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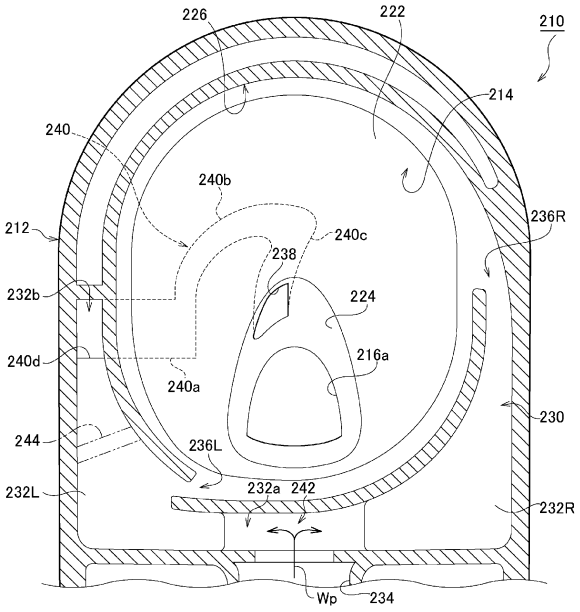
(54) FLUSH TOILET

(57) A flush toilet, comprising:
a toilet bowl part with a rim part formed in an upper end part thereof;
a first rim water passage formed on an outer peripheral side of the rim part and on one of left and right sides of a toilet body;
a second rim water passage formed on the outer peripheral side of the rim part and on the other of left and right sides of the toilet body;
a first rim discharge hole through which water is discharged from the first rim water passage into the toilet bowl part;
a second rim discharge hole through which water is discharged from the second rim water passage into the toilet bowl part;
a spout hole formed in a bottom part of the toilet bowl part or in a drainage passage part connected to the bottom part; and
a communication passage that communicates the first rim water passage and the spout hole, wherein:
the first rim water passage is formed to be a dead end at a termination end part in the extending direction thereof;
the first rim discharge hole is formed to branch off from a midway of a path from a starting end side toward a termination end side of the first rim water passage; and
a water introducing port of the communication passage opens closer to the termination end side of the first rim water passage than the first rim discharge hole.

FIG. 13



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Description

[TECHNICAL FIELD]

[0001] The present invention relates to a flush toilet.

[BACKGROUND ART]

[0002] 1. In the toilet bowl part of a toilet, there may be formed a jet spout port as an opening from which flush water is discharged, besides a rim discharge port. The rim discharge port is formed in a rim part of the toilet bowl part, and the entire toilet bowl part is flushed with flush water discharged from the rim discharge port. The jet spout port is formed in a bottom part of the toilet bowl part, for example, and flush water discharged from the jet spout port forms a flow of water for promoting discharge of waste.

[0003] For example, Patent Document 1 discloses a toilet comprising a jet spout port formed at a position higher than the highest level of pooled water stored in the bottom part of the toilet bowl part, and a flush water supply passage through which flush water is supplied to the jet spout port. In this toilet, flush water discharged from the jet spout port forms a swirling flow that swirls around a horizontal axis. Patent Document 1 discloses that, with the swirling flow, waste can be sent into the trap part, so as to be effectively discharged.

[PRIOR ART REFERENCE]

[PATENT DOCUMENT]

[0004] [Patent Document 1] Japanese Unexamined Patent Application Publication No. 2008-45276

[DISCLOSURE OF INVENTION]

[PROBLEM(S) TO BE SOLVED BY THE INVENTION]

[0005] As a result of study of the structure described in Patent Document 1, the inventors have recognized the following problem. In the toilet of Patent Document 1, after the toilet is flushed, the remaining water in the flush water supply passage will flow down, in the form of a streak of water (hereinafter, referred to as streaky water), from the jet spout port along the inner surface of the toilet bowl part. The streaky water flows down along a path irregularly changed on the inner surface of the toilet bowl part and sometimes flows down for a long period of time, which may cause disfigurement.

[0006] A first invention has been made in view of such a problem, and a purpose thereof is to provide a flush toilet of which disfigurement within the toilet bowl part caused by toilet flushing can be prevented.

[0007] 2. In the toilet bowl part of a toilet, there may be formed a jet spout hole as an opening from which flush water is discharged, besides a rim discharge hole. The rim discharge hole is formed in a rim part of the toilet bowl part, and the entire toilet bowl part is flushed with flush water discharged from the rim discharge hole. The jet spout hole is formed in a bottom part of the toilet bowl part, for example, and flush water discharged from the jet spout hole forms a flow of water for promoting discharge of waste.

[0008] For example, Patent Document 1 discloses, in FIG. 1 thereof, a toilet in which a rim water passage is formed on the outer peripheral side of the rim part, and a jet communication passage, which branches off from a midway of the rim water passage, is also formed. The toilet has a structure in which flush water supplied to the rim water passage is discharged from the rim discharge hole and also discharged from the jet spout hole after passing through the jet communication passage.

[0009] Meanwhile, in the toilet of Patent Document 1, a water introducing port of the jet communication passage opens at a midway of a path from the starting end side toward the termination end side of the rim water passage. Accordingly, flush water within the rim water passage is likely to flow toward the rim discharge hole, without changing its flowing direction to the jet communication passage. Therefore, it is difficult to bring the flush water from the rim water passage into the jet communication passage, causing the problem of a weak flow of flush water discharged from the jet spout hole.

[0010] In order to remedy the problem, there can be considered a structure in which two rim water passages are formed on the left and right sides on the outer peripheral side of the rim part, in which one rim water passage is provided with a rim discharge hole, and the other rim water passage communicates with the jet communication passage, as shown in FIG. 5 of Patent Document 1.

[0011] Also, for greater flexibility in the flushing mode, multiple rim discharge holes may be formed in the rim part, so that flush water supplied to the two rim water passages is discharged from the respective rim discharge holes. In the toilet of Patent Document 1, however, only a single rim discharge hole is formed in the rim part, and such multiple rim discharge holes are not considered. Also, the toilet of Patent Document 1 is not devised by providing such multiple rim discharge holes or enabling discharge of a strong flow of flush water from the jet spout hole.

[0012] A second invention has been made in view of such problems, and a purpose thereof is to provide a flush toilet that discharges flush water from rim discharge holes after passing through left and right rim water passages and also discharges a strong flow of flush water from a spout hole.

[MEANS TO SOLVE THE PROBLEM(S)]

[0013] To solve the aforementioned problems, a first mode of the first invention is a flush toilet. The flush toilet includes: a toilet bowl part; a trap part that is connected

to a bottom part of the toilet bowl part and that defines the water level, during a non-flushing period, of pooled water stored in the bottom part; and a water discharge part that includes a jet spout port formed in the bottom part and also includes a jet water supply passage provided to supply flush water to the jet spout port and that discharges flush water from the jet spout port to form a flow of water within the bottom part, in which the jet spout port is formed vertically across the water level of the pooled water during a non-flushing period. The "non-flushing period" means a period of a standby state before flushing within the toilet bowl part is started.

[0014] In the present mode, a lower portion of the jet spout port is submerged in the pooled water during a non-flushing period. Accordingly, after the toilet is flushed, water discharged from the jet spout port can be easily merged into the pooled water, without causing flowing down of the water along the inner surface of the toilet bowl part. Therefore, by preventing flowing down of streaky water from the jet spout port along the inner surface of the toilet bowl part after toilet flushing, disfigurement within the toilet bowl part caused by the toilet flushing can be prevented.

[0015] To solve the aforementioned problems, a first mode of the second invention is a flush toilet. The flush toilet includes: a toilet bowl part with a rim part formed in an upper end part thereof; a first rim water passage formed on an outer peripheral side of the rim part and on one of left and right sides; a second rim water passage formed on the outer peripheral side of the rim part and on the other of left and right sides; a first rim discharge hole through which water is discharged from the first rim water passage into the toilet bowl part; a second rim discharge hole through which water is discharged from the second rim water passage into the toilet bowl part; a spout hole formed in a bottom part of the toilet bowl part or in a drainage passage part connected to the bottom part; and a communication passage that communicates the first rim water passage and the spout hole, in which the first rim discharge hole is formed to branch off from a midway of a path from the starting end side toward the termination end side of the first rim water passage, and a water introducing port of the communication passage opens closer to the termination end side of the first rim water passage than the first rim discharge hole.

[0016] In the present mode, when flush water flows to the termination end part of the first rim water passage, the flush water has to change its flowing direction, so that the flush water is likely to change its flowing direction to the water introducing port located in the vicinity thereof, so as to be easily introduced into the water introducing port. Accordingly, flush water can be easily brought from the first rim water passage into the communication passage, so that high-pressure flush water can be easily discharged from the spout hole. As a result, flush water supplied to the left and right rim water passages is discharged from the multiple rim discharge holes and, also, a strong flow of flush water can be discharged from the spout hole.

[BRIEF DESCRIPTION OF DRAWINGS]

[0017] Embodiments will now be described, by way of example only, with reference to the accompanying drawings which are meant to be exemplary, not limiting, and wherein like elements are numbered alike in several Figures, in which:

FIG. 1 is a plan view of a flush toilet according to a first embodiment;
FIG. 2 is a sectional view taken along line A-A in FIG. 1;
FIG. 3 is a sectional view taken along line B-B in FIG. 2;
FIG. 4 is a diagram that shows a section of a toilet bowl part shown in FIG. 2 taken along line C-C;
FIGS. 5 are schematic diagrams that each show a flow of flush water within a jet water supply passage according to the first embodiment, in which FIG. 5A shows a state before toilet flushing is started, and FIG. 5B shows a state during toilet flushing;
FIGS. 6 are schematic diagrams that each show a flow of flush water within the jet water supply passage according to a first modification, in which FIG. 6A shows a state before toilet flushing is started, FIG. 6B shows a state during toilet flushing, and FIG. 6C shows a state during toilet flushing after the state of FIG. 6B;
FIG. 7 is a diagram that schematically shows a gradient formed on an inner bottom surface of each rim water passage according to the first embodiment;
FIG. 8 is a diagram that shows a flow of flush water within the toilet bowl part according to the first embodiment;
FIG. 9 is a schematic diagram that shows a state where flush water discharged from a rim discharge port joins pooled water before flush water is discharged from a jet spout port;
FIG. 10 is a schematic diagram that shows a change of the water level of pooled water within the toilet bowl part according to the first embodiment;
FIG. 11 is a plan view of the flush toilet according to a second embodiment;
FIG. 12 is a sectional view taken along line A-A in FIG. 11;
FIG. 13 is a sectional view taken along line B-B in FIG. 12;
FIG. 14 is a magnified view of a left rim water passage shown in FIG. 13;
FIG. 15 is a sectional view taken along line D-D in FIG. 14;
FIG. 16 is a sectional view taken along line E-E in FIG. 14;
FIG. 17 is a diagram that schematically shows a gradient formed on the inner bottom surface of each rim water passage according to the second embodi-

ment;

FIG. 18A is a diagram that shows the left rim water passage according to a first modification, and FIG. 18B is an illustrative diagram for a reduction part;

FIG. 19 is an illustrative diagram for the reduction part shown in FIG. 15; and

FIG. 20 is a diagram that shows the reduction part according to a second modification.

[MODE FOR CARRYING OUT THE INVENTION]

[0018] In the following embodiments and modifications, same reference characters designate same constituent elements, and the same description thereof will be omitted. Also, part of the constituent elements may be omitted in each drawing, for the sake of convenience.

[0019] 1. A preferred embodiment of the first invention will be described.

[0020] FIG. 1 is a plan view of a flush toilet 10 according to a first embodiment.

[0021] The flush toilet 10 comprises a toilet body 12 made of a ceramic material. The toilet body 12 is a wall-mounted toilet that is mounted to be hung on a side wall surface 100 in a toilet room.

[0022] FIG. 2 is a sectional view taken along line A-A in FIG. 1.

[0023] As shown in FIG. 1, the toilet body 12 comprises a toilet bowl part 14 formed in a front part of the toilet body 12, and a trap part 18 connected to a bottom part of the toilet bowl part 14. The trap part 18 communicates with the inside of the toilet bowl part 14 through an inlet 16 (see also FIG. 1) formed in the bottom part of the toilet bowl part 14.

[0024] FIG. 3 is a sectional view taken along line B-B in FIG. 2.

[0025] As shown in FIGS. 2 and 3, the toilet bowl part 14 comprises a receiving surface part 20 of a bowl-like shape that receives waste, a recess part 22 recessed downward from a lower edge part of the receiving surface part 20 and forming the bottom part of the toilet bowl part 14, and a rim part 24 connected to an upper edge part of the receiving surface part 20 and forming an upper end part of the toilet bowl part 14. The receiving surface part 20 is formed in an elliptical shape of which the longitudinal dimension is larger than the lateral dimension in plan view. The recess part 22 is formed in a bottomed cylindrical shape, and, on a bottom surface part thereof, the inlet 16 of the trap part 18 opens.

[0026] The toilet body 12 further comprises a water discharge part 26 for discharging flush water into the toilet bowl part 14, as shown in FIG. 3. The water discharge part 26 includes a jet spout port 28 formed in the recess part 22 of the toilet bowl part 14, and two rim discharge ports 30A and 30B formed in the rim part 24 of the toilet bowl part 14. The water discharge part 26 discharges flush water from the jet spout port 28 so as to form, within the recess part 22 of the toilet bowl part 14, a flow of water for promoting discharge of waste. The water discharge part 26 also discharges flush water from the two rim discharge ports 30A and 30B so as to form a flow of water for flushing the inner surface of the toilet bowl part 14. Although one of the main features of the flush toilet 10 resides in the water discharge part 26, particularly in the jet spout port 28, the peripheral structure thereof will be described first.

[0027] As shown in FIG. 2, the trap part 18 includes a first water pathway part 32, a second water pathway part 34, and a third water pathway part 36, provided in this order from the upstream side to the downstream side. The first water pathway part 32 is formed downward from the inlet 16 of the trap part 18. To the downstream end of the first water pathway part 32, the upstream end of the second water pathway part 34 is connected posteriorly, and the second water pathway part 34 is formed upward from its upstream end. Also, to the downstream end of the second water pathway part 34, the upstream end of the third water pathway part 36 is connected posteriorly, and the third water pathway part 36 is formed so as to extend backward from its upstream end. To the downstream end of the third water pathway part 36 is connected a drain pipe 102, and waste is discharged through the trap part 18 and the drain pipe 102 into a sewage water pathway.

[0028] Within the first water pathway part 32 and the second water pathway part 34 of the trap part 18, seal water 38 is stored to block airflow in the water flowing direction. The seal water 38 prevents backflow of odors from the sewage water pathway. In a boundary portion of the second water pathway part 34 and the third water pathway part 36 is formed a bent part 40 at which the direction of water flowing therein is changed. An upper edge 42 of an inner wall surface located inside the bent part 40 functions as an overflow edge (hereinafter, referred to as the "overflow edge 42") that defines the water level of the seal water 38 within the trap part 18 during a non-flushing period. The "non-flushing period" means a period of a standby state before flushing within the toilet bowl part 14 is started. When the level of the seal water 38 within the trap part 18 exceeds the overflow edge 42, the seal water 38 overflows from the trap part 18 over the overflow edge 42 to the downstream side.

[0029] Part of the seal water 38 within the trap part 18 is stored as pooled water 44 in the bottom part of the toilet bowl part 14. A water level WL1 of the pooled water 44 during a non-flushing period (hereinafter, referred to as the initial water level WL1) is determined according to the position of the overflow edge 42 in a vertical direction, similarly to the seal water 38.

[0030] As shown in FIG. 3, in the rim part 24, two rim conduits 48 are formed so as to extend from the respective two rim discharge ports 30A and 30B in one circumferential direction of the toilet bowl part 14 (in the counterclockwise direction in FIG. 3). The rim conduits 48 lead flush water discharged from the rim discharge ports 30A and 30B to swirl, so that the flush water is delivered from the starting end position to the termination end position

of each rim conduit 48.

[0031] The water discharge part 26 includes, besides the jet spout port 28 and the two rim discharge ports 30A and 30B, an inlet port 54, a right rim water passage 56A (first water passage), a left rim water passage 56B (second water passage), and a jet water supply passage 58. The jet spout port 28 will be detailed later, and the other configurations will now be described.

[0032] The two rim discharge ports 30A and 30B include a right rim discharge port 30A (first discharge port) and a left rim discharge port 30B (second discharge port). As shown in FIG. 1, the right rim discharge port 30A is disposed to the right of a lateral center line CL of the toilet body 12 and at a middle position in a longitudinal direction of the toilet bowl part 14. Also, the left rim discharge port 30B is disposed to the left of the lateral center line CL of the toilet body 12 and in a rear part of the toilet bowl part 14. The lateral center line CL is a straight line that extends along a longitudinal direction and bisects the lateral dimension of the outer surface portion of the toilet body 12. From the two rim discharge ports 30A and 30B, flush water is discharged in one circumferential direction along the inner peripheral surface of the rim part 24.

[0033] As shown in FIG. 2, flush water supplied from a water pipe 104a, which is part of a flush water supply device 104, flows in through the inlet port 54. FIG. 3 shows a water path Wp of flush water flowing into the water discharge part 26 from the water pipe 104a and the inlet port 54.

[0034] The right rim water passage 56A and left rim water passage 56B are provided to bifurcate the flush water flowing in through the inlet port 54. Flush water flowing through the right rim water passage 56A is supplied to the right rim discharge port 30A, and flush water flowing through the left rim water passage 56B is supplied to the left rim discharge port 30B. A bifurcation position 60 at which the right rim water passage 56A and left rim water passage 56B are separated is located in the rear of and on the back side of the rim part.

[0035] The right rim water passage 56A is formed so as to extend from the bifurcation position 60 in one circumferential direction (the counterclockwise direction) on the back side of the rim part 24. At the downstream end of the right rim water passage 56A, the right rim discharge port 30A is formed.

[0036] The left rim water passage 56B is formed so as to extend from the bifurcation position 60 in the other circumferential direction (the clockwise direction) on the back side of the rim part 24. The left rim water passage 56B is formed to be a dead end at the tip end part in the extending direction thereof. At a midway of the left rim water passage 56B, a branch pathway 62 is formed to extend radially inward and in one circumferential direction (the counterclockwise direction). At the downstream end of the branch pathway 62, the left rim discharge port 30B is formed.

[0037] As shown in FIGS. 2 and 3, the jet water supply passage 58 is connected to the tip end part of the left rim water passage 56B. The jet water supply passage 58 is provided to supply flush water to the jet spout port 28. On the inner bottom surface of the left rim water passage 56B, an introducing port 64 is formed to introduce flush water into the jet water supply passage 58. The jet water supply passage 58 is formed to connect the introducing port 64 and the jet spout port 28. More specifically, the jet water supply passage 58 includes a first portion 58a extending downward from the introducing port 64, and a second portion 58b extending to be curved downward and in the other circumferential direction (the clockwise direction in FIG. 3) from the downstream end of the first portion 58a. The second portion 58b extends to be curved from the back side of a side part of the toilet bowl part 14 to the back side of the jet spout port 28. The jet water supply passage 58 further includes a third portion 58c extending backward from the downstream end of the second portion 58b to the jet spout port 28.

[0038] The jet spout port 28 is formed on the left side and front side on a wall surface of the recess part 22 in the toilet bowl part 14. From the jet spout port 28, flush water is discharged in one circumferential direction (the clockwise direction) within the recess part 22 of the toilet bowl part 14, similarly to the direction of flush water discharged from each of the two rim discharge ports 30A and 30B. From the jet spout port 28, flush water is discharged along a horizontal direction. The "along a horizontal direction" means both the case where the discharging direction of flush water is parallel with a horizontal plane and the case where the discharging direction of flush water is substantially parallel with a horizontal plane.

[0039] FIG. 4 is a diagram that shows a section of the toilet bowl part 14 shown in FIG. 2 taken along line C-C.

[0040] As shown in FIGS. 2 and 4, the jet spout port 28 is formed vertically across the initial water level WL1 of the pooled water 44. An upper portion of the jet spout port 28 is located higher than the initial water level WL1 of the pooled water 44, and the aerial space within the jet water supply passage 58 communicates with the aerial space within the toilet bowl part 14 through the upper portion. A lower portion of the jet spout port 28 is located lower than the initial water level WL1 of the pooled water 44 and is submerged in the pooled water 44. More specifically, a lower edge 28a of the jet spout port 28 is located lower than the initial water level WL1. The lower edge 28a is part of the jet spout port 28, located vertically below the water flowing through the jet spout port 28.

[0041] There will now be described effects of the flush toilet 10 set forth above.

[0042] (1) The jet spout port 28 of the flush toilet 10 is formed vertically across the initial water level WL1 of the pooled water 44, and the lower portion of the jet spout port 28 is submerged in the pooled water 44 of the initial water level. Accordingly, after the toilet is flushed, water including replenishment water and remaining water delivered to the jet spout port 28 through the jet water supply passage 58 can be merged into the pooled water 44,

without causing flowing down of the water along the inner surface of the toilet bowl part 14. Thus, by preventing flowing down of streaky water from the jet spout port 28 along the inner surface of the toilet bowl part 14 after toilet flushing, disfigurement within the toilet bowl part 14 caused by the toilet flushing can be prevented. The "replenishment water" means water supplied to fill the pooled water 44 up to the initial water level WL1 again after the pooled water 44 is discharged through the trap part 18 during toilet flushing. Also, the "remaining water" means water remaining within the rim water passages 56A and 56B and the jet water supply passage 58 after supply of flush water from the flush water supply device 104 is finished.

[0043] If streaky water flows down from the jet spout port 28 along the inner surface of the toilet bowl part 14, part of the streaky water may adhere to and remain on the inner surface of the toilet bowl part 14. In this case, depending on the quality of the water adhering to the inner surface of the toilet bowl part 14, the adhesion position may be stained after the evaporation of the water. According to the present embodiment, however, since the flowing down of streaky water from the jet spout port 28 along the inner surface of the toilet bowl part 14 can be prevented, a stain on the inner surface of the toilet bowl part 14 due to remaining streaky water can be prevented, and disfigurement within the toilet bowl part 14 caused by toilet flushing can also be prevented. Also, by preventing a stain on the inner surface of the toilet bowl part 14 due to remaining streaky water, the inside of the toilet bowl part 14 can be kept clean.

[0044] Also, the jet spout port 28 is formed vertically across the initial water level WL1 of the pooled water 44, and the aerial space within the jet water supply passage 58 communicates with the aerial space within the toilet bowl part 14 through the upper portion of the jet spout port 28. Advantages thereof will be described.

[0045] FIGS. 5 are schematic diagrams that each show a flow of flush water within the jet water supply passage 58. FIG. 5A shows a state before toilet flushing is started. For the sake of convenience, the positions, dimensions, and shapes of the toilet bowl part 14, trap part 18, and jet water supply passage 58 shown in FIGS. 5 are made different from those shown in other drawings.

[0046] When flush water W is supplied to the left rim water passage 56B, the flush water flows into the jet water supply passage 58 through the introducing port 64, and the flush water is gradually filled from the introducing port 64 side of the jet water supply passage 58, as shown in FIG. 5B. Since the flush water W flows into the jet water supply passage 58, air within the jet water supply passage 58 is pushed out by the flush water W toward the jet spout port 28 side (see the direction Pa). As described previously, since the aerial space within the jet water supply passage 58 communicates with the aerial space within the toilet bowl part 14 through the upper portion of the jet spout port 28, the air within the jet water supply passage 58 is smoothly discharged through the jet spout port 28 (see the direction Pb). If the entirety of the jet spout port 28 is submerged in the pooled water 44, the air within the jet water supply passage 58 will be discharged in the form of bubbles from the jet spout port 28, and the bursting sound of the bubbles may give an unpleasant feeling to the user. According to the present embodiment, however, since discharge of bubbles from the jet spout port 28 can be prevented during toilet flushing, the occurrence of bursting sound of bubbles can also be prevented, enabling quiet operations of toilet flushing. In addition, prevention of discharge of bubbles from the jet spout port 28 can also prevent giving a sense of incongruity in appearance to the user.

[0047] In the following, other features of the flush toilet 10 will be described.

[0048] As shown in FIG. 5A, the jet water supply passage 58 is formed so that an aerial space 66 continuously exists in a range between the introducing port 64, through which flush water from the left rim water passage 56B flows in, and the jet spout port 28, during a non-flushing period. The "aerial space 66" is a space filled with air. Namely, in this range, part of the jet water supply passage 58 is not filled with seal water that blocks airflow in the water flowing direction. Advantages thereof will be described.

[0049] FIGS. 6 are schematic diagrams that each show a flow of flush water within the jet water supply passage 58 according to a modification.

[0050] It is assumed here that seal water 68 is formed within the jet water supply passage 58, as shown in FIG. 6A. In this case, there is upstream-side air 70 and downstream-side air 72 separated by the seal water 68 within the jet water supply passage 58. In this state, if flush water from the left rim water passage 56B flows into the jet water supply passage 58, the flush water W will push out the upstream-side air 70 together with the seal water 68 in the direction Pc, as shown in FIG. 6B. Accordingly, the seal water 68 will be merged into the pooled water 44 in the bottom part of the toilet bowl part 14, and the level of the pooled water 44 may rise from the initial water level WL1 until the jet spout port 28 is submerged (see the direction Pd) while air remains within the jet water supply passage 58, as shown in FIG. 6C. In this case, the remaining air will be discharged in the form of bubbles from the jet spout port 28 (see the direction Pe), which may cause bursting sound of bubbles.

[0051] According to the aforementioned configuration, on the other hand, the seal water 68 is not formed within the jet water supply passage 58, thereby preventing the rise of the level of the pooled water 44 due to the seal water 68 merged into the pooled water 44. Therefore, the situation can be prevented in which the entirety of the jet spout port 28 is submerged while air remains within the jet water supply passage 58 and bubbles are discharged from the jet spout port 28, so that the occurrence of bursting sound of bubbles can be effectively prevented.

[0052] Since the jet spout port 28 in the flush toilet 10

according to this example is also formed vertically across the initial water level WL1 of the pooled water 44, the effects described previously in the section (1) can be obtained.

[0053] There will now be described the contrivances to prevent flowing down of streaky water from the rim discharge ports 30A and 30B, instead of the jet spout port 28.

[0054] FIG. 7 is a diagram that schematically shows a gradient formed on the inner bottom surface of each of the rim water passages 56A and 56B. In FIG. 7, a gradient from a higher position to a lower position is indicated by an arrow.

[0055] On the inner bottom surface of each of the rim water passages 56A and 56B, a gradient inclined downward from the corresponding one of the rim discharge ports 30A and 30B toward the direction away from the rim discharge port is provided. More specifically, on the inner bottom surface of the right rim water passage 56A, a first gradient 74 is provided in which the right rim discharge port 30A corresponds to a high position, and the side of the bifurcation position 60 at which the right rim water passage 56A and the left rim water passage 56B are separated corresponds to a low position. The first gradient 74 is provided to be inclined downward from the right rim discharge port 30A toward the direction away from the right rim discharge port 30A.

[0056] Also, on the inner bottom surface of the left rim water passage 56B, a second gradient 76 is provided in which the side of the bifurcation position 60 corresponds to a high position, and the introducing port 64 of the jet water supply passage 58 corresponds to a low position. The second gradient 76 is provided to be inclined downward from the left rim discharge port 30B toward the direction away from the left rim discharge port 30B. Also, on the inner bottom surface of the left rim water passage 56B, a third gradient 78 is further provided in which a front end position 56Ba as a dead end corresponds to a high position, and the introducing port 64 of the jet water supply passage 58 corresponds to a low position. At the bifurcation position 60 between the rim water passages 56A and 56B, a recessed part 80 recessed downward is formed.

[0057] Advantages of the configuration set forth above will be described. It is assumed here that supply of flush water from the flush water supply device 104 is finished, and the water level within each of the rim water passages 56A and 56B falls to the vicinity of the lower edge of the corresponding one of the rim discharge ports 30A and 30B. In this state, water including remaining water and replenishment water on the inner bottom surfaces of the rim water passages 56A and 56B is likely to flow, because of its own weight, in the direction away from the respective rim discharge ports 30A and 30B, along the first gradient 74 and the second gradient 76 respectively. Namely, the water on the inner bottom surfaces of the rim water passages 56A and 56B is less likely to come closer to the respective rim discharge ports 30A and 30B and to flow into the toilet bowl part 14 from the respective rim discharge ports 30A and 30B. Accordingly, even when the water levels in the rim water passages 56A and 56B fall as described previously, flowing down of streaky water from the respective rim discharge ports 30A and 30B along the inner surface of the toilet bowl part 14 can be prevented, so that disfigurement within the toilet bowl part 14 caused by toilet flushing can also be effectively prevented.

[0058] Also, at least part of the introducing port 64 of the jet water supply passage 58 is positioned lower than the rim discharge ports 30A and 30B. In the present embodiment, the entirety of the introducing port 64 is positioned lower than the rim discharge ports 30A and 30B. From another perspective, at least part of the introducing port 64 is positioned lower than the highest position of each of the inner bottom surfaces provided with the first gradient 74 and the second gradient 76. In the present embodiment, the entirety of the introducing port 64 is positioned lower than the highest position of each of the inner bottom surfaces provided with the first gradient 74 and the second gradient 76. More specifically, the introducing port 64 is positioned lower than the lowest position of the inner bottom surface provided with the first gradient 74, and disposed at the same position as the lowest position of the inner bottom surface provided with the second gradient 76.

[0059] Accordingly, while the water level in each of the rim water passages 56A and 56B is falling, water on the inner bottom surface of the rim water passage can be easily led by its own weight to the introducing port 64 of the jet water supply passage 58, along the corresponding one of the first gradient 74 and the second gradient 76. Therefore, water on the inner bottom surfaces of the rim water passages 56A and 56B can be discharged through the jet water supply passage 58, so that the amount of water flowing into the toilet bowl part 14 from the rim discharge ports 30A and 30B can be reduced more easily. As a result, while the water levels in the rim water passages 56A and 56B are falling, flowing down of streaky water from the respective rim discharge ports 30A and 30B along the inner surface of the toilet bowl part 14 can be effectively prevented, so that disfigurement within the toilet bowl part 14 caused by toilet flushing can also be prevented more effectively.

[0060] In the following, a method for flushing the toilet bowl part 14 in the flush toilet 10 set forth above will be described with reference to FIG. 8.

[0061] In the flush toilet 10, the inside of the toilet bowl part 14 is flushed using a flushing method of the so-called wash-down type in which waste within the toilet bowl part 14 is flushed away into the trap part 18 by means of head of water. By operating an operation member, such as a switch and a lever, to start supply of flush water, flush water is supplied from the flush water supply device 104 into the water discharge part 26 of the flush toilet 10, within a predetermined flow rate range. In the following, an operation from the start through the end of supply of

flush water within a predetermined flow rate range will be described as one flushing operation. In the present embodiment, flush water is supplied from the flush water supply device 104 using a water supply method of the water direct pressure type by means of the water supply pressure of tap water.

[0062] Flush water supplied from the flush water supply device 104 flows into the water discharge part 26 through the inlet port 54. After flowing into the water discharge part 26, the flush water flows through each of the right rim water passage 56A, left rim water passage 56B, and jet water supply passage 58 (not illustrated) to be discharged from the corresponding one of the rim discharge ports 30A and 30B, and the jet spout port 28.

[0063] The flush water discharged from the jet spout port 28 forms a swirling flow Dwa that swirls along one circumferential direction (the counterclockwise direction) within the recess part 22 of the toilet bowl part 14. With the swirling flow Dwa, the inner surface of the recess part 22 is flushed, and waste within the recess part 22 is collected at the center of swirling.

[0064] The flush water discharged from the rim discharge ports 30A and 30B in one circumferential direction along the inner peripheral surface of the rim part 24 forms a swirling flow Dwb, which swirls along the one circumferential direction within the toilet bowl part 14. With the swirling flow Dwb, the rim part 24 and the receiving surface part 20 of the toilet bowl part 14 are flushed. Part of the flush water forming the swirling flow Dwb upon the receiving surface part 20 swirls downward, so as to form a flow Dwc from the receiving surface part 20 through the recess part 22 to the inlet 16 of the trap part 18. With the flow Dwc, the waste within the recess part 22 of the toilet bowl part 14 is flushed away into the trap part 18 through the inlet 16. Since the waste collected by the aforementioned swirling flow Dwa at the center of swirling is thus flushed away, the waste can be effectively discharged.

[0065] A flow of flush water within the jet water supply passage 58 will now be considered. As shown in FIG. 5B, after flowing into the jet water supply passage 58, flush water flows while pushing out the air within the jet water supply passage 58 toward the jet spout port 28 side, and, at the time when the flush water reaches the jet spout port 28, discharge of the flush water from the jet spout port 28 is started. Accordingly, if the entirety of the jet spout port 28 is submerged before the flush water is discharged from the jet spout port 28, as shown in FIG. 9, the air pushed by the flush water will remain within the jet water supply passage 58. In this case, the air within the jet water supply passage 58 will be discharged in the form of bubbles from the jet spout port 28 (see the direction Pf), which may cause bursting sound of bubbles within the toilet bowl part 14. Such a situation could occur when the level of the pooled water 44 is raised from the initial water level WL1 by flush water discharged from the rim discharge ports 30A and 30B, before flush water is discharged from the jet spout port 28.

[0066] Accordingly, the toilet bowl part 14 and the water discharge part 26 of the present embodiment are configured so that the flush water is discharged from the jet spout port 28 before the flush water discharged from the rim discharge ports 30A and 30B joins the pooled water 44. From another perspective, the toilet bowl part 14 and the water discharge part 26 are configured so that, after the flush water flowing into the jet water supply passage 58 through the introducing port 64 finishes pushing out air in the jet water supply passage 58 from the jet spout port 28, the flush water discharged from the rim discharge ports 30A and 30B joins the pooled water 44. This prevents the situation in which flush water discharged from the rim discharge ports 30A and 30B joins the pooled water 44 and the entirety of the jet spout port 28 is submerged because of rise of the level of the pooled water 44 before flush water finishes pushing out air in the jet water supply passage 58. As a result, the situation can be prevented in which since the entirety of the jet spout port 28 is submerged while air remains within the jet water supply passage 58, bubbles are discharged from the jet spout port 28, so that the occurrence of bursting sound of bubbles can be effectively prevented.

[0067] For such a configuration, in the water discharge part 26, the length of the water path between the inlet port 54 and each of the rim discharge ports 30A and 30B, the length of the water path in the jet water supply passage 58, the cross-sectional area of each of the water passages 56A, 56B, and 58, and the like, are adjusted. Also, for such a configuration, in the toilet bowl part 14, the radius of curvature in plan view, the inclination of each region, and the like, are adjusted. For early discharge of flush water from the jet spout port 28, the flush water needs to reach the jet spout port 28 early, so that the length of the water path in the jet water supply passage 58 may be adjusted to be shorter, and the cross-sectional area of the jet water supply passage 58 may be adjusted to be smaller, for example. Also, in order to delay the timing at which flush water discharged from the rim discharge ports 30A and 30B (hereinafter, referred to as rim flush water) joins the pooled water 44, the length of the water path between the inlet port 54 and each of the rim discharge ports 30A and 30B may be adjusted to be longer, the radius of curvature of the toilet bowl part 14 in plan view may be adjusted to be larger, and part of inclinations may be adjusted to be gentler, for example.

[0068] From another perspective, it can also be said that, in the abovementioned configuration, the toilet bowl part 14 and the water discharge part 26 are configured so that, after discharge of air in the jet water supply passage 58 from the jet spout port 28 is finished, the entirety of the jet spout port 28 is submerged. This also prevents the situation where the entirety of the jet spout port 28 is submerged because of rise of the level of the pooled water 44 before flush water finishes pushing out air in the jet water supply passage 58.

[0069] For such a configuration, it is necessary to meet the condition of preventing the level of the pooled water

44 rising until the entirety of the jet spout port 28 is submerged before the discharge of air in the jet water supply passage 58 from the jet spout port 28 is finished. Such rise of the level of the pooled water 44 occurs when rim flush water joins the pooled water 44. Accordingly, in order to meet the above condition, the water discharge part 26 and the toilet bowl part 14 may be configured so that (A) flush water is discharged early from the jet spout port 28, and (B) the timing at which rim flush water joins the pooled water 44 is delayed, as described previously. The condition (A) is set because, if flush water is discharged earlier from the jet spout port 28, discharge of air in the jet water supply passage 58 can be finished at earlier timing.

[0070] As shown in FIG. 10, during toilet flushing, the level of the pooled water 44 within the recess part 22 of the toilet bowl part 14 rises from the initial water level WL1 to a water level WL2 (see also FIGS. 2 and 4) because of flush water discharged from the jet spout port 28 and the rim discharge ports 30A and 30B. At the water level WL2, the entirety of the jet spout port 28 is submerged. The amount of flush water supplied from the flush water supply device 104 is adjusted so that the level of the pooled water 44 is set to the water level WL2.

[0071] The first invention has been described with reference to an embodiment, which merely describes principles and applications of the first invention. Also, various modifications or changes in arrangement may be made to the embodiment without departing from the scope of ideas of the first invention defined in the claims.

[0072] Although the wash-down type is described as an example of the flushing method for the flush toilet 10, the inside of the toilet bowl part 14 may be flushed using a flushing method combined with another type, such as the syphon type. Also, although the water direct pressure type is described as an example of the water supply method for the flush toilet 10, another water supply method, such as the gravity water supply type using gravity, may be employed. Further, although a wall-mounted toilet is described as an example of the toilet body 12, it may be a floor-mounted toilet mounted on the floor of a toilet room. Also, the toilet body 12 may be made of another material, such as resin, instead of a ceramic material.

[0073] Although an example has been described in which the inlet 16 of the trap part 18 opens on the bottom surface part of the bottom part (recess part 22) of the toilet bowl part 14, the inlet 16 may open on a side surface part of the bottom part.

[0074] Although an example has been described in which the jet spout port 28 is formed on the left side and front side on a wall surface of the recess part 22, the position is not limited thereto. Also, an example has been described in which the water discharge part 26 is configured to discharge flush water from the jet spout port 28 so as to form a swirling flow that swirls along one circumferential direction within the bottom part of the toilet bowl part 14. However, a flow of water formed by the flush water discharged from the jet spout port 28 is not limited thereto, and may be a flow of water flowing toward the posterior side of the trap part 18 from the inlet 16 of the trap part 18, for example. In any case, the flow of water has only to be formed so as to promote discharge of waste through the trap part 18.

[0075] Also, when the vertical dimension of the jet spout port 28 is defined as La, the jet spout port 28 may be formed so that a region thereof, which can range in vertical dimension from a quarter to three quarters of the vertical dimension La, is disposed lower than the initial water level WL1 of the pooled water 44.

[0076] The rim discharge ports 30A and 30B are described as examples of a discharge port from which flush water is discharged into the toilet bowl part 14. Such a discharge port need not necessarily be formed in the rim part 24 and may be formed in a warm water washing device mounted on the toilet body 12. Also, although an example has been described in which the two rim discharge ports 30A and 30B are formed in the rim part 24, only a single rim discharge port, or three or more rim discharge ports may be formed in the rim part 24. Further, an example has been described in which flush water is discharged from the rim discharge ports 30A and 30B in one circumferential direction along the inner peripheral surface of the rim part 24. However, a discharge port formed in the rim part 24 has only to allow flush water to be discharged into the toilet bowl part 14, and the discharging direction of the flush water is not limited thereto. For example, the flush water may be discharged downward.

[0077] Although an example has been described in which the left rim water passage 56B and the right rim water passage 56A are formed on the back side of the rim part 24, only one of them may be formed.

[0078] An example has been described in which the introducing port 64 of the jet water supply passage 58 is formed on the inner bottom surface of the left rim water passage 56B. However, when the introducing port 64 is formed on an inner wall surface of a water passage for supplying flush water to a discharge port, the introducing port 64 may be formed on an inner side surface of the left rim water passage 56B, or on the inner bottom surface or an inner side surface of the right rim water passage 56A.

[0079] When the inventions embodied by the embodiment and modifications set forth above are generalized, the following technical ideas are derived.

[0080] In the flush toilet in a second mode of the first invention, in the first mode, the toilet bowl part and the water discharge part of the first mode may be configured so that, after discharge of air in the jet water supply passage from the jet spout port is finished, the entirety of the jet spout port is submerged.

[0081] The present mode prevents the situation where the entirety of the jet spout port is submerged because of rise of the level of the pooled water before flush water finishes pushing out air in the jet water supply passage. As a result, the situation can be prevented in which since

the entirety of the jet spout port is submerged while air remains within the jet water supply passage, bubbles are discharged from the jet spout port, so that the occurrence of bursting sound of bubbles can be effectively prevented.

[0082] In the flush toilet in a third mode of the first invention, in the first mode, the water discharge part may include a discharge port from which flush water is discharged into the toilet bowl part, and the toilet bowl part and the water discharge part may be configured so that, after flush water is discharged from the jet spout port, flush water discharged from the rim discharge port joins the pooled water.

[0083] The present mode prevents the situation in which the flush water discharged from the rim discharge port joins the pooled water and the entirety of the jet spout port is submerged because of rise of the level of the pooled water before flush water finishes pushing out air in the jet water supply passage. As a result, the situation can be prevented in which since the entirety of the jet spout port is submerged while air remains within the jet water supply passage, bubbles are discharged from the jet spout port, so that the occurrence of bursting sound of bubbles can be effectively prevented.

[0084] In the flush toilet in a fourth mode of the first invention, in any one of the first through the third modes, the jet water supply passage may be formed so that an aerial space continuously exists in a range between an introducing port, through which flush water is introduced, and the jet spout port, during a non-flushing period.

[0085] If seal water for blocking airflow in the water flowing direction is formed within the jet water supply passage, when flush water flows in through the introducing port of the jet water supply passage, air between the introducing port and the seal water will be pushed out together with the seal water, and the seal water will be merged into the pooled water, so that the level of the pooled water will rise from the water level during a non-flushing period. Accordingly, the air within the jet water supply passage will be discharged in the form of bubbles from the jet spout port, which may cause bursting sound of bubbles.

[0086] In the present mode, on the other hand, the seal water is not formed within the jet water supply passage, thereby preventing the rise of the level of the pooled water due to the seal water within the jet water supply passage merged into the pooled water. Therefore, the situation can be prevented in which the entirety of the jet spout port is submerged while air remains within the jet water supply passage and bubbles are discharged from the jet spout port, so that the occurrence of bursting sound of bubbles can be effectively prevented.

[0087] In the flush toilet in a fifth mode of the first invention, in any one of the first through the fourth modes, the toilet bowl part may include a rim part that forms an upper end part of the toilet bowl part, the water discharge part may include a rim discharge port formed in the rim part and also may include a rim water passage formed on the back side of the rim part and provided to supply flush water to the rim discharge port, and, on the inner bottom surface of the rim water passage, a gradient inclined downward from the rim discharge port toward the direction away from the rim discharge port may be provided.

[0088] It is assumed here that the water level within the water passage falls to the vicinity of the lower edge of the rim discharge port. In this state, in the present mode, water on the inner bottom surface of the rim water passage is likely to flow, because of its own weight, in the direction away from the rim discharge port, along the gradient on the inner bottom surface. Namely, the water on the inner bottom surface of the rim water passage is less likely to come closer to the rim discharge port and to flow into the toilet bowl part from the rim discharge port. Accordingly, even when the water level in the rim water passage falls as described previously, flowing down of streaky water from the rim discharge port along the inner surface of the toilet bowl part can be prevented, so that disfigurement within the toilet bowl part caused by toilet flushing can also be effectively prevented.

[0089] In the flush toilet in a sixth mode of the first invention, in the fifth mode, an introducing port through which flush water is introduced into the jet water supply passage may be formed on an inner wall surface of the rim water passage, and at least part of the introducing port may be positioned lower than the rim discharge port.

[0090] In the present mode, while the water level in the rim water passage is gradually falling, water on the inner bottom surface of the rim water passage can be easily led by its own weight to the introducing port of the jet water supply passage along the gradient. Therefore, water on the inner bottom surface of the rim water passage can be discharged through the jet water supply passage, so that the amount of water flowing into the toilet bowl part from the rim discharge port can be reduced more easily. As a result, while the water level in the rim water passage is falling, flowing down of streaky water from the rim discharge port along the inner surface of the toilet bowl part can be effectively prevented, so that disfigurement caused by toilet flushing can also be prevented more effectively.

[0091] 2. A preferred embodiment of the second invention will be described.

[0092] FIG. 11 is a plan view of a flush toilet 210 according to a second embodiment.

[0093] The flush toilet 210 comprises a toilet body 212 made of a ceramic material. The toilet body 212 is a wall-mounted toilet that is mounted to be hung on a side wall surface 200 in a toilet room.

[0094] FIG. 12 is a sectional view taken along line A-A in FIG. 11.

[0095] The toilet body 212 comprises a toilet bowl part 214 formed in a front part of the toilet body 212, and a drainage passage part 216 connected to a bottom part of the toilet bowl part 214. The drainage passage part 216 is a passage for waste discharged from the toilet

bowl part 214 to the sewage water pathway (not illustrated). The drainage passage part 216 includes a trap part 220 in which seal water 218 is stored to block airflow in the water flowing direction. To the downstream end of the trap part 220 is connected a connection pipe 202, and the drainage passage part 216 is connected to the sewage water pathway via the connection pipe 202.

[0096] FIG. 13 is a sectional view taken along line B-B in FIG. 12.

[0097] As shown in FIGS. 12 and 13, the toilet bowl part 214 comprises a receiving surface part 222 of a bowl-like shape that receives waste, a recess part 224 recessed downward from a lower edge part of the receiving surface part 222 and formed in the bottom part of the toilet bowl part 214, and a rim part 226 formed in an upper end part of the toilet bowl part 214. The receiving surface part 222 is formed in an elliptical shape of which the longitudinal dimension is larger than the lateral dimension in plan view. On a bottom surface part of the recess part 224, an inlet 216a of the drainage passage part 216 opens, and part of the seal water 218 is stored as pooled water 228 within the recess part 224.

[0098] The toilet body 212 also comprises a water discharge part 230 for discharging flush water, as shown in FIG. 13. The water discharge part 230 includes two rim water passages 232L and 232R formed on the outer peripheral side of the rim part 226, a common water passage 234 (see also FIG. 12) through which flush water is supplied to each of the rim water passages 232L and 232R, and two rim discharge holes 236L and 236R formed in the rim part 226. The water discharge part 230 also includes a jet spout hole 238 formed in the recess part 224 of the toilet bowl part 214, and a jet communication passage 240 through which flush water is supplied to the jet spout hole 238. Although one of the main features of the flush toilet 210 resides in the rim water passage 232L, other features of the water discharge part 230 will be described first.

[0099] The two rim water passages 232L and 232R include a left rim water passage 232L (first rim water passage) formed on the left side, as one of left and right sides, of the toilet body 212, and a right rim water passage 232R (second rim water passage) formed on the right side, as the other of left and right sides, of the toilet body 212. The left rim water passage 232L is disposed to the left of the lateral center line CL of the toilet body 212, as shown in FIG. 1. Also, the right rim water passage 232R is disposed to the right of the lateral center line CL of the toilet body 212. The lateral center line CL is a straight line that extends along a longitudinal direction and bisects the lateral dimension of the outer surface portion of the toilet body 212.

[0100] Referring back to FIG. 13, the rim water passages 232L and 232R are formed by bifurcating the common water passage 234 at the downstream end thereof in the left and right directions. A bifurcation position 242 at which the rim water passages 232L and 232R are separated is located in the rear of the rim part 226. As shown in FIG. 12, flush water is supplied to the common water passage 234 from a water pipe 204a, which is part of a flush water supply device 204.

[0101] The left rim water passage 232L is formed so as to extend from a starting end part 232a on the bifurcation position 242 side in one circumferential direction (the clockwise direction in FIG. 13). The left rim water passage 232L is formed to be a dead end at a termination end part 232b thereof positioned at the end in the extending direction. The left rim water passage 232L will be detailed later.

[0102] The right rim water passage 232R is formed so as to extend from the bifurcation position 242 as the starting end side in the other circumferential direction (the counterclockwise direction in FIG. 13). At a termination end part of the right rim water passage 232R, positioned at the end in the extending direction, the right rim discharge hole 236R is formed. Hereinafter, "one circumferential direction" is referred to as the clockwise direction, and "the other circumferential direction" is referred to as the counterclockwise direction.

[0103] The two rim discharge holes 236L and 236R include a left rim discharge hole 236L (first rim discharge hole) formed on the left side of the toilet body 212, and a rim discharge hole 236R (second rim discharge hole) formed on the right side of the toilet body 212. As shown in FIG. 1, the left rim discharge hole 236L is disposed to the left of the lateral center line CL of the toilet body 212 and in a rear part of the toilet bowl part 214. Also, the right rim discharge hole 236R is disposed to the right of the lateral center line CL of the toilet body 212 and at a middle position in a longitudinal direction of the toilet bowl part 214.

[0104] The description will now return to FIG. 13. The left rim discharge hole 236L is provided to discharge water from the left rim water passage 232L into the toilet bowl part 214. Also, the right rim discharge hole 236R is provided to discharge water from the right rim water passage 232R into the toilet bowl part 214. Through the two rim discharge holes 236L and 236R, flush water is discharged in the counterclockwise direction along the inner peripheral surface of the rim part 226. Accordingly, a flow of water for flushing the inner surface of the toilet bowl part 214, particularly the inner surface of the rim part 226 or the receiving surface part 222, is formed. The flow of water is a swirling flow led to swirl in the counterclockwise direction within the toilet bowl part 214.

[0105] The jet spout hole 238 is formed on the left side and front side on a wall surface of the recess part 224 in the toilet bowl part 214. From the jet spout hole 238, flush water is discharged toward the pooled water 228 (see FIG. 12) within the recess part 224 of the toilet bowl part 214. More specifically, flush water is discharged in the counterclockwise direction along the inner peripheral surface of the recess part 224 of the toilet bowl part 214, toward the pooled water 228 within the recess part 224. Accordingly, a counterclockwise swirling flow is formed within the recess part 224 of the toilet bowl part 214,

thereby collecting waste within the recess part 224 at the center of swirling. By the flush water flowing from the receiving surface part 222 into the recess part 224, the waste is flushed away into the drainage passage part 216 through the inlet 216a. In this way, flush water discharged from the jet spout hole 238 forms, in the pooled water 228, a flow of water for promoting discharge of waste.

[0106] The jet communication passage 240 communicates the left rim water passage 232L and the jet spout hole 238. The jet communication passage 240 includes a first portion 240a, a second portion 240b, and a third portion 240, provided in this order from the left rim water passage 232L side to the jet spout hole 238 side. The first portion 240a extends, from a water introducing port 240d (described later) that opens on an inner wall surface of the left rim water passage 232L, downward and also inward of the radial direction of the toilet bowl part 214. The second portion 240b extends, from the downstream end of the first portion 240a, to be curved downward and in the clockwise direction at the outer peripheral side of the toilet bowl part 214. The third portion 240c extends backward from the downstream end of the second portion 240b toward the jet spout hole 238.

[0107] FIG. 14 is a magnified view of the left rim water passage 232L shown in FIG. 13.

[0108] The left rim water passage 232L has a shape extending to be bent in an L shape from the starting end part 232a toward the termination end part 232b. Flush water suppled to the starting end part 232a of the left rim water passage 232L is led to the termination end part 232b, while hitting on an inner wall surface of the left rim water passage 232L and thereby changing its flowing direction. Thus, the left rim water passage 232L is formed so as to be able to lead the flush water from the starting end side to the termination end side thereof.

[0109] The left rim discharge hole 236L is formed to branch off from a midway of a path Pa from the starting end side toward the termination end side of the left rim water passage 232L. The left rim discharge hole 236L is formed to extend from the midway of the path Pa toward the inside of the toilet bowl part 214 and in the counterclockwise direction.

[0110] The water introducing port 240d, through which flush water is introduced into the jet communication passage 240, opens closer to the termination end side of the left rim water passage 232L than the left rim discharge hole 236L. More specifically, the water introducing port 240d opens on the inner bottom surface of the termination end part 232b of the left rim water passage 232L. Also, the water introducing port 240d is disposed on the left side of the toilet body 212 and forward of the left rim discharge hole 236L in the toilet body 212.

[0111] Flush water suppled to the starting end side of the left rim water passage 232L is led into the left rim water passage 232L and then first flows into the water passage portion that is closer to the water introducing port 240d than the left rim discharge hole 236L is. When the water passage portion closer to the water introducing port 240d than the left rim discharge hole 236L starts being filled with the flush water, part of the flush water changes its flowing direction at a midway of the left rim water passage 232L from the starting end side toward the termination end side to flow into the left rim discharge hole 236L (see the direction Pb). In this way, the left rim discharge hole 236L is formed at a position into which flush water supplied from the starting end side of the left rim water passage 232L is able to flow by changing its flowing direction.

[0112] FIG. 15 is a sectional view taken along line D-D in FIG. 14, and FIG. 16 is a sectional view taken along line E-E in FIG. 14.

[0113] As shown in FIGS. 14-16, in the left rim water passage 232L, a constriction part 244 is formed between the left rim discharge hole 236L and the water introducing port 240d. In FIG. 14, the position of the constriction part 244 is indicated by dashed double-dotted lines.

[0114] The constriction part 244 is formed to constrict the flow of flush water from the starting end side to the termination end side of the left rim water passage 232L. The constriction part 244 includes a wall portion 244a that protrudes from an inner wall surface of the left rim water passage 232L, and a water flowing portion 244b through which flush water is able to flow. The water flowing portion 244b is formed as an opening surrounded by inner wall surfaces of the left rim water passage 232L and the wall portion 244a. The constriction part 244 is formed so that the space within the left rim water passage 232L is narrowed and then broadened, from the starting end side toward the termination end side of the left rim water passage 232L. The constriction part 244 has a function to reduce the flow rate of flush water flowing from a water passage portion 232d (hereinafter, referred to as a starting-side water passage portion 232d) of the left rim water passage 232L, which is positioned closer to the starting end of the left rim water passage 232L than the constriction part 244 is, into a water passage portion 232e (hereinafter, referred to as a termination-side water passage portion 232e) of the left rim water passage 232L, which is positioned closer to the termination end of the left rim water passage 232L than the constriction part 244 is.

[0115] There will now be described the operations of the flush toilet 210 set forth above.

[0116] As shown in FIGS. 12 and 13, flush water is supplied to the common water passage 234 from the water pipe 204a. The flush water supplied from the water pipe 204a is then bifurcated at the bifurcation position 242 of the common water passage 234 to be supplied to each of the rim water passages 232L and 232R (see the directions Wp in FIG. 13). The flush water flowing through the right rim water passage 232R is discharged from the right rim discharge hole 236R. Also, part of the flush water flowing through the left rim water passage 232L is discharged from the left rim discharge hole 236L, and the remaining part thereof is discharged from the jet spout

hole 238 after passing through the jet communication passage 240.

[0117] It is assumed here that the left rim discharge hole 236L is formed in the termination end part 232b of the left rim water passage 232L, and the water introducing port 240d of the jet communication passage 240 opens at a midway of the path from the starting end side toward the termination end side. In this case, flush water flowing from the starting end side within the left rim water passage 232L is likely to be led to the left rim discharge hole 236L in the termination end part 232b without changing its flowing direction, even though there is the jet communication passage 240. Accordingly, it will be difficult to bring the flush water from the left rim water passage 232L into the jet communication passage 240, so that it will also be difficult to discharge high-pressure flush water from the jet spout hole 238.

(A) In the flush toilet 210 of the present embodiment, on the other hand, when flush water flows to the termination end part 232b of the left rim water passage 232L, the flush water has to change its flowing direction, so that the flush water is likely to change its flowing direction to the water introducing port 240d located in the vicinity thereof, so as to be easily introduced into the water introducing port 240d. Accordingly, flush water can be easily brought from the left rim water passage 232L into the jet communication passage 240, so that high-pressure flush water can be easily discharged from the jet spout hole 238. As a result, flush water supplied to the left and right rim water passages 232L and 232R is discharged from the multiple rim discharge holes 236L and 236R and, also, a strong flow of flush water can be discharged from the jet spout hole 238.

(B) Also, in the left rim water passage 232L, the constriction part 244 is formed between the left rim discharge hole 236L and the water introducing port 240d. Accordingly, part of flush water flowing into a water passage portion of the left rim water passage 232L, positioned closer to the starting end of the left rim water passage 232L than the constriction part 244, further flows into a water passage portion of the left rim water passage 232L, positioned closer to the termination end of the left rim water passage 232L than the constriction part 244, through the constriction part 244. Accordingly, in the left rim water passage 232L, the water passage portion positioned closer to the starting end of the left rim water passage 232L than the constriction part 244 is likely to be filled with flush water earlier than the water passage portion positioned closer to the termination end of the left rim water passage 232L than the constriction part 244. Therefore, the pressure of the flush water in the water passage portion positioned closer to the starting end of the left rim water passage 232L than the constriction part 244 can be increased early, so that high-pressure flush water can be discharged early from the left rim discharge hole 236L after passing through the water passage portion. As a result, during one flushing operation, the time for which high-pressure flush water is discharged from the left rim discharge hole 236L can be increased, so that the toilet flushing capability and the waste discharge capability can be improved more easily.

[0118] Since the flush toilet 210 of the present embodiment has the water passage portion that is positioned closer to the termination end of the left rim water passage 232L than the left rim discharge hole 236L is, the timing of discharging high-pressure flush water from the left rim discharge hole 236L is likely to be delayed. However, by providing the constriction part 244 between the left rim discharge hole 236L and the water introducing port 240d, the advantage of discharging high-pressure flush water from the left rim discharge hole 236L early while also discharging high-pressure flush water from the jet spout hole 238 can be obtained.

[0119] Further, by adjusting the dimensions of the water flowing portion 244d of the constriction part 244, the amount of flush water distributed from the starting end side of the left rim water passage 232L to each of the left rim discharge hole 236L and the jet spout hole 238 can be adjusted.

[0120] In the following, another feature of the flush toilet 210 will be described.

[0121] The remaining water in the rim water passages 232L and 232R may flow down, in the form of a streak of water (hereinafter, referred to as streaky water), from the rim discharge holes 236L and 236R along the inner surface of the toilet bowl part 214. The streaky water flows down along a path irregularly changed on the inner surface of the toilet bowl part and sometimes flows down for a long period of time, which may cause disfigurement. In the following, the contrivances to improve such a situation will be described.

[0122] FIG. 17 is a diagram that schematically shows a gradient formed on the inner bottom surface of each of the rim water passages 232L and 232R. In FIG. 17, a gradient from a higher position to a lower position is indicated by an arrow. On the inner bottom surface of each of the rim water passages 232L and 232R, a gradient inclined downward from the corresponding one of the rim discharge holes 236L and 236R toward the direction away from the rim discharge hole is provided.

[0123] More specifically, on the inner bottom surface of the left rim water passage 232L, a first gradient 250 is provided in which the bifurcation position 242 at which the rim water passages 232L and 232R are separated corresponds to a high position, and the water introducing port 240d of the jet communication passage 240 corresponds to a low position. The first gradient 250 is provided to be inclined downward from the left rim discharge hole 236L toward the direction away from the left rim discharge hole 236L. Also, on the inner bottom surface of the right rim water passage 232R, a second gradient 252 is pro-

vided in which the right rim discharge hole 236R corresponds to a high position, and the bifurcation position 242 between the rim water passages 232L and 232R corresponds to a low position. The second gradient 252 is provided to be inclined downward from the right rim discharge hole 236R toward the direction away from the right rim discharge hole 236R. At the bifurcation position 242 between the rim water passages 232L and 232R, a recessed part 254 recessed downward is formed.

[0124] With the gradients 252 and 254, at least part of the water introducing port 240d of the jet communication passage 240 is positioned lower than the rim discharge holes 236L and 236R. In the present embodiment, the entirety of the water introducing port 240d is positioned lower than the rim discharge holes 236L and 236R.

[0125] Advantages of the configuration set forth above will be described. When supply of flush water from the flush water supply device 204 is finished, water within the rim water passages 232L and 232R is discharged from the rim discharge holes 236L and 236R and also from the jet communication passage 240 after passing through the water introducing port 240d in the left rim water passage 232L. It is assumed here that the water level within each of the rim water passages 232L and 232R falls to the vicinity of the lower edge of the rim discharge holes 236L and 236R. In this state, the remaining water on the inner bottom surface of each of the rim water passages 232L and 232R can be discharged from the jet communication passage 240 after passing through the water introducing port 240d located lower than the rim discharge holes 236L and 236R, so that the amount of water flowing into the toilet bowl part 214 from the rim discharge holes 236L and 236R can be reduced more easily. Accordingly, even when the water levels in the rim water passages 232L and 232R fall as described previously, flowing down of streaky water from the respective rim discharge holes 236L and 236R along the inner surface of the toilet bowl part 214 can be prevented, so that disfigurement within the toilet bowl part 214 caused by toilet flushing can also be effectively prevented.

[0126] The "remaining water" includes the remainder of flush water used for toilet flushing. The remaining water also includes the remainder of replenishment water supplied to fill the pooled water 228 again after the pooled water 228 is discharged through the trap part 220 during toilet flushing.

[0127] While the water level in each of the rim water passages 232L and 232R is falling, water on the inner bottom surface of the rim water passage can be easily led by its own weight to the water introducing port 240d of the jet communication passage 240, along the corresponding one of the first gradient 250 and the second gradient 252. Therefore, water on the inner bottom surfaces of the rim water passages 232L and 232R can be discharged through the jet communication passage 240, so that the amount of water flowing into the toilet bowl part 214 from the rim discharge holes 236L and 236R can be reduced more easily. As a result, while the water levels in the rim water passages 232L and 232R are falling, flowing down of streaky water from the respective rim discharge holes 236L and 236R along the inner surface of the toilet bowl part 214 can be effectively prevented, so that disfigurement within the toilet bowl part 214 caused by toilet flushing can also be prevented more effectively.

[0128] As shown in FIG. 15, a water passage portion 236d that is positioned closer to the left rim discharge hole 236L (starting end side) than the constriction part 244 is will be referred to as a starting-side water passage portion 236d, and a water passage portion 236e that is positioned closer to the water introducing port 240d (termination end side) than the constriction part 244 is will be referred to as a termination-side water passage portion 236e. A bottom surface 244c of the water flowing portion 244b of the constriction part 244 connects the inner bottom surface of the starting-side water passage portion 236d and the inner bottom surface of the termination-side water passage portion 236e so that they form a smoothly continuous surface inclined downward from the left rim discharge hole 236L side toward the water introducing port 240d side. The bottom surface 244c is formed over the entire width of the left rim water passage 232L in a width direction of the water passage, at the position where the constriction part 244 is formed, as shown in FIG. 16. Thus, the constriction part 244 has a shape such that remaining water on the inner bottom surface of the left rim water passage 232L can be led from the left rim discharge hole 236L side toward the water introducing port 240d side in a direction Pc.

[0129] Accordingly, remaining water can flow smoothly from the left rim discharge hole 236L side to the water introducing port 240d side with respect to the constriction part 244. Thus, even though the constriction part 244 is formed in the left rim water passage 232L, flush water can be easily discharged from the rim water passages 232L and 232R through the jet communication passage 240. As a result, flowing down of streaky water from the rim discharge holes 236L and 236R along the inner surface of the toilet bowl part 214 can be effectively prevented.

[0130] In this respect, the bottom surface 244c of the constriction part 244 has only to connect the inner bottom surface of the starting-side water passage portion 232d and the inner bottom surface of the termination-side water passage portion 232e so that they are horizontally and continuously connected from the starting end side toward the termination end side, or so that the termination end side is positioned lower than the starting end side. In either case, the constriction part 244 has a shape such that remaining water on the inner bottom surface of the left rim water passage 232L can be led from the left rim discharge hole 236L side toward the water introducing port 240d side.

[0131] Also, in order to achieve such an effect, the bottom surface 244c of the constriction part 244 has only to be formed over part of the left rim water passage 232L

in a width direction of the water passage, at the position where the constriction part 244 is formed.

[0132] As described previously, on the inner bottom surface of the left rim water passage 232L is provided the first gradient 250 (see FIG. 17) inclined downward toward the water introducing port 240d of the jet communication passage 240. Accordingly, when water pressure corresponding to the water supply pressure is applied to the flush water within the termination-side water passage portion 236e of the left rim water passage 232L, the flush water within the termination-side water passage portion 236e can be smoothly led to the water introducing port 240d more easily along the first gradient 250. As a result, flush water can be brought from the left rim water passage 232L into the jet communication passage 240 more easily, so that high-pressure flush water can be discharged from the jet spout hole 238 more easily.

[0133] In the following, yet another feature of the flush toilet 210 will be described.

[0134] FIG. 18A is a diagram that shows the left rim water passage 232L according to a first modification. FIG. 18A shows the left rim water passage 232L viewed from the same viewpoint as in FIG. 15. The constriction part 244 of the present example differs from that of the example of FIG. 15 in that the wall portion 244a is formed between the starting-side water passage portion 232d and the termination-side water passage portion 232e so as to block the flow of a fluid flowing through lower regions of the water passage portions. Also with this flush toilet 210, the aforementioned effects (A) and (B) can be obtained.

[0135] As a result of experimental study, the inventors have found that, with the constriction part 244 of this kind, bubbles are more likely to be discharged from the jet spout hole 238. If bubbles are discharged from the jet spout hole 238, bursting sound of bubbles or incongruity in appearance may give an unpleasant feeling to the user.

[0136] Although the mechanism thereof has not become clear, the following reason may be given. As described previously, when flush water W is supplied to the left rim water passage 232L, the starting-side water passage portion 232d is filled with the flush water W first, as shown in FIG. 18B. At the time, air Ar may remain in the termination-side water passage portion 232e without being discharged. In this case, the air Ar exists on the termination end side with respect to the water flowing portion 244b of the constriction part 244. Accordingly, if the flush water W flows into the termination-side water passage portion 232e through the water flowing portion 244b in this state, the flush water W will further flow into the jet communication passage 240, entraining the air Ar within the termination-side water passage portion 232e. Thus, it is surmised that the entrained air is discharged as bubbles from the jet spout hole 238.

[0137] In the constriction part 244 of the present embodiment, on the other hand, the wall portion 244a is formed between the starting-side water passage portion 232d and the termination-side water passage portion 232e so as to block the flow of a fluid flowing through upper regions of the water passage portions, as shown in FIG. 15. The wall portion 244a is formed over the entire width of the left rim water passage 232L in a width direction of the water passage, at the position where the constriction part 244 is formed, as shown in FIG. 16.

[0138] Advantages thereof will be described. It is assumed here that, in the left rim water passage 232L, the starting-side water passage portion 232d is filled with the flush water W first, and the air Ar remains in the termination-side water passage portion 232e, as shown in FIG. 19. In this case, in the present embodiment, the flush water W rather than the air Ar exists on the termination end side with respect to the water flowing portion 244b of the constriction part 244. Accordingly, even if the flush water W flows into the termination-side water passage portion 232e through the water flowing portion 244b in this state, the flush water W is less likely to entrain the air within the termination-side water passage portion 232e, so that the air is less likely to flow into the jet communication passage 240. Therefore, even though the constriction part 244 is formed in the left rim water passage 232L, discharge of bubbles from the jet spout hole 238 can be prevented.

[0139] In addition, by providing the wall portion 244 of the constriction part 244 as set forth above, when flush water is supplied into the left rim water passage 232L, the air Ar becomes more likely to remain in the termination-side water passage portion 232e of the left rim water passage 232L without being discharged to the outside. Accordingly, when the flush water W flows through the water flowing portion 244b of the constriction part 244, the air Ar provides resistance, so that the flush water flowing into the termination-side water passage portion 232e is less likely to spread therein. As a result, reduction of the force of flush water caused by such spreading of flush water within the termination-side water passage portion 232e can be prevented, so that a strong flow of flush water can be discharged from the jet spout hole 238 more easily.

[0140] Also, as shown in FIG. 16, when the water passage height of the left rim water passage 232L is defined as HO, the wall portion 244a of the constriction part 244 is formed, at the position where the constriction part 244 is formed, so that the height dimension H1 from the inner upper surface of the left rim water passage 232L becomes half the water passage height H0 or larger. The wall portion 244a of the constriction part 244 may be formed so that the height dimension H1 from the inner upper surface of the left rim water passage 232L becomes three-quarters of the water passage height H0 or larger.

[0141] The second invention has been described with reference to an embodiment, which merely describes principles and applications of the second invention. Also, various modifications or changes in arrangement may be made to the embodiment without departing from the scope of ideas of the second invention defined in the

claims.

[0142] The inside of the toilet bowl part 214 of the flush toilet 210 may be flushed using a flushing method, including the wash-down type and the syphon type. Also, as a water supply method for the flush toilet 210, the water direct pressure type, the gravity water supply type using gravity, or the like, may be employed. Further, although a wall-mounted toilet is described as an example of the toilet body 212, it may be a floor-mounted toilet mounted on the floor of a toilet room. Also, the toilet body 212 may be made of another material, such as resin, instead of a ceramic material.

[0143] Although an example has been described in which the left rim water passage 232L and the right rim water passage 232R are formed by bifurcating the common water passage 234 at the downstream end thereof, they may be formed separately.

[0144] Although an example has been described in which the jet spout hole 238 is formed in the bottom part of the toilet bowl part 214, the jet spout hole 238 may be formed in the trap part 220 of the drainage passage part 216. In this case, flush water discharged from the jet spout hole 238 forms, in the seal water 218, a flow of water flowing toward the downstream side of the trap part 220, thereby promoting discharge of waste. Namely, the jet spout hole 238 has only to be formed in the bottom part of the toilet bowl part 214 or in the drainage passage part 216. Accordingly, a flow of water for promoting discharge of waste is formed in the pooled water 228 or in the seal water 218.

[0145] Although an example has been described in which the jet communication passage 240 communicates the jet spout hole 238 and the left rim water passage 232L, the jet communication passage 240 may communicate the jet spout hole 238 and the right rim water passage 232R. Also, although an example has been described in which the water introducing port 240d of the jet communication passage 240 opens on the termination end part 232b of the left rim water passage 232L, the water introducing port 240d has only to open on a part of the rim water passage that is positioned closer to the termination end than the rim discharge hole is. Further, an example has been described in which the water introducing port 240d of the jet communication passage 240 opens on the inner bottom surface of the left rim water passage 232L. However, the water introducing port 240d has only to open on an inner wall surface of the rim water passage, and may open on an inner side surface, instead of the inner bottom surface, of the rim water passage.

[0146] In the example of FIG. 16, an example has been described in which the water flowing portion 244b of the constriction part 244 is formed to be surrounded by inner wall surfaces of the left rim water passage 232L and the wall portion 244a of the constriction part 244. Alternatively, a cutout 256 may be formed in the wall portion 244a of the constriction part 244, and the water flowing portion 244b may be formed to be surrounded by the cutout 256 and an inner wall surface of the left rim water passage 232L, as shown in FIG. 20. Also, multiple water flowing portions 244b may be formed, as shown in FIG. 20. Further, a through hole may be formed in the wall portion 244a of the constriction part 244, and the water flowing portion 244b may be formed only by the through hole of the wall portion 244a.

[0147] In the example of FIG. 11, an example has been described in which the first rim discharge hole 36L, from which flush water supplied to the left rim water passage 232L is discharged, is disposed to the left of the lateral center line CL, and the second rim discharge hole 236R, from which flush water supplied to the right rim water passage 232R is discharged, is disposed to the right of the lateral center line CL. Alternatively, the first rim discharge hole 236L may be disposed to the right of the lateral center line CL, and the second rim discharge hole 236R may be disposed to the left of the lateral center line CL. In any case, the positions of the rim discharge holes 236L and 236R are not particularly limited. Also, another rim discharge hole may be further formed in the rim part 226.

[0148] With reference to FIG. 17, an example has been described in which the gradients 250 and 252 are provided respectively on the inner bottom surfaces of the rim water passages 232L and 232R so that the water introducing port 240d is positioned lower than the rim discharge holes 236L and 236R. Alternatively, the water introducing port 240d may be positioned lower than the first rim discharge hole 236L by providing a step descending from the first rim discharge hole 236L toward the termination end side in the first rim water passage 232L.

[0149] Also, an example has been described in which flush water is discharged from the rim discharge holes 236L and 236R in one circumferential direction along the inner peripheral surface of the rim part 226. However, a discharge port formed in the rim part 226 has only to allow flush water to be discharged into the toilet bowl part 214, and the discharging direction of the flush water is not limited thereto. For example, the flush water may be discharged downward.

[0150] Although an example has been described in which the jet spout hole 238 is formed on the left side and front side on a wall surface of the recess part 224, the position is not limited thereto.

[0151] When the inventions embodied by the embodiment and modifications set forth above are generalized, the following technical ideas are derived.

[0152] In the flush toilet in a second mode of the second invention, in the first mode, in the first rim water passage, a constriction part for constricting the flow of flush water may be formed between the first rim discharge hole and the water introducing port.

[0153] In the present mode, in the first rim water passage, the water passage portion positioned closer to the starting end of the first rim water passage than the constriction part is likely to be filled with flush water earlier than the water passage portion positioned closer to the termination end of the first rim water passage than the

constriction part. Therefore, the pressure of the flush water in the water passage portion positioned closer to the starting end of the first rim water passage than the constriction part can be increased early, so that high-pressure flush water can be discharged early from the first rim discharge hole after passing through the water passage portion.

[0154] In the flush toilet in a third mode of the second invention, in the first or second mode, at least part of the water introducing port may be positioned lower than the first rim discharge hole.

[0155] In the present mode, remaining water within the first rim water passage can be easily discharged through the water introducing port positioned lower than the first rim discharge hole, so that the amount of water flowing into the toilet bowl part from the first rim discharge hole can be reduced more easily. Therefore, flowing down of streaky water from the first rim discharge hole along the inner surface of the toilet bowl part can be prevented.

[0156] In the flush toilet in a fourth mode of the second invention, in the second mode, at least part of the water introducing port may be positioned lower than the first rim discharge hole, and the constriction part may have a shape such that remaining water on the inner bottom surface of the first rim water passage can be led from the first rim discharge hole side toward the water introducing port side.

[0157] In the present mode, remaining water within the first rim water passage can flow smoothly from the first rim discharge hole side to the water introducing port side with respect to the constriction part. Accordingly, even though the constriction part is formed in the first rim water passage, remaining water within the first rim water passage can be easily discharged through the communication passage. Therefore, flowing down of streaky water from the first rim discharge hole along the inner surface of the toilet bowl part can be effectively prevented.

[0158] In the flush toilet in a fifth mode of the second invention, in the third or the fourth mode, on the inner bottom surface of the first rim water passage, a gradient inclined downward from the first rim discharge hole toward the direction away from the first rim discharge hole may be provided.

[0159] In the present mode, remaining water within the first rim water passage can be easily led by its own weight to the water introducing port, so that the amount of water flowing into the toilet bowl part through the first rim discharge hole can be reduced more easily. Therefore, flowing down of streaky water from the first rim discharge hole along the inner surface of the toilet bowl part can be effectively prevented.

[0160] In the flush toilet in a sixth mode of the second invention, in the second or the fourth mode, the constriction part may include a wall portion formed between a water passage portion that is positioned closer to the starting end than the constriction part is and a water passage portion that is positioned closer to the termination end than the constriction part is so as to block the flow of a fluid flowing through upper regions of the water passage portions.

[0161] It is assumed here that the starting-side water passage portion is filled with flush water first, and air remains in an upper region of the termination-side water passage portion. In this case, in the present mode, flush water rather than air is likely to exist on the termination end side with respect to the water flowing portion of the constriction part. Accordingly, even if the flush water flows into the termination-side water passage portion through the constriction part in this state, the flush water is less likely to entrain the air within the termination-side water passage portion, so that the air is less likely to flow into the communication passage. Therefore, even though the constriction part is formed in the first rim water passage, discharge of bubbles from the spout hole can be prevented.

[0162] In the flush toilet in a seventh mode of the second invention, in any one of the first through the sixth mode, the first rim discharge hole may be disposed on one of left and right sides of the toilet body, and the water introducing port may be disposed on the one of left and right sides of the toilet body and forward of the first rim discharge hole in the toilet body.

[0163] It can also be said that the embodiment and modifications set forth above include the invention described in the following item.

[Item]

[0164] A flush toilet, comprising:

a toilet bowl part with a rim part formed in an upper end part thereof;
a first rim water passage formed on an outer peripheral side of the rim part;
a first rim discharge hole through which flush water is discharged from the first rim water passage into the toilet bowl part;
a spout hole formed in a bottom part of the toilet bowl part or in a drainage passage part connected to the bottom part; and
a communication passage that communicates the first rim water passage and the spout hole, wherein:

the first rim discharge hole is formed to branch off from a midway of a path from the starting end side toward the termination end side of the first rim water passage;
a water introducing port of the communication passage opens closer to the termination end side of the first rim water passage than the first rim discharge hole; and,
in the first rim water passage, a constriction part for constricting the flow of flush water is formed between the first rim discharge hole and the water introducing port.

[EXPLANATION OF REFERENCE NUMERALS]

[0165]

10	flush toilet
14	toilet bowl part
16	inlet
18	trap part
24	rim part
26	water discharge part
28	jet spout port (spout port)
30A	right rim discharge port (first discharge port)
30B	left rim discharge port (second discharge port)
44	pooled water
56A	right rim water passage (first water passage)
56B	left rim water passage (second water passage)
58	jet water supply passage (water supply passage)
64	introducing port
66	aerial space
210	flush toilet
214	toilet bowl part
216	drainage passage part
226	rim part
232L	left rim water passage (first rim water passage)
232R	right rim water passage (second rim water passage)
236L	left rim discharge hole (first rim discharge hole)
236L	right rim discharge hole (second rim discharge hole)
238	jet spout hole (spout hole)
240	jet communication passage (communication passage)
240d	water introducing port
244	constriction part
250	gradient
252	gradient

[INDUSTRIAL APPLICABILITY]

[0166] The present invention relates to a flush toilet.

Claims

1. A flush toilet (210), comprising:

a toilet bowl part (214) with a rim part (226) formed in an upper end part thereof;
a first rim water passage (232L) formed on an outer peripheral side of the rim part (226) and on one of left and right sides of a toilet body (212);
a second rim water passage (232R) formed on the outer peripheral side of the rim part (226) and on the other of left and right sides of the toilet body (212);
a first rim discharge hole (236L) through which water is discharged from the first rim water passage (232L) into the toilet bowl part (214);
a second rim discharge hole (236R) through which water is discharged from the second rim water passage (232R) into the toilet bowl part (214);
a spout hole (238) formed in a bottom part of the toilet bowl part (214) or in a drainage passage part (216) connected to the bottom part; and
a communication passage (240) that communicates the first rim water passage (232L) and the spout hole (238), wherein:

the first rim water passage (232L) is formed to be a dead end at a termination end part (232b) thereof;
the first rim discharge hole (236L) is formed to branch off from a midway of a path from a starting end side toward a termination end side of the first rim water passage (232L); and
a water introducing port (240d) of the communication passage (240) opens closer to the termination end side of the first rim water passage (232L) than the first rim discharge hole (236L).

2. The flush toilet (210) of claim 1, wherein, in the first rim water passage (232L), a constriction part (244) for constricting the flow of flush water is formed between the first rim discharge hole (236L) and the water introducing port (240d).

3. The flush toilet (210) of claim 1 or 2, wherein at least part of the water introducing port (240d) is positioned lower than the first rim discharge hole (236L).

4. The flush toilet (210) of claim 2, wherein:

at least part of the water introducing port (240d) is positioned lower than the first rim discharge hole (236L); and
the constriction part (244) has a shape such that remaining water on the inner bottom surface of the first rim water passage (232L) can be led from a first rim discharge hole (236L) side toward a water introducing port side (240d).

5. The flush toilet (210) of claim 3 or 4, wherein, on an inner bottom surface of the first rim water passage (232L), a gradient inclined downward from the first rim discharge hole (236L) toward the water introducing port (240d) is provided.

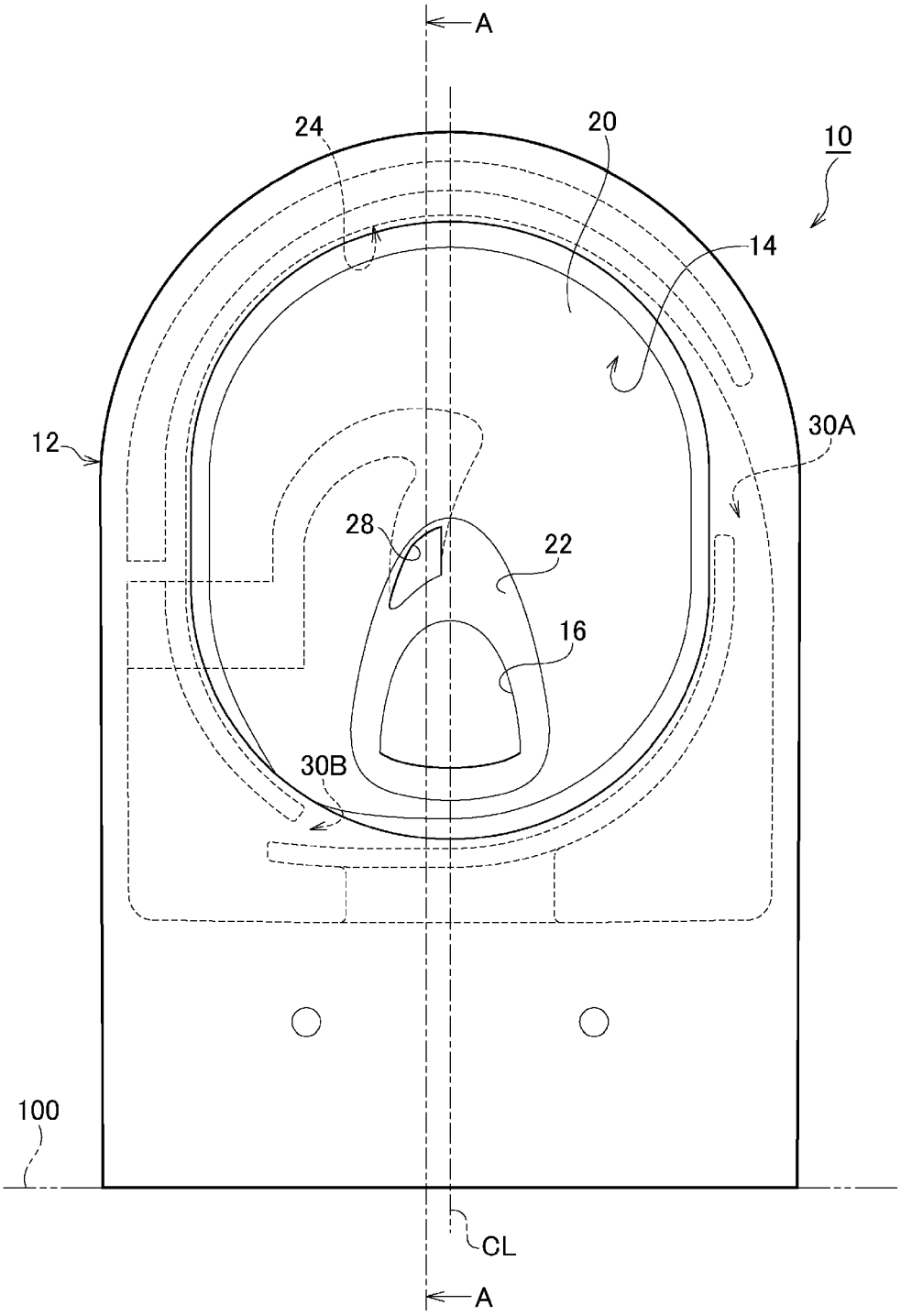
6. The flush toilet (210) of claim 2 or 4, wherein the constriction part (244) includes a wall portion (244a) formed between a water passage portion (232d) that is positioned closer to the starting end than the con-

striction part (244) is and a water passage portion (232e) that is positioned closer to the termination end than the constriction part (244) is so as to block the flow of a fluid flowing through upper regions of the water passage portions (232d, 232e).

7. The flush toilet (210) of any one of claims 1 through 6, wherein:

the first rim discharge hole (236L) is disposed on one of left and right sides of the toilet body (212); and
the water introducing port (240d) is disposed on the one of left and right sides of the toilet body (212) and forward of the first rim discharge hole (236L) in the toilet body (212).

FIG. 1



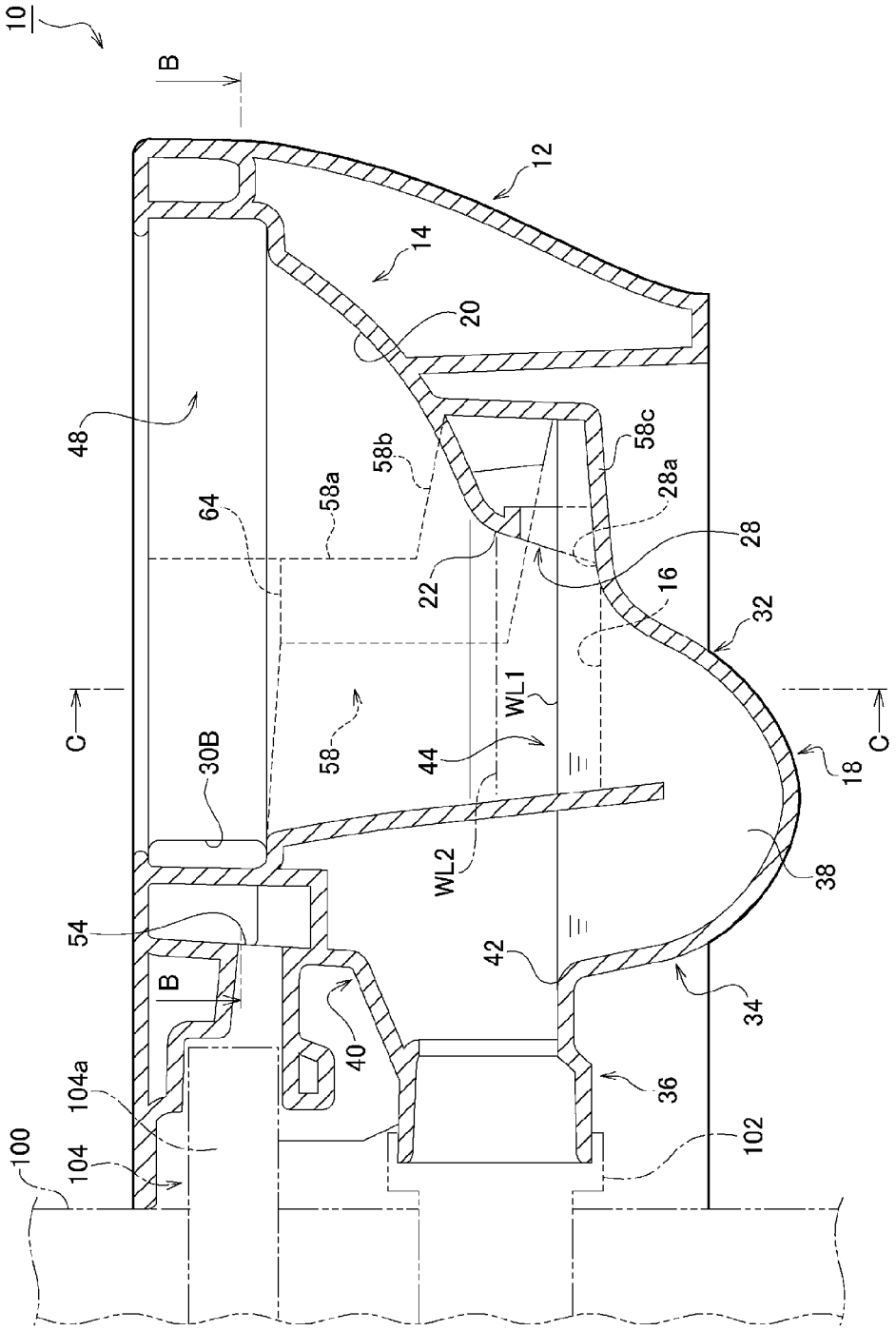

10
B
12
14
20
48
58b
58c
28a
64
58a
28
22
16
32
C
WL1
58
44
30B
18
C
38
WL2
54
42
B
34
40
36
104a
102
100
104

FIG. 2

FIG. 3

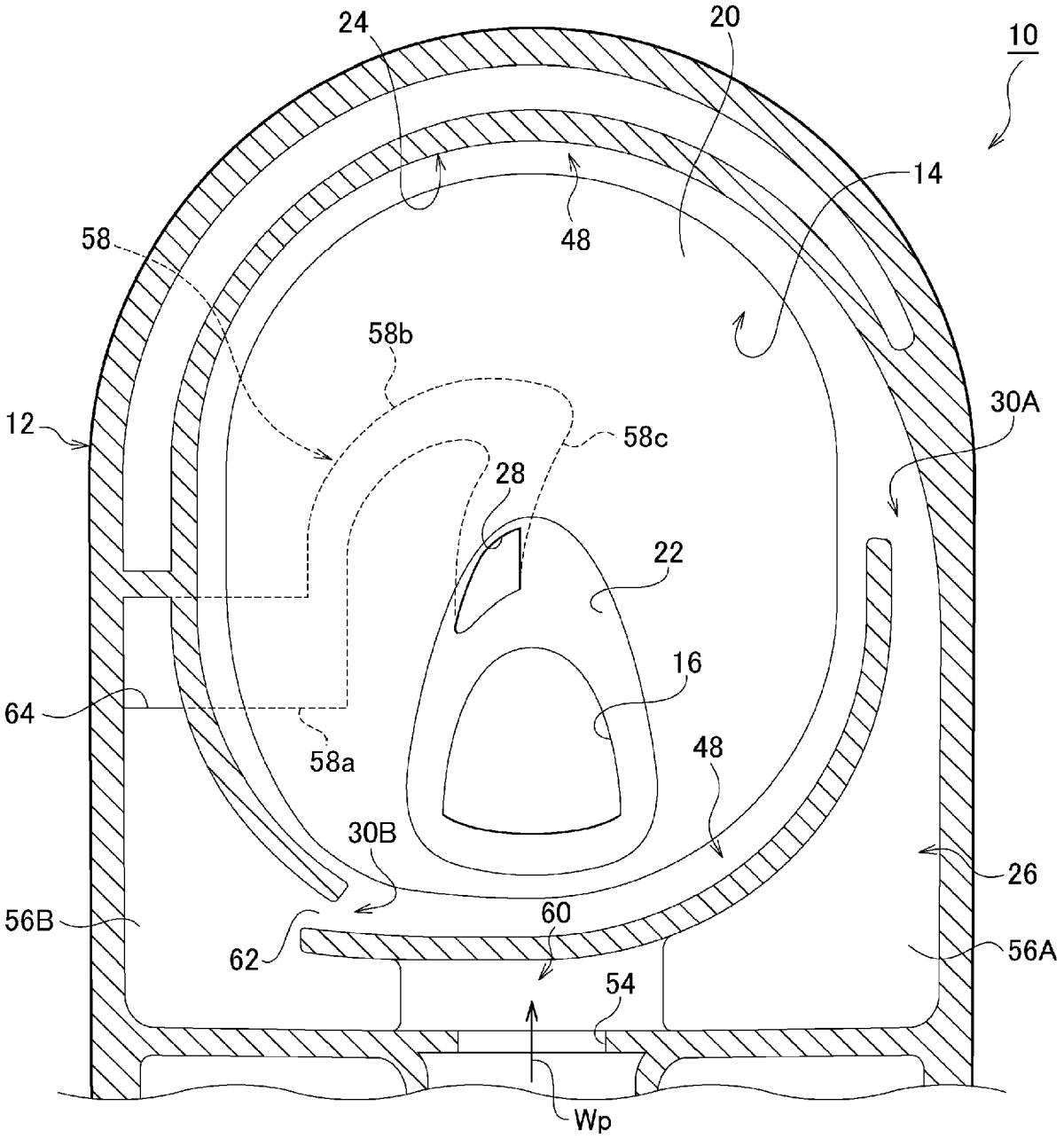

24
20
10
14
58
48
58b
12
30A
58c
28
22
16
64
58a
48
30B
26
56B
60
62
56A
54
Wp

FIG. 4

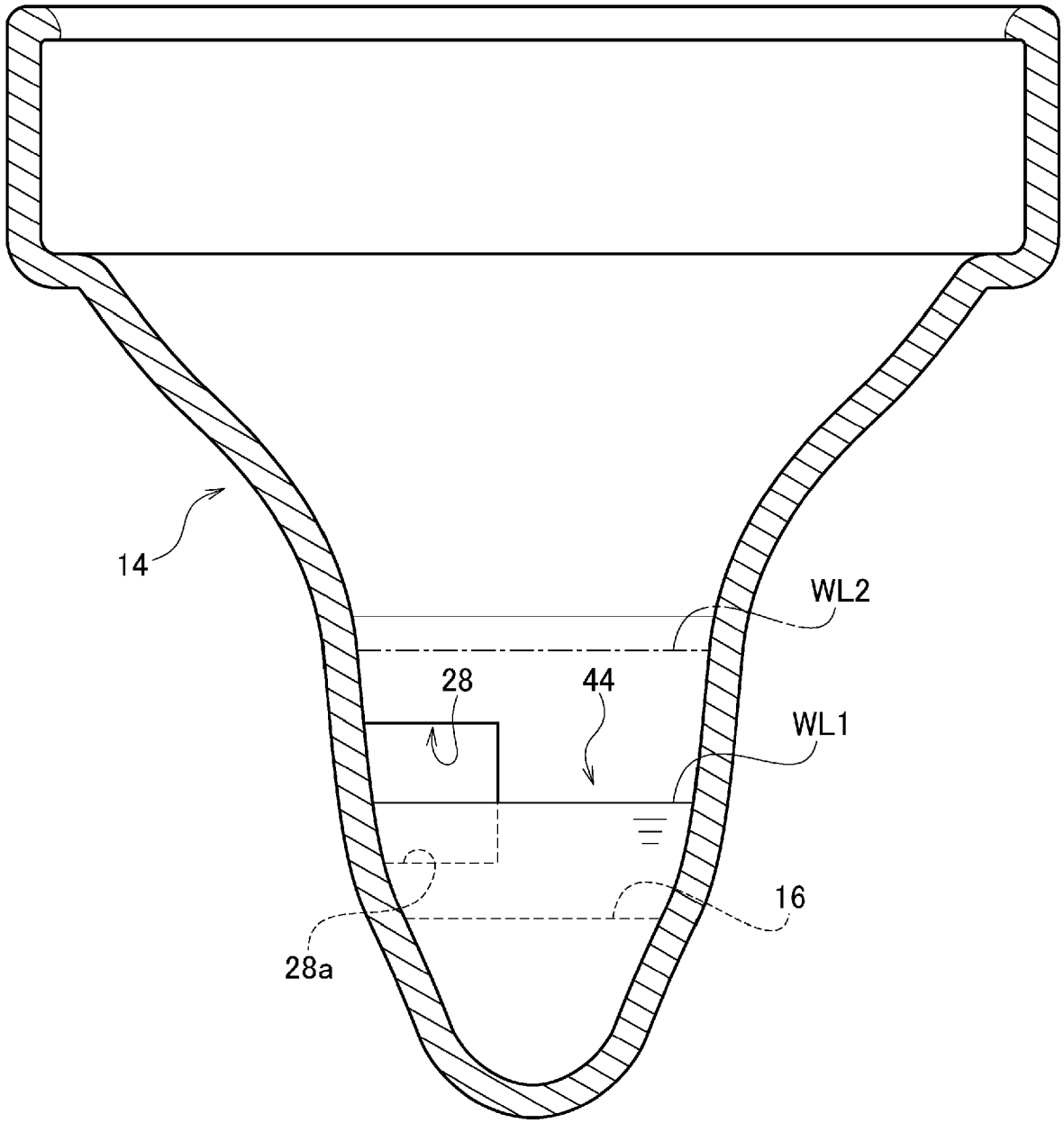


FIG. 5A

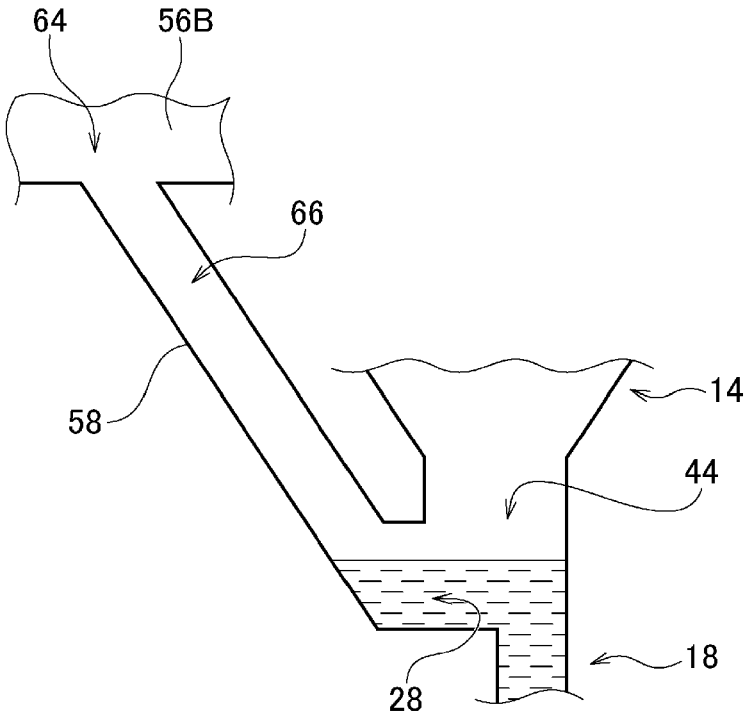


FIG. 5B

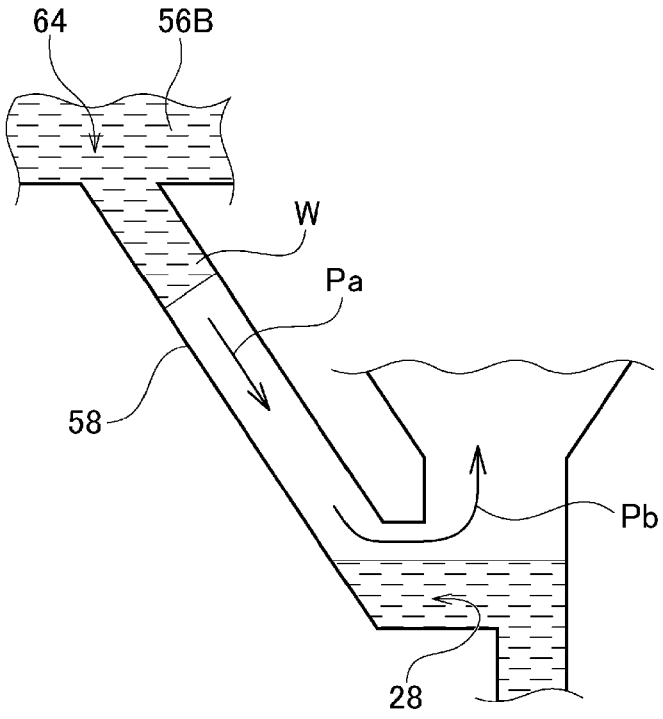


FIG. 6A

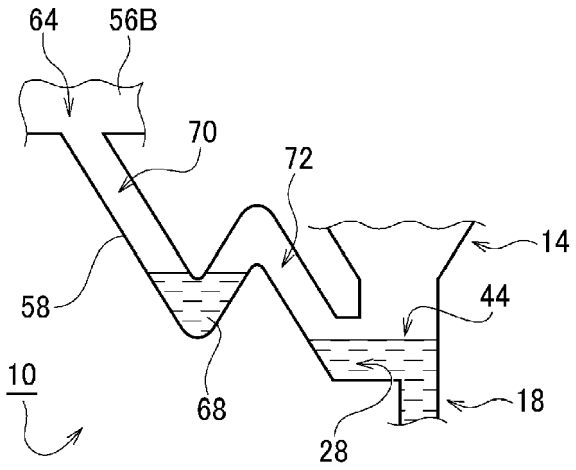


FIG. 6B

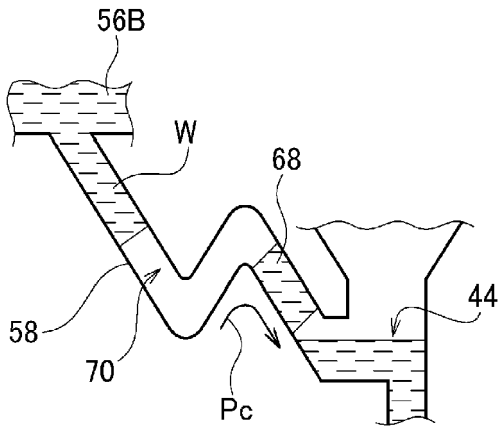


FIG. 6C

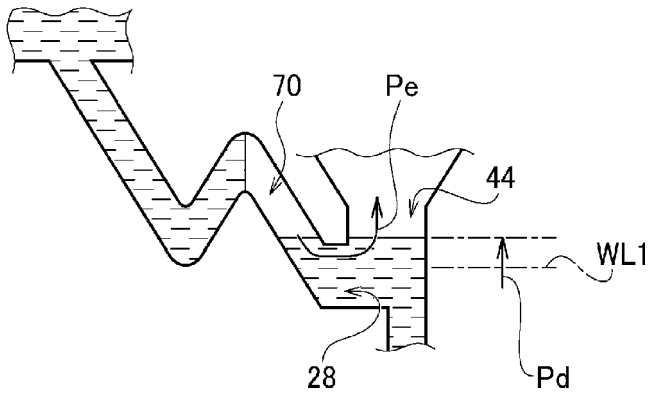


FIG. 7

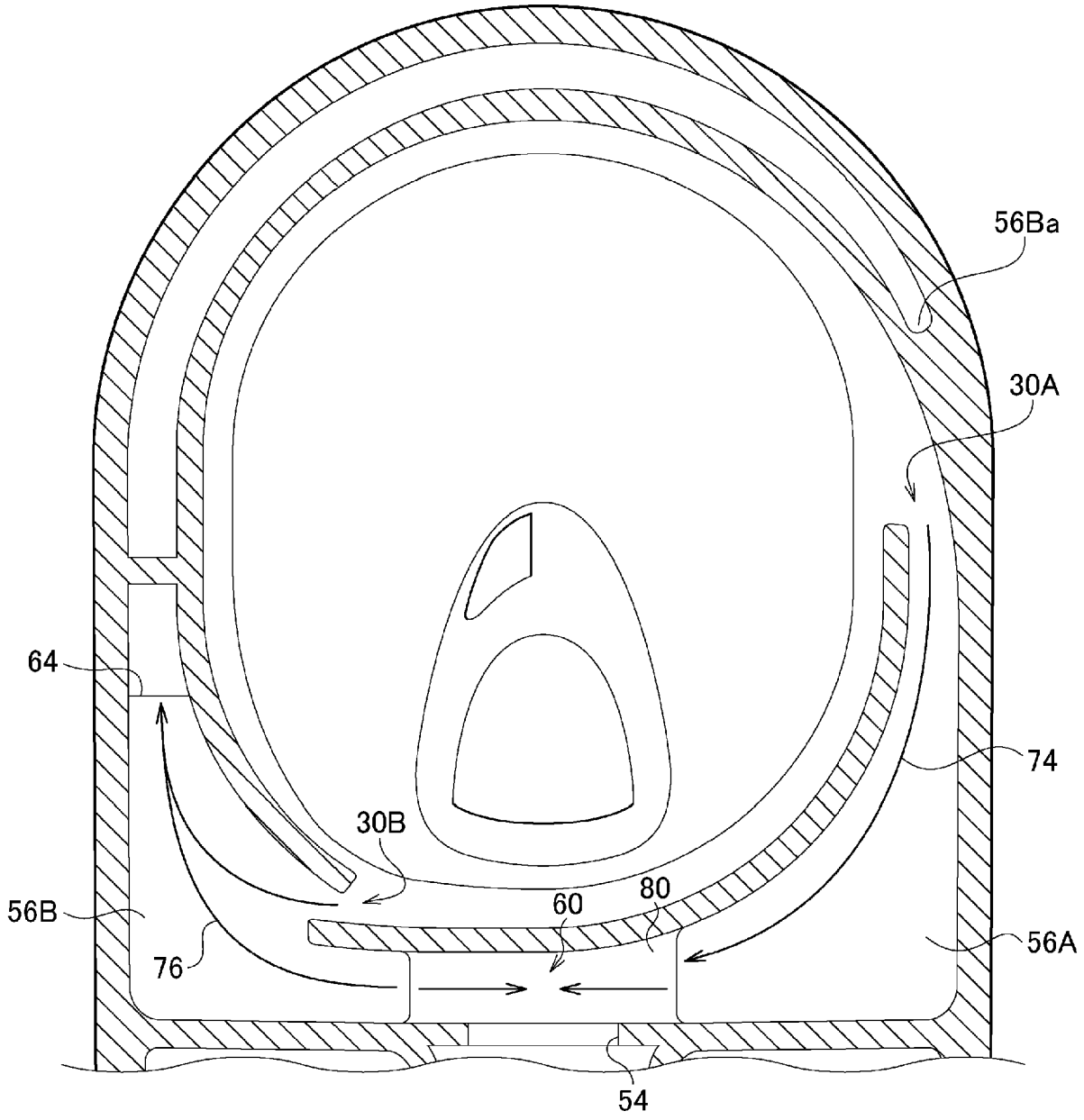
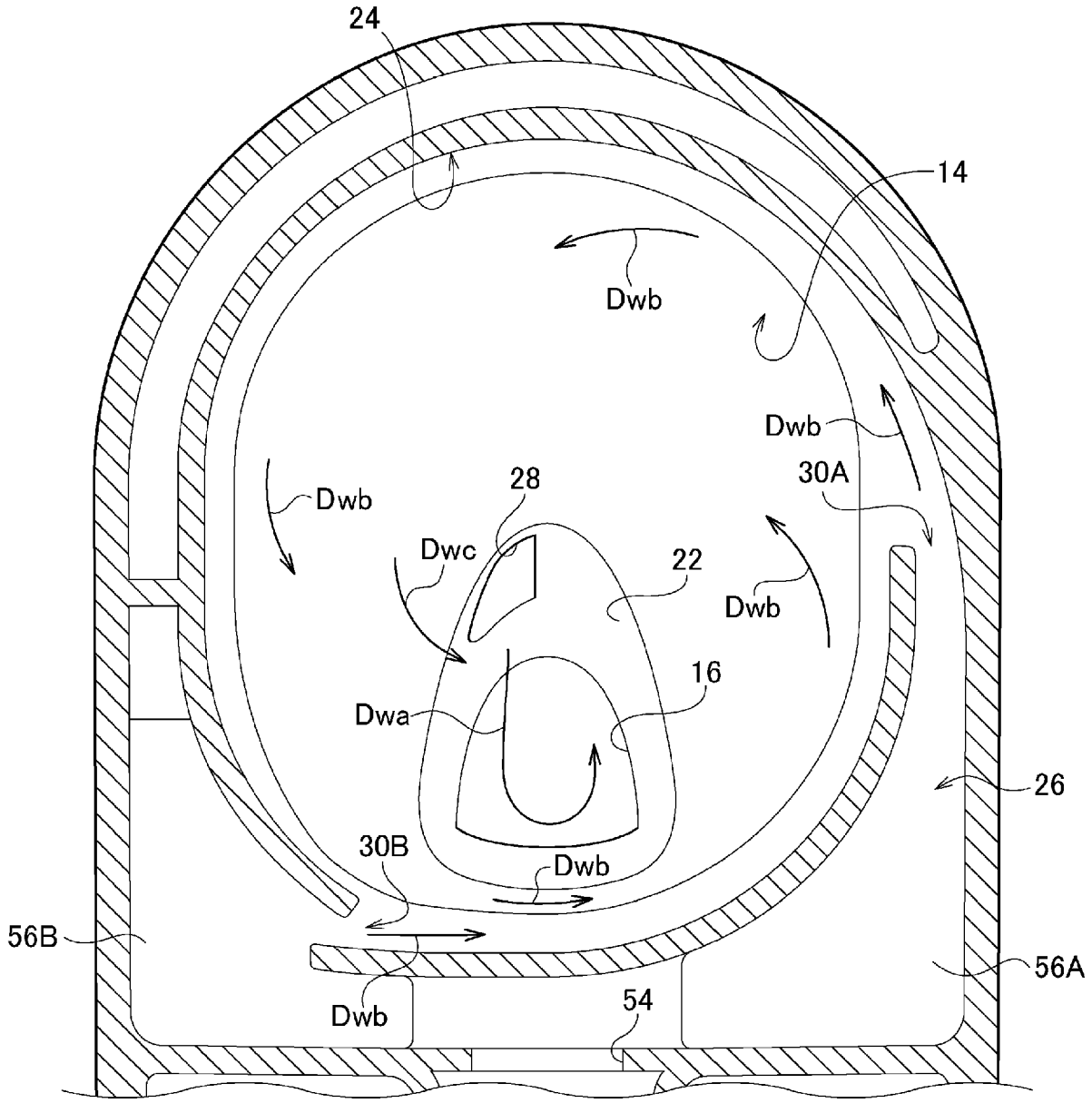


FIG. 8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Dwb
Dwb
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30A
Dwc
22
Dwb
16
Dwa
26
30B
Dwb
56B
56A
Dwb
54

FIG. 9

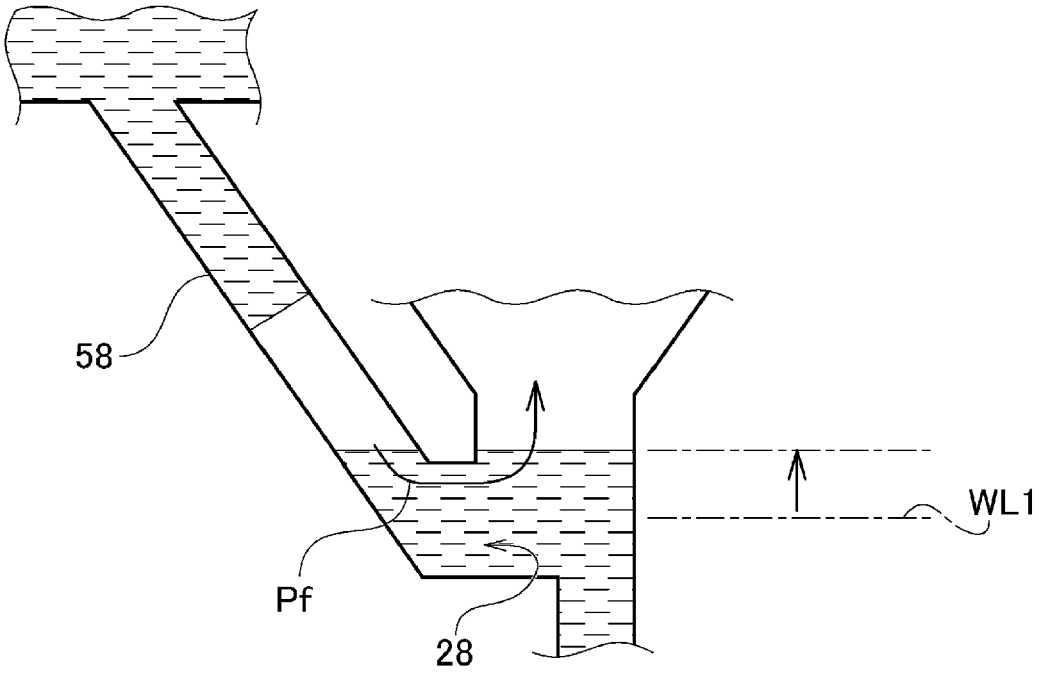


FIG. 10

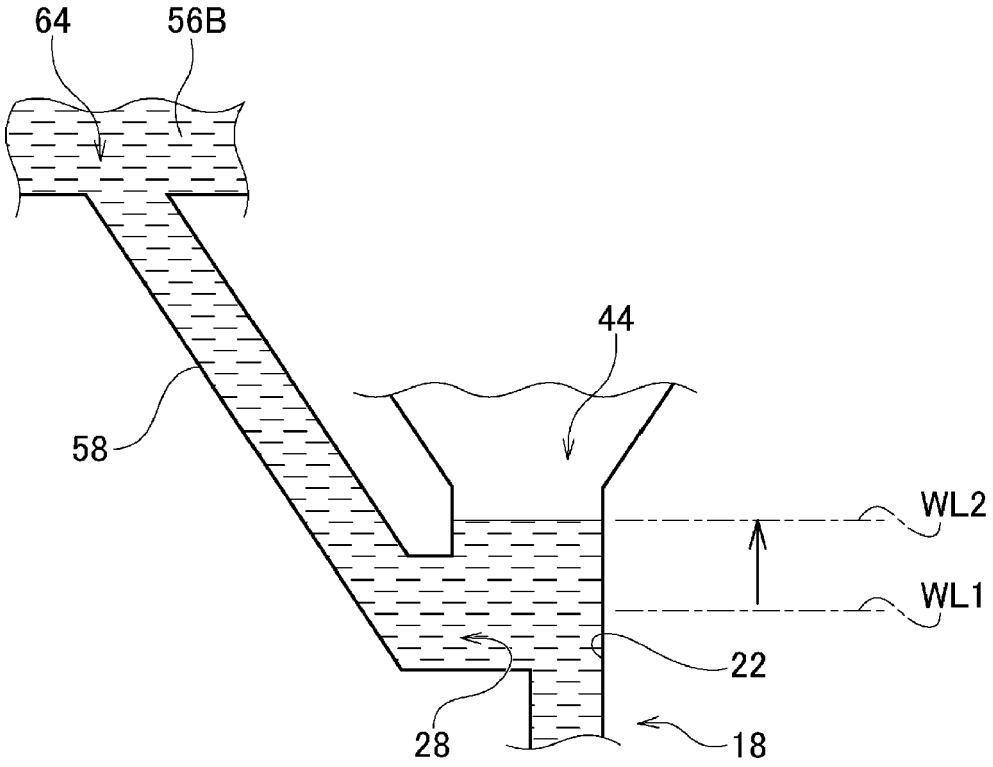
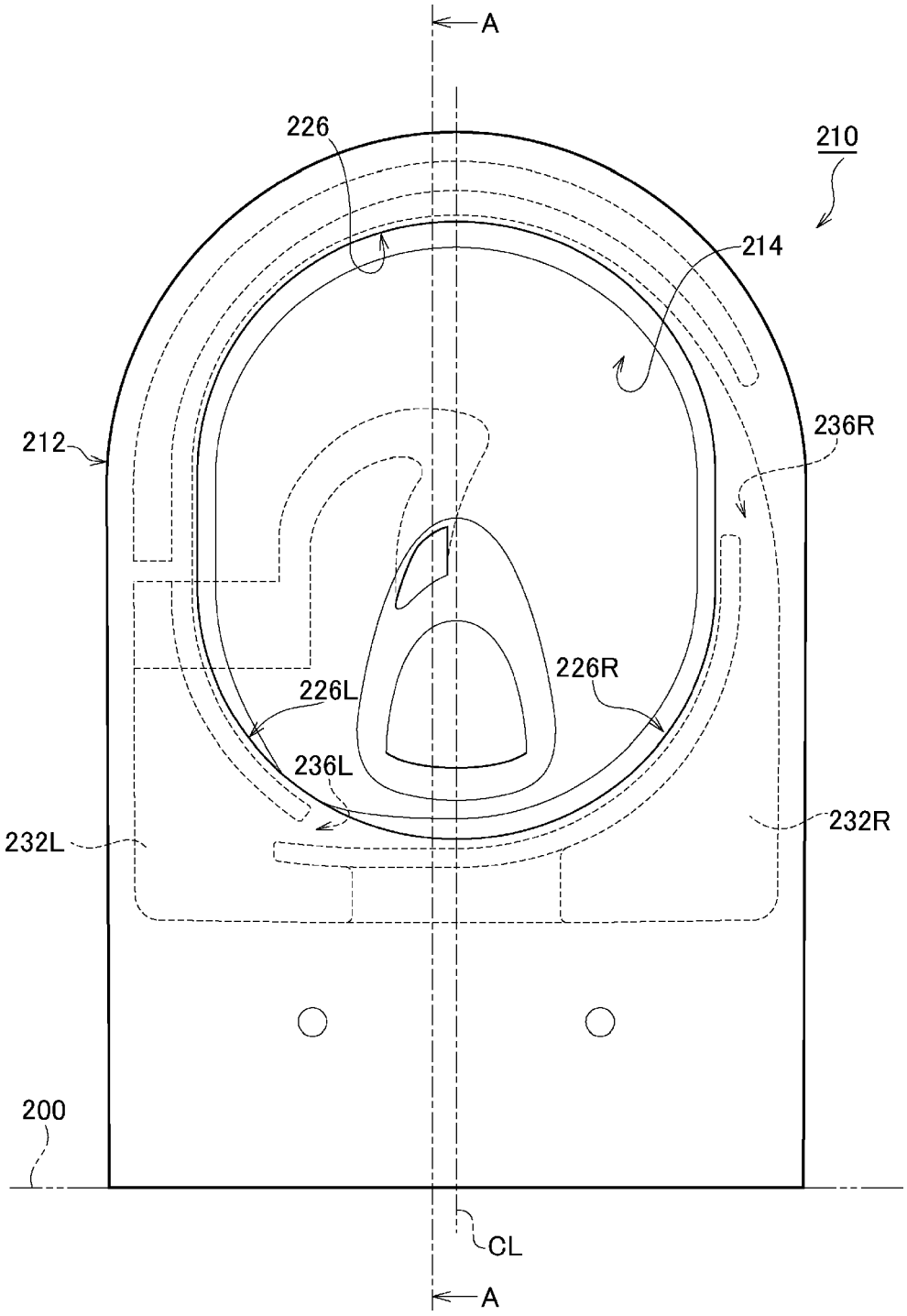
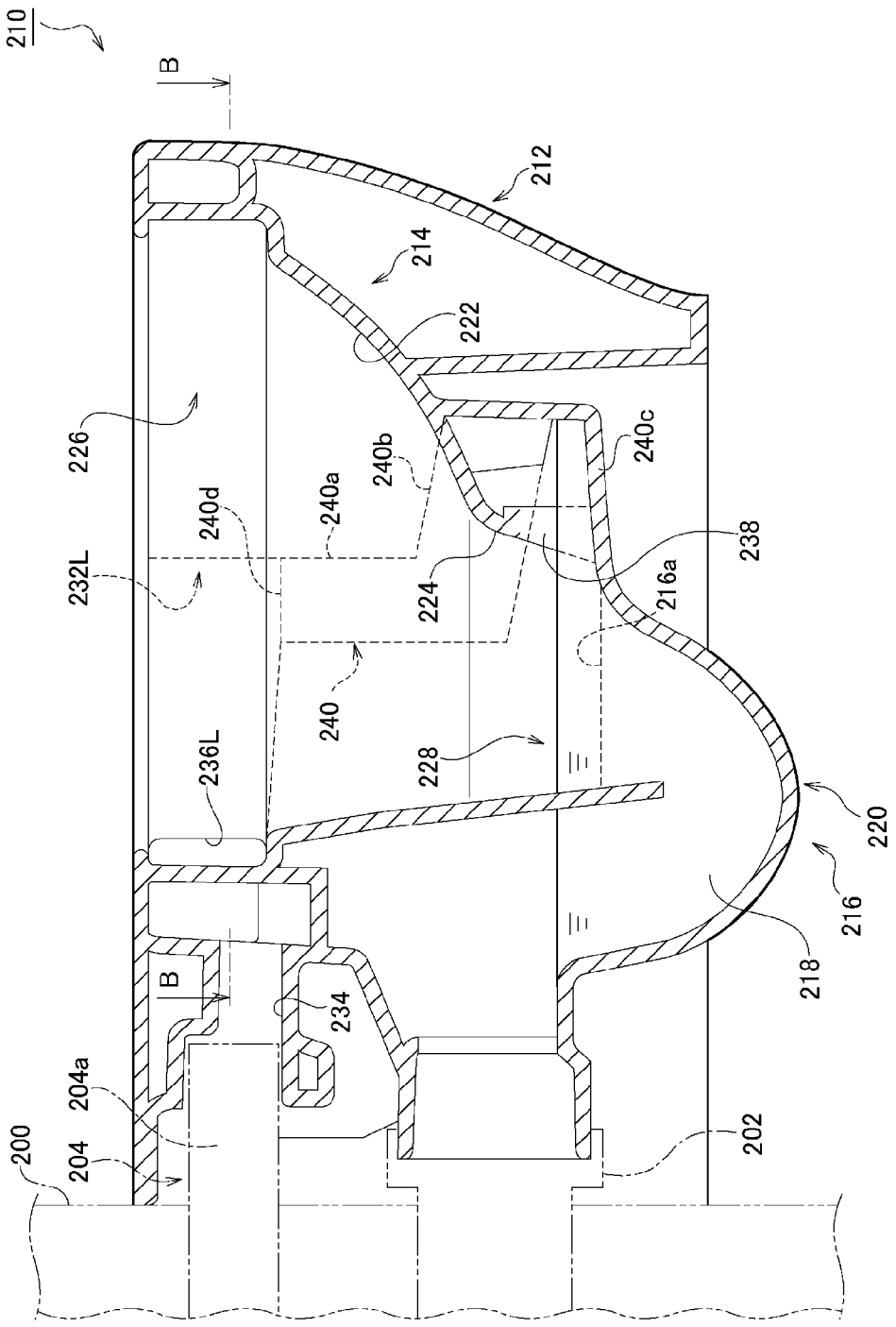


FIG. 11

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240a
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232L
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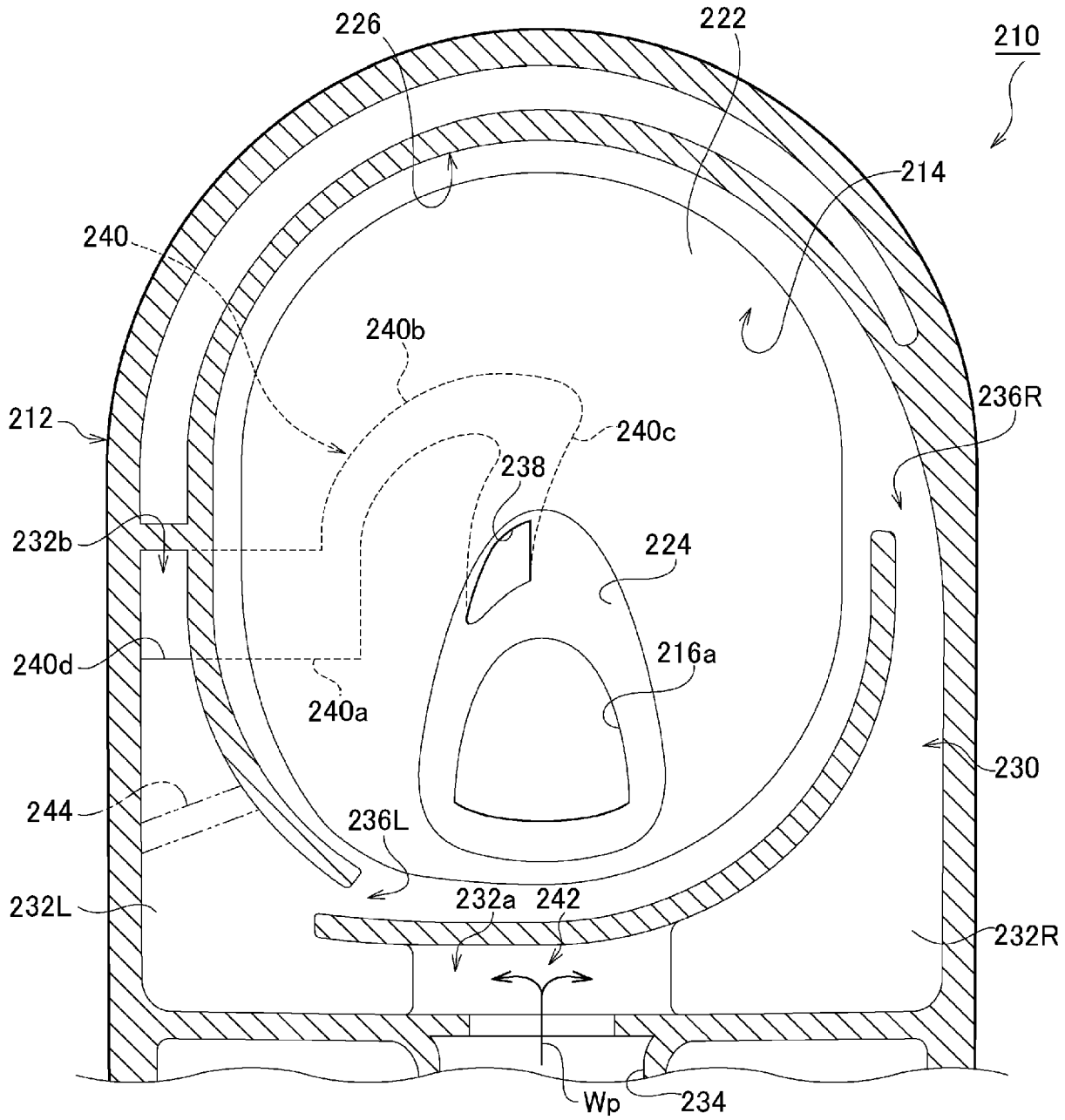
236L
220
216
218
B
234
204a
200
204
202

FIG. 12

FIG. 13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216a
240a
230
244
236L
232a
242
232L
232R
Wp
234

FIG. 14

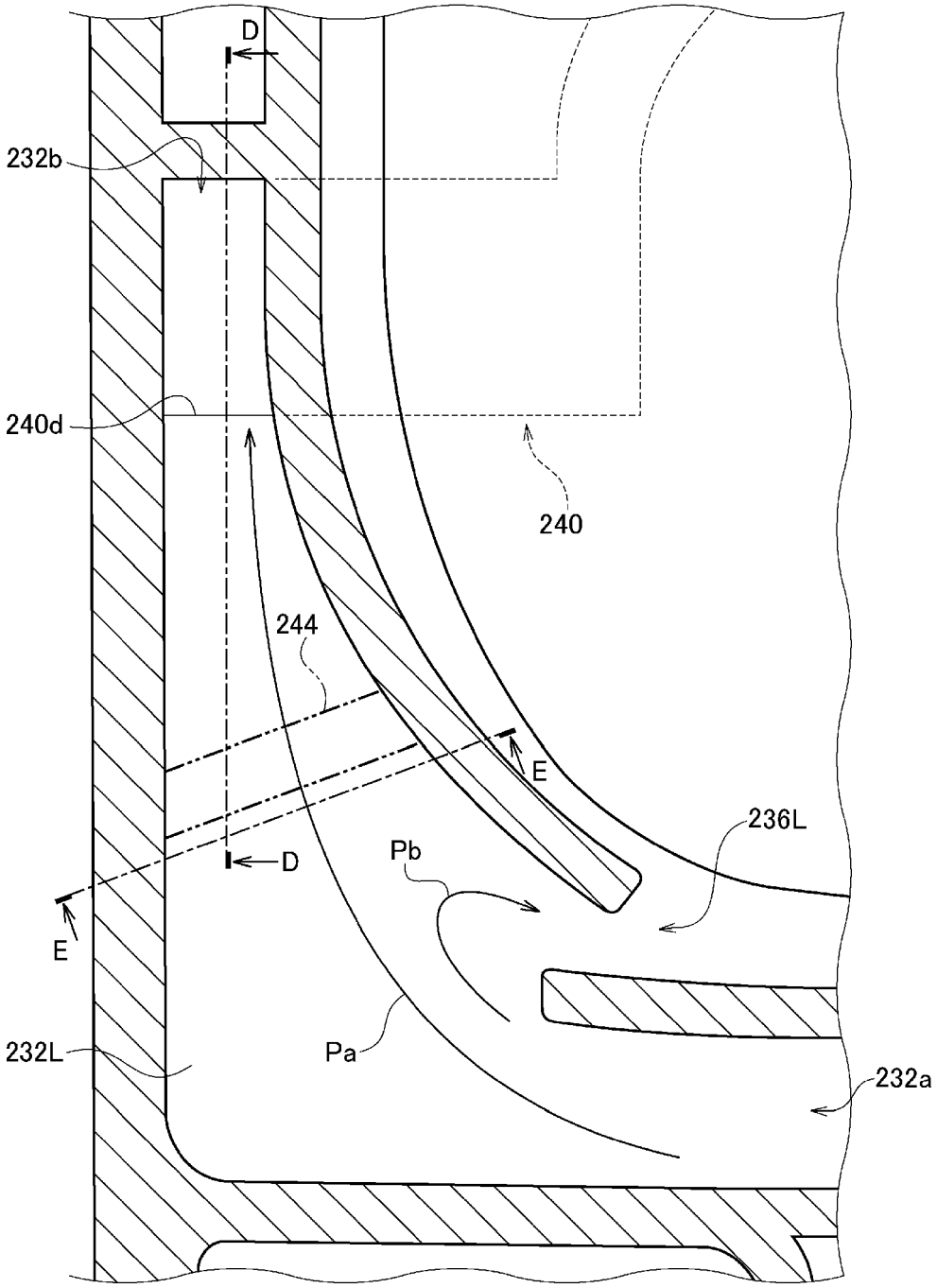
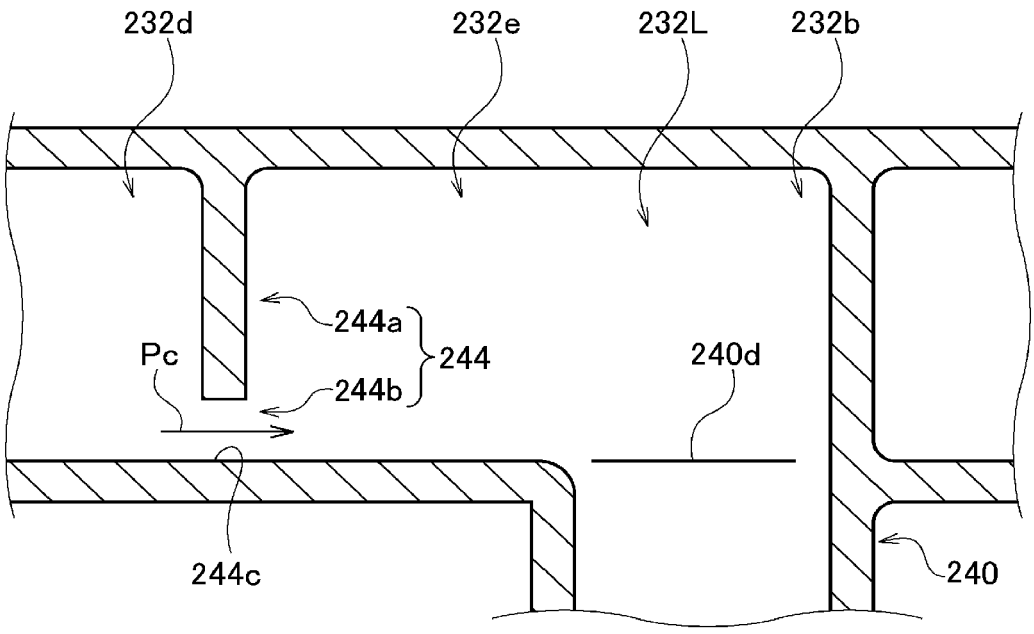


FIG. 15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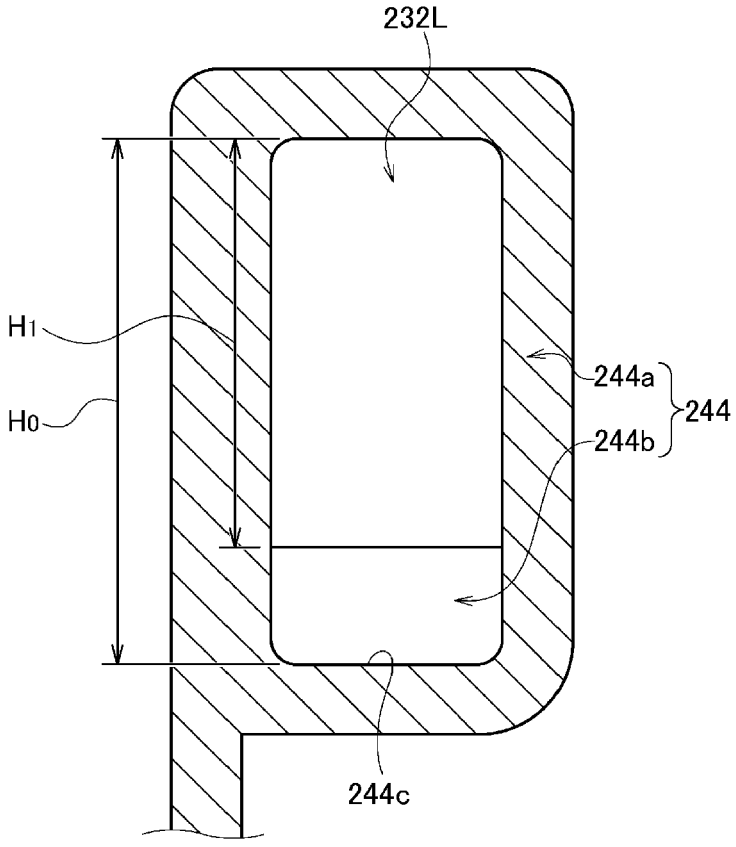
244
Pc
244b
240d
244c
240

FIG. 16


232L
H1
H0
244a
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244b
244c

FIG. 17

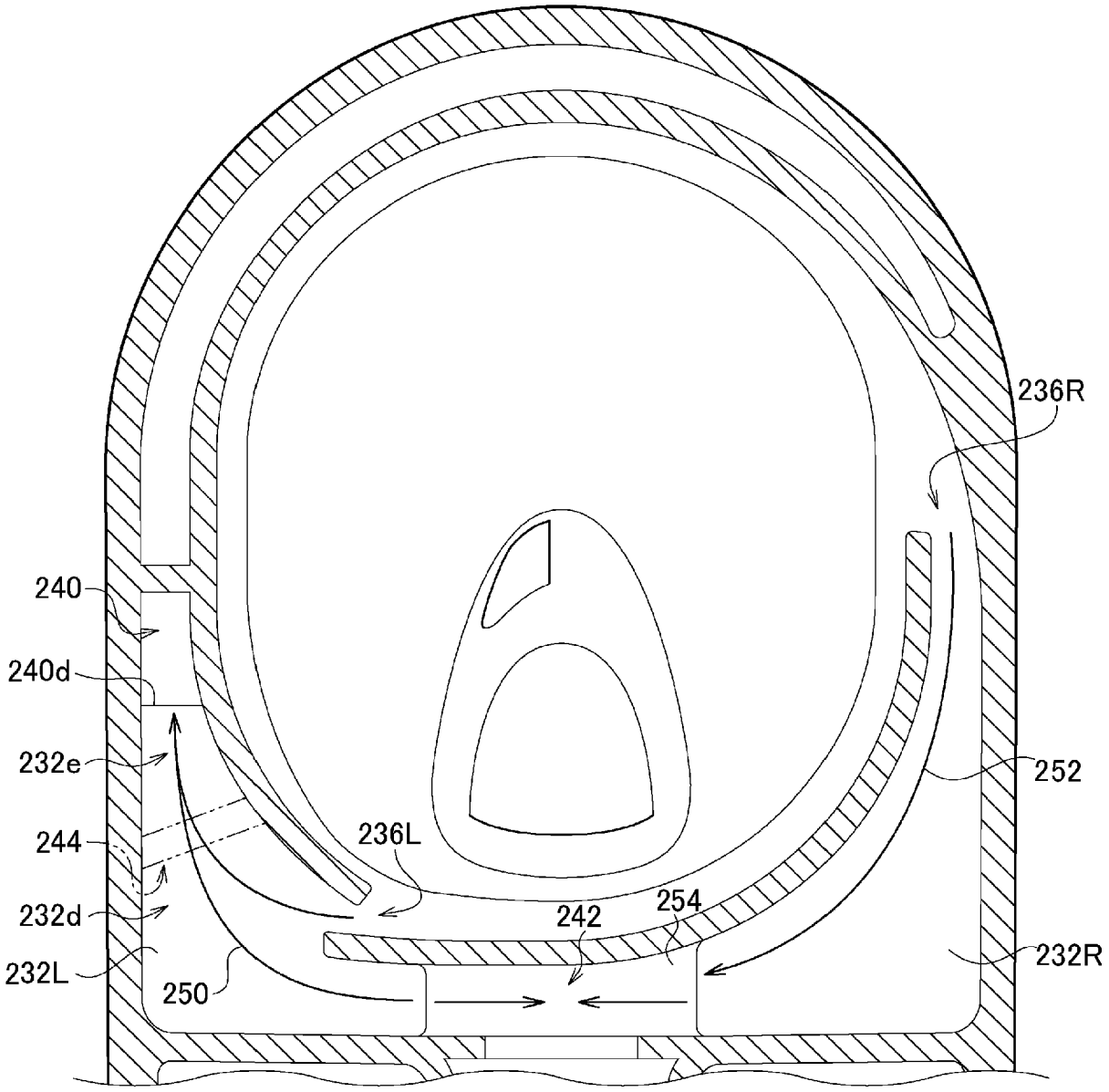


FIG. 18A

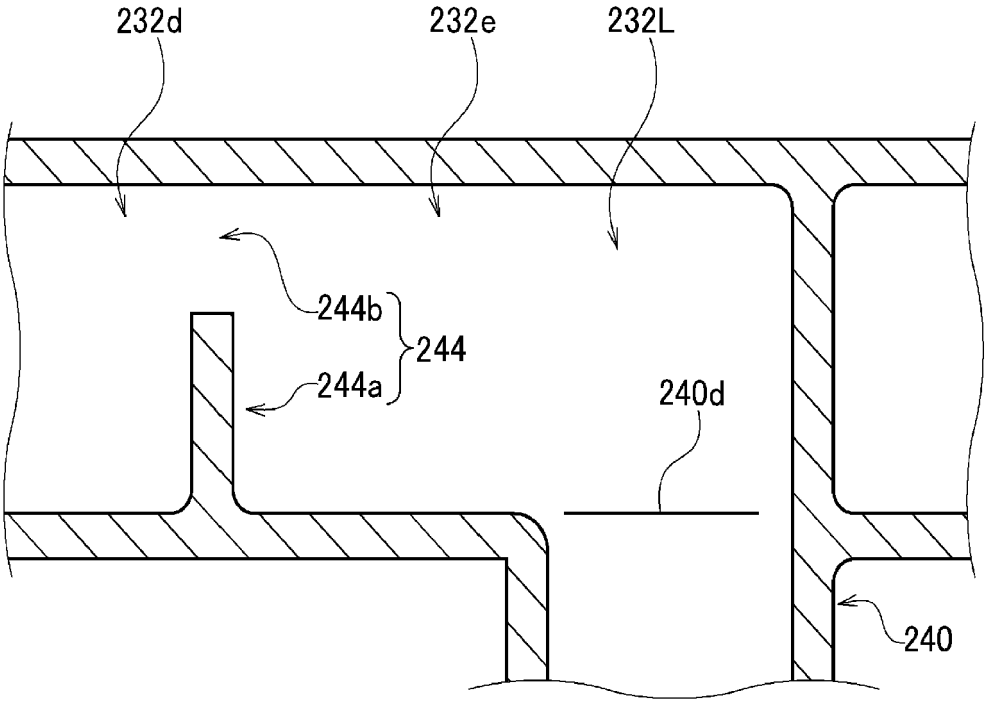


FIG. 18B

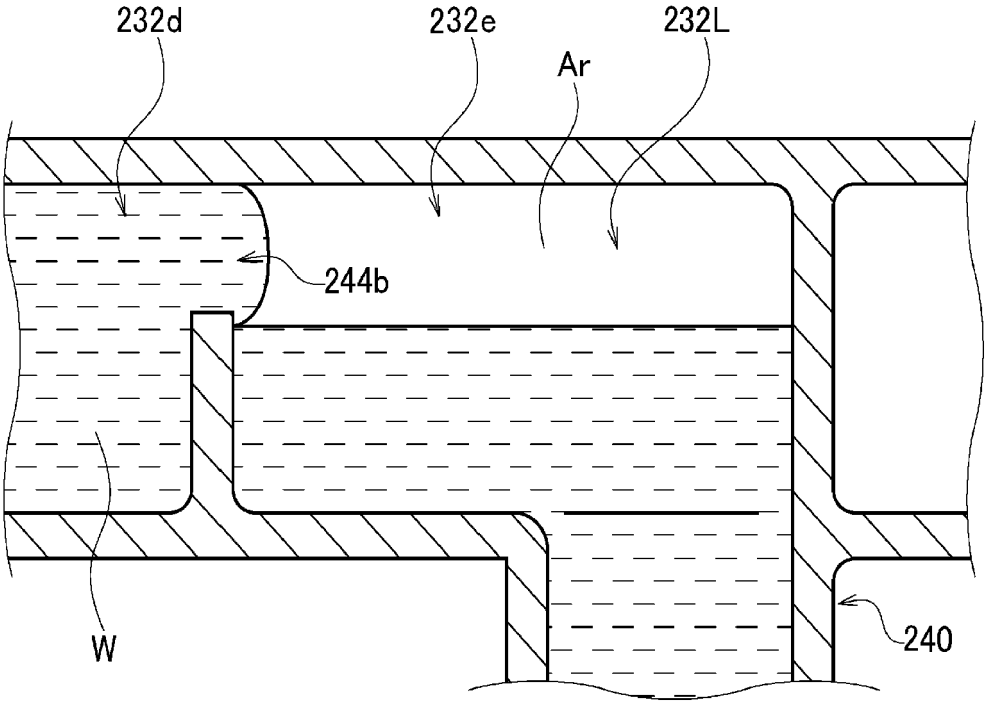


FIG. 19

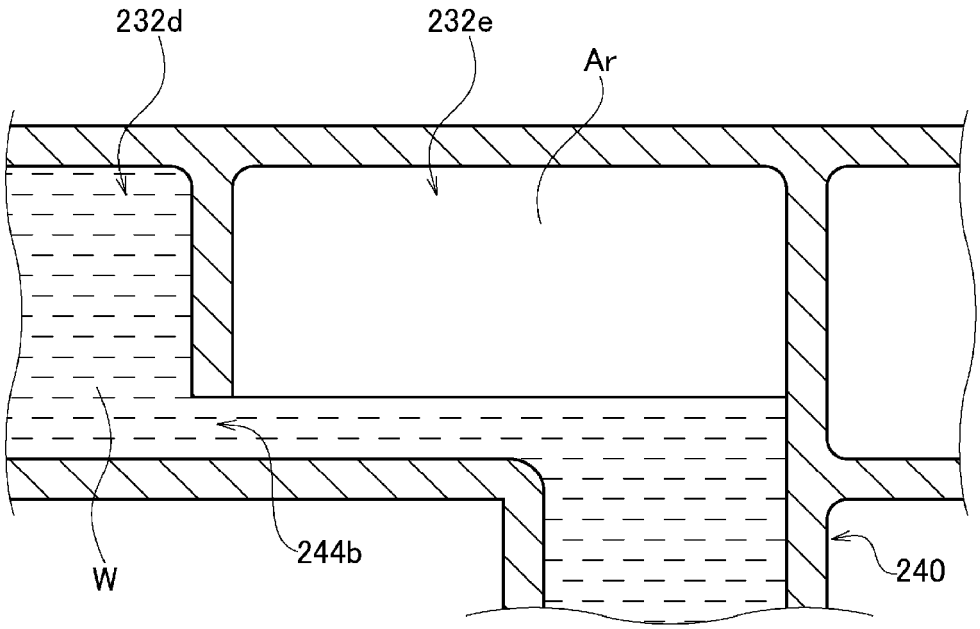
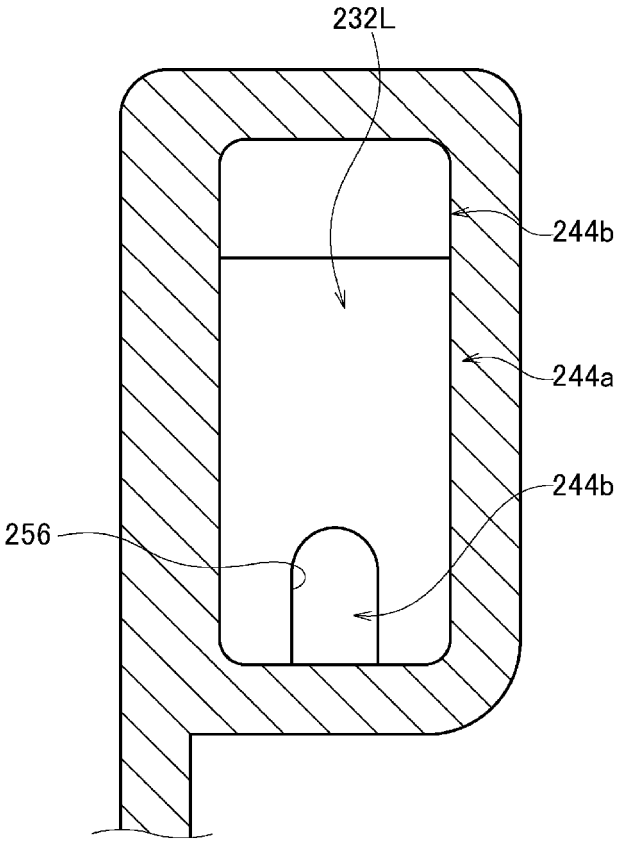


FIG. 20



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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 April 2020	Posavec, Daniel

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