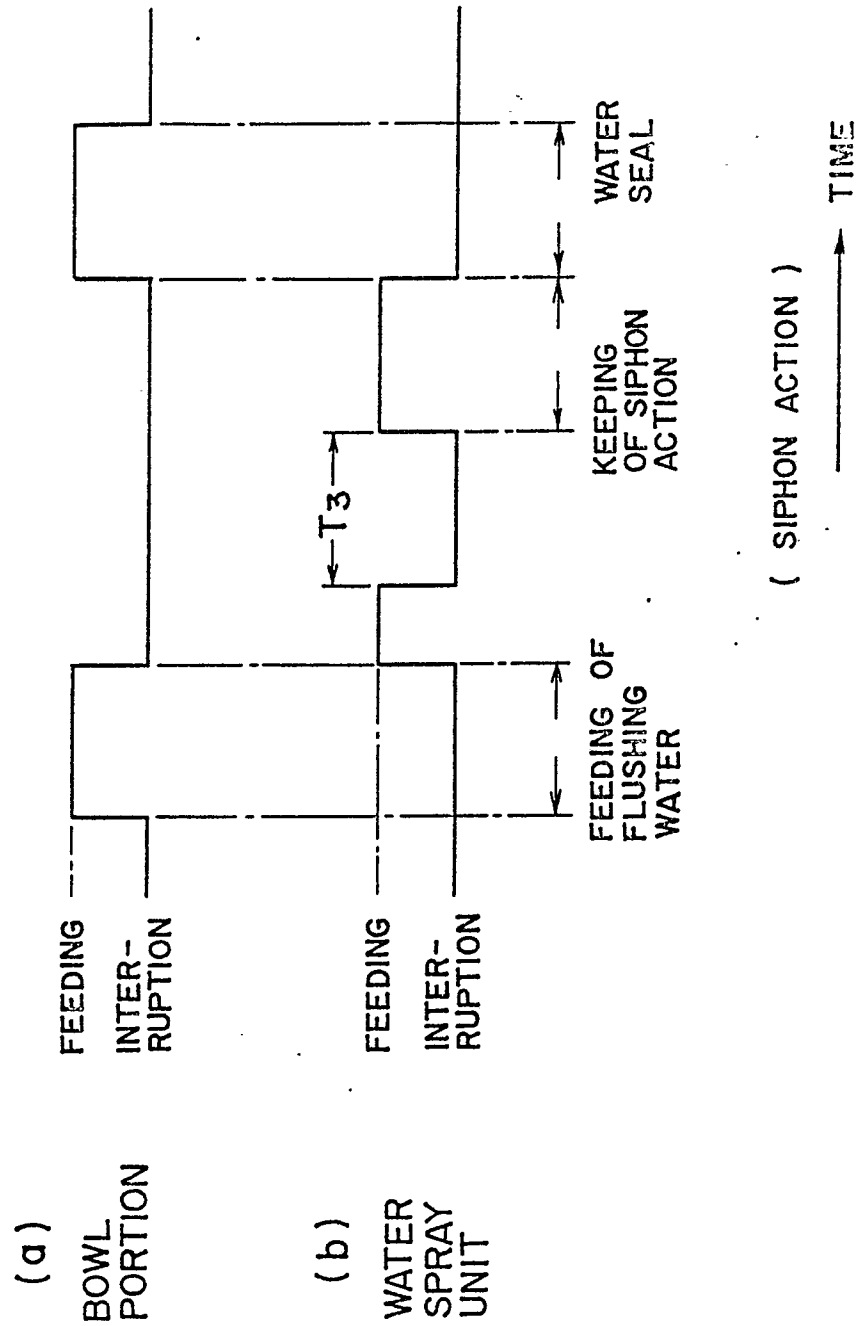


FIG. 7

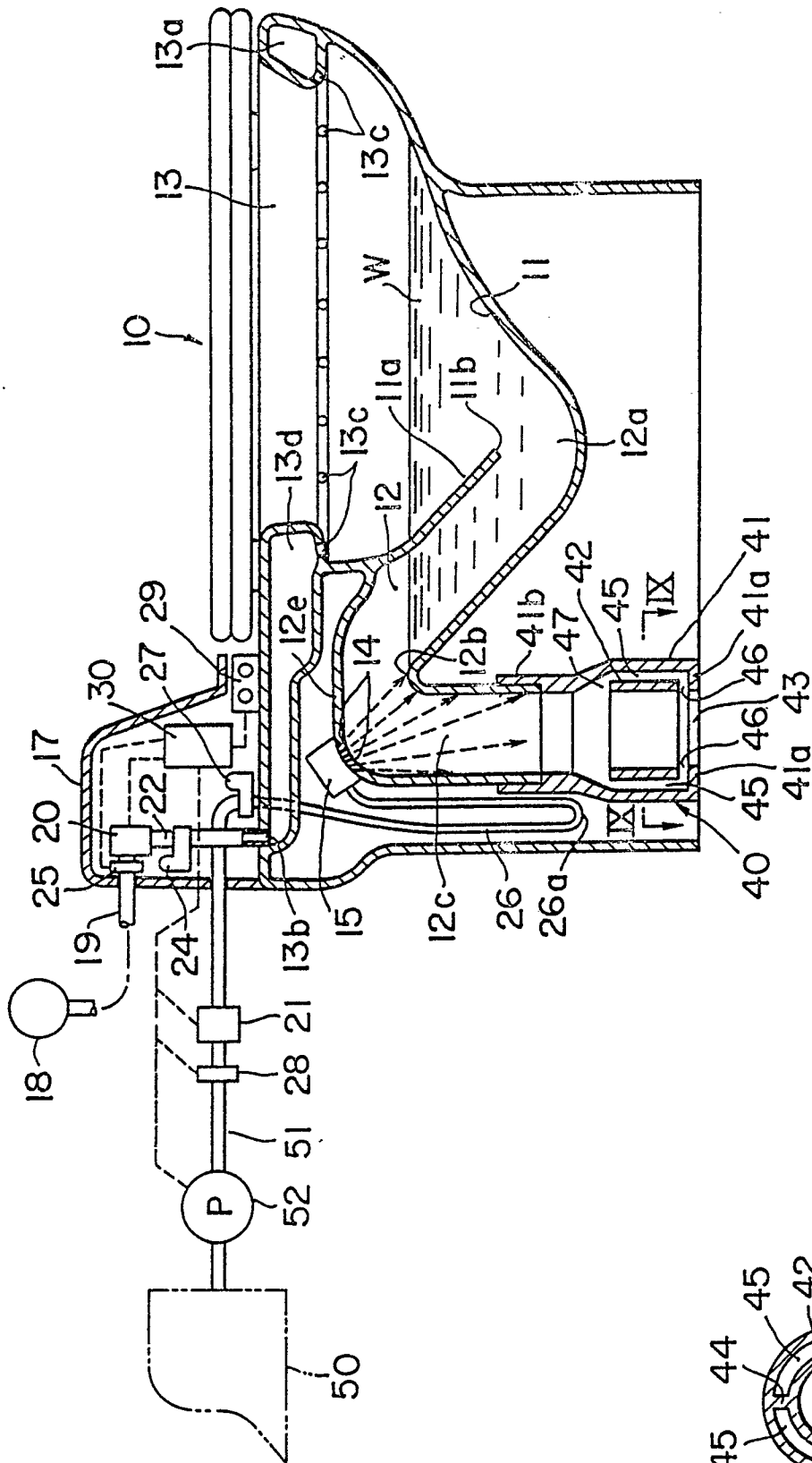


FIG. 8

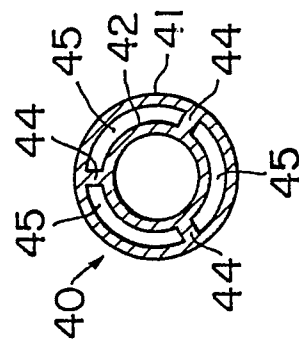


FIG. 9



DOCUMENTS CONSIDERED TO BE RELEVANT																	
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)														
X	US-A-3 224 013 (TUBBS) * Columns 2-3; figures 1,2,5 *	1-5,8, 13-18	E 03 D 5/10														
Y	---	6,7															
Y	FR-A-2 415 999 (LECAT) * Complete document *	6,7															

A	EP-A-0 228 908 (YOSHIDA) * Figures 9,10A,10B,11 *	9,10,11 ,12															

A	WO-A-8 505 649 (HAUPTMANN) * Page 2, line 16; claims 1,2 *	6,7															

A	FR-A-2 601 709 (FACT-ANAL) -----																
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)														
			E 03 D														
The present search report has been drawn up for all claims																	
Place of search THE HAGUE		Date of completion of the search 07-02-1990	Examiner HANNAART J.P.														
<table border="0"><tr><td>CATEGORY OF CITED DOCUMENTS</td><td></td></tr><tr><td>X : particularly relevant if taken alone</td><td>T : theory or principle underlying the invention</td></tr><tr><td>Y : particularly relevant if combined with another document of the same category</td><td>E : earlier patent document, but published on, or after the filing date</td></tr><tr><td>A : technological background</td><td>D : document cited in the application</td></tr><tr><td>O : non-written disclosure</td><td>L : document cited for other reasons</td></tr><tr><td>P : intermediate document</td><td>.....</td></tr><tr><td></td><td>& : member of the same patent family, corresponding document</td></tr></table>				CATEGORY OF CITED DOCUMENTS		X : particularly relevant if taken alone	T : theory or principle underlying the invention	Y : particularly relevant if combined with another document of the same category	E : earlier patent document, but published on, or after the filing date	A : technological background	D : document cited in the application	O : non-written disclosure	L : document cited for other reasons	P : intermediate document			& : member of the same patent family, corresponding document
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