W.C. pressure cistern with air bag and injector

A pressure cistern for flushing a toilet, with an airbag, an injector and its own outlet valve.

A pressure cistern for flushing a toilet (fig. 1), containing an airbag (2) or airbags. It fills with water through an injector (3) which also supplies the air vessel with air pumped in from the atmosphere through a non-return valve (5). The valve in figure 2 may be fitted to the cistern, or the valve in figure 3 may be fitted to the cistern's outlet pipe, so that water flows out through the valve in figure 2 or figure 3 towards the toilet bowl.
Description

[0001] The invention refers to a WC cistern (fig. 1) consisting of the shell of an air vessel which meets requirements for strength as well as economy of space and aesthetics. The cistern includes an airbag and its air valve, an injector with a non-return valve on its intake and an outlet valve leading to the toilet bowl.

[0002] There are two basic methods of toilet flushing:

1. The various types of gravity cisterns which are fed through a valve and include a float to regulate water level.
2. The various types of pressure valves which must be fed by a pipe of an appropriate diameter from the water supply system.

[0003] The advantages of this invention are:

1. The system is fed by an economical half-inch pipe.
2. There is no need for a float or cut-off valve.
3. It is not necessary to elevate the cistern to exploit gravity.
4. Since the water is ejected into the bowl under pressure, flushing results are better and less water is consumed.

[0004] The WC cistern (figure 1) with airbag and injector is comprised of the shell (1) which is cylindrical, spherical etc. in shape and conforms to materials strength requirements but can also be fitted in the space in an aesthetically pleasing manner.

[0005] Inside the air vessel we place an elastic airbag with a valve suitably protruding from the shell. On the bottom side of the air vessel (shell) we have created a hole for connecting the outlet pipe and valve. The valve may be fitted to the cistern shell or to its discharge pipe. Valves are shown in figures 2 and 3 respectively.

[0006] In addition, the hole is large enough to allow the empty airbag to fill up with air when required.

[0007] Also fitted to the shell of the air vessel is the connection with the water supply, via the injector, through the city's or ship's water mains. The injector has a non-return valve for uptake of atmospheric air.

[0008] We prepare the system for operation by filling the airbag (2) through its valve (3) with air under 0.2-0.3 atmospheres of pressure, more or less, depending on what is technically desirable.

[0009] We close the discharge valve (6) and open the water supply valve via the injector (4). Mains water, usually under 3-5 atmospheres of pressure, will pass through the injector (4) and fill the cistern (1), at the same time sucking in atmospheric air and pushing it into the air vessel.

[0010] The water that flows in occupies the bottom part of the space, compressing the air which enters through the injector, as well as the air inside the air bag in the top part of the space. The inflow of water will continue until the pressure of the compressed air is equal to the pressure of the water, which is 3-5 atmospheres. The non-return valve (5) which lets air in through the injector is already closed, preventing water from flowing outward. The more air pressure we have in the airbag (2), the less water will enter, and vice versa.

[0011] By now opening the discharge valve (6), the water, compressed by the air, will gush out into the bowl, with a steadily decreasing outflow, according to the principle \( P_1 V_1 = P_2 V_2 = \text{constant} \). To be sure, the system may be operated with the airbag only, or with the injector only, but using both ensures more foolproof operation.

[0012] The system's discharge valve (figures 2 and 3), fitted either on the air vessel (cistern) or on the outlet pipe, operates smoothly, in full harmony with the principles of operation of the system. The valve (figures 2 and 3) consists of two plungers (1 and 2), fitted with rubber rings (3) to make them watertight. The plungers are attached to a rod (4), at a suitable distance from each other. The rod (4) protrudes above the cover (5) and is connected to a knob (6) to pull the rod (4) and the plungers (1 and 2), which are held down by a spring (7), so that the lower valve/plunger (2) rests in the base (8) which has been suitably formed at the bottom of the jacket (9) of the valves (fig. 2 and 3).

[0013] The jacket (9), at a suitable distance above the lower valve/plunger (2) and below the pressure equalising plunger (1) has slots (10) through which the water flows out towards the toilet bowl when the knob (6) is pulled, raising the rod (4) together with the plungers (1 and 2). Plunger (2) uncovers the outlet slots (10) and the water flows out into the bowl.

[0014] The valve operates in the following manner: When the cistern has emptied and is at zero pressure, the tension of the spring (7) pushes the rod (4) together with the plungers (1 and 2) downards, and the valve/plunger (2) closes the outlet slots (10).

[0015] The cistern begins to fill with water from the pipe (11) and pressure gradually builds up in the space. The pressure acts upon equal surfaces of the plungers (1 and 2) above and below, so that the force exerted on the knob (6) by the pressure is zero.

[0016] Thus when we pull the knob (6) upward, initially we overcome the downward force exerted by the tension of the spring, but by pulling the knob we also uncover the slots (10) and then the pressure is also exerted on the bottom surface of the plunger (2). Therefore the resultant of the forces acts in an upward direction and the valve is kept open until the cistern empties and the pressure within it falls. Then the spring (7) pushes the rod (4) downward, the plunger/valve (2) seals off the slots (10), and the cistern again begins to fill from the pipe (11).

[0017] The valves pictured in figs. 2 and 3 are of the same type, but the valve in fig. 2 can be incorporated in the system, whereas the valve in fig. 3 may be fitted to the outlet pipe in any position the user desires.
Claims

1. Pressure cistern (fig. 1) for flushing toilet, with an airbag and an injector. Features include a watertight air vessel (1) suitably designed to provide durability, efficiency and good utilisation of space.

   One or more elastic airbags (2) inside the shell (1) with an air valve protruding from the shell (1) through which air under 0.2-0.3 atmospheres of pressure, more or less depending on what is technically desirable, can enter or exit the elastic airbag (2).

   Fitted to the pipe connected with the city’s or ship’s water supply is an injector (4), before the point where the water enters the air vessel (1). On the injector’s intake (4) we place a non-return valve (5) through which atmospheric air is sucked when the air vessel (1) fills with water. This air enters the air vessel (1) under the same pressure and at the same speed as the water and occupies the top part of the air vessel (1) and the space around the elastic airbag (2), which shrinks into the upper space of the air vessel, compressed by the rising level of the water.

   When the difference in pressure between the water and the air vessel decreases sufficiently, the vacuum in the uptake of the injector (4) is reduced and the non-return valve (5) closes, preventing the water from returning outward.

2. According to the specification, another feature of the pressure cistern (fig. 1) is an outlet valve (fig. 2) incorporated in the shell, and a valve (fig. 3) suitable for fitting on the outlet pipe. Both valves work in the same manner.

   The main parts of the valve are: The cylindrical jacket (9) with slots (10), the base (8), the cover (5), the rod (4), two plungers/valves (1 and 2) for equalising pressure and watertightness, with rubber rings (3), a spring to shut off the flow of water to the bowl (7) and a knob to pull the rod upwards and begin the flushing action (6).

3. The pressure cistern (fig. 1) for flushing a toilet in accordance with specifications (1) and (2) can be of any shape, in harmony with materials strength and utilisation of space.