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Milette et al.

[11] **3,788,342**

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[54] **VACUUM BREAKER VALVE**

[75] Inventors: **Kenneth A. Milette,** Laguna Beach; **Tim M. Uyeda,** South San Gabriel; **Elias D. Quintana,** Huntington Beach, all of Calif.

[73] Assignee: **International Telephone and Telegraph Corporation,** New York, N.Y.

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[21] Appl. No.: **332,371**

[52] **U.S. Cl.** **137/218**

[51] **Int. Cl.** **F16k 45/00**

[58] **Field of Search** 251/333; 137/216–218; 4/41

[56] **References Cited**

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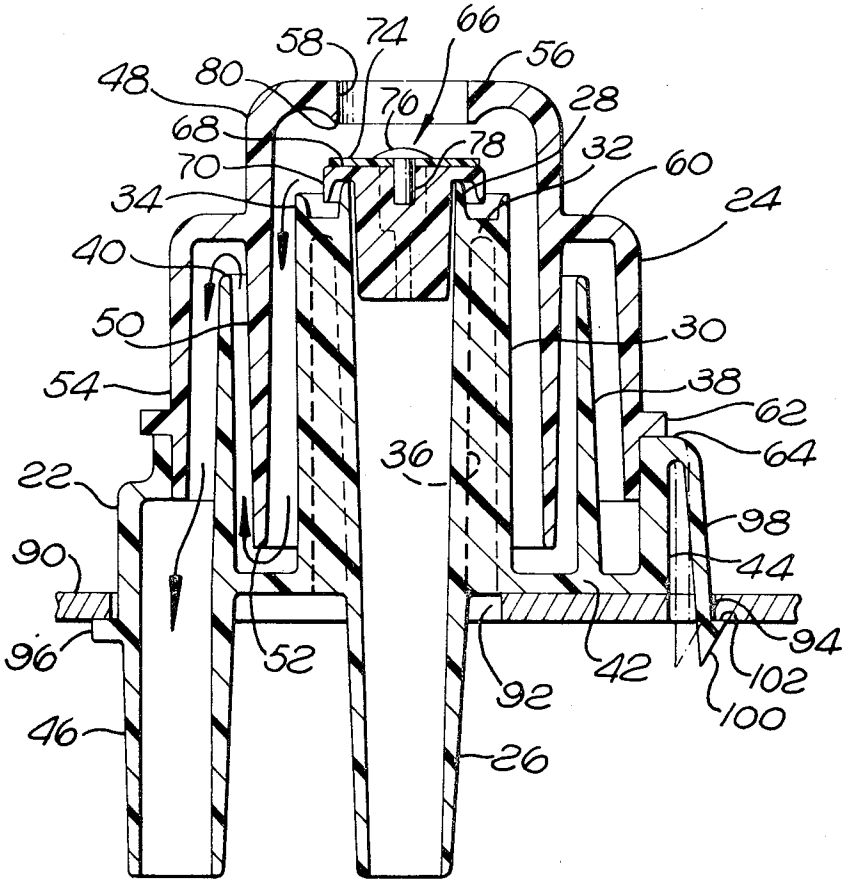
Primary Examiner—Henry T. Klinksiek

Attorney, Agent, or Firm—Thomas L. Peterson

[57] **ABSTRACT**

A vacuum breaker valve for use with a toilet such as employed in recreational vehicles. The valve comprises a two-piece plastic valve housing comprising a base member and a cap member sealed to one another. The base member includes a water inlet pipe and an outlet port. A valve element rests on the top of the water inlet pipe. The cap member has an atmospheric opening above the valve element. The base and cap members are formed with cylindrical walls positioned in nested coaxial relationship which define a tortuous path between the inlet and outlet port, which is greater than the actual vertical height of the valve.

10 Claims, 13 Drawing Figures



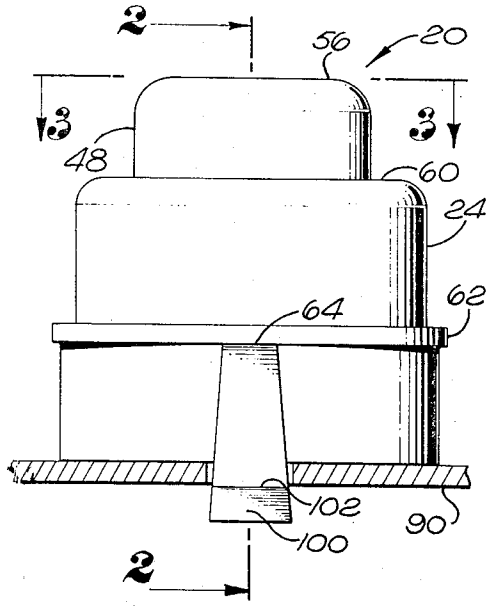


Fig. 1.

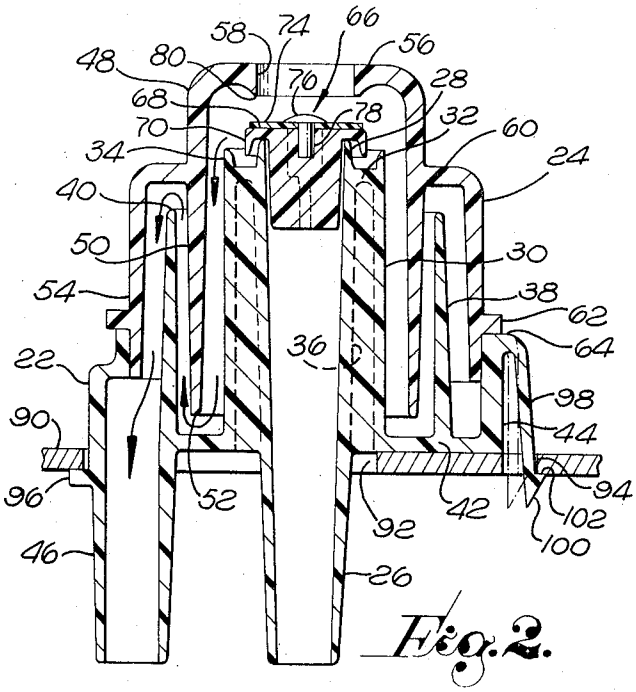


Fig. 2.

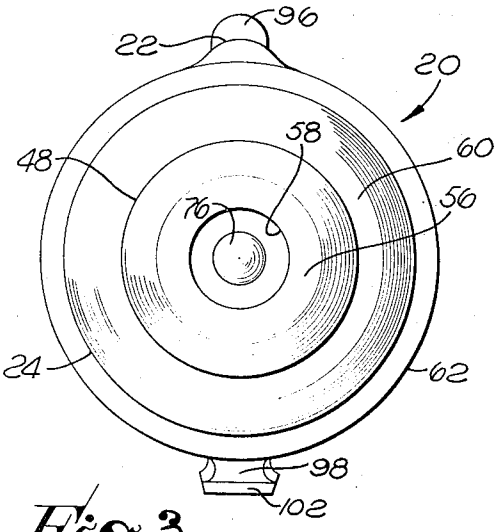


Fig. 3.

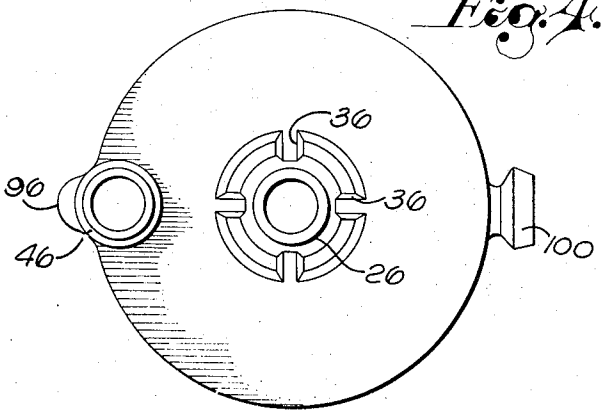


Fig. 4.

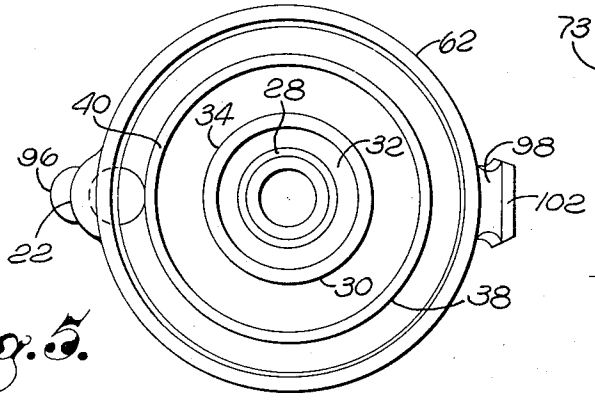


Fig. 5.

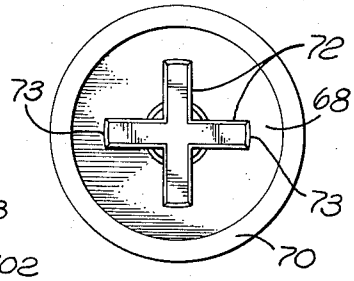


Fig. 2a.

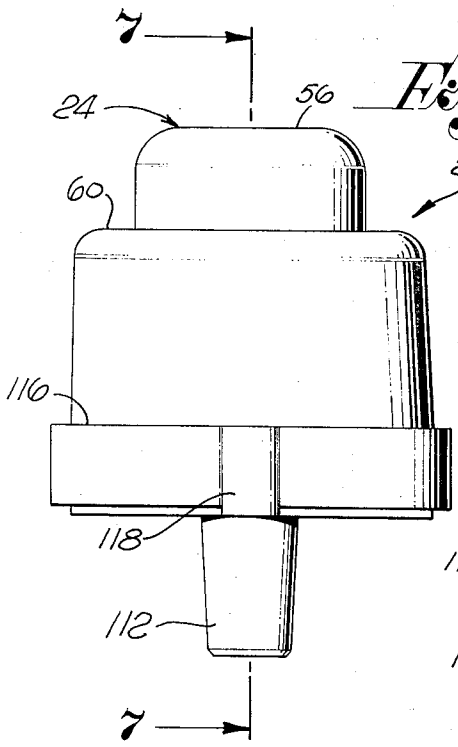


Fig. 6.

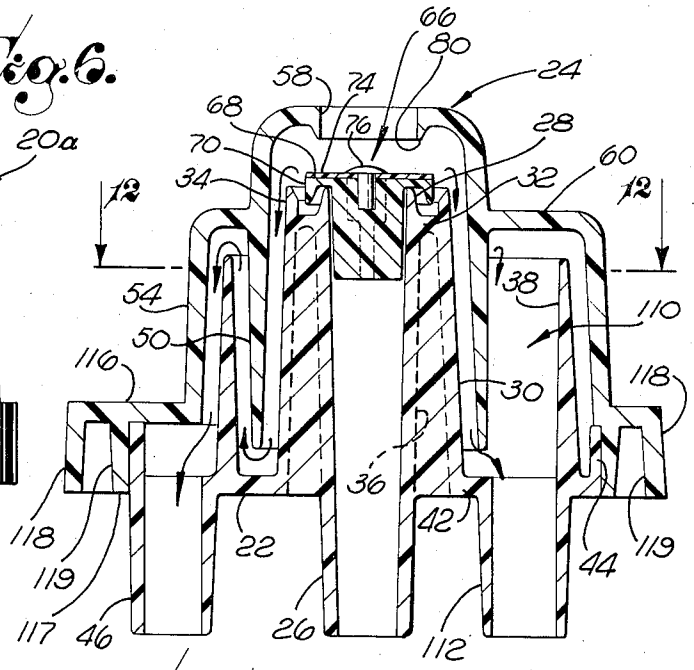


Fig. 7.

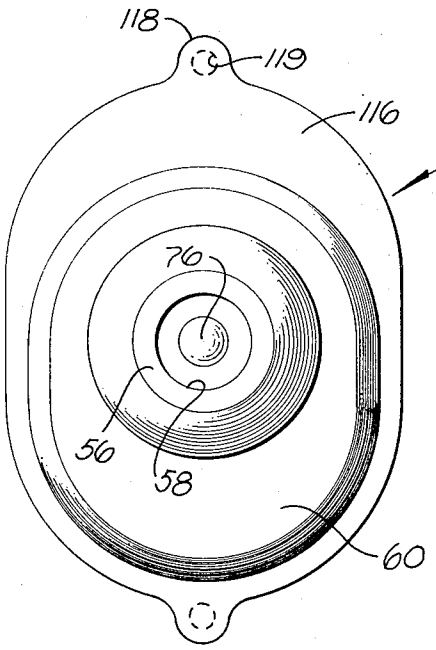


Fig. 8.

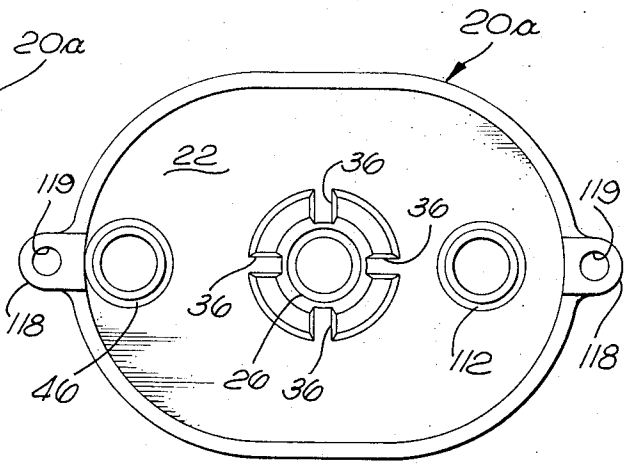


Fig. 9.

Fig. 10.

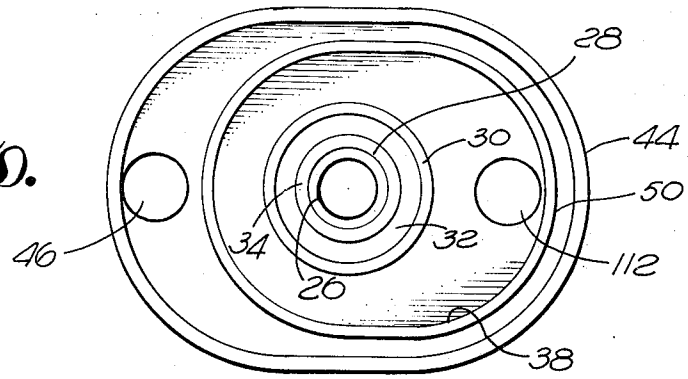


Fig. 11.

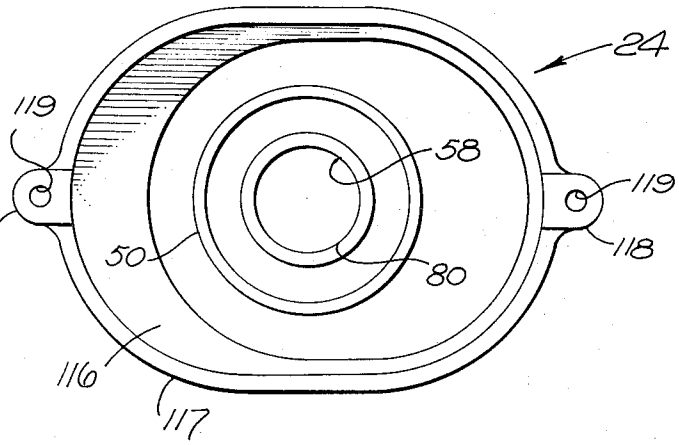
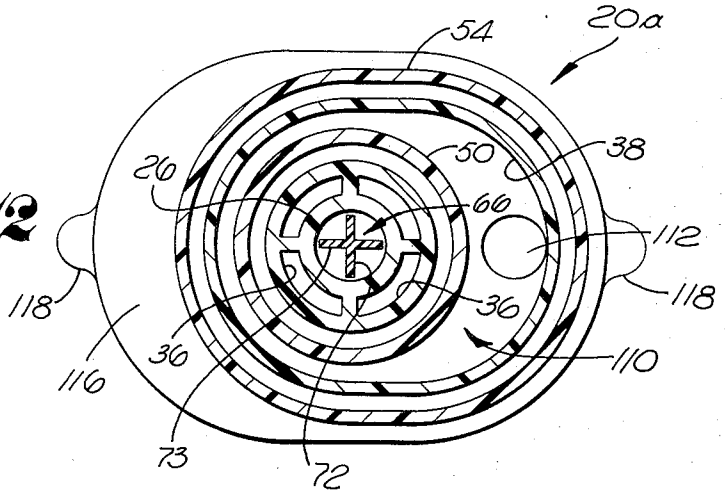


Fig. 12



VACUUM BREAKER VALVE

BACKGROUND OF THE INVENTION

This invention relates generally to a valve assembly and, more particularly, to an improved vacuum breaker valve which is suitable for use with recreational vehicle toilets.

Statutory provisions require that toilet systems be employed with vacuum breaker valves to prevent syphoning of water out of the systems back to the fresh water supply. This requirement applies to toilets for recreational vehicles as well as standard household toilets. For this application, it is desirable that the vacuum breaker valve be simple in construction and operation, low cost, and comply with local State and Federal codes. It is the object of the present invention to provide such a valve.

SUMMARY OF THE INVENTION

According to the principal aspect of the present invention there is provided a vacuum breaker valve particularly suited for recreational vehicle toilets, although it could be used with other types of toilets if desired. The valve comprises a two-piece valve housing consisting of a base member and a cap member sealed to each other. The base member includes a water inlet pipe and an outlet port. A valve element rests on the top of the inlet pipe. The cap member is formed with an atmospheric opening above the valve element which is closed when the valve element is lifted off the inlet pipe. Upstanding walls formed on the base and cap members, respectively, are positioned in nested coaxial relationship to define a tortuous path between the inlet pipe and outlet port so that the linear distance between the inlet and outlet of the valve is greater than the actual vertical height of the valve. Thus, a relatively long tortuous path is provided in a compact assembly. This path serves to minimize the possibility of contaminates in the toilet bowl passing back through the vacuum breaker valve to the water supply during a sudden vacuum surge in the system.

Because the housing of the valve assembly of the invention is formed of only two parts, it is economical to manufacture by conventional molding techniques.

According to another aspect of the invention, the valve assembly is provided with two outlet ports. The upstanding walls on the base and cap members are shaped and arranged in such a manner that a pair of tortuous paths of different lengths are provided which communicate the inlet pipe with the outlet ports so that, when the valve element is lifted from the inlet pipe, fluid entering the pipe will exit at different pressures from the two outlet ports. The high pressure port is adapted to be connected to a wash down spray nozzle which may be directed at any point in the bowl for effective cleaning. The other outlet port is adapted to be connected to the toilet bowl inlet for rinsing and filling the bowl.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of one form of a vacuum breaker valve constructed in accordance with the present invention, the valve being shown mounted on an upper wall portion of a toilet;

FIG. 2 is a vertical sectional view taken along line 2—2 of FIG. 1;

FIG. 2*a* is a bottom view of the valve element used in the assembly illustrated in FIG. 1;

FIG. 3 is a top plan view of the valve illustrated in FIG. 1;

FIG. 4 is a bottom view of the valve illustrated in FIG. 1;

FIG. 5 is a top plan view of the base member of the valve illustrated in FIG. 1;

FIG. 6 is a side elevation of an alternative form of a valve constructed in accordance with the invention;

FIG. 7 is a vertical sectional view taken along line 7—7 of FIG. 6;

FIG. 8 is a top plan view of the valve illustrated in FIG. 6;

FIG. 9 is a bottom view of the valve illustrated in FIG. 6;

FIG. 10 is a top plan view of the base member of the valve illustrated in FIG. 6;

FIG. 11 is a bottom view of the cap member of the valve illustrated in FIG. 6; and

FIG. 12 is a horizontal sectional view taken along line 12—12 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail, wherein like reference characters designate like or corresponding parts throughout the various views, there is illustrated in FIGS. 1–5 one embodiment of the valve assembly of the present invention, generally indicated **20**. The housing of the valve **20** consists of two integral parts, namely, a base member **22** and a cap member **24**.

The base member **22** includes a vertically extending water inlet pipe **26** which terminates at its upper end in an annular rim or seat **28**. A cylindrical wall **30** surrounds the upper portion of the pipe **26**. The wall **30** and pipe **26** are joined together adjacent their upper ends by means of an annular flange **32**. A portion **34** of the wall **30** extends slightly above the flange **32**. A plurality of vertically extending strengthening ribs **36** extend between the inlet pipe **26** and the cylindrical wall **30**. Four of such ribs **36** are illustrated in FIG. **4**, it being understood, however, that any number of ribs may be provided. A second cylindrical wall **38** surrounds and is spaced from the cylindrical wall **30**. The top edge **40** of the wall **38** is located below the upper portion **34** of the wall **30**. The bottoms of the walls **30** and **38** are joined together by means of a flat wall or flange **42** which lies in a plane essentially perpendicular to the longitudinal axis of the inlet pipe **26**. The wall or flange **42** extends outwardly beyond the cylindrical wall **38** and extends upwardly to provide a short cylindrical wall segment **44** which is spaced from the wall **38**. An outlet port **46** extends downwardly from the bottom wall **42** on one side of the base member between the wall **38** and the wall segment **44**.

The cap member **24** of the valve housing includes a cup-shaped portion **48** defining a cylindrical wall **50** which is coaxial to and mounted in nesting relationship between the walls **30** and **38** of the base member. The bottom edge **52** of the wall **50** is spaced slightly above the bottom wall **42** of the base member. The cap member also includes a second cylindrical wall **54** which surrounds and is spaced from the wall **50**. The spacing between the walls **50** and **54** is sufficient to allow the cylindrical wall **38** of the base member to be nested in coaxial and spaced apart relationship with respect to

said walls. The bottom or base **56** of the cup-shaped portion **48** of the cap member is spaced above the rim **28** and is formed with an atmospheric opening **58** which is coaxial with the rim. An annular flange **60** depends from the cup-shaped portion a short distance below the base **56** and joins the cylindrical wall **54.** The top edge **40** of the cylindrical wall **38** on the base member is spaced below the flange **60** on the cap member. The outer diameter of the cylindrical wall **54** of the cap member is slightly less than the inner diameter of the short cylindrical wall segment **44** of the base member so that the two members may be mounted in telescoping relationship. An annular flange **62** extending outwardly from the wall **54** rests on the top **64** of the short wall segment **44** on the base member.

It is seen that the cylindrical parts and walls **26, 30, 50, 38, 54** and **44** are concentrically mounted with respect to each other.

Preferably, the cap and base member of the valve are formed of a suitable thermo plastic, such as polypropylene or ABS, and are sealed together at the mating junction of the walls **54** and **44** by spin welding, sonic welding, or solvent bonding.

A valve element, generally indicated **66,** rests on the annular rim **28** at the top of the water inlet pipe **26.** The valve element includes a generally flat top plate **68** formed with a downwardly extending cylindrical flange **70** at its outer periphery. Four radially extending ribs **72** extend downwardly from the plate **68.** The distance between the outer edges **73** of opposed ribs of the valve element is less than the inner diameter of the water inlet pipe **26** adjacent its upper end so that the valve element may freely slide axially in the pipe. A circular gasket **74** of suitable resilient material is positioned on top of the plate **68** and is retained thereon by means of a rivet **76** which is force-fitted into a bore **78** in the valve element. A lip **80** extends downwardly from the cap member **48** adjacent the periphery of the opening **58.** The diameter of this annular lip is less than the diameter of the valve element so that when the latter is lifted, due to water pressure in the pipe **26,** the valve element will seat upon the lip **80** to close the atmospheric opening **58** thereby creating a continuous path to the outlet port **46.**

The valve **20** of the invention is adapted to be mounted on an upper wall portion **90** of a toilet assembly. The wall **90** is formed with a relatively large elongated aperture **92** and a smaller slot **94** spaced therefrom. The aperture is slightly longer than the distance between the remote sides of inlet pipe **26** and port **46.** The lower ends of the inlet pipe **26** and outlet port **46** extend through the aperture **92** below the wall **90** when the valve **20** is mounted on the wall as best seen in FIG. **2.** A small lip **96** extends outwardly from the left side of the outlet port **46.** The upper surface of the lip **96** is spaced below the lower surface of the bottom wall **42** of the valve a distance slightly less than the thickness of the wall **90** so that the lip **96** will engage under the wall **92** to secure the valve thereto. At the opposite end of the valve there is formed a resilient latching finger **98** which extends downwardly from adjacent the upper portion **64** of the short wall segment **44.** At the lower end of the finger **98** there is provided a pawl or latch **100** forming a shoulder **102** which engages the lower surface of the wall **90** when the valve is assembled thereon. As seen in FIG. **2,** the finger **98** is deformable inwardly to the position shown in phantom to allow the finger to be inserted through the aperture **94** of the wall **90** when the valve is mounted thereon. Thus, the lip **96** and latch or pawl member **100** on the resilient finger **98** serve to frictionally hold the valve assembly on the wall **90.**

It is seen from the description so far that there is provided by the present invention a valve assembly having a housing formed of only two parts, namely, the base member **22** and cap member **24.** The nested cylindrical walls formed on the two parts cooperate to define a tortuous path between the inlet pipe **26** and the outlet port **46** which provides a linear path for liquid flow which is substantially greater than the vertical height of the valve assembly. Thus, an elongaged tortuous path is provided in a relatively compact assembly.

It will be appreciated that when water is introduced into the lower end of inlet pipe **26,** the valve element **66** will lift off the rim **28** and close the atmospheric opening **58.** The water will follow the path indicated by the arrows seen in FIG. **2,** raising over the upper portion **34** of the wall **30,** dropping downwardly through the space between the walls **30** and **50,** passing upwardly through the space between the walls **50** and **38,** then downwardly through the space between the walls **38** and **54,** and out through the outlet port **46.** As will be understood in the art, the outlet port **26** is adapted to be connected to a water supply for a toilet while the outlet port **46** is adapted to be connected to the toilet bowl, not shown. When the valve element **66** is seated on the rim **28,** the port **46** is vented to atmosphere through the hole **58** in the cap member, thus breaking any vacuum which might be produced in the toilet system between the water supply and the outlet port. Thus, water in the toilet bowl connected to port **46** cannot be syphoned back through the valve to the water supply.

Reference is now made to FIGS. **6–12** of the drawings which illustrate an alternative form of the valve assembly of the present invention, generally indicated **20***a*. This valve is basically the same as that shown in FIGS. **1–5** except that the outer upstanding walls **38** and **54** of the base **22** and cap **24,** respectively, have a generally oblong circular configuration in horizontal cross-section. The center axes of these outer upstanding walls are offset from the common axes of the inner cylindrical walls **30** and **50** of the assembly. In other words, the outer upstanding oblong configured walls are eccentrically disposed with respect to the inner cylindrical walls of the valve. As a consequence, the right side of the walls **38** and **54,** as seen in FIG. **7,** are spaced from the cylindrical walls **30** and **50** a distance greater than the opposite sides of the oblong walls, thereby defining therebetween a relatively large chamber **110** on the right side of the valve. The valve illustrated in FIGS. **6–12** also differs from that shown in FIGS. **1–5** in that there is provided a second outlet port **112.** The port **112** extends downwardly from the base plate **42** of the valve and is in direct communication with the large chamber **110.** The port **112** is adapted to be connected to a spray outlet at the rim of a toilet bowl or to a hand operated sprayer. Thus, two tortuous paths of different lengths are formed in the valve, the longer path extending from valve seat **28** to outlet port **46** and the shorter path extending from valve seat **28** to outlet port **112.** By this arrangement, there is provided a pressure drop in the valve such that water exiting through port **112** to the spray outlet has a higher

pressure than the water exiting from the outlet port **46** to the bowl per se, thus allowing a stronger pressure for wash down by the spray than for filling the bowl.

The cap member **24** of the valve illustrated in FIGS. **6–12** is formed with a horizontally extending outer flange **116** terminating in a downwardly extending lip **117** which is sealed at its inner surface to the upstanding cylindrical wall segment **44** of the base member. A pair of projections **118** extend from opposite sides of the lip **117**. The projections are provided with vertically extending passages **119** which are adapted to receive screws threaded upwardly through a toilet support plate (not shown) for securing the valve to the plate.

What is claimed is:

1. A vacuum breaker valve for use with a toilet or the like comprising:

a two-piece valve housing comprising a base member and a cap member sealed to one another;

said base member including a water-inlet pipe terminating at one end in an annular rim;

a valve element resting on said rim;

said base member further including at least one outlet port;

said cap member having an opening therein above said valve element adapted to be closed by said valve element when said element is lifted off said rim; and

means on said members defining a tortuous path communicating said inlet pipe with said outlet port whereby, when said valve element is lifted off said rim, fluid entering said inlet pipe will exit from said outlet port, said path defining means including generally cylindrical walls integrally formed on said base member and said cap member, respectively, surrounding said inlet pipe and positioned in nested coaxial relationship, said walls being spaced apart a distance sufficient to allow free flow of liquid therebetween.

2. A valve as set forth in claim **1** wherein:

said base member and said cap member are each integral plastic moldings;

said base member also has a relatively flat bottom wall;

said water inlet pipe and outlet port extend perpendicular from one side of and bottom wall; and

said base member cylindrical wall extends perpendicular from the other side of said bottom wall.

3. A vacuum breaker valve for use with a toilet or the like comprising:

a two-piece valve housing comprising a base member and a cap member sealed to one another;

said base member including a water-inlet pipe terminating at one end in an annular rim;

a valve element resting on said rim;

said base member further including a pair of outlet ports;

said cap member having an opening therein above said valve element adapted to be closed by said valve element when said element is lifted off said rim; and

means on said members defining a pair of tortuous paths of different lengths communicating said inlet pipe with said outlet ports, respectively, whereby when said valve element is lifted off said rim, fluid entering said inlet pipe will exit at different pressures from said outlet ports.

4. A valve as set forth in claim **3** wherein:

said path defining means includes generally cylindrical walls on said base member and said cap member in nested coaxial relationship;

said path defining means also includes upstanding walls on said members of generally oblong circular configuration, said upstanding walls being in coaxial nested relationship; and

the center axes of said upstanding walls being offset from the axes of said cylindrical walls.

5. A valve as set forth in claim **3** wherein:

said path defining means includes a first pair of nested upstanding walls defining relatively narrow flow paths therebetween and a second pair of nested upstanding walls surrounding said first pair of walls and eccentrically disposed with respect thereto whereby one side of the walls of said second pair are spaced from the first pair a distance greater than the opposite side thereof, thereby defining between said one side and said first pair of walls a relatively large chamber.

6. A valve as set forth in claim **5** wherein:

one of said outlet ports communicates with said relatively large chamber; and

the other outlet port communicates with the space between the walls of said second pair.

7. A vacuum breaker valve for use with a toilet or the like comprising:

a two-piece valve housing comprising a base member and a cap member sealed to one another;

said base member including a water-inlet pipe terminating at one end in an annular rim;

a valve element resting on said rim;

said base member further including at least one outlet port;

said cap member having an opening therein above said valve element adapted to be closed by said valve element when said element is lifted off said rim;

means on sqid members defining a tortuous path communicating said inlet pipe with said outlet port whereby, when said valve element is lifted off said rim, fluid entering said inlet pipe will exit from said outlet port,

said base member also having a relatively flat bottom surface, said water inlet pipe and outlet port extending below said surface; and

a resilient finger on said base member extending downwardly below said surface and formed with a pawl at its terminal end.

8. A valve assembly comprising:

a two-piece valve housing comprising a base member and a cap member;

said base member including an upstanding water inlet pipe terminating at its upper end in an annular rim, a cylindrical wall surrounding said pipe and joined thereto adjacent their upper ends, an upstanding wall surrounding said cylindrical wall, a first flange joining the lower ends of said cylindrical wall and said upstanding wall, and a second flange extending outwardly from the lower end of said upstanding wall;

said cap member including an inverted cup-shaped portion having cylindrical side walls concentric with said inlet pipe and nested between said cylindrical and upstanding walls of said base member, the bottom of said cup-shaped portion being

spaced above said rim and having an opening therein adjacent to said rim, a second upstanding wall surrounding and spaced from said base member upstanding wall, a third flange joining the upper end of said second upstanding wall to said cup-shaped portion, and the lower portion of said second upstanding wall being joined to the periphery of said second flange;

said walls being spaced apart a distance sufficient to allow free flow of liquid therebetween;

a valve element resting on said rim; and

said base member further including at least one outlet port, said one port extending from said second flange and communicating with the space between the upstanding walls on said base and cap members.

9. A valve assembly as set forth in claim **8** wherein:

said base member upstanding wall is eccentrically disposed with respect to said base member cylindrical wall whereby one side of said upstanding wall is spaced from said cylindrical wall a distance greater than the opposite side thereof, thereby defining between said one side and said cylindrical wall a relatively large chamber;

said base member includes two of said outlet ports, the other outlet port extending from said first flange and communicating with said relatively large chamber.

10. A valve assembly as set forth in claim **9** wherein:

said upstanding walls are of generally oblong circular configuration; and

said outlet ports are disposed on generally opposite sides of said inlet pipe.

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