July 25, 1961 A. FRANCO 2,993,214

SOLUTION-INJECTING DEVICE

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Fig. 1.

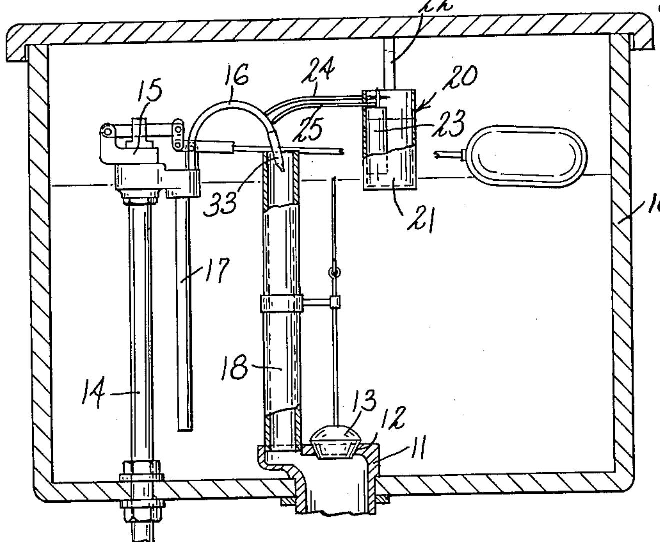

Fig. 2.

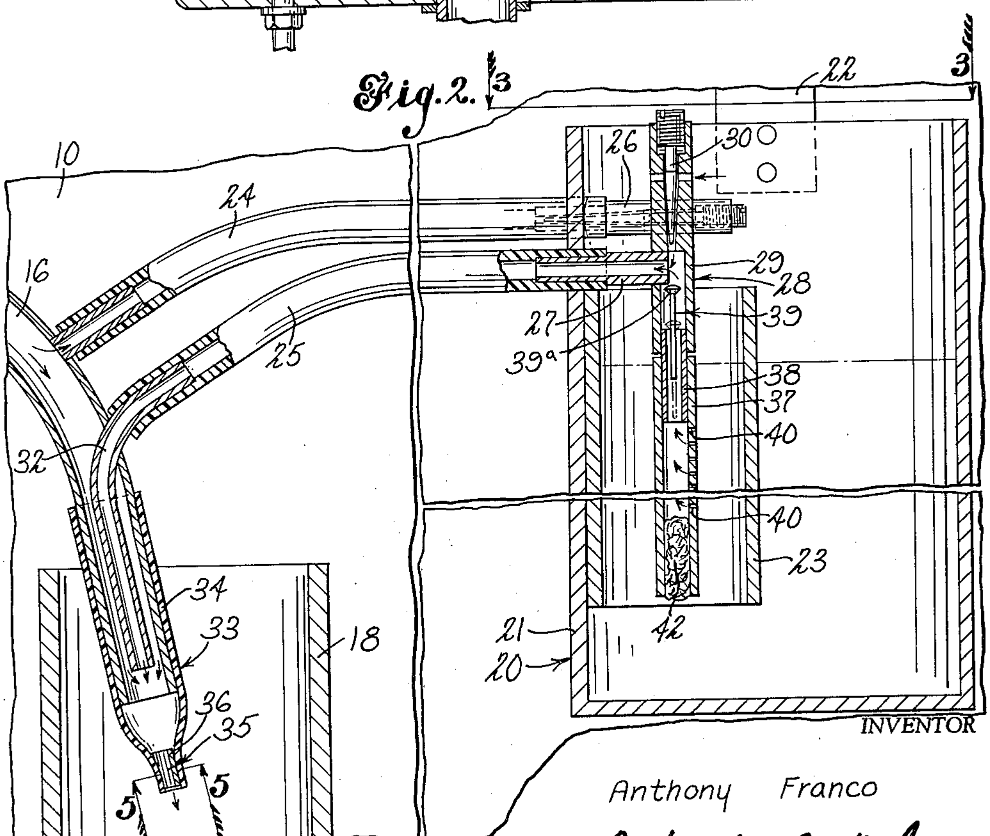

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Fig. 3.

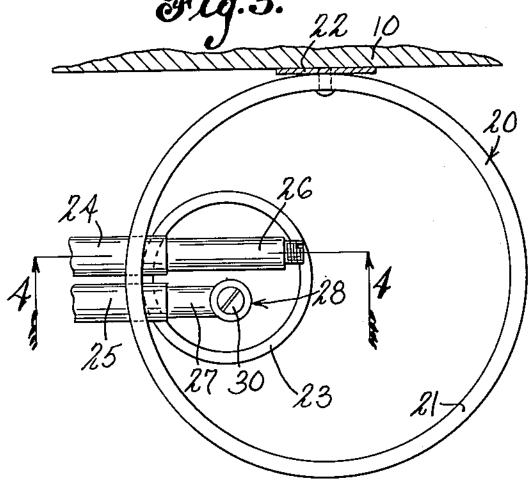

Fig. 4.

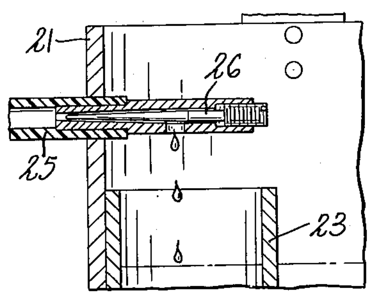

Fig. 6.

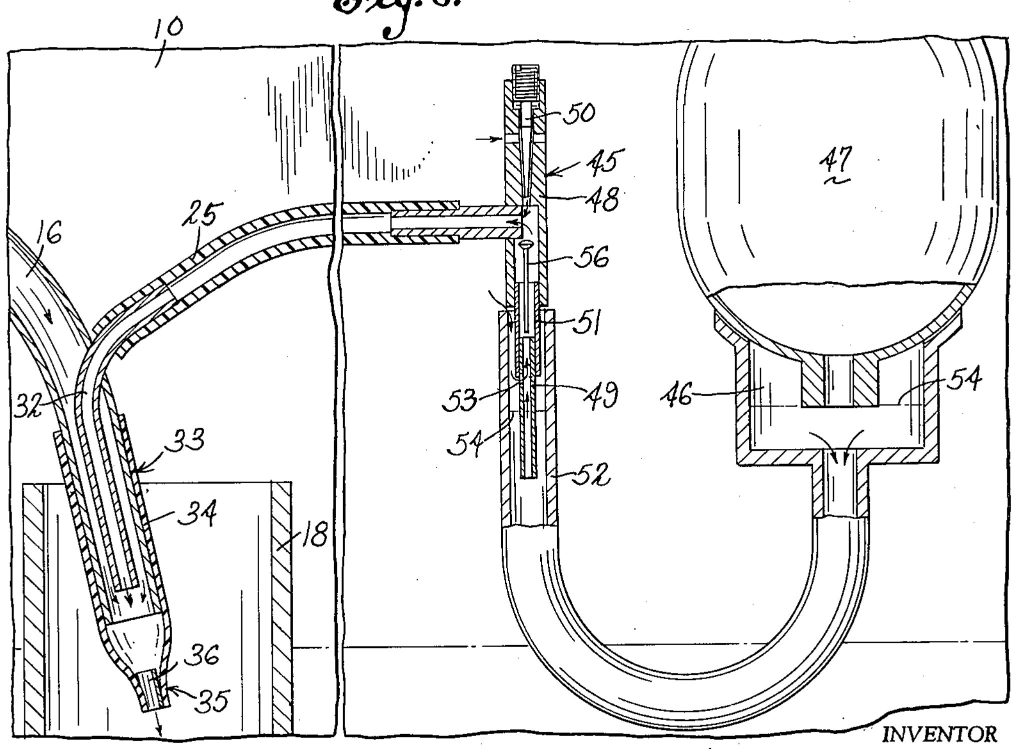

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Fig. 7.

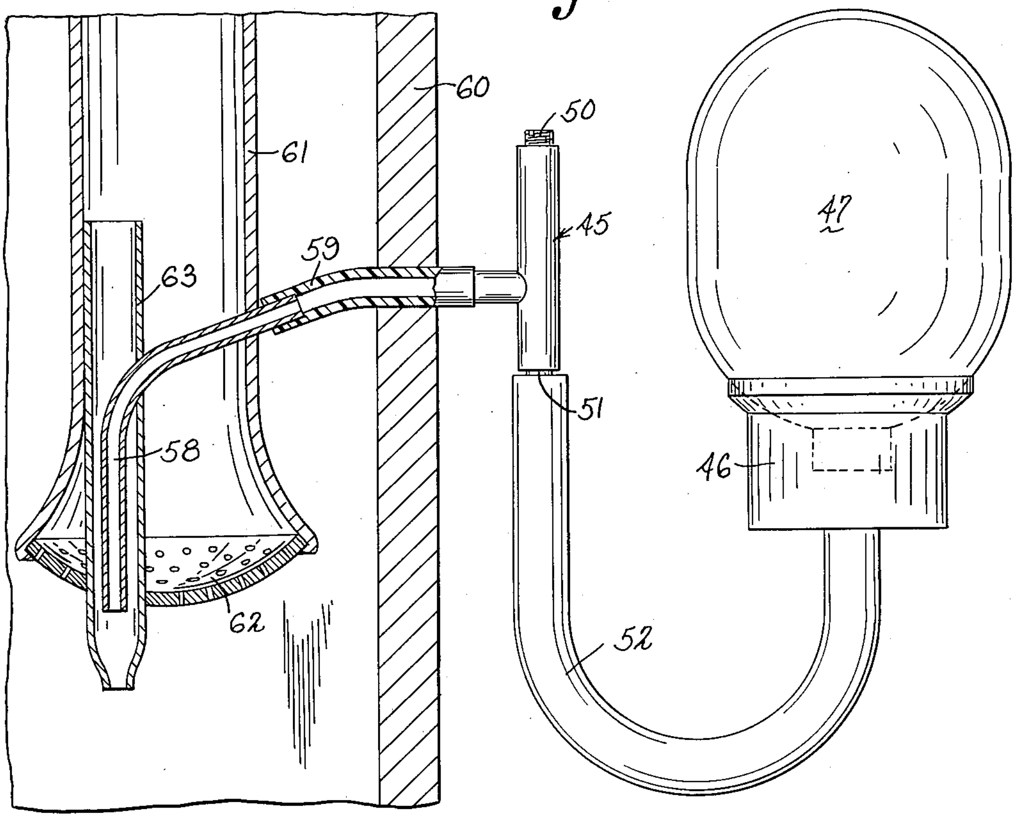
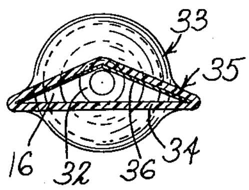


Fig. 5.



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SOLUTION-INJECTING DEVICE

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1 Claim. (Cl. 4—228)

This invention relates to a device for automatically injecting solutions into toilet and urinal bowls, and relates more particularly to a device designed for support within a conventional toilet or urinal and which dispenses automatically, on each flushing of the bowl, an amount of a concentrated and aerated solution, such as a cleanser, disinfectant and deodorizing agent.

One object of the invention is to provide an improved device for automatically injecting solutions into toilet bowls or the like.

Another object of the invention is to provide a device such as characterized above, which dispenses an aerated solution of cleanser, disinfectant and deodorizing agents.

Another object of the invention is to provide a device of the character set forth, which is simple in construction, inexpensive to manufacture, and yet effective and efficient in use.

Further objects of the invention will be apparent from the following detailed description of three forms of the device.

In the accompanying drawings:

FIG. 1 is a broken fragmentary view illustrating in vertical section a water tank of a toilet, showing the operating parts of the toilet and my improved solution-injecting device;

FIG. 2 is an enlarged fragmentary view illustrating my solution-injecting device in vertical section;

FIG. 3 is a view partially in section taken on line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3;

FIG. 5 is a sectional view on line 5—5 of FIG. 2;

FIG. 6 is a view similar to FIG. 2, illustrating a modified form of my device; and

FIG. 7 is a view similar to FIG. 6, but illustrating a further modification of the device, adapted for use with a urinal.

In the form shown in FIGS. 1 through 5, the water tank is indicated at **10** and is provided at the bottom thereof with an outlet fitting **11** through which water is discharged into a toilet bowl, not shown, in the usual manner. The outlet **11** is provided with an opening **12** communicating with the tank and controlled by a conventional valve **13** operated by the usual manually operable handle member, not shown.

A water-inlet conduit **14** is connected to a source of water under pressure, not shown. The inlet conduit **14** is provided with the usual float-operated valve **15** to control the admission of water from the inlet **14** into the inlet conduits **16** and **17**. The conduit **17** opens into the tank **10** and serves to fill the same. As shown in FIG. 1, the conduit **16** extends into a further inlet conduit **18** which is tapped into the outlet fitting **11** and forms a by-pass around the valve **13**. For the purposes of this description it is significant that the conduits **14**, **16** and **18**, together with the outlet fitting **11**, provide, in effect, conduit-forming means communicating with a source of water under pressure, for communication with a bowl which is to be flushed at intervals. It will be understood that when the valve **13** is opened water in the tank **10** is drained into the bowl. When and as the water is drained into the bowl, the float-operated valve **15** is opened and water from the pressure source is discharged into the bowl through the conduits **16** and **18**, while, at the same time, water from the pressure source

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is discharged into the tank through the conduit **17**. When the valve **13** is allowed to drop and close the opening **12**, the tank begins to fill and continues to fill until the float-operated valve **15** is closed to thereby cut off the supply of water to the conduit **16** as well as the conduit **17**.

In the form shown in FIGS. 1 through 5, the solution-injecting device is indicated generally at **20** and includes a fluid container or reservoir **21** supported from a wall of the tank as by a strap **22** having a hook-like part extending over the wall. The reservoir **21**, which may be of hollow cylindrical form, open at the top and closed at the bottom, has an open-ended well-forming tube **23** disposed therein in eccentric relation. The tube **23**, which is of considerably smaller diameter than the diameter of the reservoir **21**, is secured to the cylindrical wall of the reservoir, as by welding. The tube **23** has the bottom thereof spaced upwardly a distance from the bottom of the reservoir, as shown in FIG. 2. Above the tube or well **23** the reservoir is apertured to receive laterally extending pipes **24** and **25** preferably formed of flexible material. The pipe **24** has at one end thereof a needle-valve assembly **26** extending over the well **23** to discharge the contents of the pipe **24** therein, the other end of the pipe **24** being tapped into the conduit **16**. The arrangement is such that when water flows in the conduit **16**, water from the last-mentioned conduit enters the conduit **24** and, by proper adjustment of the needle valve, drips very slowly into the well **23**. The pipe **25** is provided at one end with a connection **27** communicating with a pipe member **28** extending downwardly into the well **23**.

The pipe member **28** comprises an upper portion **29** having at its upper extremity a needle valve **30** for controlling the admission of air from the tank **10** into the upper part of the pipe member **28**. As shown in FIG. 2, the connection **27** of the pipe **25** is located at the upper part of the pipe member **28** and is disposed below and closely adjacent the needle valve **30**. The end of the pipe **25** remote from the connection **27** is connected to a curved tube **32** through the wall structure of the conduit **16** below the pipe **24**, as shown in FIG. 2. As shown in the last-mentioned view, the tube **32** is curved to follow the direction of the flow in the conduit **16** and the lower portion of the tube **32**, which is of substantially smaller diameter than the conduit **16**, is arranged in the latter in substantially concentric relation. The tube **32** is, in effect, an aspirator or suction tube and serves to suck solution from the reservoir **21** when water flows in the conduit **16**.

Though not critical, it has been found desirable to employ a nipple (see FIG. 2) on the free end of the conduit **16** to adjustably restrict the same so that the rate of flow from the conduit **16** may be varied. The nipple, indicated at **33**, may be employed to reduce the rate at which water flows past the suction tube **32**. It will be understood that the amount of fluid which is injected into the conduit **16** through the suction tube **32** varies in accordance with the rate at which water flows past the lower end of the suction tube. The nipple **33** may have an elastic body **34**, formed of rubber or the like, stretched over the open end of the conduit **16**. The body **34** is of tubular shape and below the last-mentioned end of the conduit **16**, forms a restriction, as at **35**. In this area, the elastic material of the body tightly embraces a V-shaped member **36**, best shown in FIG. 5, formed of sheet metal. The member **36** may be deformed by finger pressure on the body to effect a larger or smaller opening in this area.

Turning once again to the details of the construction of the pipe member **28**, it will be observed that the lower part of the member **28** is formed by a pipe portion **37**, as shown in FIG. 2. A short tube **38** extends into the upper end of the portion **37** and also extends into the lower end of the pipe portion **29**. The tube **38** serves to restrict a portion of the vertical passage in the pipe member **28** and may have a press fit with the pipe portions **29** and **37**. The restriction formed by the tube **38** in the vertical passage of the pipe member **28** provides a seat for a valve-like baffle member **39** of pin form. The member **39** is provided with a tapered head **39**^{a} for creating a turbulence in the upper part of the pipe member **28** as solution is sucked from the reservoir **21**. The operative position of the baffle member **39** is shown in full lines in FIG. 2, while the inoperative position is shown in FIG. 2 in broken lines. In the last-mentioned position of the member **39**, the head **39**^{a} of the member **39** rests by gravity on the seat provided by the tube **38**. The baffle member is moved from the inoperative position to the operative position by suction.

Below the tube **38** the cylindrical side-wall structure of the pipe portion **37** is provided with a series of vertically spaced openings **40** through which solution from the reservoir **21** is sucked into the pipe portion **37**. The openings **40** are vertically spaced so that solution from different levels in the reservoir may enter the pipe portion **37**. The use of a series of apertures is particularly advantageous where the ingredients of the solution which is being used tend to separate from one another and form layers in the reservoir. Fluids from several different layers in the reservoir may simultaneously enter the pipe member **28** and be mixed therein owing to the provision of the vertically spaced apertures in the pipe portion **37**. The lower end of the pipe portion **37** is plugged, as at **42**.

From the foregoing it will be understood that when solution from the reservoir is sucked into the pipe member **28** by the action of the suction tube **32**, the solution passes upwardly in the member **28** and a turbulence or atomization is effected in the upper portion of the member **28** adjacent the outlet **27**. The turbulence is effected coincidentally with the flow of air to the upper region of the pipe member **28** around the needle valve **30**. The flow of air is effected by the suction in the tube **23**. Thus the solution from the reservoir **21** is well aerated when it enters the flow of water in the conduit **16**. It is then carried by this stream and ultimately projected with some force into the bowl where it first spreads out in the bottom of the latter and then bubbles up through the water in the bowl to thereby release to the atmosphere around the bowl the deodorant of the solution. It will be understood that by aerating the solution containing the deodorant prior to the injection of the solution into the bowl, the effectiveness of the deodorant is increased considerably. The aerated solution also tends to spread more quickly through the water in the bowl.

The pipe **24**, which is connected to the inlet conduit **16** and which discharges into the reservoir **21** through the needlevalve assembly **26**, serves to dilute the solution in the reservoir. By pouring a very concentrated solution into the reservoir **21**, and by diluting the solution with water from the pipe **24** on each flushing, the necessity of refilling the reservoir at frequent intervals is avoided. In other words, a large volume of solution of sufficient strength may be produced from a small amount of very highly concentrated solution. The well **23** tends to localize the dilution of the solution in the reservoir, the dilution tending to be localized to the area or vicinity of the pipe member extending downwardly into the reservoir.

The form of the solution-injecting device shown in FIG. 6 is similar in some respects to the form shown in FIGS. 1 through 5 and described above. In the form of FIG. 6, a pipe member, generally indicated at **45**, extends into a reservoir **46** containing the solution. The reservoir is fed by an inverted globe or vial **47** and is suitably supported from the tank structure. The connection of the pipe member **45** to the water inlet for the bowl may be the same as that described above in connection with the form shown in FIGS. 1 through 5. The pipe member **45** includes an upper pipe portion **48** and a lower pipe portion **49**. The pipe portion **48** has at its upper extremity a needle valve **50** similar to the needle valve **30** described above. The lower end of the pipe portion **48** receives and has a press fit with a passage-restricting tube **51** which extends loosely into the U-shaped extension **52** of the reservoir **46**. The extension **52** is rigid and is fixed to the reservoir **46** for support by the latter. As illustrated in FIG. 6, the pipe portion **48** is spaced upwardly a short distance from the extension **52** and the arrangement is such that air in the tank may enter the extension **52** around the tube **51**. The pipe **25**, which supports the pipe portion **48**, may be supported from the tank structure in any convenient manner. The pipe portion **49** which constitutes the lower end of the pipe member **45** is of much smaller diameter than the lower end of the pipe member **28** described above.

The pipe portion **49**, which extends downwardly from the tube **51** to a point below the liquid level in the reservoir extension **52**, has a part thereof received within and suitably secured to the lower portion of the tube **51**. Above the liquid level in the reservoir extension **52** the pipe portion **49** is provided with an aperture in the side-wall structure thereof, the aperture being indicated at **53**. Air which passes into the outer end of the reservoir extension **52** from the tank may pass through the aperture **53** into the pipe portion **49**. The liquid level of the solution in the reservoir **46** and its extension is indicated at **54**. The neck of the inverted vial **47** extends downwardly to this level and it will be understood that as long as some solution remains in the vial **47**, the liquid level **54** remains unchanged. Suitable air spaces are provided between the vial **47** and the reservoir **46** so that the solution in the reservoir **46** is subjected to atmospheric pressure.

In the form of FIG. 6, there is no water inlet discharging into the reservoir to dilute the solution therein. Instead a very concentrated solution is employed in the reservoir and only a very small amount of this solution is injected or sucked into the water inlet system of the toilet on each flushing owing in part to the small diameter of the pipe portion **49**. As shown in FIG. 6, the pipe portion **49** is not provided with a series of upwardly spaced openings in the side-wall structure thereof, but is open at the lower end. A baffle member **56** is provided similar to the baffle member **39** described in connection with the form shown in FIGS. 1 through 5. The passage-restricting tube **51** provides a seat for the member **56**.

The operation of the solution-injecting device of FIG. 6 is as follows. When water flows in the inlet conduit **16** during flushing of the toilet, the aspirator or suction tube sucks solution from the reservoir. The solution passes upwardly in the pipe portion **49** and is mixed with air sucked into the last-mentioned portion through the opening **53**. This mixture impinges the baffle member **56** which is lifted by suction and creates a turbulence in the stream. More air is sucked from the tank into the stream in the area of the needle valve **50** and the result is that the solution is well aerated when it reaches the conduit **16**. As previously indicated, the volume of solution sucked from the reservoir on each flushing of the toilet is considerably smaller than the volume sucked from the reservoir in the form of FIGS. 1 through 5. However, in the form of FIG. 6, the solution is more concentrated and on each flushing of the toilet the solution is mixed with air from the tank to a greater extent.

In the form of FIG. 7, the solution-injecting device is associated with a urinal. The solution-injecting device of FIG. 7 is identical to the solution-injecting device shown in FIG. 6, except for the construction and arrangement of the aspirator or suction tube and the pipe which connects the tube to the pipe member of the solution-injecting device. In FIG. 7 the suction tube is indicated at **58** and the pipe which connects the tube to the pipe member of the solution-injecting device is indicated at **59**. In the last-mentioned view, the vertical wall structure of the urinal is indicated at **60**. A water-inlet pipe **61** extends downwardly along the wall structure and is provided at its lower end with a spray head **62** for spraying water into a urinal bowl, not shown. The water-inlet pipe **61**, controlled by the usual manually operable valve, is connected to a suitable source of water under pressure, and as the water flowing in the pipe **61** tends to remain under some pressure owing to the provision of the spray head **62**, an open-ended pipe or conduit **63** extends upwardly through the spray head into the pipe **61** in embracing relation to the tube **58** to relieve, to some extent, the pressure of the water and increase the rate of its flow in the area of the discharge end of the suction tube **58**.

The conduit **63** is of considerably smaller diameter than the pipe **61** and is arranged eccentrically of the latter, the conduit **63** being welded to the pipe **61** and forming, in effect, an integral part of the water inlet provided by the pipe **61**. The pipe or conduit **63** is the equivalent of the conduit **16** in the form shown in FIGS. 1 through 5. The suction tube **58** passes through the side-wall structure of the conduit **63** and then extends in the direction of the flow in the conduit. The conduit **63**, unlike the conduit **16**, is not provided with a separate nipple restricting the flow at the discharge end of the conduit but is, itself, restricted at this end. The suction tube passes through the side-wall structure of the pipe **61** and is connected to the pipe **59**. The pipe **59** interconnects the suction tube and the pipe member of the solution-injecting device. The pipe **59** passes through the vertical wall structure of the urinal for support by the latter. It will be understood that the pipe member of the solution-injecting device is supported from the pipe **59**. The reservoir of the fluid-injecting device may be supported in a conventional manner on any suitable wall.

When the urinal is flushed, water flows in the pipes **61** and **63** starting the sucking action of the tube **58**. The tube **58** sucks solution from the reservoir into the stream in the pipe **63**. The solution is aerated in the same manner as in the form of FIG. 6.

In accordance with the foregoing disclosure, there is provided an improved device for automatically injecting solutions into toilet bowls or the like. There is also provided a device which dispenses an aerated solution of cleanser, disinfectant and deodorizing agents. Furthermore, the device is of simple construction and is very effective and efficient in use.

While three forms of the solution-injecting device have been shown in the drawings and described above, it will be apparent to those versed in the art that the device is susceptible of various modifications and changes in details without departing from the principles of the invention and the scope of the claim.

What I claim is:

In a device for injecting a solution into the flushing water of a toilet or the like having a water-inlet conduit for discharge into a bowl, the combination of a container forming a reservoir for the solution, an open-ended tube in the reservoir arranged vertically and forming a well, said tube being of considerably smaller diameter than the reservoir, a pipe having an inlet end connected to the water-inlet conduit and having an outlet end for discharge into said well to dilute the solution therein, means controlling the discharge from the pipe into the well, a pipe member extending downwardly in the well to a point below the liquid level and having above the latter means for controlling the admission of air to the pipe member, an aspirator tube having an inlet end and having an outlet end extending into the water-inlet conduit for inducing suction when water flows in the last-mentioned conduit, the last-named tube having the inlet end thereof connected to the pipe member to suck a volume of solution and air into the latter where they are mixed prior to injection into the water-inlet conduit through the aspirator tube, the pipe member having the lower end thereof sealed and having a series of vertically spaced fluid-inlet openings below the liquid level in the reservoir, the pipe member being provided with a restriction formed in the passage thereof, the restriction being located above said fluid-inlet openings, and a pin-like baffle element in the pipe member to create a turbulence in the stream therein when the aspirator tube is operative to suck solution from the reservoir, the baffle element having a head cooperating with said restriction in the pipe member.

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