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(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

(72) Inventor: **SATO, Yasushi**
Osaka-shi, Osaka 540-6207 (JP)

(74) Representative: **Müller-Boré & Partner Patentanwälte PartG mbB**
Friedenheimer Brücke 21
80639 München (DE)

(54) FLUSH TOILET

(57) The problem to be overcome by the present disclosure is to propose a flush toilet designed to reduce the splash of water in a backflow check structure. A flush toilet includes: a bowl; a water discharge port to discharge water into the bowl; a water supply path (3) to supply the water from a water supply source to the water discharge port; and a backflow check structure (4) to check a backflow of the water running through the water supply path (3). The backflow check structure (4) has: a water inlet port (410) communicating with the water discharge port; a water receiving wall (5), through which the water inlet port (410) is provided in a part thereof; and a water outlet port (400) spaced from the water inlet port (410) and the water receiving wall (5) and configured to channel the water supplied from the water supply source toward the water inlet port (410). The water receiving wall (5) is provided, in a part thereof below the water inlet port (410), with a water adhesion reducing portion (9) to reduce the chances of the water adhering to a lower end surface (520) of the water receiving wall (5).

FIG. 4A

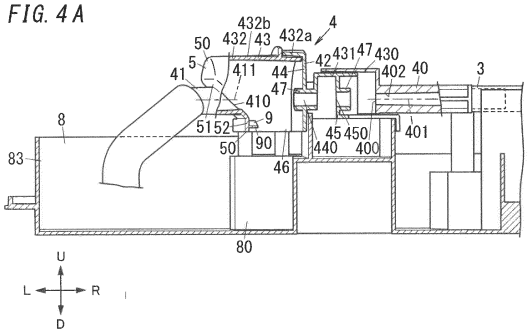
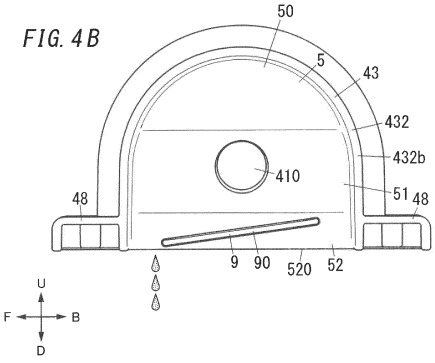


FIG. 4B



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Description

Technical Field

[0001] The present disclosure generally relates to a flush toilet, and more particularly relates to a flush toilet in which a backflow check structure is provided for a water supply path for supplying water to a bowl.

Background Art

[0002] Patent Literature 1 discloses a flush toilet in which a backflow check structure is provided for a water supply path for supplying water to a bowl. The backflow check structure includes: a water inlet port communicating with a water discharge port provided for a bowl; and a water outlet port to channel the water supplied from a water supply source toward the water inlet port. The water inlet port is arranged on a trajectory of the water running out through the water outlet port.

[0003] In the flush toilet of Patent Literature 1, part of the water flowing out through the water outlet port is received by a wall surrounding the water inlet port and falls down along the wall. At this time, sometimes a certain amount of water adheres to a lower end surface of the wall due to the surface tension.

[0004] If the pressure of the water flowing out through the water outlet port were lower than a predetermined value in such a state, then the water flowing out through the water outlet port would collide against the water adhered to the lower end surface of the wall. This would cause the adhered water to splash around and reach as far as the outside of a water receiver located under the backflow check structure.

Citation List

Patent Literature

[0005] Patent Literature 1: WO 2019/097966 A1

Summary of Invention

[0006] An object of the present disclosure is to propose a flush toilet which may reduce the splash of water in the backflow check structure.

[0007] A flush toilet according to an aspect of the present disclosure includes: a bowl to receive excreta; a water discharge port to discharge water into the bowl; a water supply path to supply the water from a water supply source to the water discharge port therethrough; and a backflow check structure provided for the water supply path and configured to check a backflow of the water running through the water supply path. The backflow check structure has: a water inlet port communicating with the water discharge port; a water receiving wall, through which the water inlet port is provided in a part thereof; and a water outlet port spaced from the water inlet port and the water receiving wall and configured to channel the water supplied from the water supply source toward the water inlet port. The water receiving wall is provided with a water adhesion reducing portion in a part thereof located below the water inlet port. The water adhesion reducing portion reduces the chances of the water adhering to a lower end surface of the water receiving wall.

Brief Description of Drawings

[0008]

FIG. 1 is a perspective view illustrating a flush toilet according to an exemplary embodiment of the present invention;
FIG. 2 is a perspective view illustrating a backflow check structure and a bowl of the flush toilet;
FIG. 3 is a perspective view illustrating the backflow check structure and its surrounding portions;
FIG. 4A is a cross-sectional view illustrating the backflow check structure and its surrounding portions taken along a vertical plane;
FIG. 4B is a side view illustrating a principal part of the backflow check structure;
FIG. 5A is a side view illustrating a first variation of the principal part of the backflow check structure;
FIG. 5B is a side view illustrating a second variation of the principal part of the backflow check structure;
FIG. 5C is a side view illustrating a third variation of the principal part of the backflow check structure; and
FIG. 5D is a side view illustrating a fourth variation of the principal part of the backflow check structure.

Description of Embodiments

1. Overview

[0009] FIG. 1 illustrates a flush toilet 1 according to an exemplary embodiment. The flush toilet 1 includes: a bowl 23 to receive excreta; a water discharge port 253 to discharge water into the bowl 23; a water supply path 3 to supply the water from a water supply source to the water discharge port 253 therethrough; and a backflow check structure 4 provided for the water supply path 3 and configured to check a backflow of the water running through the water supply path 3. The backflow check structure 4 has: a water inlet port 410 communicating with the water discharge port 253; a water receiving wall 5, through which the water inlet port 410 is provided in a part thereof; and a water outlet port 400 spaced from the water inlet port 410 and the water receiving wall 5 and configured to channel the water supplied from the water supply source toward the water inlet port 410. As shown in FIGS. 4A and 4B, the water receiving wall 5 is provided with a water adhesion reducing portion 9 in a part thereof located below the water inlet port 410. The water adhesion reducing portion 9 reduces the chances of the water

adhering to a lower end surface 520 of the water receiving wall 5.

[0010] In the flush toilet 1 according to an exemplary embodiment having such a configuration, the water adhesion reducing portion 9 may reduce, when the water receiving wall 5 receives part of the water channeled from the water outlet port 400 toward the water inlet port 410, the chances of the water adhering to the lower end surface 520 of the water receiving wall 5 due to the surface tension. Thus, the flush toilet 1 according to the exemplary embodiment may reduce the chances of the water channeled from the water outlet port 400 toward the water inlet port 410 colliding against the water adhered to the lower end surface 520 of the water receiving wall 5 to cause the water adhered to the lower end surface 520 to splash around. Consequently, the flush toilet 1 according to the exemplary embodiment may reduce the splash of the water in the backflow check structure 4.

2. Details

[0011] Next, a flush toilet 1 according to the exemplary embodiment shown in FIGS. 1-4 will be described in further detail. The flush toilet 1 is installed in a toilet room 7 as shown in FIG. 1. The rear wall 74 of the toilet room 7 is provided with a water supply pipe 71 as a water supply source. A water shut-off valve 72 is provided at a downstream end portion of the water supply pipe 71. Also, the floor 75 of the toilet room 7 is provided with a drainpipe 73 leading to a sewer pipe.

[0012] When the flush toilet 1 is installed in the toilet room 7, a connecting member 6 leading to the water supply path 3 is connected to the water shut-off valve 72 via a pipe 61 and a drain trap 76 leading to a drainpipe 232 of a bowl 23 is connected to the drainpipe 73. Letting the water shut-off valve 72 communicate with the connecting member 6 allows the water to be supplied from the water supply pipe 71 (i.e., the water supply source) to the water supply path 3 of the flush toilet 1.

[0013] The flush toilet 1 includes a toilet body 2, the water supply path 3, and a backflow check structure 4. In FIG. 1, a direction pointing from the flush toilet 1 toward the rear wall 74 of the toilet room 7 and aligned with a horizontal plane is defined herein to be a "backward direction" and the opposite direction thereof is defined herein to be a "forward direction." In addition, the rightward/leftward direction is herein defined with respect to a user who faces the backward direction in front of the flush toilet 1.

[0014] The toilet body 2 is the principal body of the flush toilet 1. The toilet body 2 includes a plurality of outer parts 21, an inner part 22, a water receiver 8 (see FIG. 2), a toilet seat (not shown), and a toilet lid 26.

[0015] The plurality of outer parts 21 form the outer shell of the flush toilet 1. These outer parts 21 are mounted on a frame (not shown). In this embodiment, the outer parts 21 include a skirt 211 supporting the inner part 22 thereon, a rear lower part 213 located behind the skirt 211, and a rear upper part 212 located over the rear lower part 213. The toilet seat and the toilet lid 26 are mounted on the rear upper part 212 so as to be rotatable around an axis parallel to the rightward/leftward direction.

[0016] The inner part 22 is arranged inside a space surrounded with the outer parts 21 and the toilet lid 26. The inner part 22 is supported by an upper end portion of the skirt 211. The inner part 22 includes the bowl 23, a water discharge portion 25, and a supporting portion 24 as shown in FIG. 2.

[0017] The bowl 23 receives excreta (i.e., urine and feces) discharged by the user. The bowl 23 is formed in the shape of a cup, of which the upper end is an opening and a lower end portion includes the drainpipe 232. The inner surface of the bowl 23 (hereinafter referred to as a "bowl surface 231") is sloped down toward the frontend portion of the drainpipe 232. The water discharged from the water discharge portion 25 swirls around an axis parallel to the vertical direction along the bowl surface 231. As shown in FIG. 1, the rear end portion of the drainpipe 232 is connected via the drain trap 76 to the drainpipe 73.

[0018] The drain trap 76 prevents unpleasant odor from flowing back from the drainpipe 73 toward the bowl 23 and also prevents sanitary insects, for example, from attempting to enter the bowl 23 from the drainpipe 73. The drain trap 76 may be implemented as a so-called "S-trap" which is an S-shaped pipe, or a movable trap, for example. The movable trap may be, for example, a flexible pipe connected to the drainpipe 232 of the bowl 23. A tip of the flexible pipe may have its state switched by a motor, for example, from a state where the tip faces upward to a state where the tip faces downward, and vice versa.

[0019] The water discharge portion 25 discharges water onto the bowl surface 231. The water discharge portion 25 is adjacent to the opening of the bowl 23. The water discharge portion 25 includes a water discharge nozzle 251, a pair of standup walls 252, and a water discharge port 253.

[0020] The water discharge nozzle 251 is a nozzle for discharging the water supplied through the water supply path 3. The water discharge nozzle 251 is arranged between the pair of standup walls 252. The pair of standup walls 252 guides the water discharged from the water discharge nozzle 251 so that the water swirls along the bowl surface 231. The water discharge port 253 discharges the water onto the bowl 23. In this embodiment, the water discharge port 253 is an opening surrounded with a frontend portion of the inner standup wall 252 of the bowl 23 and a part of the opposing outer standup wall 252 of the bowl 23. Alternatively, the water discharge port 253 may also be an opening at the tip of the water discharge nozzle 251.

[0021] The supporting portion 24 is extended outward from the outer edge of the opening of the bowl 23. The supporting portion 24 is supported by the upper end portion of the skirt 211. The bowl 23 and the water discharge portion 25 are fixed via the supporting portion 24 onto

the outer parts 21.

[0022] The water supply path 3 channels the water supplied from the water supply source toward the water discharge portion 25. An upstream end portion of the water supply path 3 leads to the connecting member 6, while a downstream end portion of the water supply path 3 leads to the water discharge nozzle 251. The water supply path 3 is provided with a water shut-off valve (not shown) and a constant flow valve (not shown) so that water flows at a constant flow rate. Thus, even if the water pressure of the water supplied from the water supply source varies to a certain degree, the water may still be discharged at a constant flow rate through the water discharge port 253 into the bowl 23.

[0023] The water supply path 3 is provided with the backflow check structure 4. The backflow check structure 4 checks the backflow of the water running through the water supply path 3. This reduces, even when the level of the water reserved in the bowl 23, for example, rises so much as to immerse the water discharge portion 25 in the water that has run up, the chances of the water reserved in the bowl 23, for example, flowing back through the water supply path 3 to the water supply source.

[0024] As shown in FIGS. 3, 4A, and 4B, the backflow check structure 4 includes a water outlet pipe 40, a water inlet pipe 41, a water receiving wall 5, a splash reducing portion 42, and a covering wall 43.

[0025] The water outlet pipe 40 is a pipe communicating with the water supply source (i.e., the water supply pipe 71) and used to channel the water supplied from the water supply source toward the water inlet pipe 41. The water outlet pipe 40 is a pipe to introduce the water into the backflow check structure 4. The downstream end surface of the water outlet pipe 40 has the water outlet port 400. The water outlet port 400 is an opening through which the water running through the water outlet pipe 40 flows out and which channels the water supplied from the water supply source toward the water inlet port 410. The water outlet pipe 40 is supported by a supporting portion 80 that protrudes upward from the water receiver 8. The center axis 401 of the water outlet pipe 40 is aligned with the horizontal plane and intersects at right angles with a vertical line (in other words, the vertical plane). An inner peripheral surface 402 at one end portion, adjacent to the water outlet port 400, of the water outlet pipe 40 is tapered such that the flow passage area thereof decreases as the distance to the water outlet port 400 decreases. This enables increasing the flow velocity of the water flowing out through the water outlet port 400.

[0026] The water inlet pipe 41 is a pipe that receives the water flowing out through the water outlet port 400 and channels the water toward the water discharge nozzle 251 (see FIG. 2). An upstream end portion of the water inlet pipe 41 is connected to the water receiving wall 5. A downstream end portion of the water inlet pipe 41 leads to the water discharge nozzle 251 via a hose, for example.

[0027] An upstream end surface of the water inlet pipe 41 has the water inlet port 410. The water inlet port 410 is provided through a part of the water receiving wall 5. More specifically, part of the surface, facing the water outlet port 400 (i.e., the right surface), of the water receiving wall 5 is provided with the water inlet port 410.

[0028] The water inlet port 410 communicates with the water discharge port 253. The center axis 411 of the water inlet pipe 41 is aligned with the horizontal plane and located on the extension of the center axis 401 of the water outlet pipe 40. That is to say, the water inlet port 410 is arranged on the trajectory of the water flowing out through the water outlet port 400 with at least a predetermined water pressure. The water inlet port 410 is tilted with respect to the center axis 411 of the water inlet pipe 41. The peripheral surface, surrounding the opening, of the water inlet port 410 is sloped down toward the water outlet port 400 with respect to the horizontal plane such that its part located closest to the water outlet port 400 in the rightward/leftward direction (in other words, in the direction aligned with the trajectory of the water) is the lowest part thereof. This makes it easier, even if the trajectory of the water flowing out through the water outlet port 400 draws a parabola, for the water inlet port 410 to receive such water.

[0029] The water receiving wall 5 includes an upper wall portion 50, an intermediate wall portion 51, and a lower wall portion 52. The upper wall portion 50 is parallel to the vertical plane. The intermediate wall portion 51 is continuous with the lower end of the upper wall portion 50 and is sloped down such that the lowest part thereof is located at the right end (i.e., closest to the water outlet port 400). The lower wall portion 52 is continuous with the lower end of the intermediate wall portion 51 and is parallel to the vertical plane.

[0030] A middle part of the intermediate wall portion 51 in the forward/backward direction is provided with the water inlet port 410. The tilt angle formed by the intermediate wall portion 51 with respect to the vertical plane is the same as the tilt angle formed by the outer peripheral edge portion surrounding the opening of the water inlet port 410 with respect to the vertical plane.

[0031] As shown in FIG. 4B, the water receiving wall 5 has a semicircular shape when viewed from the right. The outer peripheral portion, except the lower end surface 520, of the water receiving wall 5 is connected to a third covering wall 432 of the covering wall 43 (to be described later).

[0032] Part, located below the water inlet port 410, of the water receiving wall 5 is provided with a water adhesion reducing portion 9 for reducing the chances of water adhering to the lower end surface 520 of the water receiving wall 5. In this embodiment, the water adhesion reducing portion 9 is a protruding portion 90 protruding from the lower wall portion 52 of the water receiving wall 5 toward the water outlet port 400 (i.e., to the right). The upper surface of the protruding portion 90 is a sloped surface sloped with respect to the horizontal plane.

[0033] In this embodiment, the protruding portion 90 has a rectangular plate shape. The protruding portion 90 is tilted such that the frontend part thereof is located at the lowest level. The dimension of the protruding portion 90 in the forward/backward direction is larger than its dimension in the rightward/leftward direction. The upper surface of the protruding portion 90 is a flat surface and tilted toward the front end (i.e., such that the frontend part thereof is located at the lowest level).

[0034] The front and rear end parts of the protruding portion 90 are spaced from the third covering wall 432. The water received at the water receiving wall 5 runs forward along the upper surface of the protruding portion 90 and is mostly channeled toward the frontend part of the upper surface of the protruding portion 90. This makes it easier for the water to fall down from the protruding portion 90 due to its own weight, thus reducing the chances of the water adhering to the lower end surface 520 of the water receiving wall 5 due to the surface tension.

[0035] The splash reducing portion 42 reduces the chances of splashed water adhering to the water outlet port 400 while the water flowing out through the water outlet port 400 is entering the water inlet port 410. The splash reducing portion 42 is arranged between the water outlet port 400 and the water inlet port 410. The splash reducing portion 42 includes a first water interception plate 44 and a second water interception plate 45.

[0036] The first water interception plate 44 faces the water receiving wall 5 and the water inlet port 410 and receives the water splashed from the water receiving wall 5. The first water interception plate 44 is spaced from the water receiving wall 5. An opening 46 is provided between the lower end of the first water interception plate 44 and the lower end of the water receiving wall 5. The water received at either the water receiving wall 5 or the first water interception plate 44 falls down into the water receiver 8 through the opening 46.

[0037] The first water interception plate 44 is aligned with the vertical plane and intersects (e.g., at right angles in this embodiment) with the respective center axes 401, 411 of the water outlet pipe 40 and the water inlet pipe 41. The first water interception plate 44 is provided with a first water passage hole 440 penetrating through the first water interception plate 44. The diameter of the first water passage hole 440 is equal to or greater than the diameter of the water outlet port 400 and equal to or less than the water inlet port 410.

[0038] The second water interception plate 45 faces the water outlet port 400 and the first water interception plate 44. The second water interception plate 45 receives not only the water that has flowed out through the water outlet port 400 and has bounced and splashed back from the first water interception plate 44 but also the water that has flowed out through the water outlet port 400, has bounced and splashed back from the water receiving wall 5, and then has passed through the first water passage hole 440 of the first water interception plate 44. The second water interception plate 45 is aligned with the vertical plane and intersects (e.g., at right angles in this embodiment) with the respective center axes 411, 401 of the water inlet pipe 41 and the water outlet pipe 40. That is to say, the second water interception plate 45 is parallel to the first water interception plate 44. The second water interception plate 45 has a second water passage hole 450 which penetrates through the second water interception plate 45. The diameter of the second water passage hole 450 is equal to or greater than the diameter of the water outlet port 400 and equal to or less than the water inlet port 410. In this embodiment, the diameter of the second water passage hole 450 is equal to the diameter of the first water passage hole 440. Alternatively, the diameter of the second water passage hole 450 may also be larger or smaller than the diameter of the first water passage hole 440.

[0039] A peripheral wall portion 47 is provided around each of the first water passage hole 440 and the second water passage hole 450. The peripheral wall portion 47 protrudes in at least one of the rightward/leftward directions (in other words, toward the water outlet port 400 and/or toward the water inlet port 410 in the direction aligned with the trajectory of the water) from at least a part of the circumference of the first water passage hole 440, 450. In this embodiment, the peripheral wall portion 47 provided for the first water passage hole 440 protrudes both to the right and to the left from the entire circumference of the first water passage hole 440. On the other hand, the peripheral wall portion 47 provided for the second water passage hole 450 protrudes only to the right from the entire circumference of the second water passage hole 450.

[0040] Alternatively, the peripheral wall portion 47 provided for the first water passage hole 440 may protrude either only to the left or only to the right from the entire circumference of the first water passage hole 440, whichever is appropriate. Also, the peripheral wall portion 47 provided for the second water passage hole 450 may protrude only to the left, or both to the right and to the left, from the entire circumference of the second water passage hole 450. Still alternatively, the peripheral wall portion 47 may also be provided for only a part of the circumference of the water passage hole 440, 450.

[0041] The water that has bounced and splashed back from the water receiving wall 5 toward the first water interception plate 44 while the water flowing out through the water outlet port 400 is entering the water inlet port 410 collides against the peripheral wall portion 47 and falls downward. Also, even if the water runs along the first water interception plate 44, the water is prevented by the peripheral wall portion 47 from entering the first water passage hole 440. Thus, this may reduce the chances of the water flowing out through the water outlet port 400 and bounced back from the water receiving wall 5 passing through the first water passage hole 440 and flowing back toward the water outlet port 400.

[0042] The covering wall 43 reduces the chances of

the water flowing out through the water outlet port 400 bouncing back from the water receiving wall 5 or the splash reducing portion 42 and splashing toward the outside of the covering wall 43. The covering wall 43 includes a first covering wall 430, a second covering wall 431, and a third covering wall 432.

[0043] The first covering wall 430 connects the tip (i.e., the left end) of the water outlet pipe 40 to the second water interception plate 45. The first covering wall 430 covers the space between the water outlet pipe 40 and the second water interception plate 45 in the forward/backward directions, and from over and from the right of the space. The second covering wall 431 connects the second water interception plate 45 to the tip (i.e., the right end) of the peripheral wall portion 47 protruding to the right from the first water passage hole 440. The second covering wall 431 covers the space between the second water interception plate 45 and the peripheral wall portion 47 in the forward/backward directions and from over and from the left of the space. The third covering wall 432 connects the first water interception plate 44 to the water receiving wall 5. The third covering wall 432 covers the space between the first water interception plate 44 and the water receiving wall 5 in the forward/backward directions and from over the space.

[0044] In this embodiment, the third covering wall 432 includes a first part 432a protruding to the left from the first water interception plate 44 and a second part 432b protruding to the right from an outer peripheral portion of the water receiving wall 5.

[0045] The first covering wall 430 is formed integrally with the water outlet pipe 40. The first part 432a of the third covering wall 432, the first water interception plate 44, the second covering wall 431, and the second water interception plate 45 are formed integrally with each other. The second part 432b of the third covering wall 432 and the water receiving wall 5 are also formed integrally with each other.

[0046] The second part 432b of the third covering wall 432, the first covering wall 430, and the first part 432a of the third covering wall 432 are each provided with mounting portions 48 protruding in the forward/backward directions.

[0047] The front and rear mounting portions 48 are mounted onto the supporting portion 80 protruding upward from the water receiver 8. This allows the backflow check structure 4 to be mounted over the water receiver 8. The water receiver 8 is supported by the frame of the toilet body 2 and covered with, and hidden behind, the rear upper part 212 (see FIG. 1).

[0048] The water that has bounced back from the covering wall 43, the splash reducing portion 42, or the water receiving wall 5 is received at the water receiver 8. A bottom portion of the water receiver 8 is provided with a drain hole 81, to which piping 82 such as a tube is connected. The piping 82 may be connected to, for example, the bowl 23. This allows the water received at the water receiver 8 to flow into the bowl 23. Alternatively, the piping 82 may also be connected to the drain trap 76 or the drainpipe 73, for example. Still alternatively, the water received at the water receiver 8 may also be drained directly onto the floor 75 of the toilet room (see FIG. 1). The water receiver 8 includes a peripheral wall 83. When viewed in plan, the backflow check structure 4 is disposed inside the peripheral wall 83 as shown in FIG. 3.

[0049] The flush toilet 1 includes an overflow portion 84, which is provided inside the water receiver 8 in plan view. The overflow portion 84 has a circular cylindrical shape and protrudes upward from a region, located inside the peripheral wall 83, of bottom surface of the water receiver 8. The overflow portion 84 has an overflow opening 840 at the top. The overflow opening 840 is provided at a level higher than the bottom surface of the water receiver 8 and lower than the upper end of the peripheral wall 83. The overflow opening 840 drains the water that has run up inside the peripheral wall 83 when the drainage capacity required is not satisfied by only the drain hole 81 of the water receiver 8.

[0050] The water that has entered the overflow opening 840 is allowed to flow onto the floor 75 (see FIG. 1). Alternatively, the water that has entered the overflow opening 840 may also be allowed to flow into the bowl 23, the drain trap 76, or the drainpipe 73, for example.

3. Advantages

[0051] The flush toilet 1 according to the exemplary embodiment described above operates as follows when water is supplied into the bowl 23.

[0052] Specifically, when water is supplied from the water supply pipe 71 as a water supply source into the water outlet pipe 40, the water is channeled through the water outlet port 400 of the water outlet pipe 40 toward the water inlet port 410.

[0053] The water flowing out through the water outlet port 400 passes through the water passage holes 450, 440 of the water interception plates 45, 44 and enters the water inlet port 410. In the meantime, part of the water flowing out through the water outlet port 400 may be received at the water receiving wall 5.

[0054] The water received at the water receiving wall 5 runs down along the surface of the water receiving wall 5 (specifically, its surface facing to the right) and reaches the upper surface of the protruding portion 90. Then, the water runs along the upper surface of the protruding portion 90 and flows forward to be mostly channeled toward a frontend part of the upper surface of the protruding portion 90. The water then falls down due to its own weight. The water thus fallen down from the frontend part of the upper surface of the protruding portion 90 is received by the water receiver 8 and then drained through the drain hole 81.

[0055] Thus, the flush toilet 1 according to this embodiment may reduce the chances of water adhering to the lower end surface 520 of the water receiving wall 5 due to the surface tension. Consequently, the flush toilet 1

according to this embodiment reduces the frequency of occurrence of the above-mentioned problem that the water flowing out through the water outlet port 400 collides, when having a pressure lower than a predetermined value, against the water adhered to the lower end surface 520 and splashes the adhered water toward the outside of the peripheral wall 83 of the water receiver 8.

[0056] In addition, in the flush toilet 1 according to this embodiment, the protruding portion 90 protrudes from the lower wall portion 52 as a lower part of the water receiving wall 5 toward the water outlet port 400. Thus, the protruding portion 90 serves as an eave. This allows the protruding portion 90 to reduce the chances of the water flowing out through the water outlet port 400 reaching the lower end surface 520 of the water receiving wall 5.

[0057] Furthermore, in the flush toilet 1 according to this embodiment, the protruding portion 90 is provided to cover the entire lower wall portion 52 of the water receiving wall 5 except the front and rear end parts thereof, thus also making it easier to prevent the water running along the surface of the water receiving wall 5 from reaching the lower end surface 520.

4. Variations

[0058] Next, variations of the flush toilet 1 according to the exemplary embodiment described above will be enumerated one after another. Note that the variations to be described below may be adopted as appropriate in combination.

[0059] The water adhesion reducing portion 9 only needs to be configured to reduce the adhesion of water to the lower end surface 520 of the water receiving wall 5 due to the surface tension and does not have to have the structure shown in FIG. 4B.

[0060] Alternatively, the water adhesion reducing portion 9 may include a protruding portion 90, of which the upper surface includes two surfaces sloped with respect to the horizontal plane, as in a first variation shown in FIG. 5A. In the first variation, the upper surface of the protruding portion 90 has a vertex at a point in the forward/backward direction. The upper surface of the protruding portion 90 includes a surface sloped down toward the front end as one part located forward of the vertex and a surface sloped down toward the rear end as the other part located backward of the vertex.

[0061] Still alternatively, the water adhesion reducing portion 9 may also include two protruding portions 91, 92, each protruding from the lower wall portion 52 toward the water outlet port 400, as in a second variation shown in FIG. 5B. These two protruding portions 91, 92 are arranged to be spaced from each other in the forward/backward direction. The upper surface of the front protruding portion 91 is a sloped surface sloped down toward the rear end with respect to the horizontal plane. The upper surface of the rear protruding portion 92 is a sloped surface sloped down toward the front end with respect to the horizontal plane. The second variation makes it easier for the water adhered to the surface of the water receiving wall 5 to run along the respective upper surfaces of the two protruding portions 91, 92 and be mostly channeled toward, and fall down through, the gap between the two protruding portions 91, 92.

[0062] Yet alternatively, the water adhesion reducing portion 9 may also be a lower end surface 520 of the water receiving wall 5, which is sloped with respect to the horizontal plane, as in a third variation shown in FIG. 5C. In the third variation, the lower end surface 520 of the water receiving wall 5 is sloped such that the frontend part thereof is located at the lowest level. This makes it easier for the water that has been received at the water receiving wall 5 and has reached the lower end surface 520 of the water receiving wall 5 to flow forward along the lower end surface 520 and be mostly channeled toward, and fall down from, the frontend part of the lower end surface 520.

[0063] Yet alternatively, the water adhesion reducing portion 9 may also be a water repellent surface 93 provided on the water receiving wall 5 as in a fourth variation shown in FIG. 5D. In the fourth variation, the surface of the lower wall portion 52 of the water receiving wall 5 (specifically, its surface facing to the right) is the water repellent surface 93. In addition, the lower end surface 520 of the water receiving wall 5 may also be a water repellent surface 93. The water repellent surface 93 may be formed by any appropriate known means. For example, the water repellent surface 93 may be formed by providing the surface of the lower wall portion 52 with microscopic unevenness. Alternatively, the water repellent surface 93 may also be formed by applying a water repellent paint onto the surface of the lower wall portion 52 or affixing a water repellent sheet to the surface of the lower wall portion 52.

[0064] Optionally, the water adhesion reducing portion 9 according to the exemplary embodiment shown in FIG. 4B and the water adhesion reducing portions 9 according to the first to fourth variations shown in FIGS. 5A-5D may be adopted as appropriate in combination.

[0065] The protruding portion 90, 91, 92 only needs to have an upper surface sloped with respect to the horizontal plane and does not have to have a plate shape.

[0066] In addition, as long as the protruding portion 90, 91, 92 has an upper surface sloped with respect to the horizontal plane, the upper surface of the protruding portion 90 does not have to be sloped down toward the front or rear end but may also be sloped down to the right end (specifically, sloped such that its part closest to the water outlet port 400 is located at the lowest level). Likewise, the lower end surface 520 of the water receiving wall 5 does not have to be sloped down toward the front end, either, but may also be sloped down toward the rear, right, or left end.

[0067] Furthermore, the upper surface of the protruding portion 90, 91, 92 does not have to be a flat surface but may also be a surface with a level difference. The

upper surface of the protruding portion 90, 91, 92 only needs to have such a shape that causes the water adhered to the upper surface of the protruding portion 90, 91, 92 to run down and flow toward the lower end portion of the upper surface of the protruding portion 90, 91, 92. Likewise, the lower end surface 520 of the water receiving wall 5 does not have to be a flat surface, either, but may also be a surface with a level difference.

[0068] In the exemplary embodiment described above, the opening surrounded with the outer peripheral edge of the water inlet port 410 and the opening surrounded with the outer peripheral edge of the water outlet port 400 are arranged such that their respective center axes are aligned with each other. However, this is only an example and should not be construed as limiting. Alternatively, if the water flowing out through the water outlet port 400 draws a parabola, then the water inlet port 410 may be located on the parabola.

5. Recapitulation

[0069] As can be seen from the foregoing description of the exemplary embodiment and its variations, a flush toilet (1) according to a first aspect has the following configuration:

[0070] Specifically, the flush toilet (1) according to the first aspect includes: a bowl (23) to receive excreta; a water discharge port (253) to discharge water into the bowl (23); and a water supply path (3) to supply the water from a water supply source to the water discharge port (253) therethrough. The flush toilet (1) according to the first aspect further includes a backflow check structure (4) provided for the water supply path (3) and configured to check a backflow of the water running through the water supply path (3). The backflow check structure (4) has: a water inlet port (410) communicating with the water discharge port (253); a water receiving wall (5), through which the water inlet port (410) is provided in a part thereof; and a water outlet port (400) to channel the water supplied from the water supply source toward the water inlet port (410). The water outlet port (400) is spaced from the water inlet port (410) and the water receiving wall (5). The water receiving wall (5) is provided with a water adhesion reducing portion (9) in a part thereof located below the water inlet port (410). The water adhesion reducing portion (9) reduces the chances of the water adhering to a lower end surface (520) of the water receiving wall (5).

[0071] In the flush toilet (1) according to the first aspect having such a configuration, the water adhesion reducing portion (9) may reduce, when the water receiving wall (5) receives part of the water flowing out through the water outlet port (400), the chances of the water adhering to the lower end surface (520) of the water receiving wall (5). Thus, the flush toilet (1) according to the first aspect may reduce the chances of the water flowing out through the water outlet port (400) colliding against the water adhered to the lower end surface (520) of the water receiving wall (5) and splashing the adhered water around. Consequently, the flush toilet (1) according to the first aspect may reduce the splash of the water in the backflow check structure (4).

[0072] As can be seen from the foregoing description of the exemplary embodiment and its variations, a flush toilet (1) according to a second aspect has the following additional configuration which may be implemented in conjunction with the configuration of the flush toilet (1) according to the first aspect:

[0073] Specifically, in the flush toilet (1) according to the second aspect, the water adhesion reducing portion (9) is a protruding portion (90) protruding from the water receiving wall (5) toward the water outlet port (400). An upper surface of the protruding portion (90) is a sloped surface which is sloped with respect to a horizontal plane.

[0074] In the flush toilet (1) according to the second aspect having such a configuration, the sloped upper surface of the protruding portion (90) protruding from the water receiving wall (5) toward the water outlet port (400) allows the water received at the water receiving wall (5) to be channeled mostly toward the lower end portion of the upper surface of the protruding portion (90). Thus, the flush toilet (1) according to the second aspect makes it easier for the water received at the water receiving wall (5) to fall down.

[0075] As can be seen from the foregoing description of the exemplary embodiment and its variations, a flush toilet (1) according to a third aspect has the following additional configuration which may be implemented in conjunction with the configuration of the flush toilet (1) according to the second aspect:

[0076] Specifically, in the flush toilet (1) according to the third aspect, the backflow check structure (4) further includes a covering wall (43) provided to wrap the water receiving wall (5) around. The protruding portion (90) is spaced from the covering wall (43).

[0077] In the flush toilet (1) according to the third aspect having such a configuration, the covering wall (43) may prevent the water that has been channeled from the water outlet port (400) toward the water inlet port (410) and has collided against the water receiving wall (5) from splashing toward the outside of the water receiving wall (5). In addition, the flush toilet (1) according to the third aspect also allows the water running down the upper surface of the protruding portion (90) to fall down through the gap between the protruding portion (90) and the covering wall (43). That is to say, the covering wall (43) does not obstruct the water from falling down from the protruding portion (90).

[0078] As can be seen from the foregoing description of the exemplary embodiment and its variations, a flush toilet (1) according to a fourth aspect has the following additional configuration which may be implemented in conjunction with the configuration of the flush toilet (1) according to any one of the first to third aspects:

[0079] Specifically, in the flush toilet (1) according to the fourth aspect, the water adhesion reducing portion (9) is the lower end surface (520) of the water receiving

wall (5). The lower end surface (520) is sloped with respect to a horizontal plane.

[0080] The flush toilet (1) according to the fourth aspect having such a configuration causes the water that has been received at the water receiving wall (5) and has reached the lower end surface (520) of the water receiving wall (5) to be channeled mostly toward a lower part of the lower end surface (520) along the sloped lower end surface (520) and fall down smoothly.

[0081] As can be seen from the foregoing description of the exemplary embodiment and its variations, a flush toilet (1) according to a fifth aspect has the following additional configuration which may be implemented in conjunction with the configuration of the flush toilet (1) according to any one of the first to fourth aspects:

[0082] Specifically, in the flush toilet (1) according to the fifth aspect, the water adhesion reducing portion (9) is a water repellent surface (93) provided on the water receiving wall (5).

[0083] In the flush toilet (1) according to the fifth aspect having such a configuration, the water repellent surface (93) makes it easier for the water received at the water receiving wall (5) to fall down.

[0084] Note that the embodiment described above with reference to the accompanying drawings is only an exemplary one of various embodiments of the present disclosure and should not be construed as limiting. Rather, the exemplary embodiment may be readily modified as appropriate in various manners depending on a design choice or any other factor without departing from the scope of the present disclosure.

Reference Signs List

[0085]

1	Flush Toilet
23	Bowl
253	Water Discharge Port
3	Water Supply Path
4	Backflow Check Structure
400	Water Outlet Port
410	Water Inlet Port
5	Water Receiving Wall
520	Lower End Surface
43	Covering Wall
9	Water Adhesion Reducing Portion
90	Protruding Portion
93	Water Repellent Surface

Claims

1. A flush toilet comprising:

a bowl configured to receive excreta;
a water discharge port configured to discharge water into the bowl;
a water supply path configured to supply the water from a water supply source to the water discharge port therethrough; and
a backflow check structure provided for the water supply path and configured to check a backflow of the water running through the water supply path,
the backflow check structure having:

a water inlet port communicating with the water discharge port;
a water receiving wall, through which the water inlet port is provided in a part thereof; and
a water outlet port spaced from the water inlet port and the water receiving wall and configured to channel the water supplied from the water supply source toward the water inlet port,
the water receiving wall being provided with a water adhesion reducing portion in a part thereof located below the water inlet port, the water adhesion reducing portion being configured to reduce chances of water adhering to a lower end surface of the water receiving wall.

2. The flush toilet of claim 1, wherein

the water adhesion reducing portion is a protruding portion protruding from the water receiving wall toward the water outlet port, and
an upper surface of the protruding portion is a sloped surface which is sloped with respect to a horizontal plane.

3. The flush toilet of claim 2, wherein

the backflow check structure further includes a covering wall provided to wrap the water receiving wall around, and
the protruding portion is spaced from the covering wall.

4. The flush toilet of any one of claims 1 to 3, wherein the water adhesion reducing portion is the lower end surface of the water receiving wall, the lower end surface being sloped with respect to a horizontal plane.

5. The flush toilet of any one of claims 1 to 4, wherein the water adhesion reducing portion is a water repellent surface provided on the water receiving wall.

FIG. 1

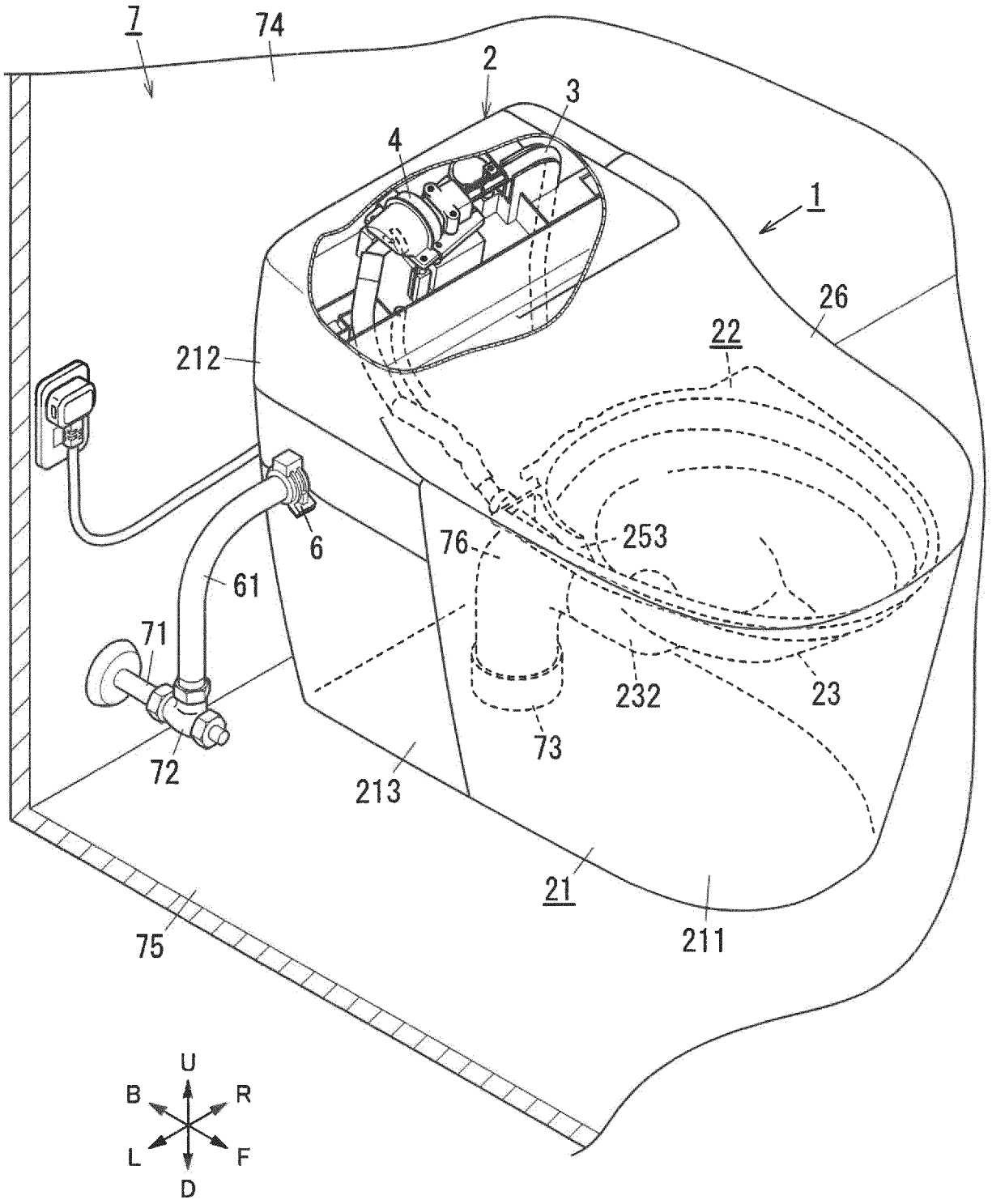

FIG. 2

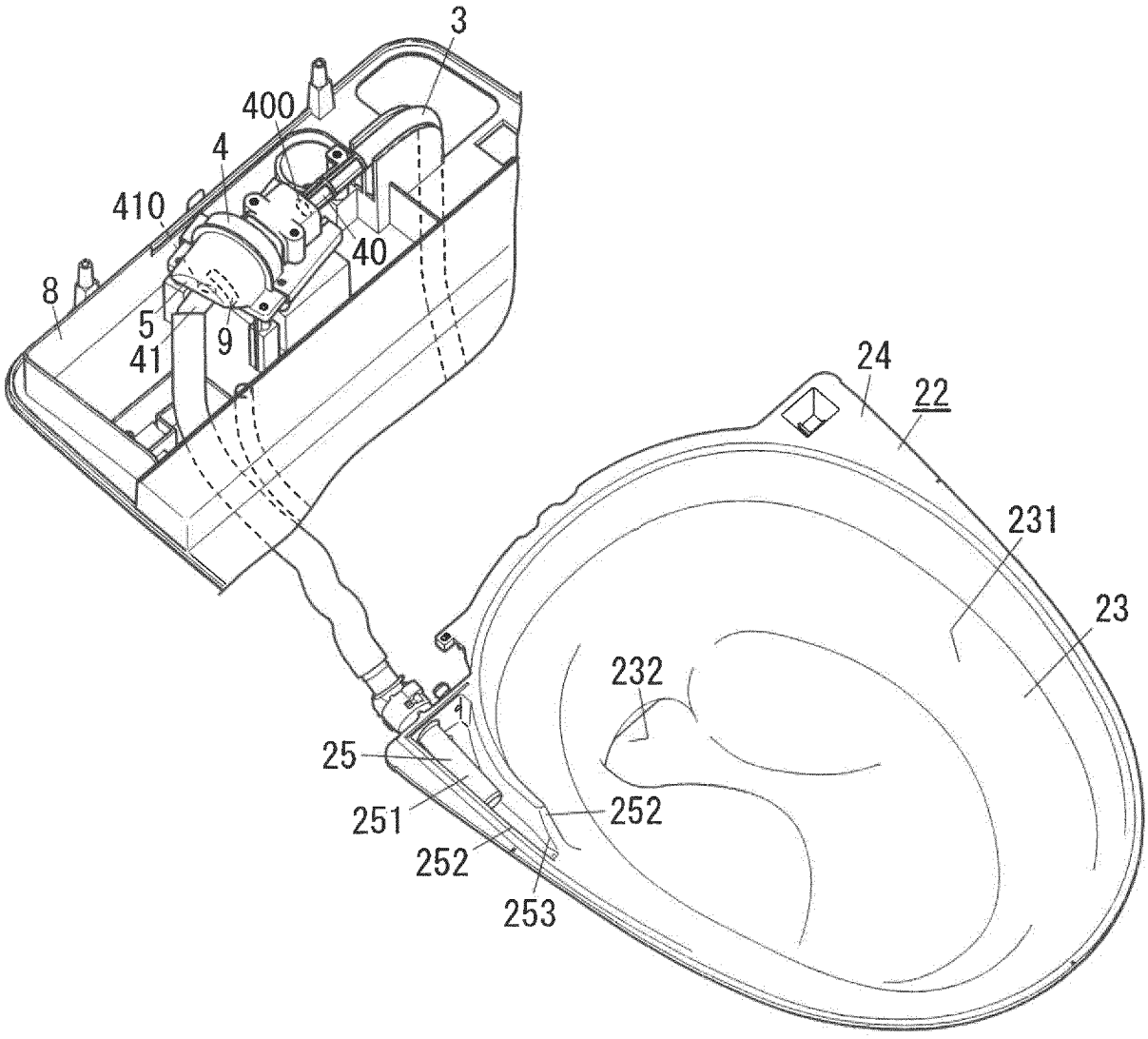

FIG. 3

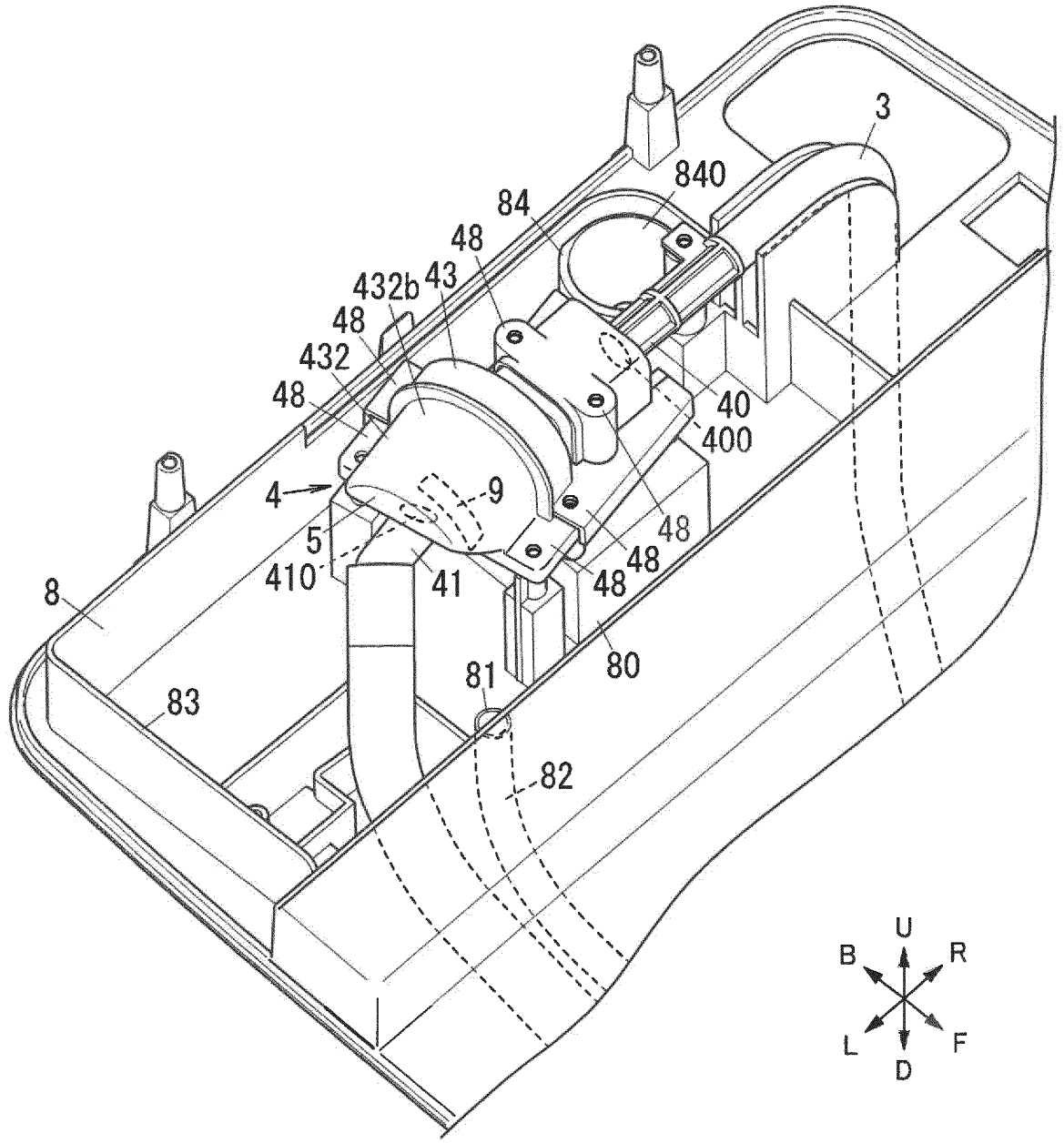
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FIG. 4A

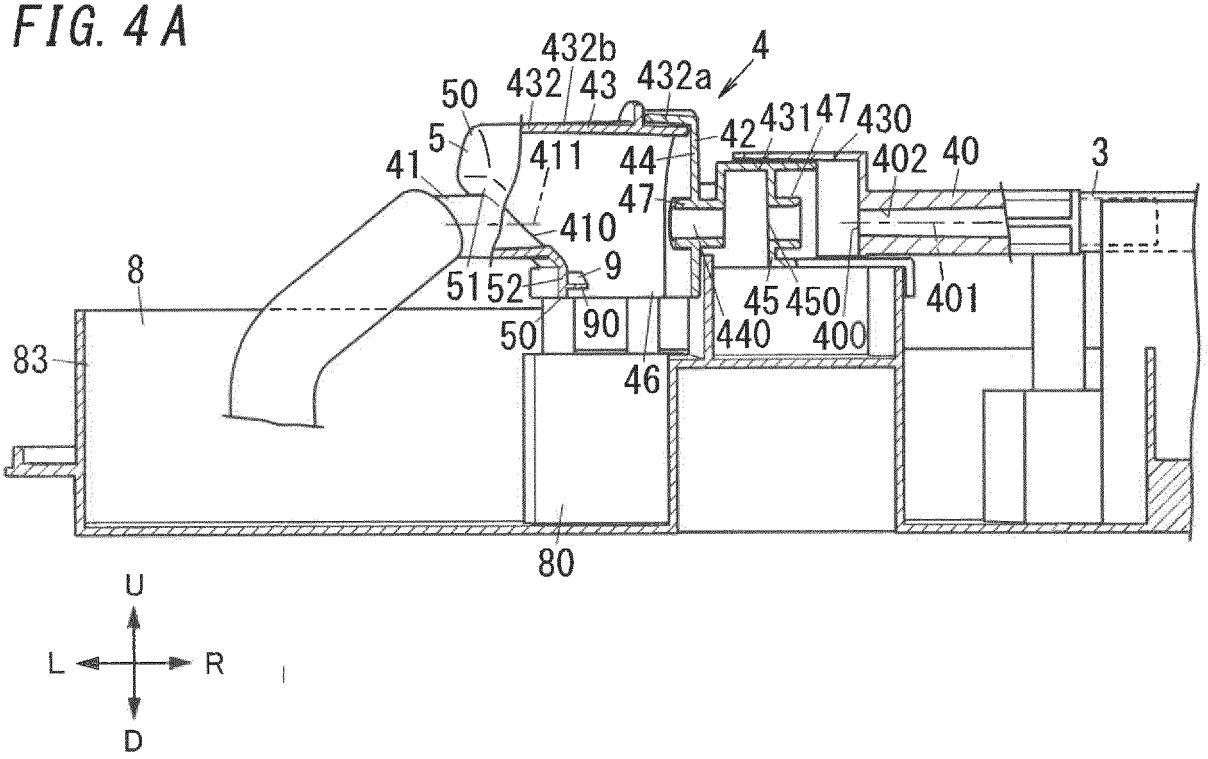
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FIG. 4B

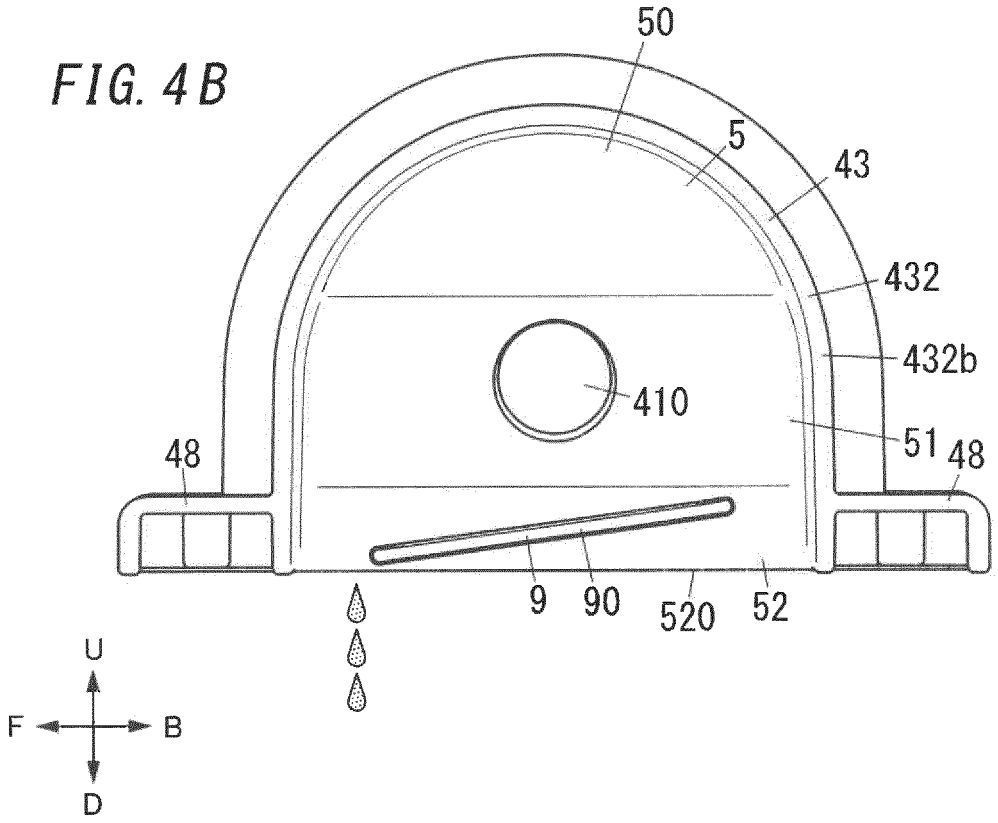
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FIG. 5A

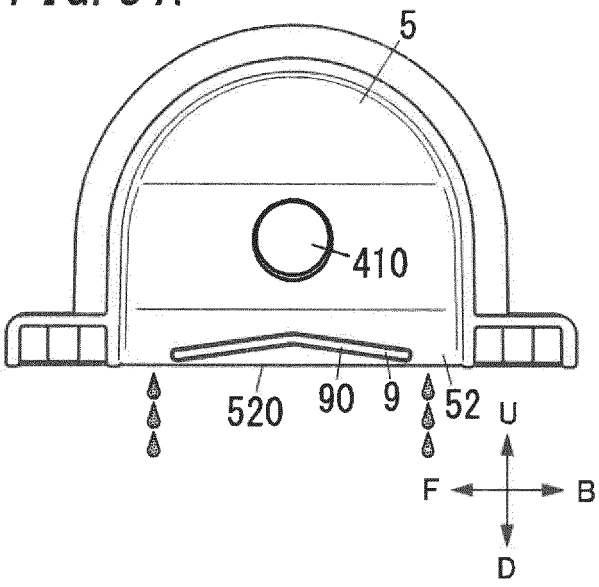


FIG. 5B

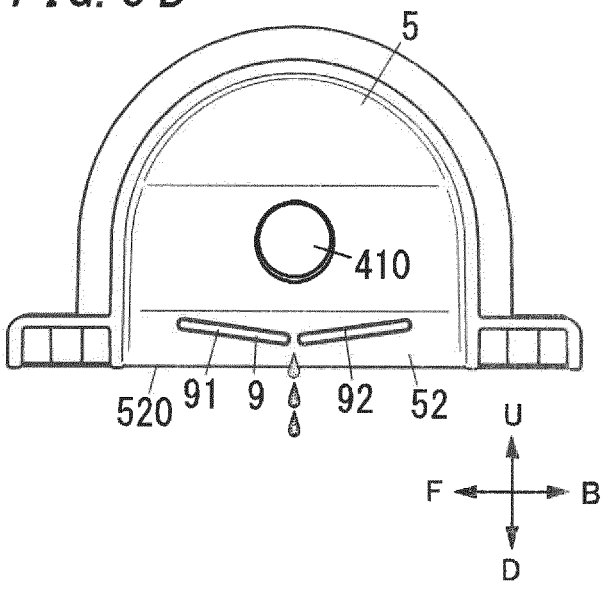


FIG. 5C

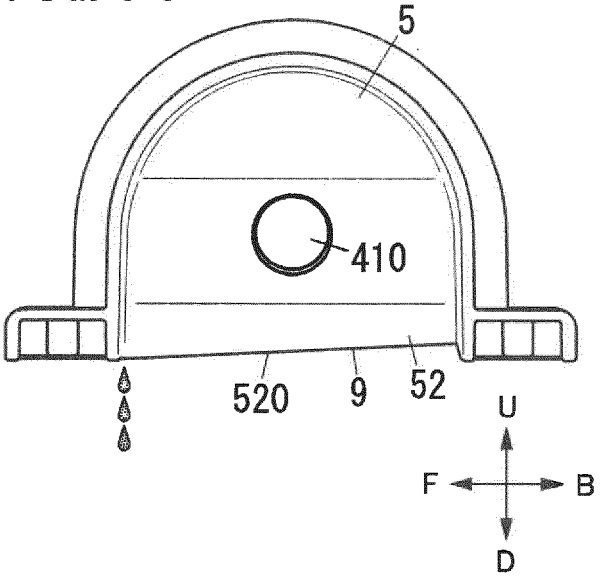
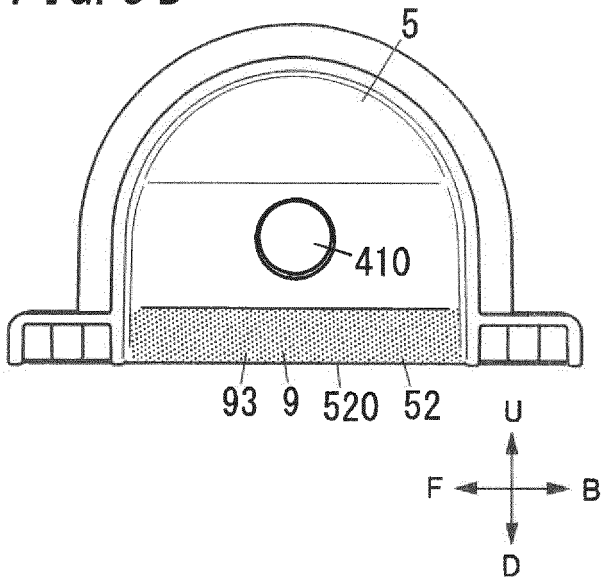


FIG. 5D



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/046558

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. E03D3/00(2006.01)i, E03D11/13(2006.01)i
FI: E03D3/00, E03D11/13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. E03D3/00, E03D11/13

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2019/097966 A1 (PANASONIC INTELLECTUAL PROPERTY MANAGEMENT CO., LTD.) 23 May 2019 (2019-05-23), paragraphs [0073]-[0088], fig. 1, 2, 8	1-5
A	JP 2008-7977 A (MATSUSHITA ELECTRIC WORKS, LTD.) 17 January 2008 (2008-01-17), entire text, all drawings	1-5
A	JP 2018-51144 A (LIXIL CORP.) 05 April 2018 (2018-04-05), entire text, all drawings	1-5

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 December 2020	12 January 2021
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/046558

WO 2019/097966 A1	23 May 2019	CN 111051624 A	
JP 2008-7977 A	17 January 2008	(Family: none)	
JP 2018-51144 A	05 April 2018	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2019097966 A1 **[0005]**