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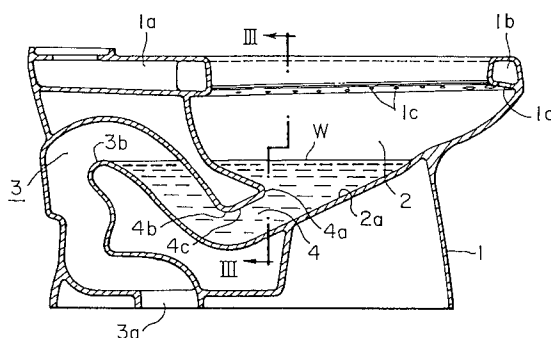
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DE FR GB SE(71) Applicant: **TOTO LTD.**
1-1, Nakajima 2-chome
Kokurakita-ku
Kitakyushu-shi
Fukuoka 802 (JP)(72) Inventor: **OGATA, Yoshikazu**
Toto Ltd.**1-1, Nakajima 2-chome****Kokura-Kita-ku****Kitakyushu-shi****Fukuoka 802 (JP)**(74) Representative: **Klunker . Schmitt-Nilson .**
Hirsch
Winzererstrasse 106
D-80797 München (DE)(54) **WATER CLOSET**

(57) A water closet comprises a bowl section (2) having an inclined surface (2a) inclining downward, a rim water passage (1b) formed on an upper peripheral edge portion of the bowl section (2) to communicate to a flush water supply passage and having a plurality of water-jet holes (1c, 1d) opened toward the bowl section, and a drainage passage (3), of which an inlet (4) is provided near the bottom portion of the bowl section (2) and has a substantially inverted U-shape. The inlet (4) of the drainage passage (3) is provided with an inclined surface (4c) which inclines from an inlet base (4a) at an upper position to an inlet end (4b) at a lower position and is formed to be substantially in parallel to an inclined surface near the bottom portion of the bowl section (2).

**FIG. 1****EP 0 686 731 A1**

Technical Field

This invention relates to a seat-type flush toilet bowl and, more particularly, a flush toilet bowl which is increased in a power of discharging sewage by flush water.

Background Art

As such a seat-type flush toilet bowl, a wash down system and a siphoning wash down system of flush toilet bowls have widely been utilized in the past.

Fig. 7 is a longitudinal sectional view showing a conventional example of a flush toilet bowl according to these systems, and Fig. 8 is a plan view thereof.

Referring to the drawings, at the upper end of the body 1 of the flush toilet bowl is provided a water supply chamber 1a which communicates with a flush water tank (not shown), and this water supply chamber 1a is connected to a rim water path 1b formed on the periphery of the upper end of a bowl part 2. The rim water path 1b is provided with small-diameter water projection holes 1c on the portion facing the bowl part 2 and, simultaneously, is provided with five large-diameter water projection holes 1d at the farthest portion away from the water supply chamber 1a, as shown in Fig. 8. Moreover, at the down-stream of the bowl part 2 is provided a substantially inverted U-shaped discharge passage 3, the terminating end of which opens at the bottom of the body 1 as a discharge port 3a.

With such a construction of the flush toilet bowl, a trap is formed by a sealed water W which is determined depending on the highest position of the bottom wall of the discharge passage 3. The flush water from the flush water tank is supplied from the water supply chamber 1a to the rim water path 1b, and released toward the bowl part 2 from the small and large-diameter water projection holes 1c and 1d.

During the process of such flush, the flush water from the small diameter water projection hole 1c flushes down the surface of the bowl part 2 above the sealed water W, and the flush water from the large-diameter water projection holes 1d flows into the sealed water W so that it concentrates on the point P shown in Fig. 8. Mainly, the flow of the powerful flush water from the large-diameter water projection holes 1d pushes out the sealed water W to the discharge passage 3, and the flush water flows together with sewage from the discharge passage 3 to the discharge port 3a and is discharged.

At the portion where a flow passage is connected from the bowl part 2 toward the discharge

passage 3, is positioned a water discharge opening 10. This water discharge opening 10 is positioned at the lowest level in the flow passage proceeding from the bowl part 2 toward the discharge passage 3, and the inner peripheral wall of the bowl part 2 forming the periphery at the upper end and at the left and right rises usually at an angle of 50 degrees and more. Accordingly, in the case where the lengths in the front and back directions of the bowl part 2 are made equal, a position of the water discharge opening 10 becomes deeper compared with a design in which the inclination of the inner peripheral wall is made gentle and, therefore, the distance from the point P, where flush water from the large-diameter water projection holes 1d converges, to the water discharge opening 10 becomes longer.

Further, provision of the water discharge opening 10 at the lowest position makes smaller a ratio of the opening area of the water discharge opening 10 to the longitudinal section which is occupied in the bowl part 2 by the sealed water W, as shown in Fig. 9.

Thus, in the case where the distance from the point P, where flush water from the large diameter water projection hole 1d concentrates, to the water discharge opening 10 is long, a power of the flush water which concentrates on the point P is apt to attenuate before it is transmitted to the water discharge opening 10. Further, the flush water which has concentrated on the point P forms a flow which acts on the sealed water W and presses it out into the discharge passage 3; however, since the volume of the sealed water W is large relative to the water discharge opening 10, as shown in Fig. 9, the power by which the flush water presses the sealed water W is apt to be dispersed, and there is a limit in magnitude of the force of action which promotes the flow toward the water discharge opening 10.

In this way, since, with the conventional flush water toilet bowl, the water discharge opening 10 is provided at the lowest level below the sealed water W, there is a tendency for the flow of flush water, which acts on the sealed water W so as to press it, to not be effectively utilized. Therefore, there are some cases which require countermeasures of making the pressure of supply of flush water higher or increasing the amount of supply thereof.

The present invention has been made taking such points into consideration, and aims at providing a flush toilet bowl which allows the discharge of sewage more effectively to be performed utilizing an energy of flush water without an increase in the pressure and amount of supply of flush water.

Disclosure of Invention

In order to achieve the above-mentioned object, a flush toilet bowl according to the present invention which comprises:

a bowl part having an inclined surface inclined downwardly;

a rim water path which is formed on the peripheral edge portion of the upper end of said bowl part in communication with a flush water supply passage and which is provided with a plurality of projection holes opening into said bowl part side; and

a discharge passage the inlet part of which is provided near the bottom of said bowl part and which is of an inverted-U shape,

said inlet part of the discharge passage having an inclined surface inclined from the base end of the inlet part at the upper position toward the terminating end of the inlet part at the lower position, said inclined surface being shaped substantially parallel to the inclined surface near the bottom of said bowl part.

As a preferable form of the present embodiment, one or more water projection holes provided substantially at the position opposite the discharge passage among said water projection holes on the rim water path are greater in diameter than the other water projection holes and are provided directed toward said inlet part of the discharge passage.

As a further preferable form of the present embodiment, the inclined surface of the inlet part of the discharge passage is shaped substantially in a straight line.

As a further preferable form of the present embodiment, the opening area at the base end of the inlet part of the discharge passage is greater than that at the terminating end of the inlet part.

According to the present invention, since the base end of the inlet part of the discharge passage is at a position higher than the terminating end of the inlet part, the distance from the position of the surface of the sealed water to the base end of the inlet part becomes short; so, a ratio of attenuation of a force of flow of the flush water projected from the water projection holes on the rim water path is small, so allowing a force of pushing out the sealed water to the discharge passage side by the projected flush water to be made great.

This function is more effectively carried out by making the opening areas of the water projection holes provided at a position substantially opposite the discharge passage among the water projection holes on the rim water path, greater than the opening area of the other water projection holes, and by providing the water projection holes so as to be directed to the inlet part of the discharge passage.

Further, since the inclined surface of the inlet part of the discharge passage is shaped substantially like a straight line, a force of pushing out the sealed water by the projected flush water can be used more effectively.

Moreover, since the opening area at the base end of the inlet part of the discharge passage is made greater than that at the terminating end of the inlet part, the sealed water can be more effectively forced into the discharge passage.

Brief Explanation of Drawings

Fig. 1 is a longitudinal sectional view showing a first embodiment of the present invention;

Fig. 2 is a plan view including a partial cutaway portion of the flush toilet bowl shown in Fig. 1;

Fig. 3 is a sectional view taken along line III-III in Fig. 1;

Fig. 4 is a longitudinal sectional view showing a second embodiment of the present invention;

Fig. 5 is a plan view including a partial cutaway portion of the flush toilet bowl shown in Fig. 4;

Fig. 6 is a longitudinal sectional view showing a third embodiment of the present invention;

Fig. 7 is a longitudinal sectional view showing a conventional flush toilet bowl;

Fig. 8 is a plan view including a partial cutaway portion of the flush toilet bowl shown in Fig. 7; and

Fig. 9 is a sectional view taken along line of IX-IX in Fig. 7.

Best Mode for Carrying Out the Invention

Figs. 1 to 3 show a flush toilet bowl according to a first embodiment of the present invention.

The body 1 of the flush toilet bowl comprises a bowl part 2 having an inclined surface 2a inclined downwardly, a rim water path 1b formed on the peripheral edge portion at the upper end of the bowl part 2 in communication with a water supply chamber 1a, and a discharge passage 3, the inlet part 4 of which is provided near the bottom of the bowl part 2 and which is substantially of an inverted U-shape.

A plurality of small-diameter water projection holes 1c are provided on the rim water path 1b in such a way as to be directed toward the bowl part 2, and at the position opposite an inlet part 4 of the discharge passage 3 are provided large-diameter water projection holes 1d each having an opening area greater than that of the small-diameter water projection holes 1c.

The inlet part 4 of the discharge passage 3 is in the form of a tube the opening axis of which is inclined in an obliquely upward direction toward the forward end side of the body 1 of the toilet bowl

(the right side in Fig. 1), and the base end 4a thereof is in a position above the terminating end 4b. Further, an inclined surface 4c inclined from the base end 4a of the inlet part to the terminating end 4b of the inlet part is formed, and is substantially parallel to the inclined surface 2a near the bottom of the ball part 2.

Moreover, in the present embodiment, the inclined surface 4c is formed substantially like a straight line. Further, the large-diameter water projection holes 1d provided on the rim water path 1b are directed toward the discharge passage 3, and the flush water projected from the large-diameter water projection holes 1d is adapted to be able to effectively flow into the inlet part 4 along the inclined surface 2a of the ball part 2.

The discharge passage 3 is so shaped that it rises toward the top 3b of the trap in an obliquely upward direction following the inlet part 4, and descends from a position of exceeding the top 3b of the trap toward the discharge port 3a.

According to the present embodiment, since the inlet part 4 of the discharge passage 3 is shaped like a tube having the inclined surface 4c, the base end 4a thereof is positioned above the terminating end 4b, and a distance H from the surface of the sealed water W to the base end 4a is smaller than the distance h in the prior art (refer to Fig. 9).

Accordingly, in the case flush wash water projected from the large-diameter water projection holes 1d reaches with concentration on P, flows down into the sealed water W and further along the inclined surface of the ball part 2, and then into the base end 4a of the inlet part of the discharge passage 3, the sealed water W forced into the discharge passage 3 from the base end 4a of the inlet part simultaneously with the projected flush water is less than the sealed water in the prior art, so; a force of flow of the flush water projected from the large diameter water projection holes 1d can be more effectively actuated on the sealed water W.

Namely, since a ratio of attenuation of the flow energy of the wash water followed by a collision of the flush water projected from the large diameter water projection holes 1d with the sealed water W becomes small, the flush water, even if less in quantity and lower in pressure than in the prior art, flows into the sealed water W forcing it into the discharge passage 3 from the inlet part 4, and exceeds the top 3b of the trap, thereby allowing the siphoning action to occur rapidly.

Moreover, making the inclined surface 4c of the inlet part 4 parallel to the inclined surface 2a of the ball part 2 allows the flush water to pass through the inlet part 4 more smoothly. Further, forming the inclined surface 4c like a straight line allows the flush water to pass through even more

smoothly.

Thus, the present embodiment allows the water head at the inlet part 4 of the discharge passage 3 to be made small, so, when flush water is supplied from the rim water path 1b into the ball part 2, a force of the flush water which pushes the sealed water W is effectively transmitted to the discharge passage 3, thereby enabling a powerful flushing of the bowl. This allows stable flushing and discharging actions to be produced with the supply of a relatively small quantity of flush water.

Figs. 4 and 5 are views showing a second embodiment of the present invention.

In the present embodiment, an angle of inclination of the inclined rising part (part which rises toward the top 13b of a trap) 13d of a trap discharge passage 13 is made greater than that of the first embodiment. This enables the inlet part 14 of the discharge passage 13 to be positioned at the back of the bowl part 2 (at the left in Fig. 4), so that the discharge of the sealed water W and flush water can be performed more smoothly.

Further, since an angle of inclination of the inclined rising part 13d of the trap discharge passage 13 is large, the time taken until flush water flows over the top 13b of the trap becomes short, thereby rapidly producing the siphoning action.

The others are the same as those in the aforementioned first embodiment of the present invention, and the inlet part 14 is provided with an inclined surface 14c which is inclined toward the terminating end 14b of the inlet part at the lower position from the base end 14a of the inlet part at the upper position, said inclined surface 14c being formed substantially parallel to the inclined surface near the bottom of the ball part 2. Also in the present embodiment, flushing and discharging actions can be effectively produced with a small quantity of flush water in a similar way to the aforementioned first embodiment.

Fig. 6 is a view showing a third embodiment of the present invention.

The present embodiment is similar to the above-mentioned first embodiment except for the construction of an inlet part 24 of the discharge passage. The inlet part 24 in the present embodiment features an opening area at the base end 24a of the inlet part of which is made greater than that at the terminating end 24b of the inlet part.

Namely, the inlet part 24 is in the form of a section divergently inclined so that it becomes large in section from the terminating end 24b of the inlet part toward the base end 24a of the inlet part. This allows the flush water and the sealed water W to flow into the inlet part 24 more smoothly, thereby enabling stable flushing and discharging actions to be produced with the supply of a small quantity of flush water.

Industrial Applicability

As explained above, the present invention allows the water head at the inlet part of the discharge passage to be made small, so, actuating a force of flow of the flush water from the rim water path effectively enabling the positive flushing and discharging actions to be produced using a smaller quantity of flush water. 5

The present invention provides superior effects through application to a relatively large-type flush toilet bowl which performs flushing and discharging actions additionally utilizing the energy of flow of the flush water from the rim water passage. 10

Claims

1. A flush toilet bowl which comprises:

a bowl part having an inclined surface inclined downwardly; 20

a rim water path which is formed on the peripheral edge portion of the upper end of said bowl part in communication with a flush water supply passage and which is provided with a plurality of projection holes opening into said bowl part side; and 25

a discharge passage the inlet part of which is provided near the bottom of said bowl part and which is of an inverted-U shape, 30

said inlet part of the discharge passage having an inclined surface inclined from the base end of the inlet part at the upper position toward the terminating end of the inlet part at the lower position, said inclined surface being shaped substantially parallel to the inclined surface near the bottom of said bowl part. 35

2. A flush toilet bowl as claimed in claim 1, characterized in that one or more water projection holes provided substantially at the position opposite the discharge passage among said water projection holes on the rim water path are greater in diameter than the other water projection holes and are provided directed toward said inlet part of the discharge passage. 40 45

3. A flush toilet bowl as claimed in claim 1, characterized in that the inclined surface of the inlet part of the discharge passage is formed substantially like a straight line. 50

4. A flush toilet bowl as claimed in claim 1, characterized in that the opening area at the base end of the inlet part of the discharge passage is greater than that at the terminating end of the inlet part. 55

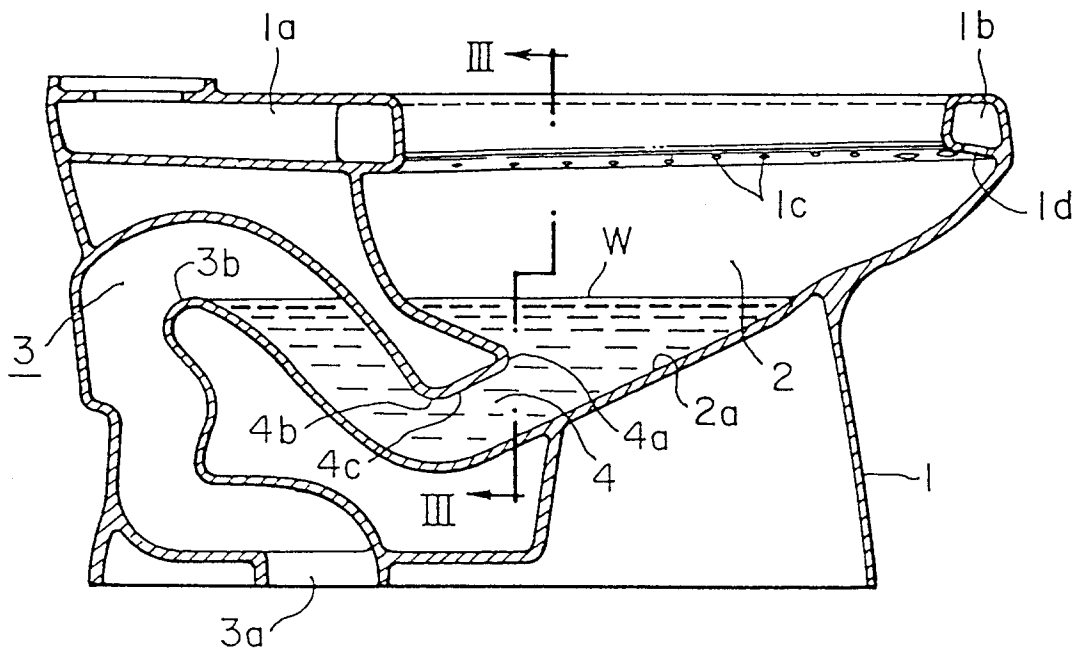


FIG. 1

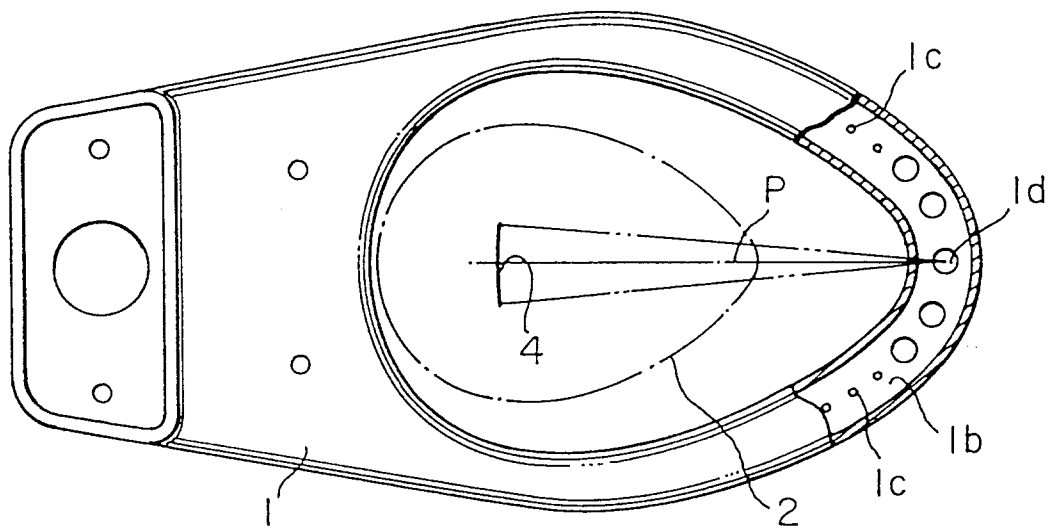


FIG. 2

FIG. 3

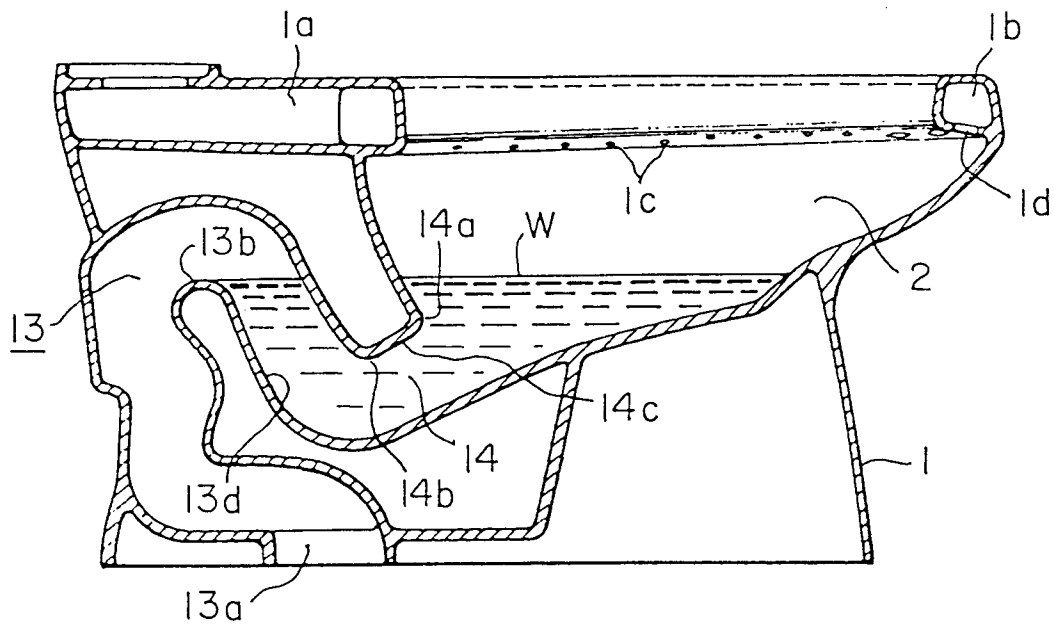
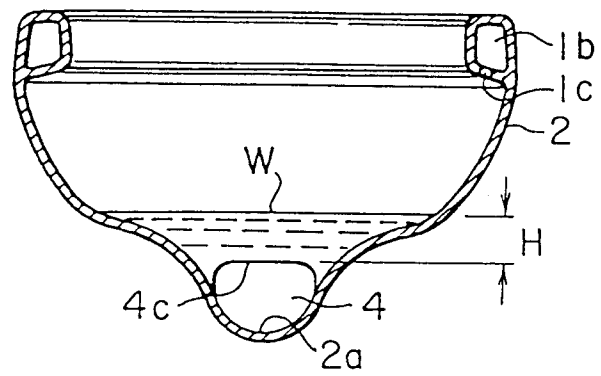


FIG. 4

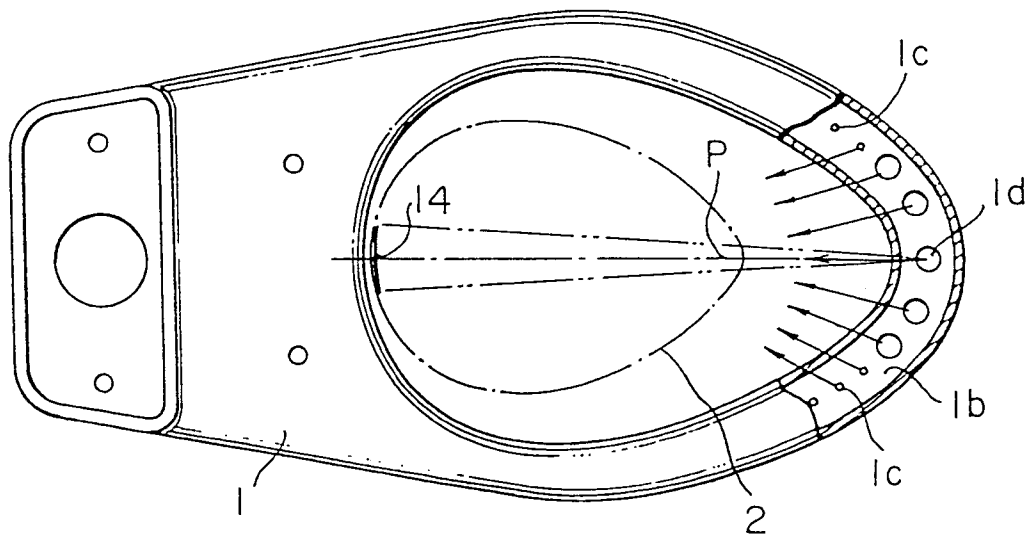


FIG. 5

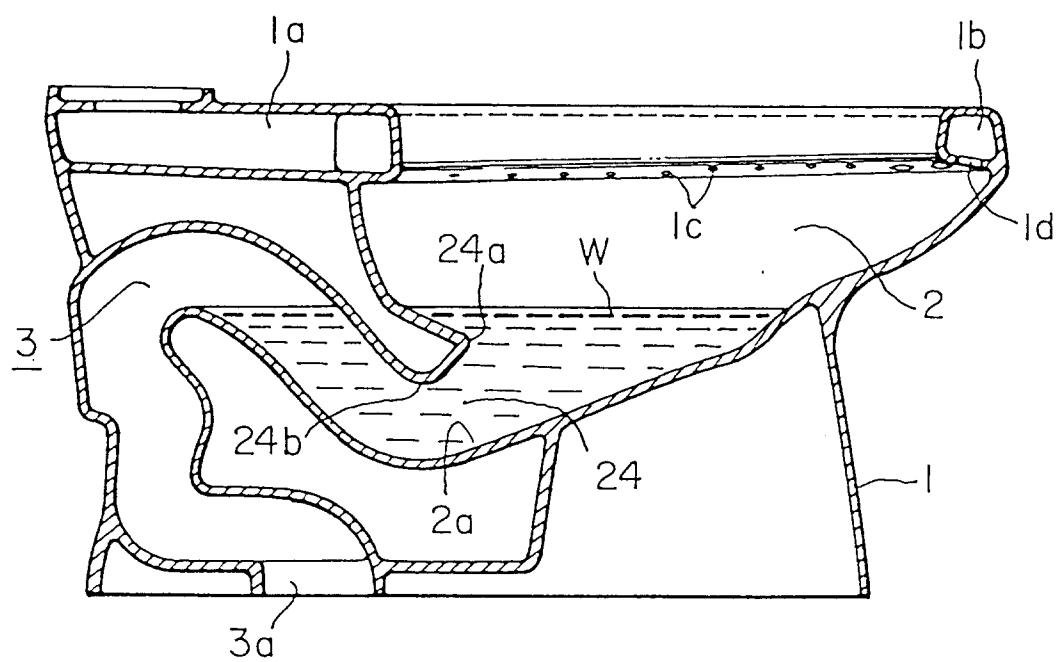


FIG. 6

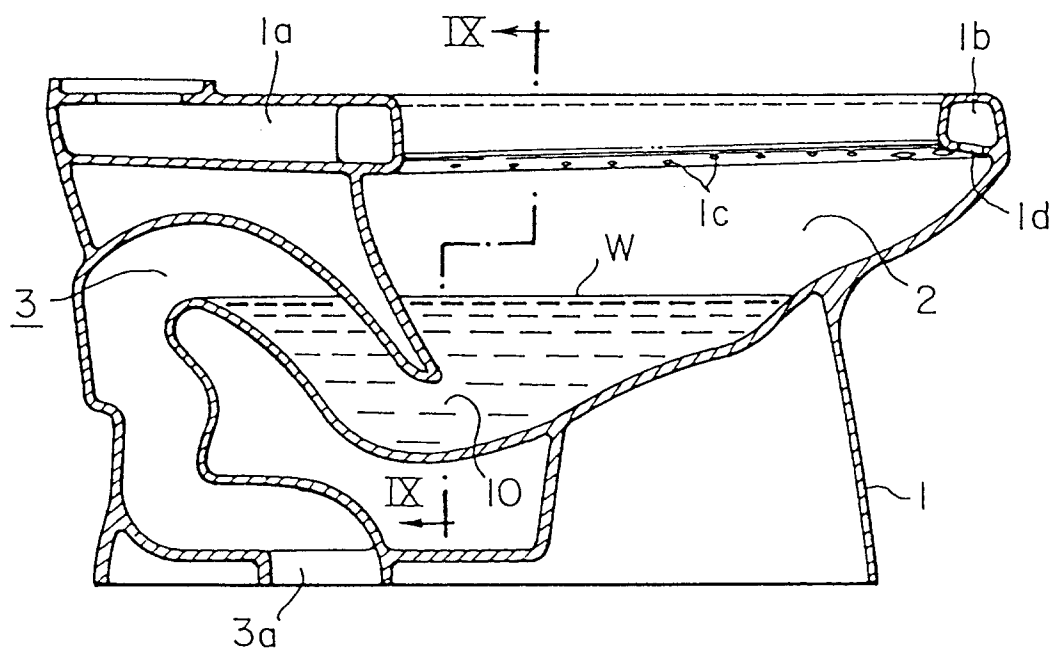


FIG. 7

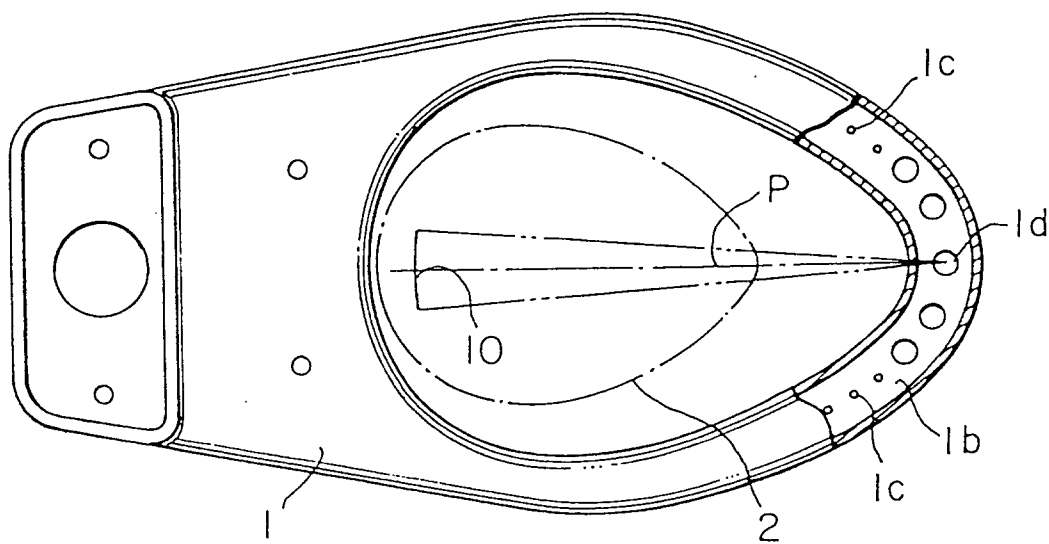


FIG. 8

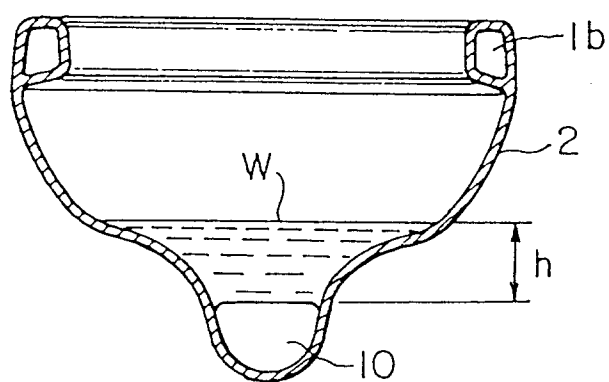


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP94/02219

A. CLASSIFICATION OF SUBJECT MATTER		
Int. Cl ⁶ E03D11/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
Int. Cl ⁵ E03D11/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Jitsuyo Shinan Koho 1926 - 1994		
Kokai Jitsuyo Shinan Koho 1971 - 1994		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP, A2, 223,764 (Louis Marc), May 27, 1987 (27. 05. 87), Fig. 1	1-4
Y	JP, U, 60-85379 (TOTO Ltd.), June 12, 1985 (12. 06. 85), Fig. 1 (Family: none)	1-4
Y	JP, Y2, 2-18133 (TOTO Ltd.), May 22, 1990 (22. 05. 90), Fig. 2 (Family: none)	2
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search March 13, 1995 (13. 03. 95)		Date of mailing of the international search report April 4, 1995 (04. 04. 95)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.		Authorized officer Telephone No.