

[54] **LIQUID DISPENSING APPARATUS AND METHOD FOR TOILET FLUSH**

[76] Inventor: **John E. Dolan**, Old Orchard St., Quarry Height, Harrison, N.Y. 10604

[22] Filed: **July 31, 1972**

[21] Appl. No.: **276,285**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 114,265, Feb. 10, 1971, abandoned.

[52] U.S. Cl. **4/228, 248/311**

[51] Int. Cl. **E03d 9/02**

[58] Field of Search **4/227, 228; 248/311**

[56] **References Cited**

UNITED STATES PATENTS

1,437,303	11/1922	Hatch	248/311
2,351,580	6/1944	Beckman	4/227 X
2,587,388	2/1952	Ryder, Jr.	4/227
2,620,097	12/1952	Titmas	4/227 X
2,647,266	8/1953	Vierra	4/227
2,658,206	11/1953	Martinez	4/228
2,688,754	9/1954	Willits et al.	4/228
2,839,763	6/1958	Newsom	4/227

2,913,734	11/1959	O'Hare	4/227
2,967,310	1/1961	O'Hare	4/227
3,341,074	9/1967	Pannutti	4/227 X
3,698,021	10/1972	Mack et al.	4/227

FOREIGN PATENTS OR APPLICATIONS

1,256,631	2/1961	France	4/228
-----------	--------	--------------	-------

Primary Examiner—Harvey C. Hornsby
Attorney, Agent, or Firm—Browne, Beveridge, DeGrandi & Kline

[57]

ABSTRACT

A concentrated liquid supply vessel is inverted within a toilet flush tank and suspendingly supports the closure cap which serves as a dilution vessel. The concentrated liquid within the supply vessel has a density greater than water and flows through the supply vessel outlet opening into the dilution vessel during the period when the flush tank water is lowered from its normal full position to the elevation of the supply vessel outlet opening. This concentrated liquid mixes with water retained within the dilution vessel. Upon refilling of the flush tank, the diluted liquid in the dilution vessel will migrate into the flush tank water.

11 Claims, 15 Drawing Figures

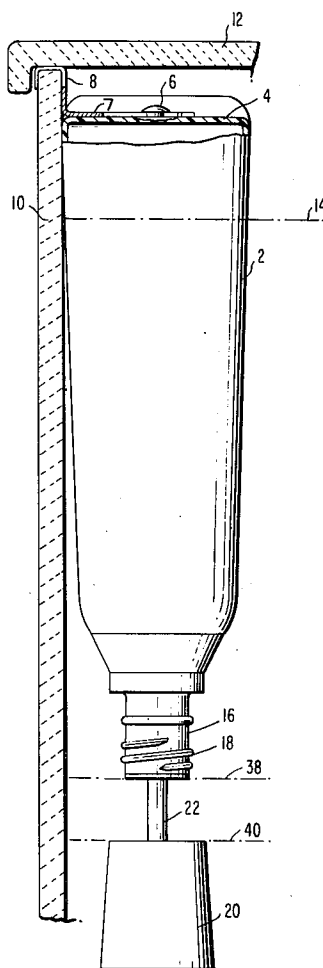


FIG. 1

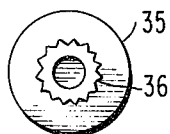
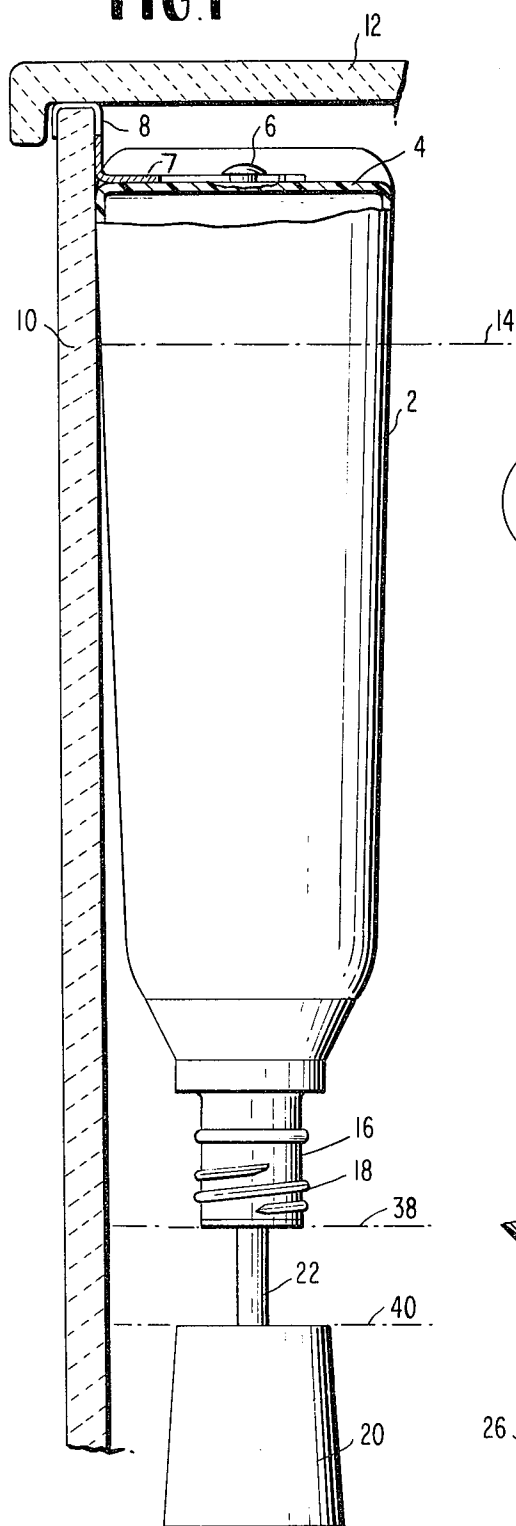


FIG. 3

FIG. 2

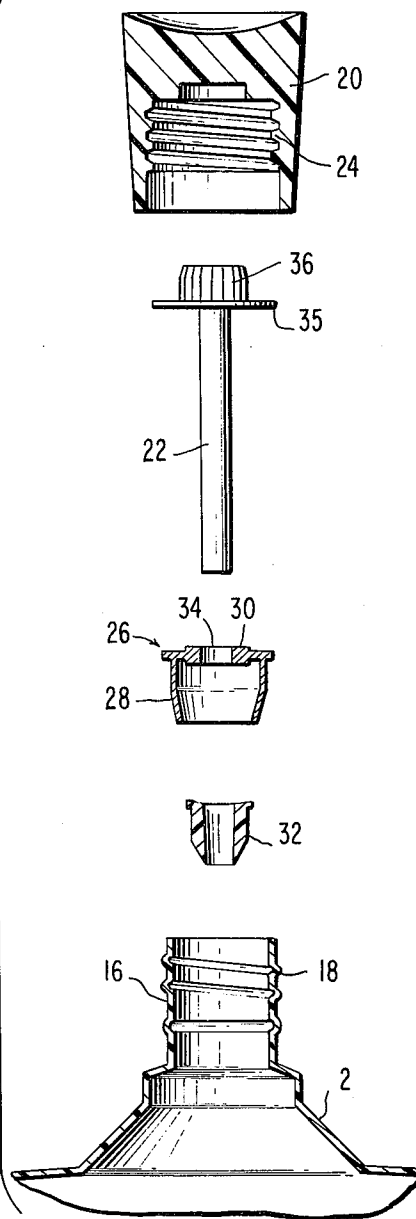
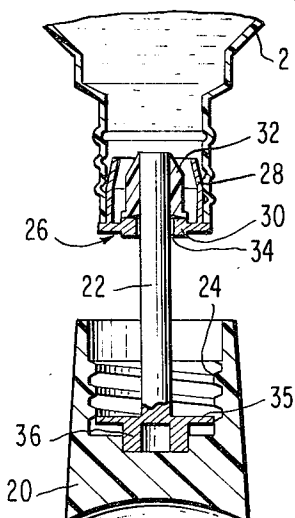


FIG. 4



INVENTOR

JOHN E. DOLAN

BY *Beveridge & De Grandi*

ATTORNEYS

FIG. 5

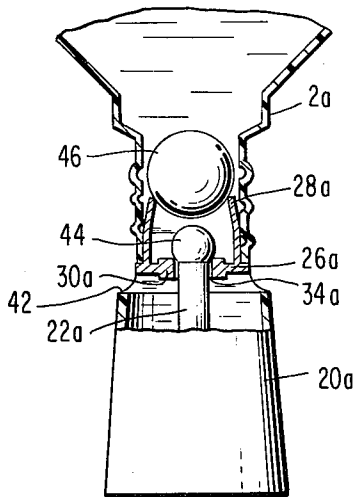


FIG. 6

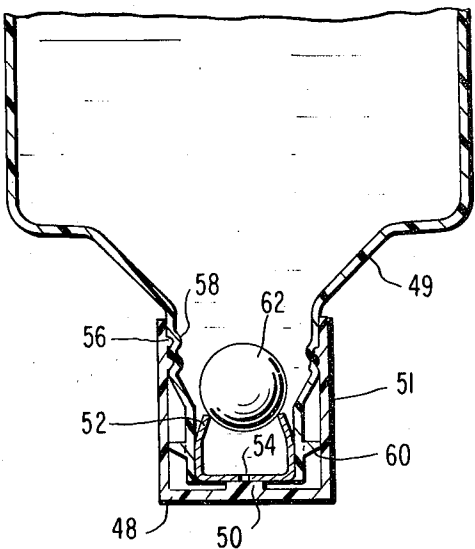


FIG. 7

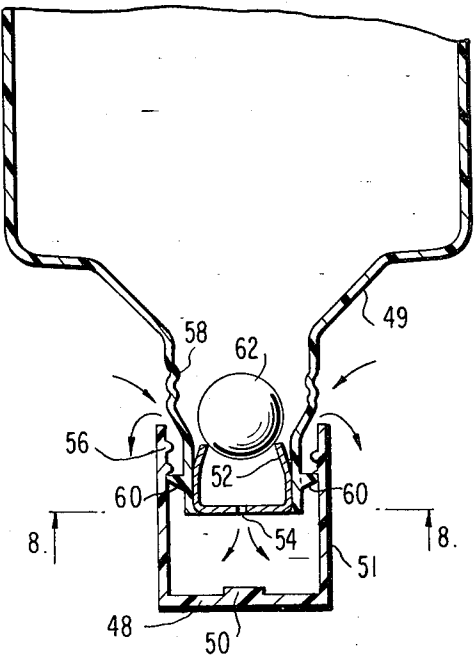
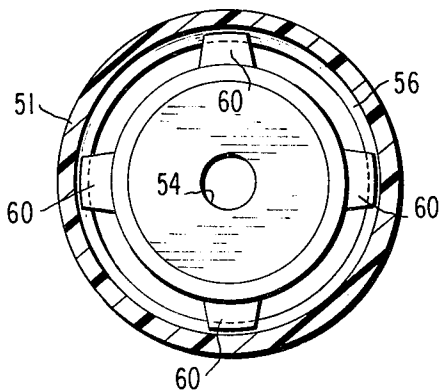


FIG. 8



INVENTOR

JOHN E. DOLAN

BY *Beveridge & De Grandi*

ATTORNEYS

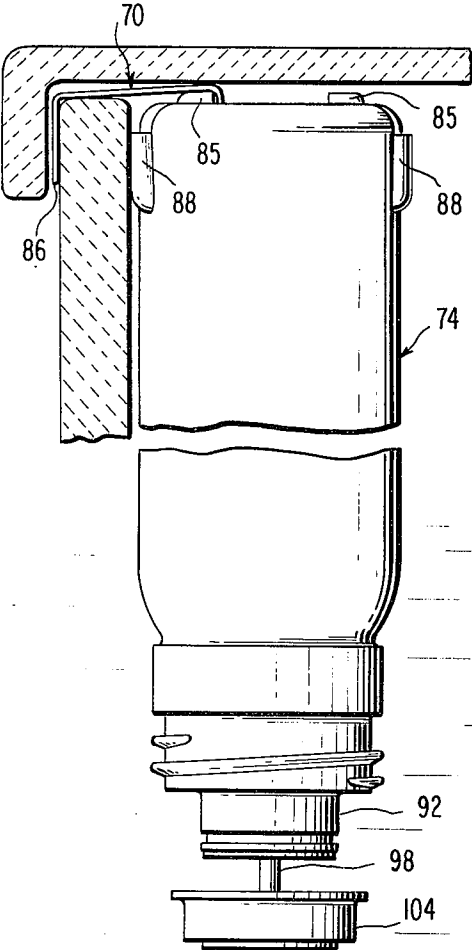


FIG. 9

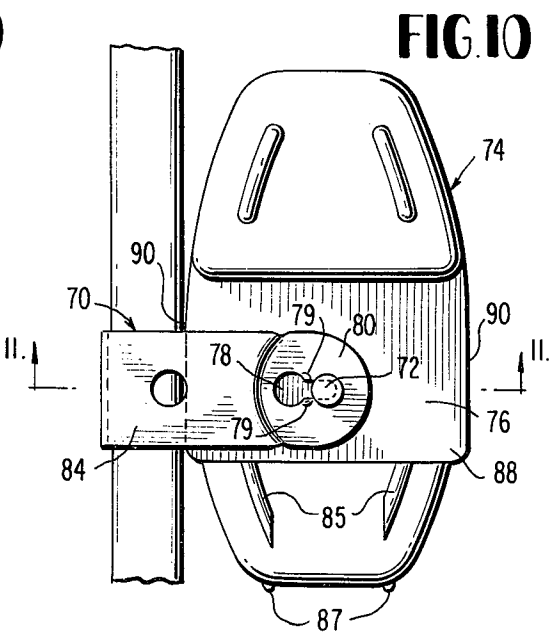


FIG. 10

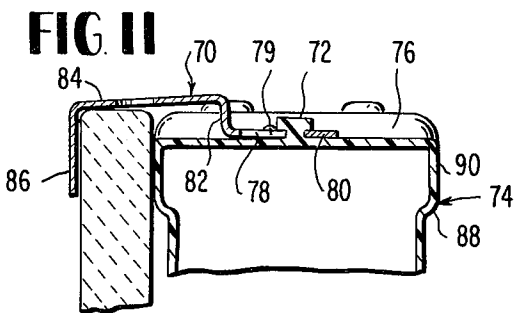


FIG. 11

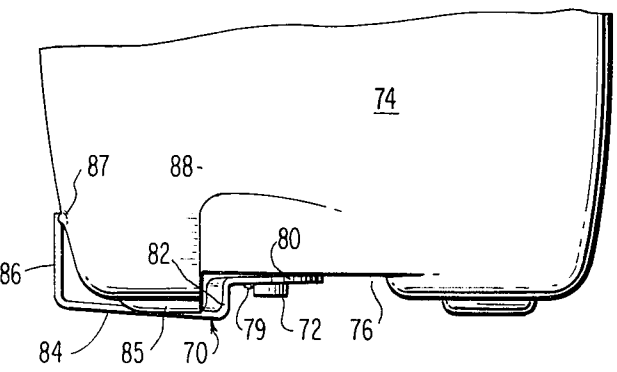


FIG. 12

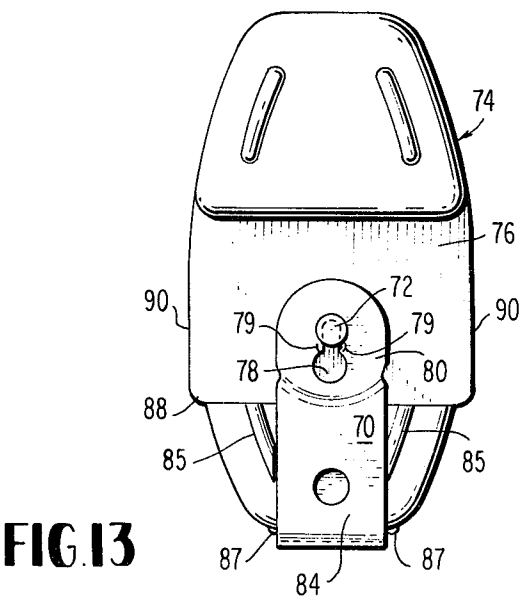


FIG. 13

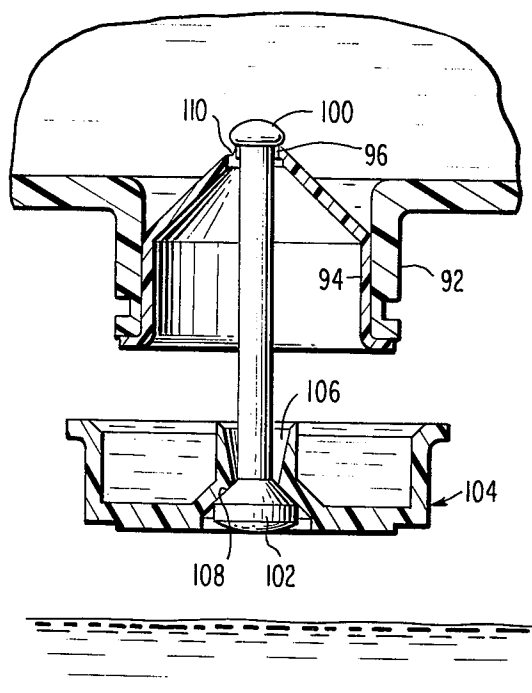
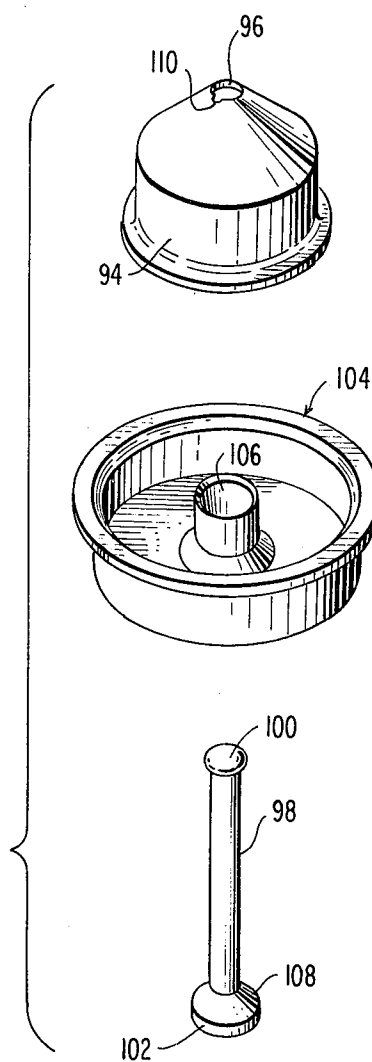


FIG. 14

FIG. 15



LIQUID DISPENSING APPARATUS AND METHOD FOR TOILET FLUSH

This is a continuation-in-part of my earlier patent application Ser. No. 114,265, filed Feb. 10, 1971 and abandoned and entitled Liquid Dispensing Apparatus and Method for Toilet Flush Tank.

This invention relates to a method and apparatus for dispensing a concentrated liquid, typically a disinfectant or deodorant solution, into the contents of a toilet flush tank. Apparatus of this general type is well known and widely available; however, it lacks the desirable operating characteristics and/or simple structure disclosed in this specification.

Many types of prior flush tank dispensers typified by U.S. Pat. Nos. 2,647,266 and 2,688,754 discharge the liquid into the flush tank as the water level is lowered during the normal flush cycle. With such an arrangement, there is no significant dispersion of the solution in the flush tank when it is filled since dispensing occurs principally during the discharge phase of the toilet flush cycle. Another approach has been to provide a dilution vessel which is filled during the refill phase of the flush cycle and then discharged during the discharge phase of the flush cycle.

A somewhat complicated approach to dispensing concentrated solutions into a flush tank during the refill phase of its operation is represented by U.S. Pat. Nos. 2,913,734 and 2,967,310. In these prior devices, a float operated pump-like device has a chamber which is filled by the concentrated liquid in response to the lowering of the flush tank water level and is discharged in response to the rising of the flush tank water level. This prior apparatus purposely prevents any preliminary dilution of the concentrated liquid by providing an umbrella skirt which prevents entry of the flush tank water into the dispensing chamber.

According to the present invention, a dilution vessel is located beneath the outlet opening of the concentrated liquid supply vessel. There is free horizontal communication between the dilution vessel and the water in the flush tank. The dilution vessel retains water from the flush tank throughout the entire flushing cycle and it receives liquid from the supply vessel as the flush tank water level is lowered, thereby resulting in a mixture in the dilution vessel of the concentrated liquid and the retained flush tank water. When the tank refills to the level of the dilution vessel lip or other opening, the dilute solution then may migrate freely into the remainder of the tank contents with the partial assistance of the chemical solubility of the solution in water and the turbulence which exists during the tank-refilling phase of the flush cycle.

The objectives of the invention are to provide an uncomplicated yet effective device which will discharge a concentrated solution into the flush tank of a toilet during the refilling phase of the flush cycle.

Reference is now made to the drawings wherein:

FIG. 1 is a perspective view of one form of the apparatus in its suspended position within a toilet flush tank;

FIG. 2 is an exploded view of the apparatus of FIG. 1;

FIG. 3 is an end view of the stem used in the apparatus of FIG. 1;

FIG. 4 is a sectional view of the apparatus of FIG. 1 in operative condition;

FIG. 5 is a sectional view of a second form of the apparatus;

FIG. 6 is a sectional view of a third form of the apparatus showing the closure cap in its sealing position to permit transportation of the device when not in use;

FIG. 7 is a view similar to FIG. 6, but showing the closure cap in a position where it is suspended from the supply vessel to serve as a dilution vessel;

FIG. 8 is a sectional view along the line 8—8 in FIG. 7;

FIG. 9 is an elevational view of a fourth form of the invention located within the flush tank of a toilet;

FIG. 10 is a top plan view of the device of FIG. 9 as it appears when installed within a toilet flush tank; and,

FIG. 11 is a sectional view seen along the line 11—11 in FIG. 10.

FIGS. 12 and 13 are, respectively, elevational and plan views of the bottom of the container when the hanging clip is in its storage position prior to installation of the device in a toilet flush tank;

FIG. 14 is a sectional view through the dispensing elements of the device shown in FIG. 9; and,

FIG. 15 is an exploded view of the dispensing elements.

This invention will now be described by reference to these drawings which illustrate several preferred embodiments of the invention.

FIG. 1 shows one embodiment of the apparatus of this invention in its operative position where an inverted bottle 2 preferably formed of a plastic such as polyethylene or the like, serves as a supply vessel for the concentrated liquid. The bottle may be made by any convenient technique such as blow molding etc. and is provided at its bottom wall with a diametrically-extending recess having a recessed wall portion 4 and an integrally molded, headed stud 6. A suspension clip member 7 is laterally confined within the bottom recess and is bifurcated to provide a slot which rides slidably on the shank of the stud 6. The suspension clip 7 has a hooked end portion 8 which is engageable with the upper edge of wall 10 of a conventional toilet flush tank. The lid 12 of the flush tank overlies the horizontal leg of the hooked end portion 8 so there is preferably no exteriorly visible portion of the apparatus when installed in a flush tank.

The flush tank and the mechanisms associated therewith are conventional and well known to the average homeowner. A float valve normally maintains the tank in a normal filled position which is represented by the broken line 14 in FIG. 1. A flush cycle for this type of apparatus involves a discharge phase and a refill phase, with the discharge phase being initiated by the opening of a discharge or flush valve at the lower portion of the flush tank. This lowers the water level in the flush tank and releases the flush tank water into the toilet bowl. The discharge valve then closes and the apparatus undergoes a refill phase where fresh water is added until the water level is restored to the normal level 14.

The significant portions of the invention reside in the liquid discharging and diluting assembly which appears at the lower portion of the apparatus in normal use. This includes the bottle neck 16 which may have the usual exterior threads 18, a dilution vessel 20 which has an open upper end which forms an opening in free horizontal communication with water in the flush tank and a stem 22 which, in this embodiment, is the means for

supporting the dilution vessel 20 from the supply vessel 2.

As shown in FIGS. 2-4, the dilution vessel 20 is a conventional closure cap with interior threads 24 which cooperate in the usual fashion with the threads 18 on the bottle neck 16.

Within the neck of the bottle, there is a plug member 26 which overlies the lip of the bottle and has a generally cylindrical skirt portion 28 which is frictionally retained by and sealingly engages the interior wall of the bottle neck. The innermost portion of the skirt 28 is slightly tapered in order to facilitate its insertion into the bottle and to serve as a check valve seat in some embodiments of the apparatus.

At the center of the plug 26, there is a boss 30 provided with a central opening through which the stem member 22 projects. As viewed in FIG. 4, the stem is held at its lower position due to the presence of a transverse enlargement in the form of a retainer 32. The retainer is press fit onto the upper end of the stem 22 and has its lower surface constructed to contact the upper surface of the boss 30 at spaced-apart portions, thereby leaving a passage for fluid communication between the interior of the bottle 2 and the outlet opening 34. The outlet opening 34 is annular, being defined exteriorly by the hole in the center of the boss 30 and interiorly by the stem 22. The difference between the diameters of the stem 22 and the hole in the plug 26 is about 0.009 inch. A convenient range of spacing has been found to be about 0.005 to 0.050 inch. Such a spacing insures flow of the disinfectant down the stem 22 without any significant dispersion of the disinfectant into the flush water.

The stem 22 has a circular flange 35 and a fluted and tapered cylindrical head 36 which frictionally engages within a corresponding recess in the cap or dilution vessel 20. The stem 22 and the plug 26 are made of polyethylene and therefore display non-wetting characteristics which tends to prevent formation of a film of liquid which would migrate through the outlet opening 34 and downwardly along the stem. A meniscus is formed between the stem and the supply vessel outlet opening 34.

It will be evident that the apparatus will be merchandised in a conventional upright position for a bottle, with the threads 24 on the cap engaging the exterior threads 18 on the neck of the bottle. In this position, the flange 34 will engage the boss 30 and sealingly close the outlet opening 34 to prevent any inadvertent loss of the liquid contents of the supply vessel 2. When the consumer wishes to install the apparatus in the toilet flush tank, the cap is loosened and the bottle is inverted so that the cap falls until retainer 32 engages the plug 26, thereby enabling the stem 22 to suspend the cap or dilution vessel 20 below the outlet opening 34. The inverted bottle is then placed in the flush tank and retained in position by the hooked end 8 of the clip member. The normal operation of this apparatus involves a concentrated liquid discharging phase which takes place during the flush cycle substantially only during the lowering of the water level from the level 14 until it arrives at the level 38 which is horizontally aligned with the supply vessel outlet opening 34. During this liquid discharging phase, the dilution vessel 20 is filled and is in free horizontal communication with the tank contents. This would appear to involve some risk that the concentrated liquid would migrate into the flush tank water and be released during the flush then in

progress. This possibility is avoided as alluded to above by adjusting the size of the outlet opening 34 and by using a concentrated solution in the supply vessel 2 which has a specific gravity greater than that of water so that when the solution is discharged through the outlet opening 34, it will flow directly downwardly in wisp or ribbon-like patterns into the dilution vessel 20. The loss of small amounts of the concentrated solution into the flush tank contents at this point may further be inhibited by shortening the stem 22. By using dimensions as above described for the orifice 34 and conventional flush bowl concentrated disinfectant or cleaner solution having specific gravities greater than water, substantially no solution is dissipated into the flushing water from stem 22 or opening 34 during the flush cycle. Examples of some preferred concentrated solutions for use in this invention include (by weight):

A

Two parts of sodium xylene sulfonate liquid (40% active), two parts of sodium lauryl sulfate (30% active), 0.1 parts of blue dye, 0.5 parts of perfume oil and 95.4 parts of water. Specific gravity is about 8.6 lbs/gal. (water being 8.3 lbs/gal.)

B

Five parts of isooctyl phenyl polyethoxy ethanol (100% active non ionic detergent), 0.1 parts of blue dye, 0.5 parts of perfume oil and 94.4 parts of water. Specific gravity is about 8.6 lbs/gal.

Inert fillers may be added to the solution to increase the specific gravity if desired. The solutions were noted to form beads on a polyethylene surface which were thinner than adjacent water beads of the same diameter. Both solutions are partially soluble in water to the extent that substantially no dispersion takes place during dispensing down the stem, but excellent dispersion, with turbulence, takes place from the dilution vessel.

As the discharge phase of the flush cycle continues, the concentrated liquid will mix with the flush tank water retained in the dilution vessel 20. Then, after the flush tank discharge valve closes and the refill phase of the flush cycle continues to the point that the flush tank water level reaches the elevation 40 of the lip or other discharge opening in the dilution vessel 20, the then-dilute solution is free to migrate into the tank contents with the assistance of the currents created in the tank during the refill phase of the flush cycle.

FIG. 5 illustrates another embodiment of this invention which is similar in principle to the embodiment shown in FIGS. 1-4. The differences reside in the relative elevations of the supply vessel 2a and the dilution vessel 20a, the nature of the enlargement at the upper end of the stem 22a and the presence of a check valve means in the flow path between the interior of the vessel and the outlet opening 34a.

As seen in FIG. 5, the opening formed by the uppermost edge 42 of the dilution vessel is relatively close to the peripheral edge of the plug member 26a. In fact, these bodies are close enough that a meniscus extends between them so that water fills the space below the plug 26a even after the flush tank water level has receded below the dilution vessel 20a.

The upper end of the stem 22a has a generally spherical enlargement 44 which is formed by exposing it to flame. This enlargement is not a true sphere and the

area thereof which rests on the boss **30a** is not truly circular so there is always an opening leading to the supply vessel outlet opening **34a**. As in the embodiment of FIGS. 1-4, the size of the fluid passage provided by this arrangement is such that the concentrated liquid in the supply vessel **2a** will not normally be discharged when the exterior pressure at the supply vessel outlet opening **34a** is equal to or greater than atmospheric pressure. However, it has been discovered unexpectedly that the concentrated liquid is discharged by the supply vessel outlet opening **34a** in thin ribbons or wisps upon reduction of the external hydrostatic head at the outlet side of the opening **34a**.

The embodiment of FIG. 5 may utilize a check valve which comprises a spherical body **46** which has a greater density than the concentrated liquid and rests on a seat defined by the annular upper edge of the skirt portion **28a** of the plug member **26a**. The check valve provides a constricted flow passage which prevents excessive discharge of the concentrated liquid particularly when the supply vessel **2a** is filled so that its contents exert a high hydrostatic head at the outlet opening.

The reason why the concentrated liquid is able to pass around the check valve is not completely understood, but it may result from slight irregularities in the spherical body **46** or in the annular seat formed by the skirt **28a**. Whatever the explanation, it has been proven that the concentrated liquid does arrive at the outlet opening **34a**, apparently without filling the intervening space between the check valve and the supply vessel outlet opening **34a**. As in the preceding embodiment, the only significant discharge of the concentrated solution through the discharge outlet **34a** occurs when there is a reduction of the hydrostatic head produced at the outlet opening **34a** by the flush tank water. Some concentrated liquid may be released after the supply vessel outlet opening is exposed to the atmosphere, but this is in relatively insignificant quantities in relation to the amount released when the hydrostatic head at the supply vessel outlet opening is decreasing. Again, and because of the adjustment of specific gravity, non-wetting characteristics and size of orifice opening **34a**, substantially no solution dissipates into the flush water during flush. Typical dimensions found particularly suitable for carrying out the objectives of this invention by this embodiment are as follows:

1. a blow molded polyethylene bottle having a height of about 7 inches, a base of about $3\frac{1}{2}$ by $1\frac{1}{2}$ inches, a tapered end portion of about $\frac{5}{8}$ inches in height and a cylindrical neck portion **16** of about $\frac{7}{8}$ inches in height,
2. the cylindrical neck portion **16** has an outer diameter of about 0.7 inches and an inner diameter of about 0.6 inches,
3. skirt **28a** and boss **30a** have a total height of about $\frac{1}{2}$ inch with boss **30** having a thickness of about 0.08 inches, orifice **34a** having a diameter of about 0.225 inches, and upper tapered portion which retains marble **46** having an inner diameter of about 0.47 inches and an outer diameter of about 0.55 inches. The outer diameter of the nontapered portion is about 0.61 inches,
4. marble **44** of ordinary glass having a diameter of about $\frac{17}{32}$ inches,
5. stem **22a** has a diameter of about 0.216 inches a total height including head **36** of about 2 inches, the height

of head **36** being about 0.27 inches. A stem **22a** of about 0.125 inches in diameter is found too small such that immediate dissipation into the flush water occurs. The flame retaining bubble **44** is about 0.25 inches in diameter.

6. Cap **20a** is tapered, has a height of about 1.25 inches and a cylindrical fluid retaining section with a head **36** inserted therein of a diameter of about $\frac{15}{16}$ inches and a height of about $\frac{11}{16}$ inches.

The apparatus of FIG. 5, either with or without the marble **46**, discharges the concentrated solution from the vessel **2a** whenever there is a reduction in the hydrostatic head at the supply vessel outlet opening **34a**, even when there is no opportunity for air to enter the vessel **2a**. For example, when the water level is repeatedly raised and lowered between level **14** and an intermediate level above the opening **34a**, it has been found that the concentrated liquid is always released under conditions of diminishing hydrostatic pressure.

The embodiment shown in FIGS. 6-8 differs from those discussed above by virtue of the manner in which the dilution vessel closure is suspended by the supply vessel.

The cap **51** which serves as the dilution vessel in this third embodiment is of generally closed-ended cylindrical construction with the closed lower end **48** having a boss **50** contacting a plug **52** which lies within the neck of the bottle **49**. The boss **50** obstructs and seals the supply vessel outlet opening **54** so the device may be transported safely when not in use.

The closure cap **51** is provided with interior threads **56** which engage threads **58** on the bottle neck. Further down the bottle neck, there are four externally radiating projections **60** which are best shown in FIG. 8. These projections lie in the path of the internal threads **56** or a specifically provided annular interior ridge. As shown in FIG. 7, the projections engage the threads or interior ridge to retain the dilution vessel and suspend it from the supply vessel **49**.

As in the preceding embodiment, there is a marble **62** which seats on the annular upper edge of the plug member **52**, thereby preventing excessive discharge of the concentrated liquid in the supply vessel **49** into the dilution vessel **51**. Since the principles of operation of this apparatus are similar to that described above, it will not be discussed in detail. The appropriate operation may require some routine experimentation with the size of the supply vessel outlet opening **54** in order to achieve optimum results.

In the embodiments discussed above, it has been found that water enters the bottle when the hydrostatic head at the bottle outlet is increasing. After extended usage, the bottle contents become dilute so the device will appear to function improperly.

A fourth and presently preferred embodiment of the invention is illustrated in FIGS. 9-15 which is constructed to prevent dilution of the bottle contents. As in the previously-discussed embodiments, a dilution vessel receives the concentrated liquid from the container.

The container-supporting means in the embodiment of FIG. 9 is somewhat different than previously discussed. A retaining clip **70** is pivotally mounted on a button **72** which is molded integrally with the container **74**. The button is located within an indentation in the bottom wall of the container and, as best seen in FIG. 11, the button **72** has a reduced diameter stem and an

enlarged head which serves to retain the clip 70 on the container.

Referring to FIGS. 11 and 12, it will be seen that the clip 70 has a base portion 80, an arcuate upstanding flange 82, a horizontal extension 84 and a vertical leg 86. The base portion 80 lies in contact with the horizontal wall of the indentation 76 and it has a keyhole slot 78 which engages the button 72 for pivotal movement. Inadvertent sliding movement of the clip is prevented by the small bumps 79 in the base 80 which retain the stem of button 72 in the narrow portion of the keyhole slot 78.

When the clip 70 is in its storage position shown in FIG. 13, the horizontal portion 84 is located between the two feet 85 which prevent the clip from inadvertently being deflected. The clip is also retained in its storage position by the bumps 87 on the container which lie on opposite sides of the vertical leg 86 of the clip 70. In this condition, the container may be placed upright on a shelf prior to installation in a toilet tank. The container will rest on the feet and on the horizontal leg 84 of the clip 70.

The arcuate flange 82 provides the necessary offset for the horizontal portion 84, and its arcuate shape facilitates the pivotal movement of the clip 70 on the button 72. As will be seen in FIGS. 9 and 11, when the device is supported in a tank of a toilet, the horizontal extension 84 of the clip 70 lies on the upper edge of the tank wall, while the vertical leg 86 is in contact with the outer wall of the toilet tank. In order to prevent the container from rocking on the toilet tank, the faces of the container have projections 88 which afford a flat surfaces 90 aligned with the clip when in its position of use as shown in FIG. 10. The clip 70 may be swung in either direction to permit placement of the container at a location where it will not contact any moving parts of the toilet mechanism.

The dispensing of the concentrated fluid takes place within the elements shown in FIGS. 14 and 15 where it will be seen that the neck 92 of the bottle receives an inverted cup 94 which has an opening 96 in its upper end for passage of the concentrated liquid. A stem 98 extends through the opening 96 and has an enlarged upper end 100 which limits the downward movement of the stem 98 with respect to the inverted cup 94.

The dilution vessel 104 is supported at the lower end of the stem 98. The stem 98 extends through a central aperture 106 in the dilution vessel 104, and the lower end of the stem has an enlarged head 102 which has an upper conical surface 108 conforming to a conical lower portion of the opening 106. Of course, the stem 98 may be made integrally with the dilution vessel 104, but the illustrated structure is the most economical to manufacture.

The upper lip of the dilution vessel 104 lies about 0.280 inch below the inverted cup 94, so that no meniscus will form between these elements. If such a meniscus were permitted to form, the desired amount of air would not be introduced into the container when the water rises, and the dispensing elements of this embodiment would not function properly.

The elements shown in FIG. 15 are assembled by passing the upper head 100 of the stem 98 through the aperture 106 in the dilution vessel, and then forcing the head 100 through the aperture 96 in the inverted cup 94. A small notch 110 in the dilution vessel facilitates

this latter step and provides a small opening for the passage of the liquid when the device is in use.

The inverted cup 94 serves to prevent water in the toilet tank from entering the bottle, thereby avoiding any unwanted dilution of the concentrated bottle contents. As the water in the toilet tank rises in preparation for the next flush, air is trapped within the inverted cup 94 and some air is forced through the opening 96 into the bottle. When the toilet is flushed and the water level in the tank recedes, the reduction of pressure within the inverted cup 94 will cause some of the concentrated liquid to pass through the opening 96 and into the dilution vessel 104 where it becomes mixed with the toilet tank water left in the dilution vessel. A partial vacuum remaining within the container will prevent excessive dispensing of the concentrate through the small outlet opening. In this manner, the liquid concentrate is not dropped immediately into the receding water but is instead retained in the dilution vessel 104 where it becomes premixed with the retained water. Then, as the water level rises, the premixed solution in the dilution vessel 104 becomes mixed with the liquid in the toilet tank. Continued rising of the water forces more air into the container so that more liquid will be released from the container when the water again recedes.

Those studying the disclosure will realize that there are further variations of the invention which will utilize the novel principles discussed in this specification. The following claims are therefore intended to cover all forms of apparatus which utilize the spirit of the invention as defined by the claims. As a matter of convenience in terminology, the apparatus is described in terms of the relationship of its elements when located within a toilet flush tank, but it is to be understood that the claims are intended to cover all apparatus constructed and designed to assume the claimed relationship, even when in an upright position prior to its installation in a flush tank.

I claim:

1. Apparatus for dispensing liquid into a toilet flush tank which is normally filled to a given water level, is discharged during a flush to reduce the water level and then is refilled to the given water level preparatory to the next flush, said apparatus comprising the following:
 - a supply vessel for a concentrated liquid, said supply vessel having an outlet opening,
 - means for supporting the apparatus in a flush tank at an orientation where the supply vessel outlet opening lies below the level of concentrated liquid therewithin, said supply vessel outlet opening being in communication with the toilet flush tank at all times regardless of the water level,
 - an upwardly open dilution vessel having an opening which is in free substantially horizontal communication with water in the flush tank to permit its filling by water in the flush tank,
 - means for supporting the dilution vessel at a position under the supply vessel outlet opening, said dilution vessel being constructed to remain spaced from said outlet opening regardless of the water level in the toilet flush tank whereby lowering of the water level in the flush tank below the dilution vessel opening will result in a mixture in the dilution vessel of concentrated liquid from the supply vessel and water retained by the dilution vessel, thereby providing a dilute liquid which will be dis-

pensed into the flush tank water after it returns to the elevation of the supply vessel outlet opening.

2. The apparatus of claim 1 having a concentrated liquid in the supply vessel, said concentrated liquid having a density greater than water whereby the concentrated liquid tends to flow downwardly into the dilution vessel rather than migrate laterally into the flush tank water during the initial portion of a flush before the water level in the flush tank becomes lower than the dilution vessel opening.

3. The apparatus of claim 1 wherein the means for supporting the dilution vessel is a stem which is attached to the dilution vessel and extends centrally through the supply vessel outlet opening to suspend the dilution vessel from the supply vessel.

4. The apparatus of claim 1 wherein the supply vessel has a neck portion leading to the supply vessel outlet opening, a plug within the neck portion, said supply vessel outlet opening being located in the plug.

5. The apparatus of claim 4 wherein the means for supporting the dilution vessel is a stem which is attached to the dilution vessel and extends through the supply vessel outlet opening, said stem suspending the dilution vessel and having a transverse enlargement larger than the supply vessel outlet opening to prevent removal of the stem and the dilution vessel from the apparatus.

6. The apparatus of claim 5 wherein the plug is an inverted cup having the supply vessel outlet opening located in its upper wall; whereby air is entrapped within said inverted cup and forced into the supply vessel as the flush tank water rises above the level of the dilution vessel.

7. The apparatus of claim 1 wherein the size of the supply vessel outlet opening is capable of discharging concentrated liquid when the hydrostatic head at the

supply vessel outlet opening is decreasing.

8. The apparatus of claim 7 in combination with a concentrated liquid in the supply vessel, said concentrated liquid having a density greater than water whereby the concentrated liquid tends to flow downwardly into the dilution vessel rather than migrate laterally into the flush tank water during the initial portion of a flush before the water level becomes lower than the dilution vessel opening.

9. The apparatus of claim 1 having an inverted cup attached to the supply vessel for concentrated liquid, said supply vessel outlet opening being located in the upper wall of said inverted cup whereby air is entrapped within said inverted cup and forced into the supply vessel as the flush tank water rises above the level of the dilution vessel.

10. A method of dispensing a concentrated liquid into a toilet flush tank which contains a dilution vessel, said method comprising the steps of

- a. simultaneously lowering the water level in the flush tank and feeding the concentrated liquid into the dilution vessel to permit the concentrated liquid to mix with flush tank water retained by the dilution vessel to form a dilute solution, and
- b. raising the water level in the flush tank until it comes into communication with the dilute solution in the dilution vessel so that the dilute solution migrates into the flush tank contents.

11. The method of claim 10 wherein the step of feeding the concentrated solution is performed while the dilution vessel is immersed by water in the flush tank, said concentrated liquid being released at a point above the dilution vessel and flowing substantially vertically downwardly into the dilution vessel by virtue of its having a density greater than water.

* * * * *

40

45

50

55

60

65