United States Patent

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[54] **TOILET BOWL (REVERSE TRAP BOWL)**
12 Claims, 3 Drawing Figs.

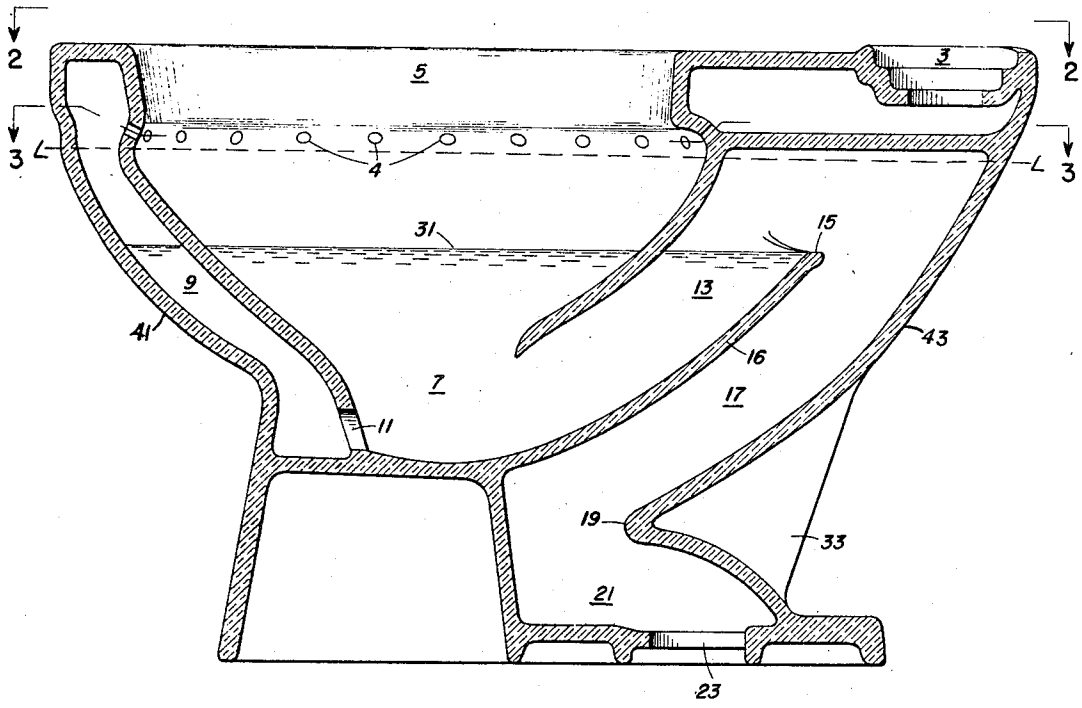
[52] **U.S. Cl.** **4/69**
[51] **Int. Cl.** **E03d 11/02,**
E03d 11/18
[50] **Field of Search** 4/69, 73,
93, 94, 14, 22, 252

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ABSTRACT: Covers a toilet bowl of the reverse trap type which is about one-seventh lighter in weight than other such bowls and may be made by joining only two parts together. The bowl includes jet, up-leg, down-leg and horizontal passageways in which the jet and up-leg passageways are inclined at equal but opposite angles and the up-leg and down-leg passageways are parallel to each other and separated by a thin wall providing the normal weir of the bowl.



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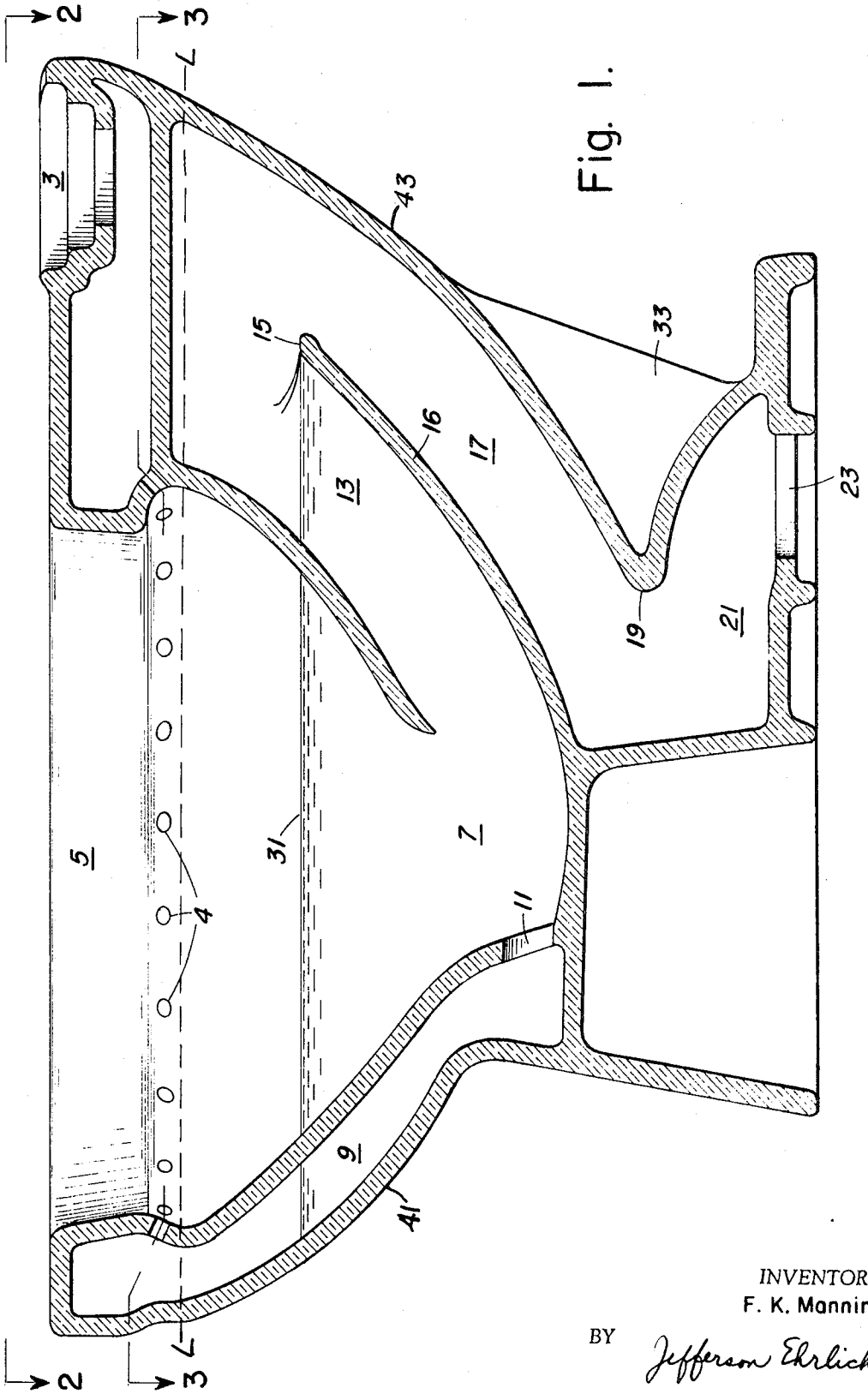


Fig. 1.

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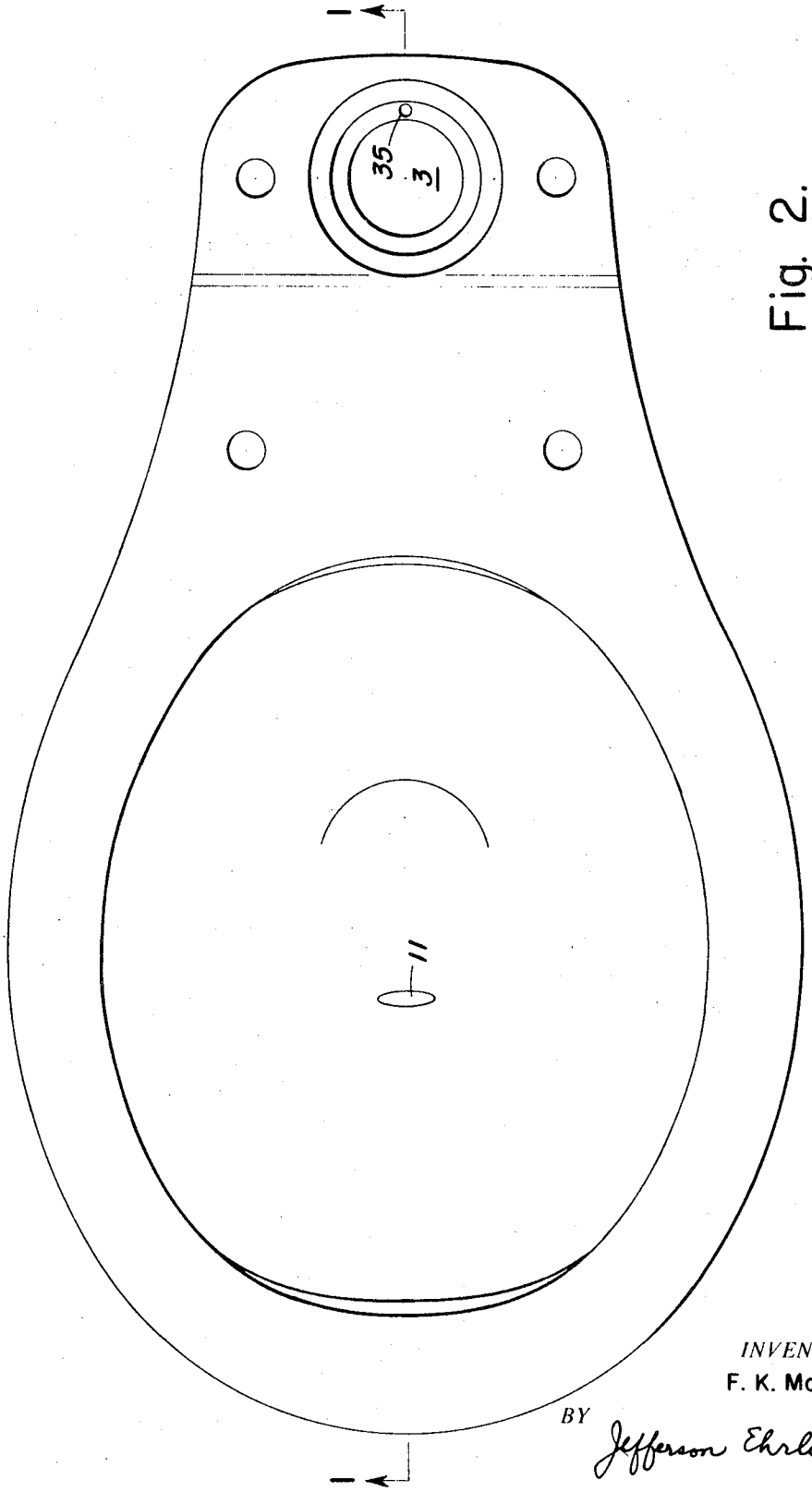


Fig. 2.

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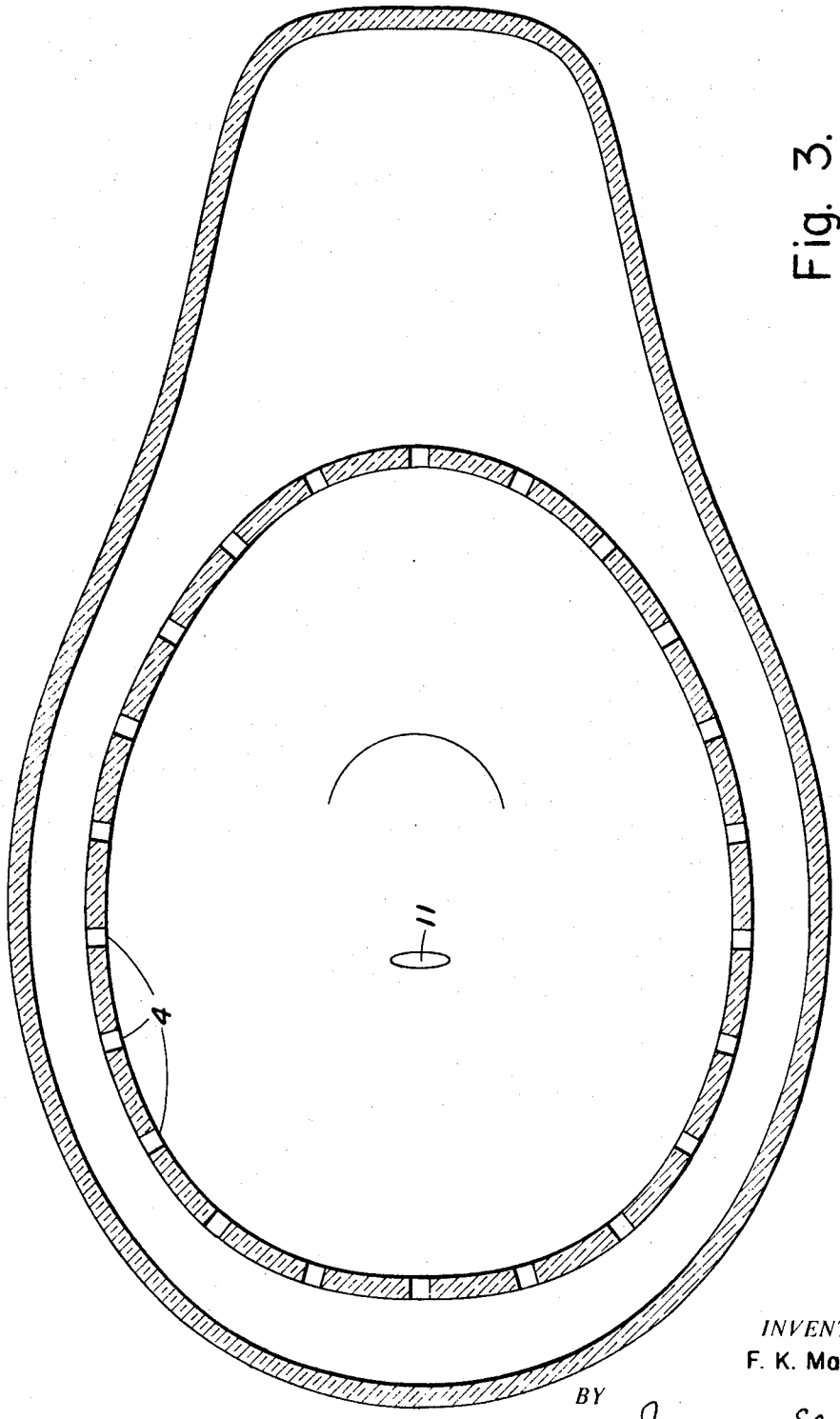


Fig. 3.

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TOILET BOWL (REVERSE TRAP BOWL)

This invention relates generally to toilet bowls, sometimes called "water closets," and, more particularly, to toilet bowls of the siphon-forming type. Still more particularly, this invention relates to toilet bowls in which the jetway is located at the front of the bowl, such toilet bowls being commonly called "reverse trap" bowls. And still more particularly, this invention relates to toilet bowls of the reverse trap type which are lighter in weight than conventional toilet bowls, easier to manufacture and less costly than conventional bowls.

The toilet bowl of the present invention includes a combination of four distinct paths for the main flow of water through the bowl for flushing purposes. These four paths are, for convenience, referred to hereinafter as the jetway passageway, the up-leg passageway, the down-leg passageway and the horizontal passageway. According to this invention, the jetway passageway, which is the first of the four paths, is positioned in the very front of the bowl and extends to the area of the center or midpoint of the bowl. The up-leg passageway and down-leg passageway provide two separate paths which are toward the rear of the bowl and are separated by a divider which forms a weir, the two paths being substantially parallel to each other. The up-leg passageway extends upwardly and directs the water within the bowl and supplied to the bowl toward the rear of the bowl while the down-leg passageway directs the water over a parallel path toward the center of the bowl. The horizontal passageway deflects the water from the down-leg passageway toward the rear of the bowl, but the horizontal passageway releases the water through a floor outlet intermediate the center and rear of the bowl, thus completing a flushing series of paths. Water will be moved at considerable speed over a sequential path through the jetway passageway in a downgrade, then upwardly over a similar grade through the up-leg passageway and over its weir, then downwardly through the down-leg passageway and finally through the horizontal passageway into the outlet in the floor which leads to the sewer or other disposing point. The divider between the up-leg passageway and down-leg passageway provides the only weir of the toilet bowl.

The toilet bowl of this invention is unique in that the down-leg slopes forward allowing a common wall between it and the up-leg. Since the down-leg slopes forward and joins the horizontal-leg forward of the outlet, the direction of flow in the horizontal-leg is to the rear which is opposite to the flow of conventional reverse trap bowls. This feature contributes to the reduced weight and to the simplified construction of this toilet bowl invention.

One of the main objects of the construction and physical embodiment of this invention is to provide a toilet bowl having considerably less weight than conventional toilet bowls while maintaining as much siphonic activity and flushing power as conventional bowls.

Another of the principal objects of this invention is to provide a toilet bowl which is simple in construction and easy to manufacture, requiring considerably less labor to produce than conventional toilet bowls. The toilet bowl of this invention is made only of two pieces which may be joined or stuck together while semiplastic at a line near the top of the bowl. Conventional bowls, due to their complexity, necessarily have three, four or more pieces; yet conventional reversed trap bowls also cannot ordinarily avoid having the same three, four or more pieces. Because of the above-noted structural features of this invention, there is a substantial labor saving in producing the two parts and joining them together to complete the bowl of this invention.

Another of the objects of this invention is to manufacture a bowl with so little material that about seven bowls may be manufactured from the material heretofore required for some six bowls. This constitutes a considerable saving in material and, therefore, results in a reduction in labor and in cost as well.

This invention will be better understood from the more detailed description hereinafter following when read in connection with the accompanying drawing in which:

FIG. 1 illustrates a lateral cross-sectional view of the toilet bowl of the present invention;

FIG. 2 shows a top plan view of the same toilet bowl as it is viewed from lines 2–2 of FIG. 1;

and FIG. 3 shows a cross-sectional view taken along lines 3–3 of FIG. 1.

Like reference characters will be used throughout the drawing to illustrate like parts.

Referring to the drawing, and especially to FIG. 1 of the drawing, the toilet bowl construction includes a main water passageway 3 to which a tank and flush valve combination of any well-known types may be associated in a conventional manner. An appropriate form of tank and flush valve combination disclosed in the B. Hurko et al. U.S. Pat. No. 2,773,268, issued Dec. 11, 1956, and assigned to the same assignee, or, in the alternative, a conventional flushometer and water supply feed pipe of well-known construction, may be associated in a conventional manner with the toilet bowl. The main flow passageway 3 leads to a rim or flange 5 providing a raceway having a plurality of separate swirl holes or cylinders 4 therein of conventional construction, all of which are built into the flange 5. Such swirl holes 4 may be substantially equally spaced from each other along the periphery of the rim or flange 5. Each such swirl hole or cylinder 4 may be directed or pointed downwardly at substantially the same angle from the horizontal plane, pointing more or less equally toward the center 7 of the bowl, more frequently called the " well" of the bowl. The main passageway 3 is connected via the rim or flange 5 to the jet passageway 9 which, as is observed from the drawing, may be located at the very front end of the toilet bowl, as shown. The front end construction of the jetway 9, as shown, is substantially straight or curved to a very limited extent, as shown, and is pointed in a direction which is about equal to 45° with respect to the floor. The jetway 9 has an opening 11 at its lower end which is adjacent to the well 7, so that the jetway 9 will couple the rim or flange 5 to the well 7. Water travelling through the jetway 9 reaches a substantially high-velocity upon exit from the jet orifice 11. The flow of the water through the jetway 9 is influenced by cross-sectional dimensions and shape of the jetway 9 and by the difference in elevation between the rim or flange 5 and the well 7, all of these factors affecting the velocity of the jet efflux which, as noted, is relatively high.

The up-leg passageway designated 13 is positioned and directed at a substantially complementary angle of around 45° with respect to the floor, the up-leg passageway extending from the well 7 to the weir 15. The up-leg passageway 13 is more or less linear in direction. The weir 15 may be a crown weir. The up-leg passageway 13 is adjacent to the down-leg passageway 17 which is substantially parallel to the up-leg passageway and is separated from the up-leg passageway merely by a relatively thin wall member 16. It will be observed that both passageways 13 and 17 are of larger cross-sectional areas so as to accommodate the waste material along with the water to be delivered out of the bowl in the flushing operation.

The down-leg passageway 17, which extends to about the point 19, enters or joins with the horizontal passageway 21 which leads to the discharge opening 23. The down-leg passageway 17 is relatively short but sufficiently wide to accommodate all of the waste material products to be discharged from the toilet bowl into the sewer system or other sewage depository. The point 19 which separates the down-leg passageway 17 from the horizontal passageway 21 is but a small distance from the discharge opening 23, as shown. Furthermore, the horizontal passageway 21 embodies no weir formation therein. The toilet bowl construction embodies a rear web or rib 33 which is relatively thin and this element aids in supporting the bowl.

The weir 15 will generally fix the upper level of the water within the bowl during its idle or nonflushing condition and

this is shown generally by the horizontal waterline **31**. As the water level rises or tends to rise for any reason above the uppermost point of the weir **15**, the excess will freely flow over the weir **15** and down through the down-leg passageway **17** and through the horizontal passageway **21** into the discharge opening **23**.

In one construction according to the invention, the discharge opening **23** was of a diameter of about 2¼ inch. The jet orifice **11** was of a diameter of about 1 inch. The spacing of the jetway, i.e., the average spacing between the two walls of the jetway **9**, was something of the order of seven-eighths inch. On the other hand, the average spacing between the front and rear walls of the up-leg passageway **13** was of the order of 2¼ inch and the corresponding spacing of down-leg passageway **17** was of the order of about 2 inches. The point **19** was something better than 2 inches above the opening of the discharge port **23**. Furthermore, the waterline **31** was almost 5 inches from the upper level of the rim or flange **5**. The normal volume of water retained by the bowl up to the trap seal at the weir **15** and waterline **31** was approximately 3½ quarts.

One of the most important features of the construction of this toilet bowl is the direction of flow in the down-leg passageway **17** and in the horizontal passageway **21**, wherefore these passageways are joined toward the center of the bowl, thereby contributing to the weight reduction. Many conventional constructions of toilet bowls have bulging rear surfaces, generally almost vertically disposed, at the rear of the bowl where the down-leg passageway is embodied. Such bulging constructions obviously increase the troublesome weight problem.

As already suggested hereinabove, the bowl of this invention is some 6 or 7 pounds lighter than conventional toilet bowls of the reverse trap type. This is about 14 to 16 percent less in weight than conventional reverse trap bowls. This means that an additional bowl may be manufactured from the materials required for about six bowls. This constitutes an important saving in material, in the cost of the material for each bowl and in the overall manufacturing cost of the bowl as well as its packing and shipping cost.

Another important feature of the construction of this invention is that, due to the shapes and configurations of the passageways, only two pieces are required to manufacture the toilet bowl. The so-called "stickup" line L–L constitutes the dividing line between the two separately molded parts of the toilet bowl that must be put together in the pottery while in their semiplastic state. The segment above the line L–L and the segment below the line L–L are joined together in a single step. This simple constructional feature also reduces the manufacturing cost. Conventional reverse trap bowls are necessarily composed of three, four or more segments due to the complexity of their designs and this, of course, materially affects the cost of labor in the manufacture of the toilet bowl.

When the flush valve or flushometer (not shown) is opened in order to evacuate the bowl, water will travel at a rather rapid rate through the main opening 3 and around the circular path formed within the rim or flange **5** of the bowl and then into the jetway **9**. This rapidly travelling water will be emitted from the jet orifice **11**. Accompanying the efflux of water through the jet orifice **11**, an additional volume of water will be simultaneously traversing the various swirl holes 4 in the rim or flange **5** and these will be directed in separated streams toward the well **7** to join the water emitted from the jet orifice **11** in the flushing operation. The joint and simultaneous action of the waters emerging from the jet orifice **11** and from the several swirl holes will coact and drive the waste products upwardly through the up-leg passageway **13**, over the weir **15**, then through the down-leg passageway **13**, through the horizontal passageway **21** and out through the exhaust port **23**. The water level **31** in the bowl will soon drop below the level of the weir **15** due to the coacting forces.

The flow of water over the weir **15** at the upper terminals of wall **16** and into the down-leg passageway **17** produces, in effect, a screen or curtain as the water passes the weir **15** and again as it passes point **19**. The screen or curtain effect of the water causes siphonic action to be initiated within the bowl. The strength or pressure of the siphon becomes increased by the displacement of the entrapped air within the down-leg passageway **17**. The strength of the siphon may reach its maximum magnitude as the water in the down-leg passageway **17** fairly completely displaces the entrapped air and reaches toward the upper level of the passageway **17**. The effect of the increased suction is to drive the waste product materials within the bowl from the well **7** at a substantially high flow rate through the up-leg passageway **13** and over the weir **15** and then, as is expected, down through the down-leg passageway **17**, the horizontal passageway **21** and finally into the discharge opening **23**.

It is noted that the end walls **41** and **43** of the bowl respectively at the front and at the rear, that is, adjacent respectively to the jetway **9** and the down-leg **17**, are pointed away from the upper ends of the front wall and backwall of the bowl as shown. This feature reduces the volume and the weight of the material required in the manufacture of the bowl to its minimum. The essential purpose is to economize in the manufacture and construction of the bowl without affecting its operative characteristics. This yields a lower cost bowl which is especially suitable for low-cost housing.

While this invention has been shown and described in a certain embodiment merely for the purpose of illustration, it will be clearly understood that the arrangement may be set up in other and widely varying embodiments without departing from the spirit and scope of this invention.

I claim:

1. A toilet bowl of the reverse trap type formed essentially by joining two pieces of vitreous china, said bowl having a flanged raceway along its upper edge having a plurality of small swirl openings distributed along the periphery of the raceway and pointed toward the well of the bowl, a single jet passageway for said bowl, said single jet passageway being located at the front of the bowl and extending downwardly from the raceway to the well located at the center of the bowl, an up-leg passageway extending upwardly from the well of the bowl in a direction toward the rear of the bowl, said jet passageway providing the only jetstream of the bowl, said jetstream up-leg passageway, a down-leg passageway substantially parallel to the up-leg passageway and separated from the up-leg passageway by a wall providing a weir to fix the normal upper water level in the bowl, and a horizontal passageway extending from the down-leg passageway, in a direction toward the rear of the bowl, to the discharge opening directed downwardly through the bottom of the bowl, said jet passageway substantially defining the front structural wall of the bowl while the down-leg passageway substantially defines the rear structural wall of the bowl so that the front and rear walls of the bowl are at substantially equal and opposite angles.

2. A toilet bowl of the reverse trap type according to claim 1, in which the jet passageway has an orifice through which water is emitted at high velocity into the well of the bowl.

3. A toilet bowl of the reverse trap type according to claim 2, in which the jetway and up-leg passageways are directed at complimentary angles of about 45° with respect to the floor of the bowl.

4. A toilet bowl of the reverse trap type according to claim 3 in which the outer walls of the front and rear of the bowl are parts of the jetway and down-leg passageways, respectively, and are relatively thin and are pointed toward the center of the bowl.

5. A toilet bowl of the reverse trap type according to claim 4, in which the adjacent surfaces of the up-leg and down-leg are separated from each other by a thin common wall.

6. A toilet bowl according to claim 5, in which the entire recited combination is constructed of vitreous china in only two parts which are separated from each other about a line substantially coinciding with the bottom of the flanged raceway, the two parts being joined together while in a semiplastic state.

7. A toilet bowl according to claim 6, in which the down-leg passageway and the horizontal passageway meet each other toward the center of the bowl and in front of the discharge opening.

8. A toilet bowl formed essentially by joining two pieces of vitreous china, said bowl having jet, up-leg, down-leg and horizontal passageways, the jet passageway being adjacent the front of the bowl and having an orifice on one side of the well of the bowl while the opening to the up-leg passageway is located on the other side of said well, said jet passageway providing the only jet stream traveling through the well of the bowl and upwardly through the up-leg passageway, the up-leg and down-leg passageways being substantially parallel to each other and spaced by a thin wall providing a weir to establish the normal level of water in the bowl, the jet passageway forming an angle with the floor of the bowl which is substantially equal and opposite to the angle of the up-leg passageway, said jet passageway substantially defining the front structural wall

of the bowl while the down-leg passageway substantially defines the rear structural wall of the bowl so that the external front and rear walls of the bowl are at substantially equal and opposite angles.

9. A toilet bowl according to claim 8 in which the outer walls of the down-leg and horizontal passageways are joined by a relatively thin wall.

10. A toilet bowl according to claim 9 in which the angles of the jet, up-leg and down-leg passageways are substantially equal to 45°.

11. A toilet bowl according to claim 10 having a flanged raceway along its upper edge having a plurality of swirl holes therein.

12. A toilet bowl according to claim 11 in which the flow through the horizontal passageway is rearward toward a discharge opening in the bottom of the bowl.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,591,869 Dated July 13, 1971

Inventor(s) Franklin Keith Manning

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 43, after "stream" insert -- traveling through the well of the bowl and upwardly through the --.

Signed and sealed this 11th day of April 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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