[Name of Document] ABSTRACT

[Abstract]

[Object] To provide a flush toilet that can reduce splashing of flush water due to collision of flush water and that a user can use comfortably.

[Solution] A flush toilet according to the present invention includes a bowl unit including a waste receiving surface and a rim, a trapway, and flush water supply means. The waste receiving surface of the bowl unit includes an upper waste receiving surface and a recessed portion. The flush water supply means includes a pair of first nozzles that form a first flow of flush water directed from a front region of the upper waste receiving surface into the recessed portion, a second nozzle that forms a second flow of flush water directed from a back region of the upper waste receiving surface into the recessed portion, and a pair of third nozzles that form third flows of flush water directed from the left and right sides of the second nozzle into the recessed portion. The directions of the second nozzle and the third nozzles are set so that flush water ejected from the second nozzle and flush water ejected from the third nozzles flow from the back region of the upper waste receiving surface into the recessed portion.

[Selected Figure] Fig. 2

[Name of Document] CLAIMS

[Claim 1]

A flush toilet that cleans a toilet bowl and discharges waste using flush water supplied from a flush water supply source, the flush toilet comprising:

a bowl unit including a bowl-shaped waste receiving surface and a rim, the rim being formed along an upper edge of the waste receiving surface and having a rim water passage formed therein;

a trapway having an inlet connected to a lower part of the bowl unit and allowing waste to be discharged therethrough; and

flush water supply means for supplying flush water to the bowl unit,

wherein the waste receiving surface of the bowl unit includes an upper waste receiving surface connected to the rim and a recessed portion connected to the trapway from an inner side of the upper waste receiving surface,

wherein the flush water supply means includes

a pair of first nozzles respectively disposed at a left back part and a right back part of the bowl unit in the rim water passage, the first nozzles ejecting flush water into left and right parts of the rim water passage and guiding the flush water along the rim water passage to a front part of the bowl unit to form a first flow of flush

water directed from a front region of the upper waste receiving surface into the recessed portion,

a second nozzle disposed at a back part of the bowl unit at substantially a center in a left-right direction, the second nozzle ejecting flush water toward the recessed portion to form a second flow of flush water directed from a back region of the upper waste receiving surface into the recessed portion, and

a pair of third nozzles respectively disposed on a left side and a right side of the second nozzle at back parts of the bowl unit, the third nozzles ejecting flush water toward the recessed portion to form third flows of flush water directed from the left and right sides of the second nozzle into the recessed portion, and

wherein directions of the second nozzle and the third nozzles are set so that flush water ejected from the second nozzle and flush water ejected from the third nozzles flow from the back region of the upper waste receiving surface into the recessed portion.

[Claim 2]

The flush toilet according to Claim 1, wherein the front region of the upper waste receiving surface includes an inclined surface having an inclination angle in the range of 22.5 to 32.5 degrees so that the inclined surface

suppresses spreading of flush water in the left-right direction when the flush water flows downward.

[Claim 3]

The flush toilet according to Claim 1 or 2, wherein the recessed portion of the waste receiving surface of the bowl unit forms a pooled water surface having a predetermined area.

[Claim 4]

The flush toilet according to any one of Claims 1 to 3, wherein the flush water supply means includes a tank and an ejection unit, the tank stores flush water to be supplied and has a drain hole formed in a bottom surface thereof, and the ejection unit includes the first nozzles, the second nozzle, and the third nozzles for ejecting flush water supplied from the tank.

[Claim 5]

The flush toilet according to any one of Claims 1 to 4, wherein the rim of the bowl unit includes an upper edge portion and a vertical wall portion, the upper edge portion extending inward from the upper edge of the upper waste receiving surface in a horizontal direction, the vertical wall portion extending vertically downward from the upper edge portion, and wherein at least a back part of the vertical wall portion has such a height that the back part

covers an inner side of the ejection unit in the horizontal direction.

[Claim 6]

The flush toilet according to any one of Claims 1 to 5, wherein the second nozzle of the flush water supply means has a slit-like shape extending laterally, and each of the pair of third nozzles of the flush water supply means has two holes.

[Claim 7]

The flush toilet according to any one of Claims 1 to 6, wherein the flush toilet is a wash-down flush toilet.

Dated this 25th Day of September, 2014

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Applicant's Agent

FIG. 1

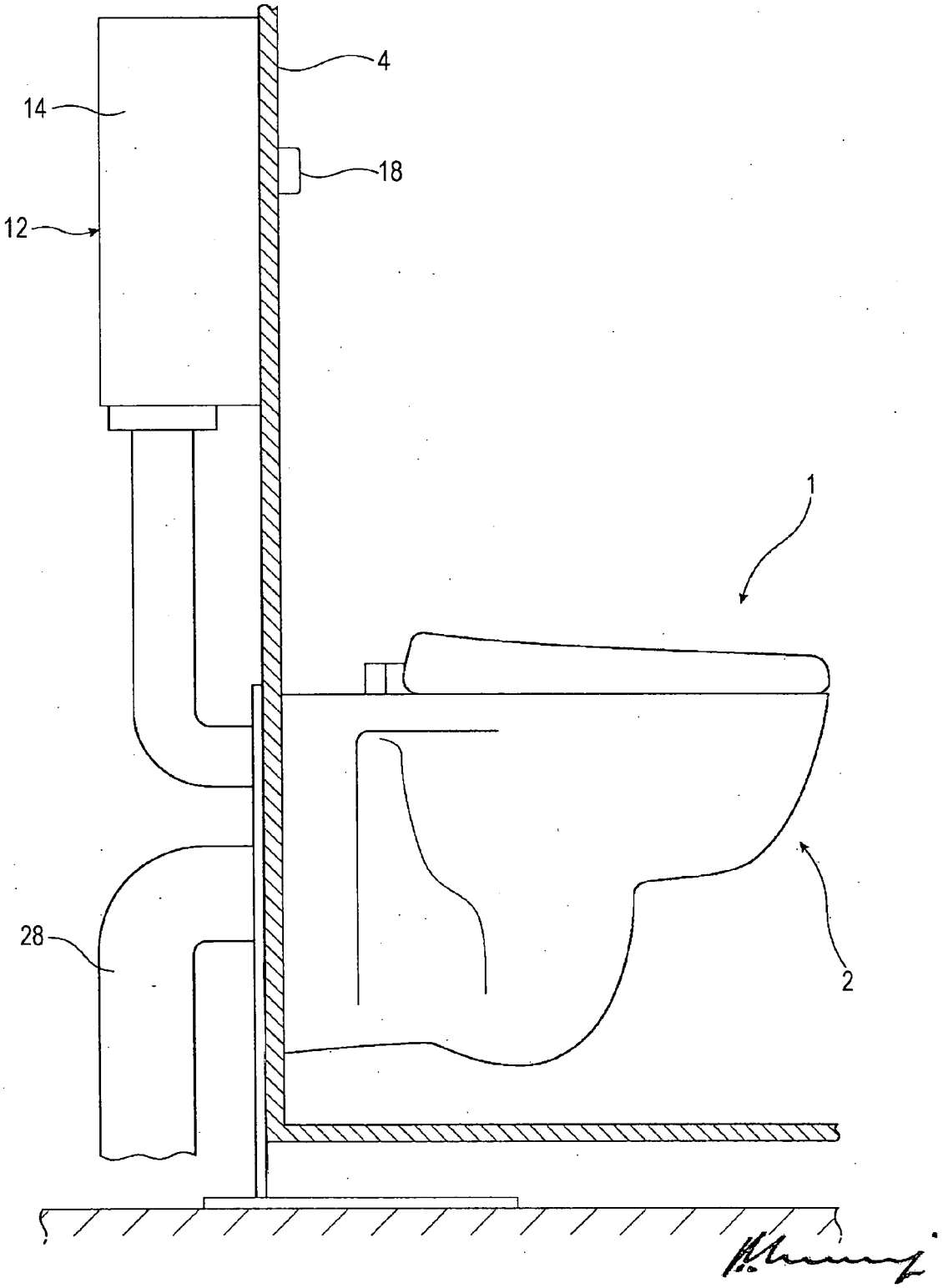

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FIG. 2

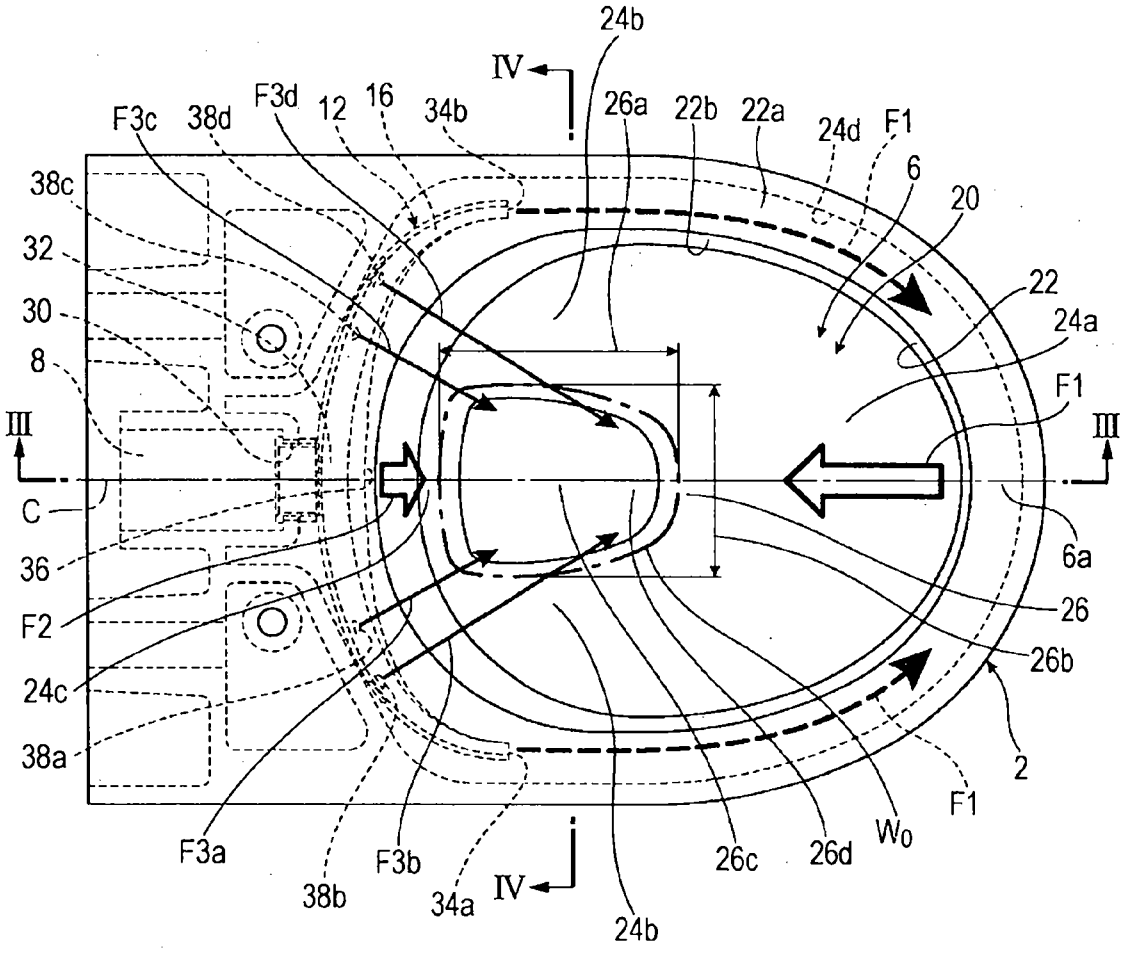

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FIG. 3

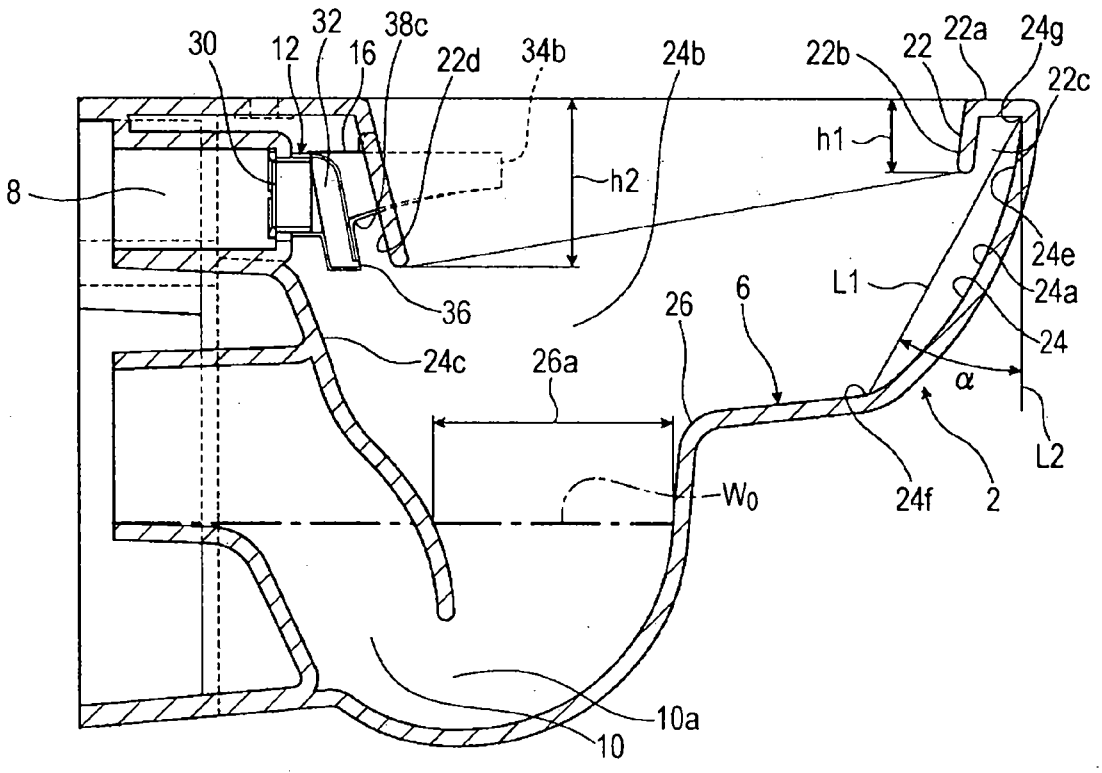

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FIG. 4

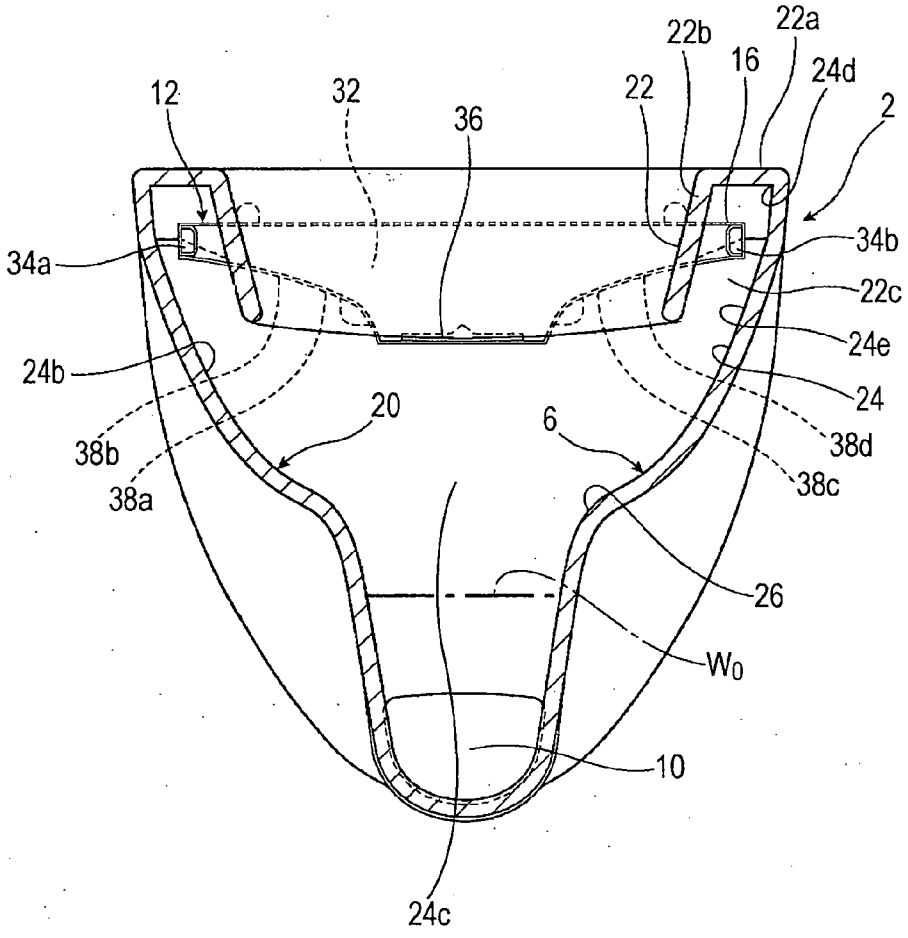

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FIG. 5

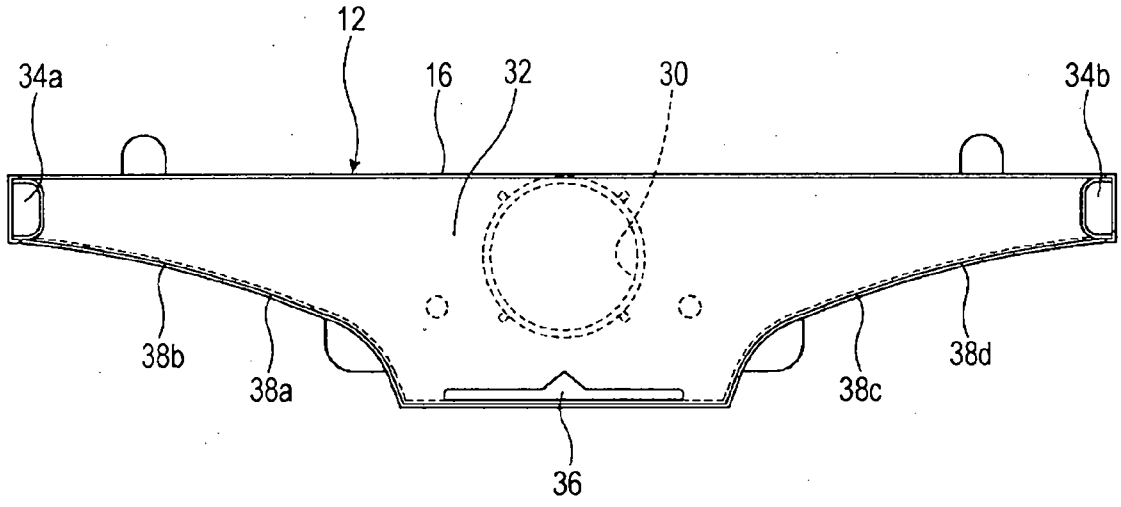

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FIG. 6

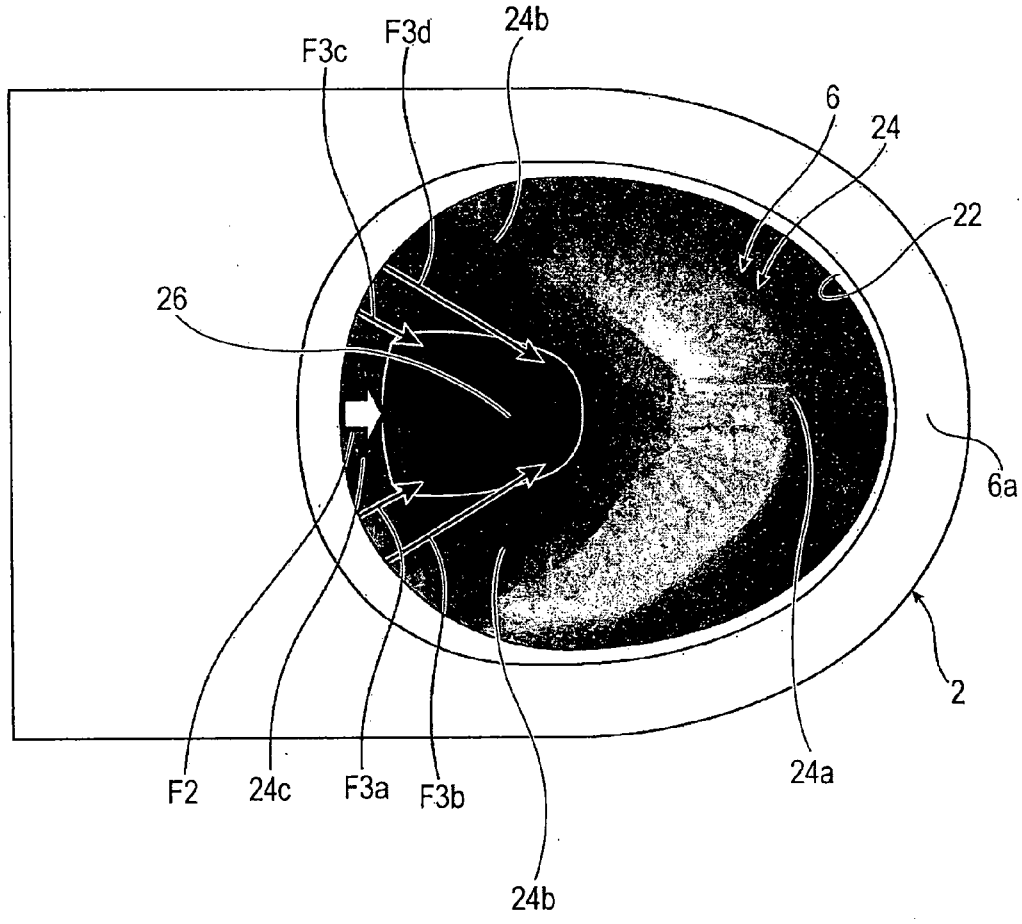

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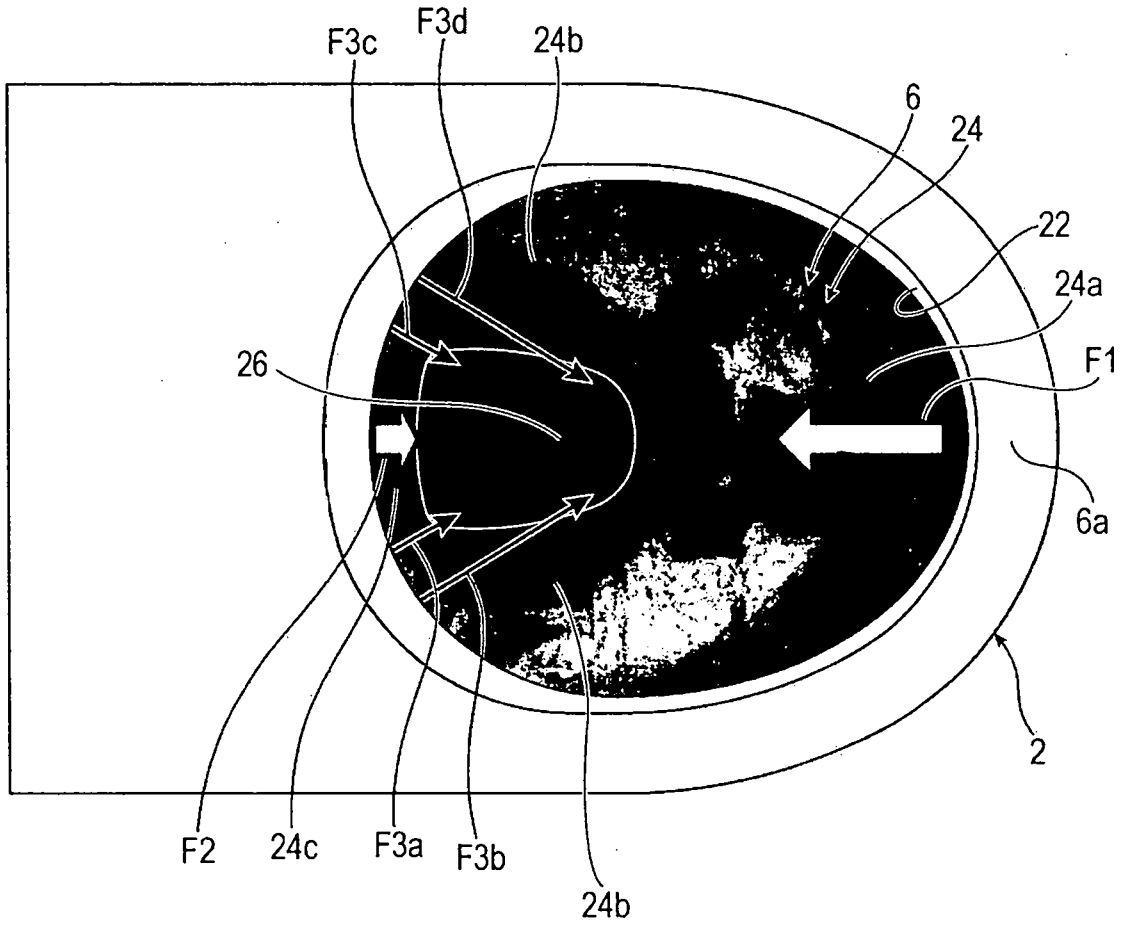
FIG. 7



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[Name of Document] DESCRIPTION

[Title of Invention] FLUSH TOILET

[Technical Field]

[0001]

The present invention relates to a flush toilet, and, in particular, to a wash-down flush toilet or the like, which cleans a toilet bowl and discharges waste using flush water supplied from a flush water supply source.

[Background Art]

[0002]

For example, as disclosed in Patent Document 1, some flush toilets known to date include a water supply pipe that branches into left and right branch pipes, each having a discharge hole and a diversion hole. Flush water is ejected from the discharge holes and the diversion holes so as to form a plurality of flows of flush water in different directions. Thus, the ability of the flush toilet to clean a bowl unit is improved by combining currents and swirl flows.

[Citation List]

[Patent Literature]

[0003]

[PTL 1] Japanese Unexamined Patent Application Publication No. 8-120740

[Summary of Invention]

[Technical Problem]

[0004]

However, in the flush toilet described in Patent Document 1, opposing currents are generated on an inner peripheral surface of a bowl and two opposing swirl flows in forward and backward directions are generated so as to cross these currents. Therefore, the flush toilet has a problem in that the currents and the swirl flows of flush water collide with each other on the inner peripheral surface and the flush water is splashed on a user, and the user feels discomfort.

[0005]

An object the present invention, which has been devised in order to solve the problem of existing technologies described above, is to provide a flush toilet that can suppress splashing of flush water due to collision of flush water and that a user can use comfortably.

[Solution to Problem]

[0006]

To achieve the object, a flush toilet according to the present invention, which cleans a toilet bowl and discharges waste using flush water supplied from a flush water supply source, includes a bowl unit including a bowl-shaped waste receiving surface and a rim, the rim being formed along an upper edge of the waste receiving surface and having a rim

water passage formed therein; a trapway having an inlet connected to a lower part of the bowl unit and allowing waste to be discharged therethrough; and flush water supply means for supplying flush water to the bowl unit. The waste receiving surface of the bowl unit includes an upper waste receiving surface connected to the rim and a recessed portion connected to the trapway from an inner side of the upper waste receiving surface. The flush water supply means includes a pair of first nozzles respectively disposed at a left back part and a right back part of the bowl unit in the rim water passage, the first nozzles ejecting flush water into left and right parts of the rim water passage and guiding the flush water along the rim water passage to a front part of the bowl unit to form a first flow of flush water directed from a front region of the upper waste receiving surface into the recessed portion; a second nozzle disposed at a back part of the bowl unit at substantially a center in a left-right direction, the second nozzle ejecting flush water toward the recessed portion to form a second flow of flush water directed from a back region of the upper waste receiving surface into the recessed portion; and a pair of third nozzles respectively disposed on a left side and a right side of the second nozzle at back parts of the bowl unit, the third nozzles ejecting flush water toward the recessed portion to form third flows of flush water directed

from the left and right sides of the second nozzle into the recessed portion. Directions of the second nozzle and the third nozzles are set so that flush water ejected from the second nozzle and flush water ejected from the third nozzles flow from the back region of the upper waste receiving surface into the recessed portion.

According to the present invention, the second nozzle generates the second flow of flush water, which is directed from the back region of the upper waste receiving surface into the recessed portion; the third nozzles generate the third flows of flush water, which are directed from the left and right sides of the second nozzle into the recessed portion; and the first nozzles generate the first flow of flush water, which is directed from the front region of the upper waste receiving surface into the recessed portion. Therefore, it is possible to suppress collision between flush water ejected from the second and third nozzles and flush water ejected from the first nozzles in the front region of the upper waste receiving surface. Accordingly, with the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[0007]

In the present invention, preferably, the front region of the upper waste receiving surface includes an inclined

surface having an inclination angle in the range of 22.5 to 32.5 degrees so that the inclined surface suppresses spreading of flush water in the left-right direction when the flush water flows downward.

In this case, it is possible to suppress spreading of flush water ejected from the first nozzles in the left-right direction in the front region of the upper waste receiving surface, and therefore the flush water can smoothly flow from the front region of the upper waste receiving surface into the recessed portion. Thus, with the present invention, it is possible to suppress collision between flush water ejected from the second nozzle and the third nozzles and flush water ejected from the first nozzles in the front region of the upper waste receiving surface. As a result, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[0008]

In the present invention, preferably, the recessed portion of the waste receiving surface of the bowl unit forms a pooled water surface having a predetermined area.

In this case, because the recessed portion forms a pooled water surface having a predetermined area, flush water ejected from the second nozzle can easily flow from the back region of the upper waste receiving surface into

the recessed portion. Moreover, flush water ejected from the third nozzles can easily flow from the left and right sides of the second nozzle into the recessed portion, and flush water ejected from the first nozzles can easily flow from the front region of the upper waste receiving surface into the recessed portion. Thus, it is possible to efficiently suppress collision between flush water ejected from the second and third nozzles and flush water ejected from the first nozzles in the front region of the upper waste receiving surface. Accordingly, with the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[0009]

In the present invention, preferably, the flush water supply means includes a tank and an ejection unit, the tank stores flush water to be supplied and has a drain hole formed in a bottom surface thereof, and the ejection unit includes the first nozzles, the second nozzle, and the third nozzles for ejecting flush water supplied from the tank.

In this case, by means of the ejection unit, it is possible to correctly set the directions of the first nozzles, the second nozzle, and the third nozzles. Thus, it is possible to suppress variations in the direction of the first flow of flush water ejected from the first nozzles,

the direction of the second flow of flush water ejected from the second nozzle, and the direction of the third flows of flush water ejected from the third nozzles. Accordingly, with the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[0010]

In the present invention, preferably, the rim of the bowl unit includes an upper edge portion and a vertical wall portion, the upper edge portion extending inward from the upper edge of the upper waste receiving surface in a horizontal direction, the vertical wall portion extending vertically downward from the upper edge portion; and at least a back part of the vertical wall portion has such a height that the back part covers an inner side of the ejection unit in the horizontal direction.

In this case, even if a part of flush water is ejected inward from the ejection unit in the horizontal direction, it is possible to cause the flush water to collide with the vertical wall portion to change the direction and guide the flush water toward the recessed portion. Accordingly, with the present invention, splashing of flush water can be suppressed.

[0011]

In the present invention, preferably, the second nozzle of the flush water supply means has a slit-like shape extending laterally, and each of the pair of third nozzles of the flush water supply means has two holes.

In this case, the second nozzle, which has a laterally elongated slit-like shape, forms the second flow of flush water directed from the back region of the upper waste receiving surface into the recessed portion. The third nozzles, which have two holes disposed on each of the left and right sides of the second nozzle, form the third flows of flush water directed from the left and right sides of the second nozzle into the recessed portion. The first nozzles form the first flow of flush water directed from the front region of the upper waste receiving surface into the recessed portion. Thus, for example, as compared with a case where the third nozzles include only a single nozzle disposed on each of the left and right sides of the second nozzle, it is possible to eject linear flows of flush water from two holes disposed on each of the left and right sides while suppressing spreading of the flush water in the left-right direction in the back region of the upper waste receiving surface. As a result, it is possible to suppress collision between flush water ejected from the third nozzles and flush water ejected from the first nozzles in the front region of the upper waste receiving surface. Accordingly,

with the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[0012]

In the present invention, preferably, the flush toilet is a wash-down flush toilet.

In this case, in a wash-down flush toilet, which discharges waste by using gravity acting on flush water in the bowl unit, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet comfortably.

[Advantageous Effects of Invention]

[0013]

The flush toilet according to the present invention can suppress splashing of flush water due to collision of flush water, and therefore a user can use the flush toilet comfortably.

[Brief Description of Drawings]

[0014]

[Fig. 1] Fig. 1 is a schematic view illustrating a flush toilet according to an embodiment of the present invention and the inside of a wall on which the flush toilet is mounted.

[Fig. 2] Fig. 2 is a plan view of the flush toilet according to the embodiment of the present invention.

[Fig. 3] Fig. 3 is cross-sectional view taken along line III-III of Fig. 2.

[Fig. 4] Fig. 4 is cross-sectional view taken along line IV-IV of Fig. 2.

[Fig. 5] Fig. 5 is a front view illustrating an ejection unit of the flush toilet according to the embodiment of the present invention.

[Fig. 6] Fig. 6 illustrates a second main flow F2 and third main flows F3a, F3b, F3c, and F3d that flow into a recessed portion of the flush toilet according to the embodiment of the present invention immediately after a flushing operation is started.

[Fig. 7] Fig. 7 illustrates a first main flow F1 that flows into the recessed portion of the flush toilet according to the embodiment of the present invention while the second main flow F2 and the third main flows F3a, F3b, F3c, and F3d flow into the recessed portion when a flushing operation is being performed.

[Description of Embodiments]

[0015]

Hereinafter, the structure of a flush toilet according an embodiment of the present invention will be described with reference to the drawings.

Fig. 1 is a schematic view illustrating a flush toilet according to an embodiment of the present invention and the

inside of a wall on which the flush toilet is mounted. Fig. 2 is a plan view of the flush toilet according to the embodiment of the present invention. Fig. 3 is cross-sectional view taken along line III-III of Fig. 2. Fig. 4 is cross-sectional view taken along line IV-IV of Fig. 2.

[0016]

As illustrated in Figs. 1 to 4, a flush toilet 1 is a so-called wash-down flush toilet, which disposes of waste by using flow of flush water generated by gravity in a bowl unit. The flush toilet 1, which is a so-called wall-mount flush toilet, includes a toilet body 2 that is made of a ceramic and attached to the front side of a wall 4. The toilet body 2 includes a bowl unit 6 formed in an upper front part thereof; a flush water channel 8 formed in an upper back part thereof, and a trapway 10 formed below the flush water channel 8. The trapway 10 has an inlet connected to the bowl unit 6. The toilet body 2 may be made of a resin instead of a ceramic.

[0017]

The flush toilet 1 further includes flush water supply means 12 for supplying flush water to the bowl unit. The flush water supply means 12 includes a flush water tank 14 and an ejection unit 16. The flush water tank 14 stores flush water to be discharged to a toilet bowl. The ejection

unit 16 ejects flush water, which is discharged from the flush water tank 14, into the toilet body 2.

The flush water supply means 12, which supplies flush water to the bowl unit 6, is not limited to flush water supply means using the flush water tank 14, which is a gravity-flow water tank, as in the present embodiment. Alternatively, flush water supply means that uses the pressure of running water or flush water supply means that includes a pump for increasing pressure may be used.

[0018]

The flush water tank 14 is attached to the back side of the wall 4, which is opposite to the front side to which the toilet body 2 is attached. The flush water tank 14 includes a controller (not shown) for controlling the flush water tank 14 and a discharge valve (not shown) for opening/closing a discharge hole (not shown) formed in the bottom surface of the flush water tank 14. When a user presses an operation button 18 attached to the wall 4, the controller (not shown) opens the discharge valve (not shown) to supply flush water to the flush water channel 8 of the toilet body 2. The flush water tank 14 is capable of supplying flush water in the amounts of, for example, 6 liters when disposing of solid waste and 3 liters when disposing of liquid waste.

The ejection unit 16 ejects flush water supplied from the flush water channel 8 of the toilet body 2 onto the bowl unit 6 of the toilet body 2 as described below.

[0019]

The bowl unit 6 includes a waste receiving surface 20 and a rim 22, which is formed along the entire upper edge of the bowl unit 6.

The waste receiving surface 20 includes an upper waste receiving surface 24, which is connected to the rim 22, and a recessed portion 26, which is connected from an inner side of the upper waste receiving surface 24 to the trapway 10 below. An inlet 10a of the trapway 10 (described above) is located below the recessed portion 26. An outlet of the trapway 10 is connected to a drain pipe 28 disposed on the back side of the wall 4 via a drain socket (not shown).

[0020]

The upper waste receiving surface 24 of the waste receiving surface 20 includes a front region 24a in a front part thereof, side regions 24b in side parts thereof, and a back region 24c in a back part thereof.

The recessed portion 26 of the waste receiving surface 20 is formed so that the cross-sectional area of a passage formed therein gradually decreases from an inner side of the upper waste receiving surface 24 to the trapway 10 below.

The recessed portion 26 serves to pool flush water, and flush water pooled in the bowl unit 6 forms a pooled water surface W_0 in the recessed portion 26. From positions above the pooled water surface W_0 of the recessed portion 26, flush water is ejected from first nozzles, a second nozzle, and third nozzles (described below). Then, the flush water flows into the recessed portion 26, and the flush water is discharged together with waste while the flush water is churned in the recessed portion 26.

[0021]

The pooled water surface W_0 in the recessed portion 26 has a comparatively large area so that the lines of flows of flush water ejected from a second nozzle 36 (described below) and third nozzles 38a, 38b, 38c, and 38d (described below) pass through the pooled water surface W_0. To be more specific, the recessed portion 26 has a longitudinal side 26a having a length in the range of 120 to 140 mm in the front-back direction and a lateral side 26b having a length in the range of 95 to 115 mm in the left-right direction. The area of the pooled water surface W_0 of the recessed portion 26 is approximately equal to (the length of the longitudinal side 26a) x (the length of the lateral side 26b). The recessed portion 26 has an opening having such an area that the lines of flows of flush water ejected from the

second nozzle 36 and the third nozzles 38a, 38b, 38c, and 38d (described below) pass through the opening.

[0022]

The rim 22 includes an upper edge portion 22a and a vertical wall portion 22b. The upper edge portion 22a is formed above the upper waste receiving surface 24 so as to extend inward from an upper edge 24d of the upper waste receiving surface 24 in the horizontal direction. The vertical wall portion 22b extends downward from the inner side edge of the upper edge portion 22a. A rim water passage 22c is formed in a space surrounded by the upper waste receiving surface 24, the upper edge portion 22a, and the vertical wall portion 22b. The rim water passage 22c is formed on the back side of the vertical wall portion 22b so as to extend along an inner peripheral surface 24e of an upper part of the upper waste receiving surface 24.

At least a back part of the vertical wall portion 22b has such a height that the back part covers the front side of the ejection unit 16. To be more specific, a front part of the vertical wall has a height h1. The height of the vertical wall increases gradually from the front part toward the back part. The back part of the vertical wall has a height h2. The vertical wall portion 22b has such a height that the vertical wall portion 22b covers inner sides of the nozzles of the ejection unit 16 in the horizontal direction.

[0023]

Next, referring to Figs. 2 to 5, the ejection unit 16 (mentioned above) will be described in detail.

Fig. 5 is a front view illustrating an ejection unit of the flush toilet according to the embodiment of the present invention.

[0024]

The ejection unit 16 includes an inlet portion 30; a distribution channel 32; first nozzles 34a and 34b; the second nozzle 36; and the third nozzles 38a, 38b, 38c, and 38d. The inlet portion 30 is connected to the flush water channel 8. The distribution channel 32 distributes flush water, which has flowed into the inlet portion 30, to each nozzle. The first nozzles 34a and 34b are respectively disposed in the rim water passage 22c at a left back part and a right back part of the bowl unit 6 and eject flush water into left and right parts of the rim water passage 22c. The second nozzle 36 is disposed at substantially the center of a back part of the bowl unit 6 in the left-right direction and ejects flush water toward the recessed portion 26. The third nozzles 38a, 38b, 38c, and 38d are disposed on the left and right sides of the second nozzle 36 at back parts of the bowl unit 6 and eject flush water toward the recessed portion 26.

[0025]

The first nozzles 34a and 34b, which are disposed in the rim water passage 22c at the left back part and the right back part of the bowl unit 6, eject flush water toward the front side of the toilet body 2. The distribution channel 32 has a cross-sectional area that gradually decreases toward the first nozzles 34a and 34b and has openings in the first nozzles 34a and 34b that face forward in the toilet bowl. Therefore, the first nozzles 34a and 34b can eject flush water in the forward direction at a comparatively high flow rate.

[0026]

The second nozzle 36 has a rectangular slit-like shape extending laterally and is disposed so as to face forward in the toilet body 2.

The third nozzles 38a, 38b, 38c, and 38d each has two holes disposed on the left and right sides of the second nozzle 36 so as to face the inside of the recessed portion 26.

The third nozzle 38a is disposed at a left back part of the bowl unit 6 so as to be separated by a certain distance from the center line C of the toilet body 2. The third nozzle 38b is disposed outside of the third nozzle 38a so as to be separated by a certain distance from the third nozzle 38a. The third nozzle 38c is disposed at a right back part of the bowl unit 6 so as to be separated by a certain

distance from the center line C of the toilet body 2. The third nozzle 38d is disposed outside of the third nozzle 38c so as to be separated by a certain distance from the third nozzle 38c. The third nozzle 38a and the third nozzle 38c are disposed at positions that are symmetric about the center line C. The third nozzle 38b and the third nozzle 38d are disposed at positions that are symmetric about the center line C.

The third nozzle 38a and the third nozzle 38b may be integrated into a single third nozzle, and the single third nozzle on the left side may form a third main flow that flows into the recessed portion 26 substantially linearly. The third nozzle 38c and the third nozzle 38d may be integrated into a single third nozzle, and the single third nozzle on the right side may form a third main flow that flows into the recessed portion 26 substantially linearly. In other words, the number of third nozzles on each of the left and right sides may be any appropriate number that is greater than or equal to one.

[0027]

The front region 24a of the upper waste receiving surface 24 forms an inclination angle α in the range of 22.5 to 32.5 degrees. Due to the inclination angle α of the front region 24a, spreading of flush water in the left-right

direction when the flush water flows downward can be suppressed.

As illustrated in Fig. 3, the inclination angle α of the front region 24a is defined as an angle between a line L1 and a line L2. The line L1 is a line connecting the upper front edge 24g of the front region 24a to a lower portion 24f of the front region 24a. The line L2 is a line extending vertically downward from the upper front edge 24g of the front region 24a. The inclination angle α of the inclined surface of the front region 24a of the upper waste receiving surface 24 is set to be in the range of 22.5 to 32.5 degrees, which is a comparatively acute angle, for the following reason. By doing so, after flush water ejected from the first nozzle 34a on the left side and flush water ejected from the first nozzle 34b on the right side have collided with each other in the front region 24a of the upper waste receiving surface 24, spreading of the flush water in the left-right direction on the front region 24a can be suppressed. Therefore, the flush water can flow straightly downstream along the inclined surface of the front region 24a and can linearly flow from the front region 24a into the recessed portion 26.

[0028]

Next, referring to Figs. 1 to 8, the operation (and the effect) of a flush toilet according to the embodiment of the present invention will be described.

Fig. 6 illustrates a second main flow F2 and third main flows F3a, F3b, F3c, and F3d that flow into the recessed portion of the flush toilet according to the embodiment of the present invention immediately after a flushing operation is started. Fig. 7 illustrates a first main flow F1 that flows into the recessed portion of the flush toilet according to the embodiment of the present invention while the second main flow F2 and the third main flows F3a, F3b, F3c, and F3d flow into the recessed portion when a flushing operation is being performed.

In Figs. 6 and 7, the direction of a first main flow (first flow) of flush water ejected from the first nozzles 34a and 34b is indicated by an arrow F1; the direction of a second main flow (second flow) of flush water ejected from the second nozzle 36 is indicated by an arrow F2; and the directions of third main flows (third flows) of flush water ejected from the third nozzles 38a, 38b, 38c, and 38d are respectively indicated by arrows F3a, F3b, F3c, and F3d.

[0029]

First, when a user presses the operation button 18 to start a flushing operation, a discharge valve (not shown) of the flush water tank 14 is opened, and flush water in the

flush water tank 14 flows into the flush water channel 8 of the toilet body 2. The flush water flows through the flush water channel 8 and flows into the distribution channel 32 through the inlet portion 30 of the ejection unit 16. Then, the flush water is ejected into the bowl unit 6 from each of the first nozzles 34a and 34b, the second nozzle 36, and the third nozzles 38a, 38b, 38c, and 38d.

[0030]

Flush water ejected from the first nozzles 34a and 34b forms branches of the first main flow F1, which flow forward in the bowl unit along the left and right parts of the rim water passage 22c. Part of flush water ejected from the first nozzles 34a and 34b flows downward to the side regions 24b of the upper waste receiving surface 24 and flows into the recessed portion 26 before reaching a front end portion 6a of the bowl unit 6.

Flush water ejected from the second nozzle 36 forms the second main flow F2, which flows linearly forward over the back region 24c.

Flush water ejected from the third nozzles 38a, 38b, 38c, and 38d forms third main flows F3a, F3b, F3c, and F3d, which pass through left and right sides of the back region 24c and/or the back sides of the side regions 24b and flow linearly toward the recessed portion 26 in directions diagonally forward relative to the center line C.

[0031]

The branches of the first main flow F1, which have been ejected from the first nozzles 34a and 34b, collide with each other from the left and right sides in the front end portion 6a of the bowl unit 6. As a result, the direction of the flows are changed so as to form a backward flow from the front region 24a of the upper waste receiving surface 24 into the recessed portion 26, and the flush water flows into the pooled water surface W_0 in the recessed portion 26.

Accordingly, the first main flow F1 ejected from the first nozzles 34a and 34b mainly flows backward in the front region 24a and mainly cleans the front region 24a.

[0032]

Spreading of the first main flow F1, whose branches have collided with each other in the front end portion 6a of the bowl unit 6, outward in the left-right direction is suppressed by the front region 24a, which has the predetermined inclination angle α. The first main flow F1 flows in the front region 24a along the center line C toward the recessed portion 26.

Accordingly, the first main flow F1 flows into the recessed portion 26 from a comparatively central part of the front region 24a. Therefore, in the front region 24a, it is possible to suppress collision between the first main flow F1 and the second main flow F2 ejected from the second

nozzle 36 and collision between the first main flow F1 and the third main flows F3a, F3b, F3c, and F3d ejected from the third nozzles 38a, 38b, 38c, and 38d.

[0033]

The second main flow F2 of flush water ejected from the second nozzle 36 flows forward over the back region 24c and flows into the pooled water surface W_0 of the recessed portion 26 from the back of the recessed portion 26.

For example, when a part of flush water is ejected from the second nozzle 36 toward an upper front space, the part of flush water collides with a back surface 22d of the vertical wall portion 22b, falls onto the back region 24c, and flows into the recessed portion 26. Accordingly, it is possible to suppress splashing of flush water that may occur when a part of flush water ejected forward from the second nozzle 36 collides with another part of flush water.

[0034]

The third main flow F3a of flush water ejected from the third nozzle 38a is a flow that flows substantially linearly into a central region 26c of the recessed portion 26 from the left back inner side of the toilet body 2. The third main flow F3b ejected from the third nozzle 38b is a flow that flows substantially linearly into a front region 26d of the recessed portion 26 from the left back outer side of the toilet body 2. The third main flow F3c ejected from the

third nozzle 38c is a flow that flows substantially linearly into the central region 26c of the recessed portion 26 from the right back inner side of the toilet body 2. The third main flow F3d ejected from the third nozzle 38d is a flow that flows substantially linearly into the front region 26d of the recessed portion 26 from the right back outer side of the toilet body 2. Accordingly, the main flows of flush water ejected from the third nozzles 38a, 38b, 38c, and 38d clean mainly the side regions 24b and the back region 24c.

Because the third nozzles 38a, 38b, 38c, and 38d include two nozzles (two holes) disposed on each of the left and right sides, the waste receiving surface can be sufficiently cleaned. As compared with a case where, for example, the third nozzles include only a single hole disposed on each of the left and right sides the second nozzle, spreading components of flow in the left-right direction and in the front-back direction can be suppressed, and therefore flows that flow linearly toward the recessed portion 26 can be formed.

[0035]

The longitudinal side 26a of the recessed portion 26 in the front-back direction is comparatively long, and the lateral side 26b in the width direction is comparative long. As a result, the area of the opening of the recessed portion 26 (pooled water surface) is comparatively large.

Accordingly, the third main flow F3a of flush water can easily flow into the recessed portion 26, and the third main flow F3c of flush water can easily flow into the recessed portion 26. The third main flow F3b of flush water can easily flow into the recessed portion 26, and the third main flow F3d of flush water can easily flow into the recessed portion 26. Accordingly, flowing of flush water ejected from the third nozzle 38a and the third nozzle 38b, which is disposed so as to be separated outward from the third nozzle 38a by a predetermined distance, into the front region 24a can be suppressed. Moreover, flowing of flush water ejected from the third nozzle 38c and the third nozzle 38d, which is disposed so as to be separated outward from the third nozzle 38c by a predetermined distance, into the front region 24a can be suppressed. Furthermore, the four third main flows F3a, F3b, F3c, and F3d can flow into the recessed portion 26 while cleaning a comparatively large region. After entering the recessed portion 26, the main flows F1, F2, F3a, F3b, F3c, and F3d flow downward to the pooled water surface W_0 along a comparatively steep slope of the recessed portion 26.

[0036]

The first main flow F1 of flush water flows backward mainly in the front region 24a, the third main flows F3a, F3b, F3c, and F3d of flush water flow forward mainly in the

side regions 24b and the back region 24c, and the second main flow F2 of flush water flows forward mainly in the back region 24c.

Accordingly, the entirety of the waste receiving surface 20 of the bowl unit 6 (the front region 24a, the side regions 24b, and the back region 24c) can be efficiently cleaned with the first main flow F1, the second main flow F2, and the third main flows F3a, F3b, F3c, and F3d. At this time, on the front region 24a, direct collision between the second and third main flows F2, F3a, F3b, F3c, and F3d of flush water, which are directed forward, and the first main flow F1 of flush water, which is directed backward, is suppressed.

Collision between the first main flow F1 of flush water, the second main flow F2 of flush water, and the third main flows F3a, F3b, F3c, and F3d of flush water occurs while these flows are flowing downward in the recessed portion 26. Therefore, the occurrence of splashing of flush water on a user due to collision between flows of flush water on the upper waste receiving surface 24 can be reduced.

[0037]

Thus, flush water ejected from the first nozzles 34a and 34b, flush water ejected from the second nozzle 36, and flush water ejected from the third nozzles 38a, 38b, 38c,

and 38d flow downward into the recessed portion 26 without colliding with each other while smoothly flowing over the waste receiving surface 20 and sufficiently cleaning the waste receiving surface.

These flows generate a flow that effectively discharges waste through the inlet 10a of the trapway 10 below the recessed portion 26. When flush water discharges the waste from the trapway 10 and flush water in the flush water tank 14 is discharged by a certain amount, a device (not shown) disposed in the flush water tank 14 finishes the discharging operation and performs an operation of supplying flush water to the flush water tank 14. Thus, the series of flushing operations is finished.

[0038]

With the flush toilet 1 according to the embodiment of the present invention, the second nozzle 36 generates the second main flow F2 of flush water, which is directed from the back region 24c of the upper waste receiving surface 24 into the recessed portion 26; the third nozzles 38a, 38b, 38c, and 38d generate the third main flows F3a, F3b, F3c, and F3d of flush water, which are directed from the left and right sides of the second nozzle 36 into the recessed portion 26; and the first nozzles 34a and 34b generate the first main flow F1 of flush water, which is directed from the front region 24a of the upper waste receiving surface 24

into the recessed portion 26. Therefore, it is possible to suppress collision between flush water ejected from the second and third nozzles 36, 38a, 38b, 38c, and 38d and flush water ejected from the first nozzles 34a and 34b in the front region 24a of the upper waste receiving surface 24. Accordingly, with the flush toilet 1 according to the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet 1 comfortably.

[0039]

With the flush toilet 1 according to the embodiment of the present invention, it is possible to suppress spreading of flush water, which is ejected from the first nozzles 34a and 34b, in the left-right direction in the front region 24a of the upper waste receiving surface 24, and therefore the flush water can smoothly flow from the front region 24a of the upper waste receiving surface 24 into the recessed portion 26. Thus, with the flush toilet 1 according to the present invention, it is possible to suppress collision between flush water ejected from the second and third nozzles 36, 38a, 38b, 38c, and 38d and flush water ejected from the first nozzles 34a and 34b in the front region 24a of the upper waste receiving surface 24. As a result, splashing of flush water due to collision of flush water can

be suppressed, and a user can use the flush toilet 1 comfortably.

[0040]

With the flush toilet 1 according to the embodiment of the present invention, because the recessed portion 26 forms a pooled water surface W_0 having a predetermined area, flush water ejected from the second nozzle 36 can easily flow from the back region 24c of the upper waste receiving surface 24 into the recessed portion 26. Moreover, flush water ejected from the third nozzles 38a, 38b, 38c, and 38d can easily flow from the left and right sides of the second nozzle 36 into the recessed portion 26, and flush water ejected from the first nozzles 34a and 34b can easily flow from the front region 24a of the upper waste receiving surface 24 into the recessed portion 26. Thus, it is possible to efficiently suppress collision between flush water ejected from the second and third nozzles 36, 38a, 38b, 38c, and 38d and flush water ejected from the first nozzles 34a and 34b in the front region 24a of the upper waste receiving surface 24. Accordingly, with the flush toilet 1 according to the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet 1 comfortably.

[0041]

With the flush toilet 1 according to the embodiment of the present invention, by means of the ejection unit 16, it is possible to correctly set the directions of the first nozzles 34a and 34b, the second nozzle 36, and the third nozzles 38a, 38b, 38c, and 38d. Thus, it is possible to suppress variations in the direction of flows of flush water ejected from the first nozzles 34a and 34b, the direction of flush water ejected from the second nozzle 36, and the direction of flush water ejected from the third nozzles 38a, 38b, 38c, and 38d. Accordingly, with the flush toilet 1 according to the present invention, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet 1 comfortably.

[0042]

With the flush toilet 1 according to the embodiment of the present invention, even if a part of flush water is ejected inward from the ejection unit 16 in the horizontal direction, it is possible to cause the flush water to collide with the vertical wall portion 22b to change the direction and guide the flush water toward the recessed portion 26. Accordingly, the flush toilet 1 according to the present invention can suppress splashing of flush water.

[0043]

With the flush toilet 1 according to the embodiment of the present invention, the second nozzle 36, which has a

laterally elongated slit-like shape, forms the second main flow F2 of flush water directed from the back region 24c of the upper waste receiving surface 24 into the recessed portion 26. The third nozzles 38a, 38b, 38c, and 38d, which are disposed on the left and right sides of the second nozzle 36, form the third main flows F3a, F3b, F3c, and F3d of flush water directed from the left and right sides of the second nozzle 36 into the recessed portion 26. The first nozzles 34a and 34b form the first main flow F1 of flush water directed from the front region 24a of the upper waste receiving surface 24 into the recessed portion 26. Thus, for example, as compared with a case where the third nozzles include only a single hole disposed on each of the left and right sides of the second nozzle, it is possible to eject linear flows of flush water from two holes disposed on each of the left and right sides while suppressing spreading of the flush water in the left-right direction in the back region 24c of the upper waste receiving surface 24. As a result, it is possible to suppress collision between flush water ejected from the third nozzles 38a, 38b, 38c, and 38d and flush water ejected from the first nozzles 34a and 34b in the front region 24a of the upper waste receiving surface 24. Accordingly, with the flush toilet 1 according to the present invention, splashing of flush water due to collision

of flush water can be suppressed, and a user can use the flush toilet 1 comfortably.

[0044]

With the wash-down flush toilet 1 according to the embodiment of the present invention, which discharges waste by using gravity acting on flush water in the bowl unit 6, splashing of flush water due to collision of flush water can be suppressed, and a user can use the flush toilet 1 comfortably.

[Reference Signs List]

[0045]

1: flush toilet

2: toilet body

6: bowl unit

12: flush water supply means

14: flush water tank

16: ejection unit

22: rim

22b: vertical wall portion

24: upper waste receiving surface

24a: front region

24c: back region

26: recessed portion

34a: first nozzle

34b: first nozzle

36: second nozzle

38a: third nozzle

38b: third nozzle

38c: third nozzle

38d: third nozzle

C: center line

F1, F2, F3a, F3b, F3c, F3d: main flow

W_0: pooled water surface

α: inclination angle