

- [54] **FLUID CONTROL VALVE**  
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 [21] **Appl. No.:** 36,265  
 [52] **U.S. Cl.:** 137/359, 137/119, 137/467, 4/148  
 [51] **Int. Cl.:** F16k 51/00  
 [58] **Field of Search:** 137/119, 467, 359, 360; 4/145, 4/148

3,499,940 3/1970 Gibbs.....137/119 X

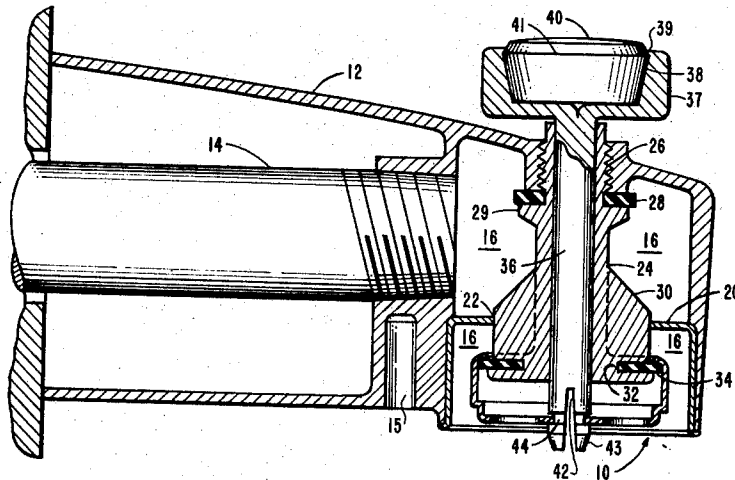
*Primary Examiner*—Harold W. Weakley  
*Attorney*—Fraser and Bogucki

[57] **ABSTRACT**

A diverter valve is provided which in a preferred embodiment has an outlet chamber which communicates with a water supply. A seat within the chamber has a central aperture through which water flows to the tub when the valve is open. The valve is closed by moving the restricted mouth of a cup against the seat where water pressure against the restricted mouth holds it in place. Standing water drains through holes in the bottom of the cup which are sealed by a flexible seal attached to a fixed post when the water pressure exceeds a selected amount. The absence of moving parts on the high pressure side of the seat and a pressure compensation feature keep the valve action smooth and uniform, regardless of water pressure.

- [56] **References Cited**  
**UNITED STATES PATENTS**  
 3,336,935 8/1967 Ward.....137/119  
 3,416,555 12/1968 Chapou .....137/119  
 3,459,207 8/1969 Bacheller.....137/119  
 3,461,901 8/1969 Bucknell.....137/119

**8 Claims, 7 Drawing Figures**



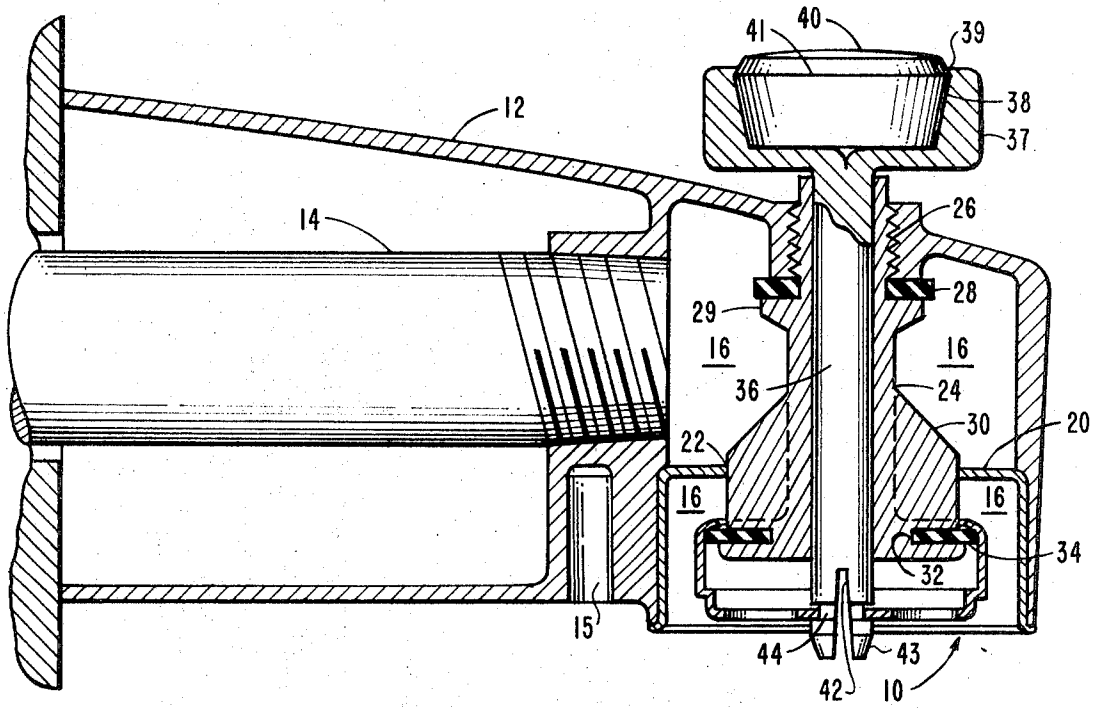


FIG.-1

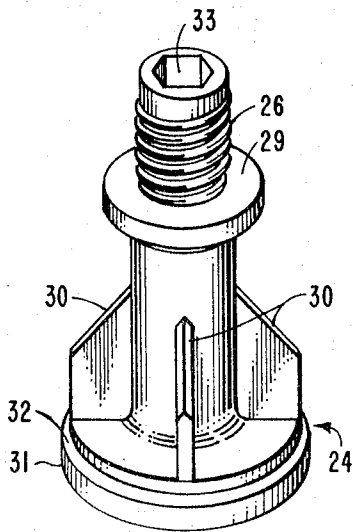


FIG.-2

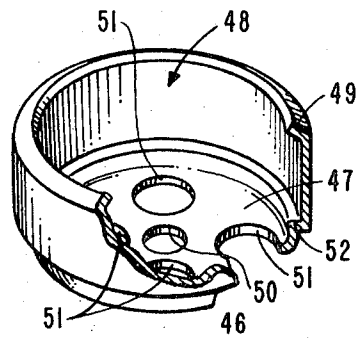


FIG.-3

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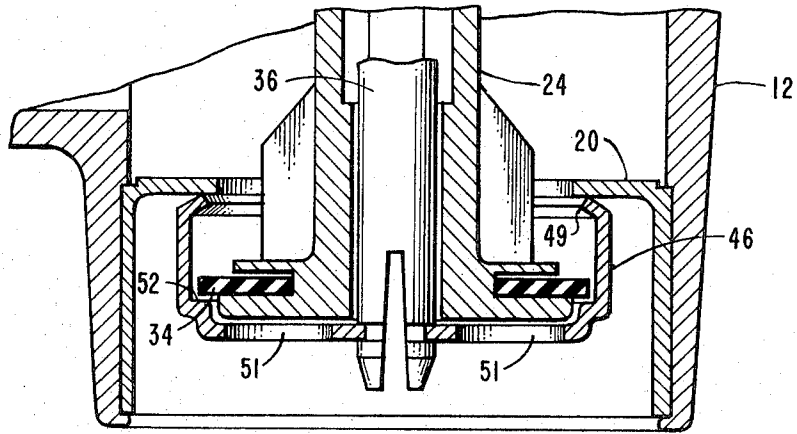


FIG.-4A

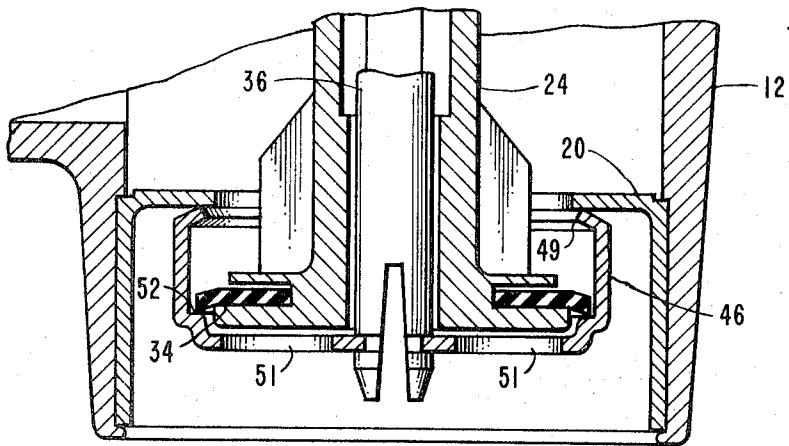


FIG.-4B

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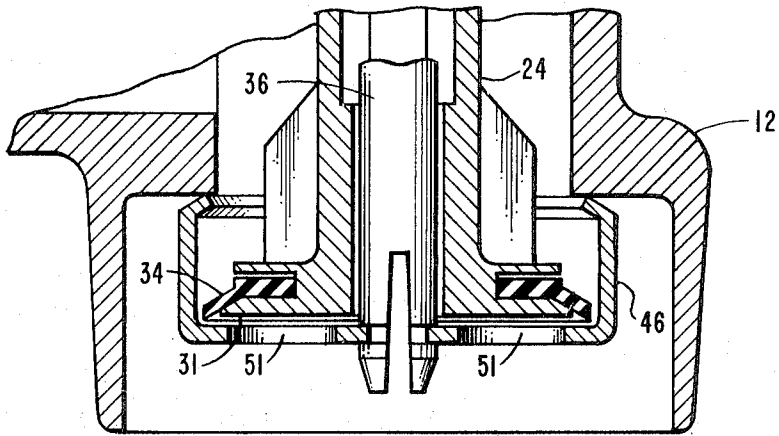


FIG.-5A

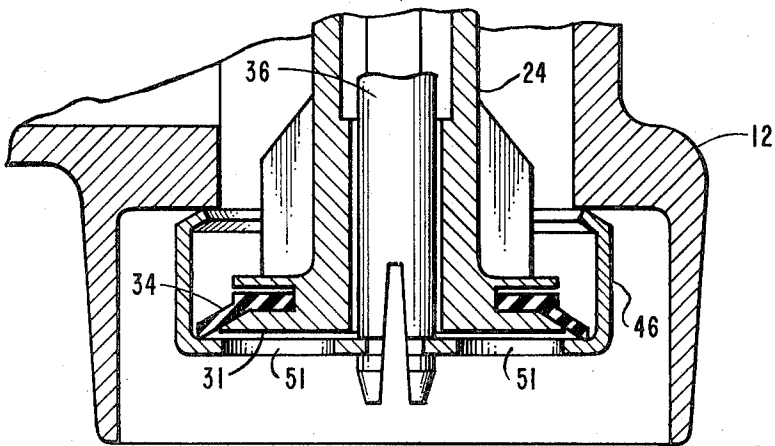


FIG.-5B

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## FLUID CONTROL VALVE

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates to an adjustable, replaceable valve assembly for controlling the flow of a fluid. The assembly may be employed in various applications for controlling the flow of fluid in a conduit as well as for diverting the flow of fluid from one path to another. In a preferred embodiment shown herein the assembly of the invention comprises a valve for diverting water between a bathtub and a shower. When the valve is closed passage through the bathtub spout is blocked and water is forced through a shower riser to the shower head. Water pressure holds the valve in the closed position. When the water supply is turned off a seal opens up allowing water to slowly drain from the shower riser. When the water level drains below a certain point the water pressure which holds the valve in the closed position is overcome by gravity causing the valve to open. Because the valve opens automatically when the water is shut off, the water will always be diverted to the tub when turned back on and a person cannot be accidentally sprayed with water.

## 2. Prior Art

Many tub-shower diverter valves have been devised in the past. A common type which is currently in use incorporates a sliding gate valve operated by a lift button and is disclosed in the now expired patent, R. H. Zinkil et al., U.S. Pat. No. 2,022,875. When the gate is raised flow to the tub is blocked and diverted to the shower. These gate valves have several disadvantages, one being that if the gate is raised slowly water pressure causes it to bind, thereby making complete closing of the valve difficult. In addition, the effort needed to open or close the valve as well as the leak rate past the gate varies with the water pressure. Another disadvantage is that relatively expensive castings must be used having rather close tolerances.

Another type of diverter valve is disclosed by P. A. Mongerson, U.S. Pat. No. 3,473,558. This arrangement uses a cylindrical diverter sliding within an annular seal. However, to maintain the sliding seal the cylindrical diverter and annular seal must be made with a great deal of precision, thereby increasing manufacturing costs. Furthermore, the build-up of mineral deposits on the cylindrical diverter soon interferes with sliding movement within the annular seal.

## SUMMARY OF THE INVENTION

This invention provides a cup valve for controlling the flow of a fluid. In a preferred embodiment shown herein the valve is employed for diverting water between a tub and a shower. When the valve is closed, flow to the tub is blocked and the water is forced through the shower pipe to the shower head. Gravity causes the valve to open automatically when not held closed by water pressure.

The cup valve assembly is contained within the bathtub spout which has an outlet chamber communicating with a water supply. Within the chamber is located a seat having a central aperture therein. A post extends through the aperture and is fastened by threads at one end to the spout. The other end has a cylindrical head, the circumference of which includes a groove which receives a flexible washer-shaped seal. A central bore runs through the length of the post and receives a stem, the bottom end of which is attached to a cup. The top end of the stem terminates in an enlarged handle which has a cavity that receives a weight. The mouth of the cup, which is restricted by a flange, fits over the cylindrical head at the bottom end of the post. The bottom of the cup contains one or more holes and a sealing flange around its inside circumference. The post is adjusted to place the washer-shaped seal affixed to its head a very slight distance above the sealing flange at the bottom of the cup when the mouth of the cup is against the seat. The valve is closed by pulling up on the handle which extends above the spout, thereby pulling the mouth of the cup into contact with the seat where it is held in place by water pressure against the restriction at the mouth. The

flexible washer-shaped seal which is spaced very close to the sealing flange at the bottom of the cup flexes downward against the flange from the pressure of the water against it, sealing off the holes in the bottom of the cup. Thus all leakage is stopped.

The strength of the flexible washer-shaped seal and its spacing from the sealing flange are chosen so that when the water is shut off and the pressure against the washer decreases it will lift from the ridge, breaking the seal and allowing water to drain from the shower riser through the holes in the bottom of the cup. When the water level in the riser drops below a certain level, the upward pressure on the restrictive flange will be insufficient to resist the weight of the cup and handle and gravity will cause the cup to drop away from the seal, opening the valve. Because water drains automatically when the faucet is turned off, no water remains standing in the spout or shower riser to cause corrosion and no one can be accidentally sprayed because the valve automatically opens.

Unlike presently known diverter valves, this invention contains no parts which must make sliding contact while under high water pressure. The only parts having surfaces in sliding contact are the post and stem. Because these parts do not form a seal relatively inexpensive castings with large tolerances may be used. Furthermore, because there are no parts moving within the high pressure portion of the spout there can be no binding of sliding surfaces caused by unequal water pressure.

Another advantage of a cup valve according to this invention is that the force needed to open and close the valve is substantially independent of water pressure. As the water pressure increases, increased upward force on the restrictive flange at the mouth of the cup is substantially counter balanced by increased downward force on the flexible seal contacting the bottom of the cup. Thus, the net force on the cup remains substantially constant regardless of the water pressure. In one arrangement the post may be adjusted to a position where the force of the seal against the bottom of the cup holds the mouth of the cup very near, but not quite in contact with the seat. Under this arrangement the valve action is extremely smooth and the leakage is negligible.

## BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention may be had from a consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of a diverter spout and cup valve assembly according to the invention;

FIG. 2 is a perspective view of a post used in the cup valve assembly;

FIG. 3 is a perspective view partially broken away of a cup used in the cup valve assembly;

FIG. 4a is a cross-sectional view of a closed cup valve assembly under a low pressure leak condition;

FIG. 4b is a cross-sectional view of a closed cup valve assembly under a high pressure no leak condition;

FIG. 5a is a cross-sectional view of an alternate arrangement of a cup valve assembly under a low pressure leak condition; and

FIG. 5b is a cross-sectional view of an alternate arrangement of a cup valve assembly under a high pressure no leak condition.

## DETAILED DESCRIPTION

FIG. 1 shows a cup valve assembly 10 incorporating a bathtub spout 12 and a water pipe 14. When flow through the pipe 14 is blocked by the cup valve assembly 10, water is forced through a connecting shower riser (not shown). A cavity 15 in the spout 12 may receive a rod or other device for driving the spout 12 onto the pipe 14.

The cup valve assembly 10 includes a chamber 16 having an outlet. Located within the chamber 16 is a seat 20 having a central aperture 22. The seat 20 may be pressed from suitable non-corrosive material such as brass and may be slightly con-

cave downward to insure drainage through the central aperture 22.

A post 24 extends through the central aperture 22 and is fastened at one end to the spout 12 by screw threads 26. A compressible gasket 28 seals off the threads 26 from the chamber 16. As best shown in FIG. 2, the post 24 has a flange 29 which supports the gasket 28. Ribs 30 center the post 24 within the central aperture 22 and prevent the water stream from swirling. The circumference of the head 31 has a groove 32. A bore 33 runs longitudinally through the center of the post 24 having a hexagonal shape at the threaded end for driving the screw threads 26. These threads not only affix the post 24 to the spout but permit adjustment of its position. The post 24 is preferably made from a plastic material such as Noryl.

As shown in FIG. 1, a flexible washer-shaped seal 34 snaps into the groove 32. The seal may be punched from a sheet of synthetic rubber such as a Nitrile compound.

A stem 36 which extends through the bore 33 terminates at one end in an enlarged handle 37 having a cavity 38. A flange 39 is formed in the sidewall of the cavity 38 near the top. A generally cylindrical weight 40 has a small flange 41 in the sidewall which slips past the flange 39, thereby securing the weight 40 within the cavity 38. At the opposite end of the stem 36 a longitudinal slot 42 permits compression of the beveled tip 43. The slot 42 extends through a circular groove 44 near the beveled tip of the stem. The stem 36 can be made from a plastic material such as Nylon or Delrin and the weight 40 can be made of a heavy material such as stainless steel, brass or zinc.

As shown in FIG. 3 a cup 46 which may be stamped from a non-corrosive material such as brass has a bottom 47 and a mouth 48 which is restricted by a flange 49. The flange 49 slips over the washer-shaped seal 34 and the compressible tip 43 of the stem 36 fits into an attachment hole 50 in the bottom 47 of the cup 46. A groove 44 in the stem 36 the attachment hole 50 in the bottom of the cup 46. The bottom 47 also has drain holes 51 and a sealing flange 52 on the inside circumference.

When the cup valve assembly 10 is open, the restricting flange 49 rests against the washer disk 34 and water is free to pass through the aperture 22 in the seat 20.

The valve is closed by pulling up on the handle 37, thereby raising the cup 46 until the restricting flange 49 contacts the seat 20 as best shown in FIG. 4a. The position of the post 24 should be adjusted by means of the screw threads 26 to place the washer disk 34 a very slight distance above the sealing flange 52 of the cup 46 when the cup is in the closed position. If water is introduced into the spout 12 while the valve is closed the water enters the cup and exerts an upward force on the inside of the restricting flange 49 sufficient to hold the flange against the seat 20, thereby blocking the flow of water between the cup and the seat. In addition, as shown in FIG. 4b, the water pressure causes the washer-shaped seal 34 to flex downward, contacting the sealing flange 52 and sealing off the drain holes 51. Thus no water is able to pass through the cup valve assembly.

The water pressure within the valve is substantially reduced when the faucets are turned off, having only the head pressure from water standing in the shower riser. Under this reduced pressure the washer-shaped seal flexes upward, breaking the seal and assuming the configuration of FIG. 4a. Water can then seep between the washer disk 34 and the sealing flange 52 to drain through the drain holes 51 in the bottom of the cup. When the head pressure drops below a certain amount because of the drainage of water from the shower riser the upward pressure on the restricting flange 49 will be insufficient to overcome the force of gravity exerted on the cup 46, the stem 36 and the weight 40. At this point the cup will drop away from the seat 20, opening the valve.

Thus, even if a person forgets to open the valve after taking a shower, the shower riser will soon drain causing the valve to open automatically so that the next person using the bathtub or shower will not be sprayed accidentally. Furthermore, no

water is left to stand in the pipes or spout, causing corrosion and harboring bacteria.

An alternate configuration of a cup valve assembly according to this invention is shown in FIGS. 5a and 5b. FIG. 5a shows the closed valve under a low pressure condition. In this configuration the sealing flange is omitted, leaving the bottom of the cup flat, but the washer disk 34 extends below the head 31 of the post 24 until it almost touches the flat bottom of the cup. When the water pressure is increased the washer disk 34 flexes downward against the bottom of the cup and seals off the drain holes 51 in a manner similar to the configuration of FIGS. 4a and 4b as previously described. FIGS. 5a and 5b also illustrate an alternative arrangement for the seat 20. In this arrangement the seat is cast as an integral part of the spout 12 rather than being inserted as a separate element.

Although there have been described above specific arrangements of a cup valve assembly in accordance with the invention for the purpose of illustrating a preferred embodiment thereof, it will be understood that the invention is not limited thereto. Accordingly, any and all modifications, variations or equivalent arrangements which fall within the scope of the annexed claims and which may occur to those skilled in the art should be considered to be within the scope of the invention.

What is claimed is:

1. A cup valve assembly comprising:

a housing providing a fluid passage between a seat having a central aperture therein and a fluid supply, said housing having a small hole for receiving a stem;

a cup having a restricted mouth, a bottom with at least one drain hole therein, and a flange around the bottom of the cup on the inside thereof, said cup being movably disposed adjacent the seat with the seat between the cup and the inlet and the mouth of the cup encompassing the central aperture;

a post having a central longitudinal bore, a first end terminating in a cylindrical head with a groove in the circumference thereof, and a second end adjustably fastened to the housing with the longitudinal bore and stem hole in alignment, said post extending through the central aperture with the first end within the cup;

a seal supported by the groove in the first end of the post; and

a stem extending through the stem hole and the central bore, said stem having a first end affixed to the bottom of the cup and a second end terminating in a weighted handle.

2. A cup valve assembly comprising:

a seat having a central aperture therein;

a housing providing a fluid passage between the seat and a fluid supply, said housing having a small hole for receiving a stem;

a cup having a restricted mouth and a bottom with at least one drain hole therein, said cup being movably disposed adjacent the seat with the seat between the cup and the fluid supply and the mouth of the cup encompassing the central aperture;

a post having a central longitudinal bore, a first end terminating in a cylindrical head with a groove in the circumference thereof, and a second end adjustably fastened to the housing with the longitudinal bore aligned with the stem hole, said post extending through the central aperture and having the first end within the cup;

a seal supported in the groove in the first end of the post; and

a stem extending through the stem hole and the central bore, said stem having a first end affixed to the bottom of the cup and a second end terminating in a weighted handle.

3. A cup valve assembly comprising:

a housing including an outlet chamber having an outlet end and an inlet end communicating with a fluid supply;

a seat having a central aperture disposed within said chamber;

a cup movably disposed within said chamber between the seat and the outlet end, said cup having a bottom with at least one drain hole therein and having a restricted mouth;

a post having a first end with a groove therein, a second end and a central, longitudinal bore, said post extending through the central aperture with the second end adjustably secured to the housing and the first end within the cup;

a flexible seal snapped into the groove on the first end of the post;

a stem extending through the bore in the post and fastened to the cup at a first end and terminating at a second end in a handle having a cavity; and

a weight secured within said cavity.

4. A cup valve assembly comprising:

a seat having a central aperture therein;

a housing providing a fluid passage between the seat and a fluid supply, said housing having a small hole for receiving a stem;

a cup having a restricted mouth and a bottom with at least one drain hole therein, said cup being movably disposed adjacent the seat with the seat between the cup and the fluid supply and the mouth of the cup encompassing the central aperture;

a seal;

a post including a central longitudinal bore aligned with the small hole in the housing, a central portion extending through the central aperture, a first end supporting the seal within the cup, and a second end affixed to the housing; and

a stem extending through the small hole in the housing and the central bore in the post, said stem having a first end affixed to the cup and a second end terminating in a handle.

5. A cup valve assembly comprising:

a seat having a central aperture therein for the passage of fluid;

a housing providing a fluid passage between the seat and a fluid supply;

a cup movably disposed adjacent said seat with the seat between the cup and the fluid supply, said cup having a bottom with at least one drain hole therein and a restricted mouth against which pressure is applied by fluid entering the device holding the mouth against the seat with the mouth surrounding the central aperture;

a flexible seal disposed within said cup at a selected distance from the seat against which fluid pressure is applied in a direction opposite the pressure on the mouth and sealing off the drain hole when the pressure exceeds a selected

amount; and

means for moving the cup between a first position wherein the restricted mouth is against the seat and the flexible seal is sufficiently close to the bottom of the cup to flex and seal off the bottom of the cup when the fluid pressure exceeds a selected amount, said first position preventing flow of fluid through the central aperture and thereby causing the fluid to be diverted through a different path, and a second position wherein the restricted mouth is substantially spaced apart from the seat, permitting fluid to flow through the central aperture.

6. A cup valve assembly having a first position wherein the passage of fluid along a path through an aperture is blocked, forcing the fluid to flow along a diverted path, and a second position wherein fluid is permitted to flow along a path through said aperture, said assembly comprising:

a seat having a central aperture therein;

a housing providing a fluid passage between the seat and a fluid supply;

a cup movably disposed adjacent said seat with the seat between the cup and a fluid supply, said cup having a bottom with at least one drain hole therein and having a restricted mouth;

a flexible seal disposed within the cup;

means for supporting the flexible seal a selected distance from the central aperture independent of the cup; and

means for moving the cup between first and second positions in relation to said seal and central aperture whereby fluid is diverted alternatively along a diverted path and a path through the central aperture respectively.

7. A cup valve assembly comprising:

an outlet chamber having an outlet end and an inlet end communicating with a fluid supply;

a seat having a central aperture disposed within said chamber;

a cup movably disposed within said chamber between the seat and the outlet end, said cup having a bottom with at least one drain hole therein and a restricted mouth;

means for selectively placing the mouth of the cup about the central aperture in sealing contact with the seat; and

means for selectively sealing the drain hole.

8. A cup valve assembly comprising:

a seat having an aperture;

a cup having a restricted mouth suitable for holding the cup in sealing contact with the seat when subjected to fluid pressure;

means for relieving fluid pressure on the bottom of the cup; and

means for selectively making and breaking the sealing contact between the seat and the cup.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,656,503 Dated April 18, 1972

Inventor(s) Irving A. Ward

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 36, after "stem 36" and before "the"  
insert --snaps into--.

Signed and sealed this 19th day of March 1974.

(SEAL)  
Attest:

EDWARD M. FLETCHER, JR.  
Attesting Officer

C. MARSHALL DANN  
Commissioner of Patents