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APPARATUS FOR PREVENTING RETURN-FLOW OF LIQUID FROM A RECEPTACLE SUPPLIED UNDER PRESSURE BY A SUPPLY NETWORK BACK INTO THE LATTER

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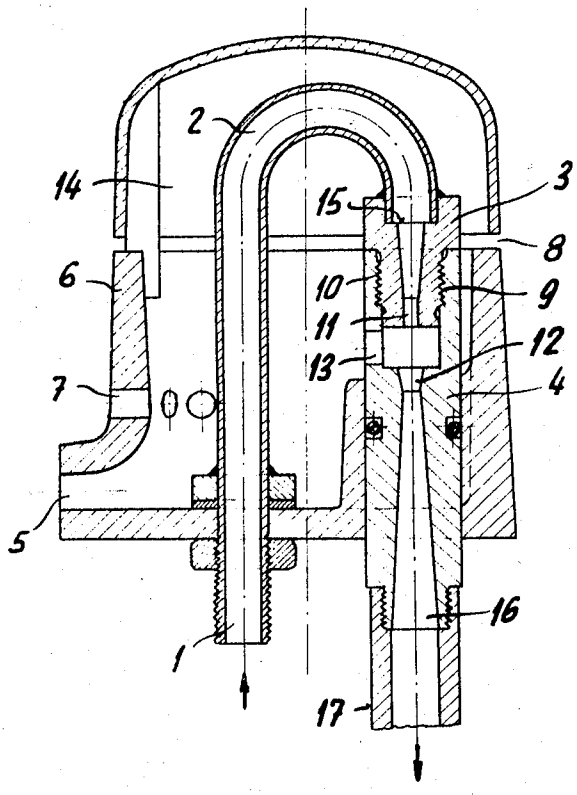

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APPARATUS FOR PREVENTING RETURN-FLOW OF LIQUID FROM A RECEPTACLE SUPPLIED UNDER PRESSURE BY A SUPPLY NETWORK BACK INTO THE LATTER

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ABSTRACT OF THE DISCLOSURE

A method and apparatus is disclosed for preventing the return-flow of liquid from a receptacle or tank supplied under pressure by a supply network. The subject invention serves to transform the pressure energy of the incoming liquid from the supply network into approximately pure kinetic energy in the form of a liquid stream or jet, this liquid stream or jet communicating with atmospheric pressure and, thereafter, at least a portion of the liquid stream being at least partially transformed back into pressure energy. In one form, the subject invention comprises a nozzle and a diffuser, the nozzle and diffuser being substantially axially aligned and cooperating with one another to provide therebetween a free space communicating with the atmosphere, the diffuser having a smaller flow capacity than the nozzle.

The present invention has reference to an improved method for preventing the return-flow of liquid from a receptacle or tank supplied under pressure by a supply network back into the supply network upon the appearance of an underpressure at the latter and improved apparatus for the performance of the aforesaid method.

A number of different methods and apparatuses are already known to the art for the purpose of preventing return-flow of liquid from a receptacle or container supplied under pressure by a supply network back into the latter upon the appearance of an underpressure at such supply network. Thus, for instance, in lavatory flushing installations or spray apparatus for washing the lower regions of the body there have been employed either flushing tanks or pumps which, among other things, should prevent that upon rupture of a conduit of the supply network, wherein there can appear a vacuum and thus return-flow, feces or other waste material is sucked back into the supply network. However, the use of a flushing cabinet or tank requires a great deal of space and a pump is expensive in both cost and maintenance.

Accordingly, it is a primary object of the present invention to effectively overcome the aforementioned disadvantages of the prior art.

A further important object of this invention has reference to an improved method of, and apparatus for effectively preventing return-flow from a receptacle or the like back into a supply network upon appearance of an underpressure at the latter, wherein the apparatus is relatively simple and compact in construction, economical to manufacture, highly reliable in operation, and does not require any great maintenance or servicing.

Still another important object of this invention has reference to an improved method and apparatus for effectively preventing undesired return-flow of a liquid, particularly in connection with sanitary installations, which is foolproof in operation and easy to install at existing sanitary systems.

The method of the present invention for preventing the return-flow of liquid from a receptacle supplied under pressure by a supply network back into the latter upon the appearance of an underpressure in such supply network is characterized by the features that the pressure energy of the liquid coming from the supply network is transformed in a nozzle into at least approximately pure kinetic energy, thereafter the liquid stream or jet is communicated with atmospheric pressure or the atmosphere along a path which is above the highest possible liquid level in the receptacle, and thereafter at least a portion of the liquid stream is conducted into a diffuser where the kinetic energy thereof is at least partially again transformed back into pressure energy.

The present invention also pertains to an improved apparatus for carrying out the aforementioned method which incorporates a nozzle and a diffuser. More specifically, both said nozzle and diffuser are axially aligned and they cooperate with one another such as to provide therebetween a free space which communicates with atmosphere, and the liquid stream flowing from the nozzle to the diffuser freely traverses such free space and thus also communicates with atmosphere.

The inventive apparatus structure is particularly useful for separating the water infeed for sanitary installations from the supply network, especially for use with spray devices for washing the lower regions of the body, bidets, lavatory flushing installations and the like.

Other features, objects and advantages of the invention will become more readily apparent by reference to the following detailed description and the single figure of the drawing which depicts an exemplary, preferred embodiment of inventive apparatus.

The depicted embodiment of apparatus can be used to advantage with any suitable sanitary installation in order to prevent return-flow of water, for instance from a non-illustrated receptacle back into a non-illustrated supply network upon the appearance of an underpressure at the supply network, as such might be caused if a conduit thereof ruptured.

Insofar as actual physical structure of the apparatus is concerned, it will be understood that the water coming from the non-illustrated supply network under pressure is delivered via the connecting nipple or pipe stud **1** through a curved conduit **2** to the nozzle **3** which is shown to converge from its inlet end **15** towards the discharge end **11** thereof and is capable of converting pressure energy into kinetic energy in the usual manner. Both the conduit **2** and the nozzle **3** are located within a hollow housing **6**. In the exemplary embodiment this nozzle **3** has a threaded portion **9** engaging with a complementary threaded portion **10** of a diffuser **4** which is also at least partially located within the hollow housing **6**. Nozzle **3** and diffuser **4** are aligned with one another and the discharge end or outlet **11** of the nozzle **3** is spaced from the inlet **12** of the diffuser **4** to provide therebetween a free path or space **13** which communicates with atmosphere, as will be explained shortly, and through which freely traverses the stream or jet of water when moving from the nozzle **3** into the diffuser **4**.

It will be appreciated that in the nozzle **3** the pressure energy of the water coming from the supply network is at least approximately transformed into pure kinetic energy, and then such water stream is brought into communication with the atmosphere along a short path, namely when traversing the free space **13**, and thereafter is at least partially conducted into the diffuser **4** where the kinetic energy of the water jet or stream is again at least partially transformed into pressure energy. Of course, the nozzle and diffuser could be completely spaced from one another, could also even be formed in a

common member. What is important is that they cooperate with one another to provide a free space or path communicating with atmosphere therebtween, specifically between the discharge end of nozzle and inlet of diffuser.

Moreover, the diffuser 4, in the illustrated embodiment, is designed in such a manner that only about 70% to 90%, and here assumed to be 85%, of the quantity of water flowing through the infeed conduit **2** and the nozzle **3** flows through the aforesaid diffuser **4**. By virtue of this measure, there is positively prevented that air is sucked into the diffuser 4, which is often-times undesirable. The excess water is withdrawn by a drain channel or conduit **5** located beneath the inlet opening **12** of the diffuser **4**. As an additional security measure there is provided at least one overflow bore **7** at the housing **6** which is located beneath the discharge opening **11** of the nozzle **3** yet above the highest point of the drain channel **5**, and which prevents that in the event of any possible clogging of the discharge or drain channel **5**, the free path or space **13** between the nozzle **3** and the diffuser **4** is not submerged in water and thus if there is any eventual rupture of a pipe of the water supply network, feces or other waste matter, for instance from a closet bowl cannot be sucked up. The slot **8** provided at the housing **6** serves to ensure that the inner compartment **14** thereof in which the entire apparatus is arranged is always under atmospheric pressure, in other words, that the free space **13** communicates with atmosphere, so that no return-flow is possible. Not only is the free space **13** above the highest level of water in the housing **6** but it is also above the highest possible level of the water in the non-illustrated receptacle to which the water jet or stream emanating from the discharge end **16** of the diffuser **4** is delivered via the pipe or conduit **17**.

While there is shown and described a present preferred embodiment of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced.

What is claimed is:

1. Apparatus for preventing the return-flow of liquid from a receptacle supplied under pressure by a supply network back into the supply network upon the appearance of an underpressure in the latter, said apparatus comprising a nozzle and a diffuser, said nozzle and diffuser being substantially axially aligned and cooperating with one another to provide therebetween a free space communicating with atmosphere, the liquid stream flowing from the nozzle to said diffuser freely traversing said free space and communicating with atmosphere, said diffuser having a flow capacity smaller than the flow capacity of said nozzle such that only a portion of the liquid stream delivered from said nozzle can flow through said diffuser, and drain means for draining the excess liquid comprising the remaining portion of the liqund stream delivered from said nozzle.

2. Apparatus as defined in claim **1**, wherein said nozzle has an inlet end and a discharge end, said diffuser having an inlet end and a discharge end, the discharge end of said nozzle and the inlet end of said diffuser being spaced from one another to provide therebetween said free space.

3. Apparatus as defined in claim **2**, wherein said nozzle converges from its inlet end to its discharge end.

4. Apparatus as defined in claim **1** wherein said flow capacity of said diffuser is such that 70% to 90% of the quantity of liquid delivered to said nozzle flows through said diffuser.

5. Apparatus as defined in claim **1**, further including a hollow housing in which said nozzle and diffuser are mounted, means provided at said hollow housing for communicating the interior of the latter and said free space with atmosphere.

6. Apparatus as defined in claim **5**, wherein said hollow housing is provided with said drain means positioned beneath said free space to ensure that the highest level of the liquid which may collect in the hollow housing is below said free space so that the latter continually communicates with atmosphere.

7. Apparatus as defined in claim **6**, wherein said drain means incorporates at least one discharge channel at the lower region of said hollow housing and at least one overflow bore located above said discharge channel.

References Cited

UNITED STATES PATENTS

1,830,955	11/1931	Moseley	137—216 X
2,056,357	10/1936	Luff	137—216
2,287,534	6/1942	Powers	137—216
3,072,137	1/1963	McDougall	137—216
3,155,106	11/1964	Baron	137—216
3,183,923	5/1965	Henrikson	137—216

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