

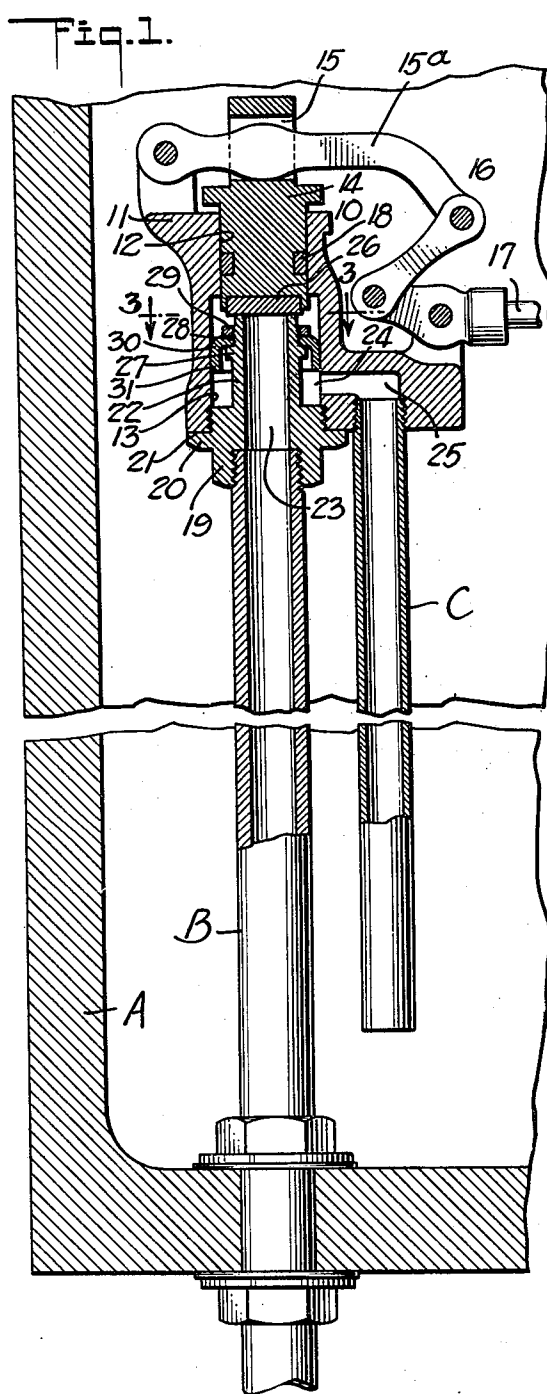
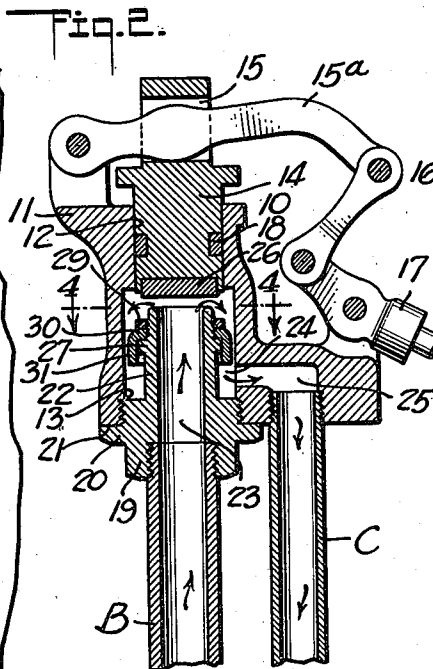
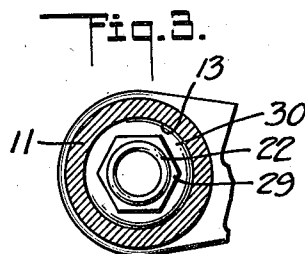
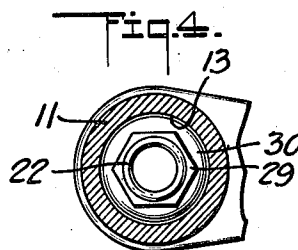
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VALVE MECHANISM

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VALVE MECHANISM

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12 Claims. (Cl. 251-133)

My invention relates to valve mechanisms generally and same is more particularly designed and intended for use in conjunction with plumbing systems.

5 Broadly speaking, my invention has for an object the provision of automatically controlled mechanism which, for example, will serve to positively destroy communication in one direction between a ball cock or a flush valve and
10 the water intake pipe of an ordinary plumbing system at a time when there exists in the piping of the system conditions that tend to compel a return flow of flushing water to the intake pipe by induced siphonic action.

15 It is understood that many forms of flush valves will "back-siphon" from a plumbing fixture incident to the coming together at a critical instant of the required forces, such, for instance, as (1) upon the flooding of a toilet bowl,
20 with the resulting formation of a vacuum at the flush valve mechanism; (2) upon sudden movement of the valve from a normal closed position, the water in the bowl being, let us say, at a normal level, at which moment a slight vacuum
25 will be formed, the force of which is sufficient to cause a back siphonage at the flush valve; or (3) when under-sized water piping is employed in a building and two or more flush valves on the same riser are simultaneously operated, at
30 which time a vacuum will be formed at some other flush valve of sufficient force to induce a back-siphonage at said other valve.

An analysis of water samples taken from drinking fountains and lavatories disclosed,
35 without question, the presence therein of bacteria coli. These fountains and lavatories were regularly installed in a plumbing system of usual form. A laboratory test of a common form of flush valve taken from the same system proved
40 that the plunger of the valve would jump open and with the water in the bowl at its normal level a vacuum was formed at the valve, the force of which was sufficient to cause back-siphonage, thus proving very conclusively that flush water
45 may get by the valve and re-enter the intake pipe even though the water in the bowl occupies its normal level. It has been further proven that in the tank type of water closet, if the onset of a vacuum occurs when the float is down and
50 the ball-cock is thus open for refilling the tank, the remaining contents of the tank will be withdrawn back into the building piping system by the vacuum thus produced. It obviously follows that when once flushing water has been
55 delivered to a flush tank it is not intended, for

sanitary reasons, that it be used at any other place in the system. Conditions existing in the common forms of flush tanks are known to be such as will necessarily promote the growth
5 of algae or fungi, slime and other filth, and that this water is thus polluted and contaminated. Should one drink thereof sickness could obviously be expected to follow. It should, therefore, be borne in mind that regardless of the
10 type of flushing means employed in any conventional system, same is most always an integral part of the system, and is, therefore, connected in the same piping from which water is intended to be delivered to other fixtures,
15 such as sink and tub faucets, drinking fountains, etc. It is clearly to be understood, therefore, that water which has been polluted may, at some time or another, find its way to those fixtures where use of such water would be dangerous.

An important object of my invention is to
20 provide a valve mechanism whose parts are so structurally designed that when a vacuum is formed in the intake pipe or line it will automatically act directly upon the mechanism and effect an instantaneous sealing off of the
25 polluted or contaminated water at the fixture with which it is used, thus positively preventing this water from returning to the intake pipe where it would otherwise be permitted or, in fact, compelled, to find escape from some other fixture
30 in the system.

When the invention is employed in association with water closet flush tanks, its design, construction and arrangement of parts employed
35 are such that the operation of the mechanism will in no manner be interfered with by movements of the valve plunger.

Another object is to provide in said mechanism means which will function as set forth,
40 and in addition thereto enable the mechanism to operate in a perfectly quiet manner at all times.

With the above and other objects in view, which will appear as the nature of the invention is better understood, the same consists in the
45 improved construction and novel arrangements of parts which will hereinafter be fully described and particularly pointed out in the hereto appended claims.

In the accompanying drawing has been illustrated a single and preferred form of the invention wherein same is employed as a ball
50 cock, it being understood, however, that this is not to be considered as a limitation, but that
55

it may be employed in connection with flush valves or other valve mechanisms.

In the said drawing,

Figure 1 is a vertical section through the mechanism with the flexible sealing means in a closed position;

Figure 2 is a view similar to Figure 1, showing the flexible sealing means in an open position;

Figure 3 is a section taken on line 3—3 of Figure 1;

Figure 4 is a section taken on the line 4—4 of Figure 2.

In the drawing, A designates a flush tank of usual form, the same provided with a vertical water intake pipe B which extends upwardly into the tank and through the bottom thereof in the customary manner.

Upon the upper end of the pipe B is mounted a ball cock 10, the same consisting of a casing 11 having a vertical bore 12 of small diameter and a communicating larger bore 13. The reduced bore 12 has slidably mounted therein a plunger type valve element 14 whose upper end is operatively connected at 15 to the power transmitting or lifting arm 15a of any well known form of link mechanism 16 with which the float rod 17 is connected as shown. It follows that from the arrangement of the parts just referred to motion in a vertical direction will be imparted to the plunger 14, according as the rod 17 is moved in one direction or another, as is the ordinary operation of such mechanisms. The plunger 14 is provided with an annular sealing ring 18 which coacts with the walls of the bore 12 to provide a water tight joint between said walls and said plunger.

Threadedly secured to the lower end of the casing 11 is a member 19, the same having a broad base flange 20 whose upper face is adapted to be securely advanced against the adjacent flat face 21 of the casing, so as to securely seal the lower end of the bore 13 against leakage. This member is formed with a tubular extension 22 which passes part way into the enlarged bore 13 and same is formed with an axial intake port 23 which connects directly with the water intake pipe B. The extension 22 is concentrically related to the walls of the said bore 13 so that an annular water chamber 24 is thus formed, between the extension and said walls, the purpose of which I will explain presently. Formed in the lower body portion of the casing 11 is a radial port way 25, one end of which opens to the chamber 24 and the other end thereof connects with the upper end of a depending filling tube or pipe C from which latter water may be taken into the tank A when the link mechanism 16 is actuated in the usual manner. The upper end of the extension 22 constitutes a valve seat against which the sealing disk or face 26 at the lower portion of the plunger 14 is adapted to bear when the plunger is in its fully lowered position.

Intermediate of its ends and formed as an integral part of the extension is an annular shoulder 27 and above said shoulder said extension is threaded as at 28 for the adjustable accommodation of a clamping nut 29. Interposed between said nut 29 and said shoulder 27 is a flexible cupped washer 30. This washer is preferably formed of thin leather or other suitable well known material, and same has an annular skirt 31. It will be noted that with the skirt interposed between the peripheral surface

of the shoulder 27 and the walls of the enlarged bore 24, a clearance is provided between the inner face of said skirt and said peripheral surface of the shoulder so as to allow said skirt to move radially to one or the other of two extreme positions. When the skirt is spread outwardly to its full extent, its exterior face is yieldingly and firmly presented to the walls of the chamber 24, at which time no water will be allowed to flow past same in a direction leading from the port way 25. When the skirt moves to its other extreme position, where its inner face is presented rather securely against the periphery of the shoulder 27, an annular space will be provided between the walls of the bore 13 and the exterior surface of the skirt, whereby to permit water as it leaves the seat end of the extension 22 to flow downwardly into the chamber 24, thence to the filling pipe C by way of the port way 25, such as would be necessary when filling the tank C. This will be clearly understood on reference to Figures 2 and 4 of the drawing.

Having described the essential structural features of the invention and the operative relationship of one structural part to the other, their functional actions will be described as follows:

When the plunger 14 is elevated so as to uncover the seat at the upper end of the extension 22, water may freely pass to the tank A, as previously described. It will be appreciated that by reason of the pressure behind the water the skirt 31 will be acted upon thereby and circumferentially contracted, at which time the aforesaid space will be formed between the external surface of the skirt and the walls of the bore 13. It is for this reason that an unobstructed passageway is provided, whereby the water may quickly enter the tank. The flexible non-metallic action of the leather skirt affords means which acts to effectively silence the movement of the water as it proceeds over the course just referred to. More or less of a hush well is provided beneath the skirt, and this too functions to materially quiet the action of the mechanism during the movement of said water. Now, let it be assumed that due to any one of the several causes first above referred to a vacuum is formed in the pipe B, at which time the plunger 14 is slightly raised from its seat. In consequence thereof, an upward pulling force is created in the bore 13 at a point just above the skirt 31 and of sufficient amplitude to expand or spread the skirt circumferentially, thus firmly forcing its external surface against the walls of the bore 13 so as to positively prevent water in the tank A from finding passage to the pipe B. The skirt, therefore, acts as a valve which automatically co-acts with the element 14 during regular admission or supply of water to the tank, and, secondly, as a valve to seal off the tank A from said pipe B. In view thereof, I shall, in the claims to follow, refer to said skirt broadly as a flexible pneumatically influenced non-metallic valve. The plunger 14 and its co-acting seat constitute the intake valve by means of which water may be supplied to said tank.

It is to be understood that I have, merely for the purpose of suitable illustration, named certain causes that are responsible for back siphonage in plumbing systems, but that many additional causes could be readily added to those first referred to. It may be generally stated that no matter what may be the precise cause for this back siphonage, the mechanism

herein fully disclosed and described has been found most reliable for the purpose of arresting the reverse flow of water when pressure or suction in the line tends to set up a reverse flow in said line. It follows that whenever in plumbing systems there is a submerged inlet, water will of necessity be diverted from the fixture, the moment a particular valve or other cross connection jumps open.

What is claimed is:

1. A valve structure comprising a casing having water intake and discharge ports and a by-pass chamber into which said ports open; a member extending into the chamber in spaced-apart relationship to the walls thereof, the intake port being formed in said member; the member terminating at one end in a valve seat; a liquid controlled valve element co-operable with the seat to cover and uncover the said intake port; and non-metallic, circumferentially expansible and contractible valve means interposed between the member and the walls of the chamber and co-operable with the latter when in one position and when the aforesaid valve element is moved to uncover said seat to allow water to be transferred to the outlet port from said intake port and adapted when in another position and when said element is moved away from its seat to arrest a return flow of water to the intake port from said discharge port.

2. A valve structure comprising a casing having an axial bore and a member having an extension passing into the bore and bearing a relationship to the walls thereof so as to define an annular chamber between said walls and the extension, the extension having an intake port co-operable with the chamber and adapted to effect a transfer of water to the chamber, a liquid controlled valve element co-operable with the port and serving to normally close same and adapted to respectively cover and uncover same; the casing having a discharge port opening to the chamber, and a flexible non-metallic valve located in the chamber at a point between the discharge port and the intake port and co-operable with the walls of the chamber so that when the valve element is moved to uncover the intake port, water discharging from said intake port may freely pass said flexible non-metallic valve and flow to said outlet port, the said valve being also directly co-operable with the discharge port so that when the valve is acted upon by suction induced at the intake port and the latter is uncovered, a return flow of the water to the intake port from the discharge port will be arrested.

3. A valve structure having a chamber, means extending into the chamber and provided with an intake port adapted to open into the chamber, an axially movable liquid controlled valve element co-operable with said means to respectively cover and uncover said intake port and serving to normally cover same, said means being concentrically spaced from the walls of said chamber, the structure having a discharge port opening to the chamber, and an annular skirt surrounding said means at a point to one side of the discharge port being of a flexible non-metallic material capable of being acted upon by the pressure of water as the water leaves the intake port so as to allow the water to flow to said discharge port and to be acted upon by suction induced at one side thereof to

arrest a return flow of water to the intake port from said discharge port.

4. As a new article of manufacture, means for arresting a return flow of water to the intake pipe of a valve structure of the type including a sliding liquid controlled valve element for controlling admission of water to a discharge port of the structure and including a chamber in which the valve element is adapted to operate, comprising a member having a part adapted to be inserted into the chamber and formed with an intake port adapted to co-act with said valve element; and suction actuated valve means carried by said part and positioned to co-act with the walls of the chamber and the intake port so as to arrest a return flow of water to the intake port of the member from the discharge port of the structure upon the setting up of a suction in the chamber of the structure, and adapted to be acted upon by the pressure of water during movement of the water from the intake port to said discharge port.

5. As a new article of manufacture, means for arresting a return flow of water to the intake pipe of a valve structure of the type including a sliding liquid actuated valve element for controlling admission of water to a discharge port of the structure and including a chamber in which the valve element is adapted to operate, comprising a member having a part adapted to be inserted into the chamber and formed with an intake port adapted to co-act with said valve element; and suction actuated valve means carried by said part and positioned to co-act with the walls of the chamber and the intake port so as to arrest a return flow of water to the intake port of the member from the discharge port of the structure upon the setting up of a suction in the chamber of the structure, and adapted to be acted upon by the pressure of water during movement of the water from the intake port to said discharge port, said suction actuated valve being characterized by a flexible radially movable skirt extending about said part.

6. A valve mechanism comprising a structure provided with a by-pass chamber, an intake port and an outlet port, the former occupying a position axially of the chamber and being formed so that its exterior walls are spaced apart from the walls of the chamber, a slidably mounted liquid controlled valve element co-operable with the intake port and normally closing same, and an annular pressure influenced valve element of flexible material concentrically positioned in the chamber and extending about the exterior walls of the intake port and including an annular skirt cupped in the direction of the discharge port and movable freely relatively to the walls of said chamber, as and for the purpose set forth.

7. A valve mechanism comprising a structure provided with a by-pass chamber, an intake port and an outlet port, the former occupying a position axially of the chamber and being formed so that its exterior walls are spaced apart from the walls of the chamber, a slidably mounted liquid controlled valve element co-operable with the intake port and normally closing same, and an annular pressure influenced valve element of flexible material concentrically positioned in the chamber and extending about the exterior walls of the intake port and including an annular skirt cupped in the direction of the discharge port and movable freely relatively to the walls

of said chamber, the walls of the intake port terminating in a seat against which the sliding element is adapted to engage.

8. A valve mechanism for flushing apparatus comprising a casing; a reciprocally mounted liquid controlled valve in said casing; the casing having a discharge port; means closing one end of the casing and having an extension situated in the casing and spaced concentrically from the inner walls thereof to provide a chamber between the latter and the external walls of the extension; the extension having an intake port for transferring water to the discharge port by way of said chamber; the extension having one end formed to provide a seat which is co-operable with the reciprocal valve to enable the intake port to be opened and closed by the valve and said valve being normally engaged with said seat; and a valve carried by the extension and co-operable with the inner walls of the chamber to open the discharge port to the intake port when the reciprocal valve is opened and to close the discharge port from the intake port against return movement of water to the latter from the discharge port should the reciprocal valve leave its seat.

9. In a valve organization for water closet flush tanks of the float actuated type; a casing having a ported member for attachment to a supply pipe for water under pressure and said casing having a chamber into which said member is extended and into which water can discharge from the port of the member and said member being concentrically spaced apart from the walls of said chamber; the member terminating at one end in a valve seat disposed within the chamber; the casing having a filling pipe in communication with the chamber; a fluid pressure actuated valve in said chamber movable relative to the walls thereof to respectively open and close communication between the port of the member and said filling pipe; and a float actuated valve movable in the chamber relative to the seat of said member and being normally engaged therewith to close the port of the member from said chamber.

10. A valve mechanism comprising a casing having an intake port and a valve movable in the casing from a position closing the port to a position opening same; said casing having a discharge port to which liquid can pass from

the intake port when the latter is open; a circumferentially expansible and contractible valve in said casing, the size of which will enable same to close against the inner walls of the casing when the valve is expanded; and means for mounting the last named valve to dispose same between said ports to enable same when expanded to close the intake port from the outlet port and adapted when contracted, to provide a circumferential clearance between said valve and the inner walls of the casing for passage of liquid to the outlet port from said inlet port.

11. A valve mechanism comprising a casing having an intake port and a valve movable in the casing from a position closing said port to a position opening same; said casing having a discharge port to which liquid can be conducted from the intake port; an expansible and contractible valve in the casing, the size, form and position of which relative to the inner walls of the casing and the intake and outlet ports enable the valve to be contracted by pressure of liquid thereagainst so that liquid can pass to the outlet port from said inlet port and whereby said valve can be expanded against said inner walls of the casing by suction induced at the intake port to prevent return flow of liquid to the intake port from said outlet port.

12. A valve mechanism comprising a casing having liquid intake and outlet ports; a valve co-operable with the intake port; means for controlling said valve to respectively open and close said intake port; and a cup-shaped valve contained in the casing and disposed between the intake port and said outlet port and being of a size and of a material to enable such contraction thereof by pressure thereagainst of liquid when said first valve is opened by said controlling means to enable liquid to pass from the intake port to the outlet port and between the circumference of the valve and the inner walls of the casing, and said valve being expansible against the inner walls of the casing by suction induced at the intake port, thus closing the latter from the outlet port against return flow of liquid to the inlet port from said outlet port.

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