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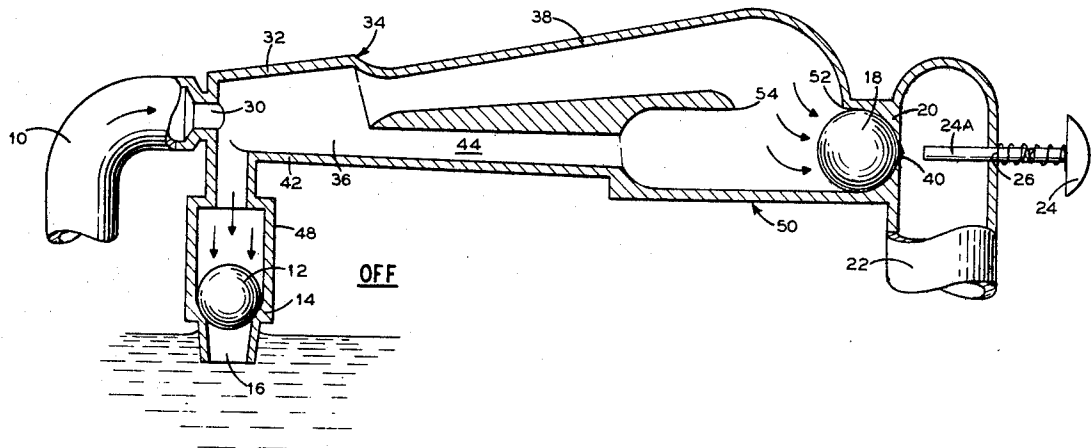
[54] AUTOMATIC REFILL DEVICE HAVING
FLUIDICALLY OPERATED CONTROL
16 Claims, 3 Drawing Figs.

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137/81.5
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F15c 3/06
[50] Field of Search 137/81.5,
386, 608

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ABSTRACT: A refill mechanism, for example, a water closet tank refill apparatus, having a valve which maintains itself in the "on" position once the fluid flow starts and switches to the "off" position in response to the attainment of a predetermined liquid level.



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FIG. 2

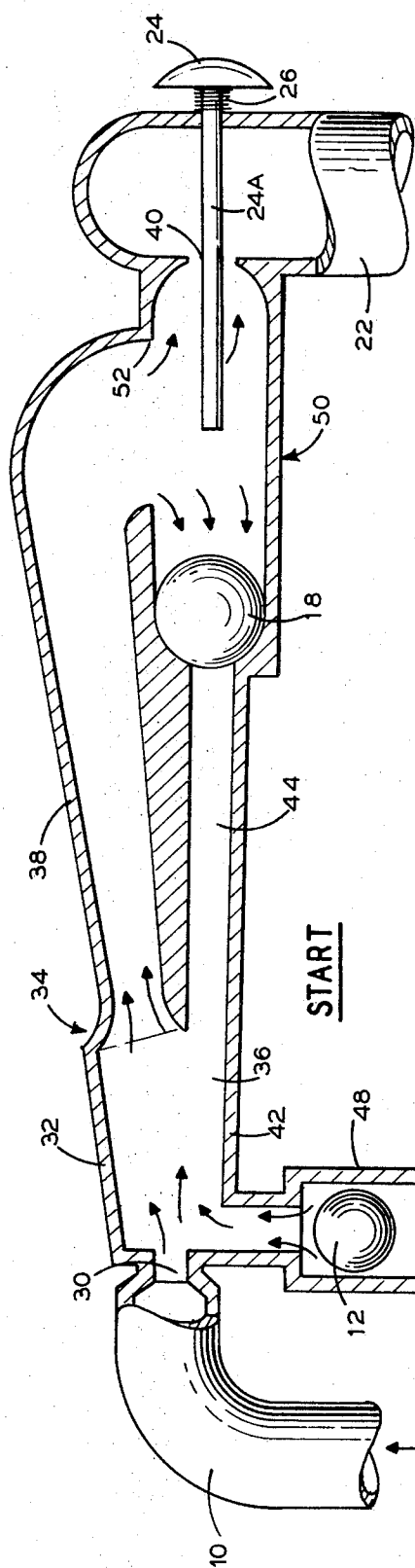
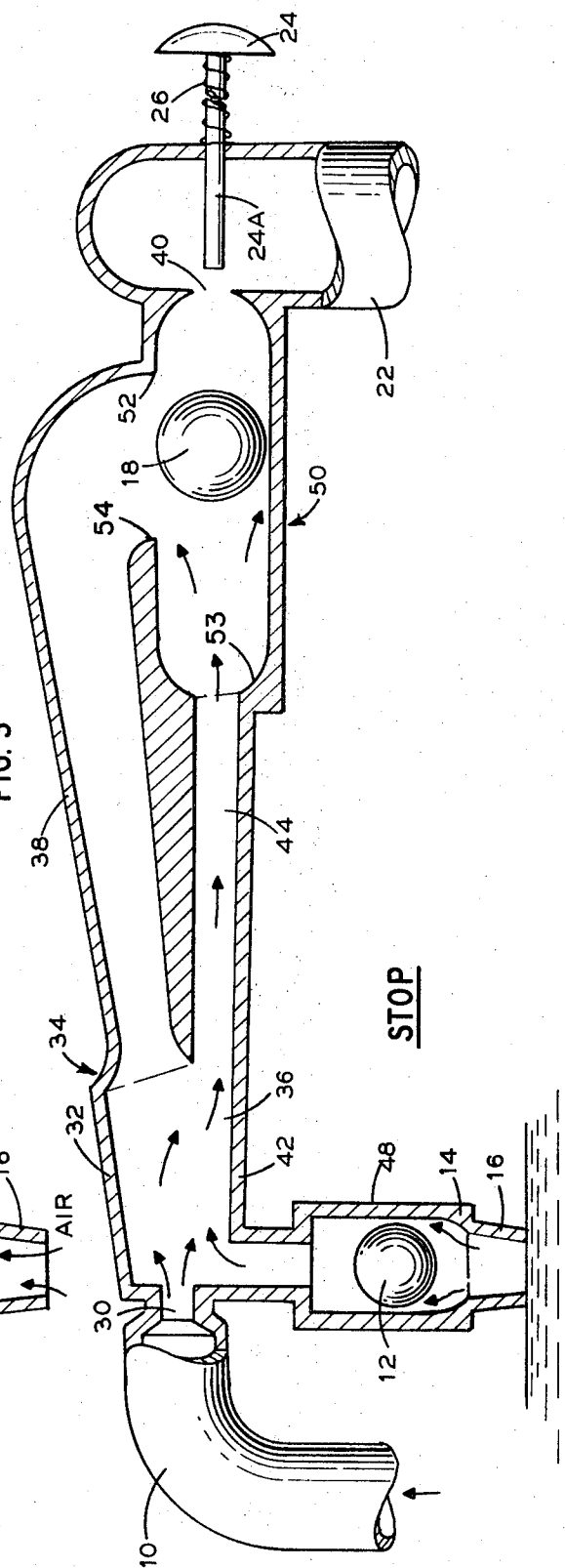


FIG. 3



AUTOMATIC REFILL DEVICE HAVING FLUIDICALLY OPERATED CONTROL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a fluid refill mechanism and more particularly to a refill mechanism which incorporates a fluidic switching mechanism.

2. Description of the Prior Art

The need for an inexpensive, efficient, reliable refill mechanism, for a variety of applications has long existed. A typical situation is found in the case of water closet tank refill devices. These devices are characteristically noisy, are excessively subjected to wear and do not stay in the full open position during the entire filling operation, but rather begin a slow close procedure well before the tank is completely filled. Furthermore, these valves require the use of a large float and lever arm mechanism and are relatively expensive.

A further problem is that leakage of any sort from the tank causes the water control valve to open, thus replenishing the water lost due to leakage. A permanent "or" situation could thus be produced, resulting in flooding or the like.

SUMMARY OF THE INVENTION

It has now been found that a refill mechanism can be designed which can maintain itself in the refill position, that is, in the completely open position during the entire cycle, and then, through the use of a fluidic switching mechanism, automatically stop the refill cycle.

The mechanism includes an inlet conduit, a control chamber and at least one valve chamber. The control chamber includes a primary fluid inlet, a first and a second outlet leg and a control fluid inlet. The valve chamber housing includes a first inlet at one end which is in communication with the aforementioned second leg, and a first outlet at the other end. A second inlet is intermediate the first inlet and the first outlet and is in communication with the first outlet leg of the control chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects, features and advantages of the present invention will be fully understood as the description of the invention proceeds, particularly when taken together with the accompanying drawings wherein like reference numerals indicate similar parts throughout the several drawings wherein:

FIG. 1 is a schematic representation of a refill mechanism in accordance with the present invention, said mechanism being in the "Off" position; and

FIG. 2 is a schematic representation of the mechanism of FIG. 1, in the "start" position; and

FIG. 3 is a schematic representation of the valve structure of FIG. 1 in the "stop" position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The filling mechanism is normally at rest in the "off" position as shown in FIG. 1.

Conduit 10 is at all times in communication with the refill liquid. In the case of a water closet refill system, water at a pressure in the range from 5 to 120 pounds per square inch would be supplied to conduit 10. The fluid pressure acts on ball 12, keeping the ball firmly seated on the valve seat 14, thus sealing the vent opening 16. Similarly, the ball 18 is firmly seated against the valve seat 20, sealing the passage to refill conduit 22.

As shown in FIG. 2, in order to start the refill operation, the plunger 24 is depressed against the force of spring 26, causing the ball 18 to move toward the opposite end of the valve chamber 50. The movement of ball 18 opens the passage to the refill conduit 22 thus permitting fluid to flow through the refill conduit 22 and into the receptacle being filled. Simultaneously, the pressure holding ball 12 in its seat is

relieved and air is aspirated or siphoned through the vent or control port 16 as a result of the low pressure created by fluid entrainment in the jet issuing from the inlet nozzle 30. The jet becomes attached to the upper wall 32 of the control chamber 34 due to the low pressure created by fluid entrainment in the jet near the upper wall and the near ambient pressure in the lower part 36 of the control chamber provided by the inflow of air through the control port 16. The ball 18 is held to the backwall 53 by a force created by the differences in pressures existing in valve chamber 5 and leg 14. The jet will thus continue to flow into leg 38 and thence discharge through port 40 until the liquid level of the reservoir being filled reaches the mouth of the control port duct 16 and block the flow of air to the control chamber 34.

With the cessation of airflow into the control chamber as shown in FIG. 3, at least a portion of the jet will attach to the lower wall 42 of the control chamber 34 and discharge through leg 44 moving ball 18 to its seat 20, thus stopping flow through discharge port 40. Line pressure will then exert a force through control port 46 which will seat ball 12 thus stopping all flow of water and air through the duct 16.

The chamber 48 or an extension thereof, can be positioned so that the vent opening 16 is at a height which would suit the application. It is evident that either the conduit 46 can be of the required length or a conduit can be provided in communication with, and extending from the vent opening 16.

Flow through the device can be started manually, or through hydraulic or mechanical linkage to a machine or appliance, or it can be started electrically by use of a solenoid.

The vent chamber 48 can be connected to the control chamber 34 by any convenient type of conduit, either flexible or rigid, as required in the particular application, or can be fixed in position and have a flexible or rigid conduit extending the required distance.

For example, the system can be used to regulate the filling of a bath tub to a predetermined height. The vent chamber could in such a case be connected to the control chamber by a telescoping linkage or a flexible conduit. In the latter case, the chamber 48 or the flexible length of conduit could be fixed in the desired position by means of a conventional suction cup. In either case, if the chamber 48 or conduit accidentally moves out of the desired position, since its motion will always be downward, the flow will merely stop prematurely.

The duct 16 can be sealed by means of a conventional stem or check valve in lieu of the ball valve. Similarly, the cylindrical valve chamber could employ, in lieu of a ball 18, an elongated rod having a hemispherical end portion which would seat alternately in a valve seat 20, or other shaped valve bodies in combination with cooperatively shaped valve seats.

The distance between the juncture 54 of the leg 38 and the back end 53, of chamber 50 must be sufficient so that the ball 18 is substantially out of contact with the main flow of water in the valve chamber 50.

The refill control device can be simply extrusion molded in two mirror image halves. The valve seats 14 and 20 can be formed at the time of the molding or can be inserts which are set in place before the two halves are sealed to each other. In the case of insert-type valve seats, circumferential grooves can be employed for receiving the seats and holding them in place.

It should be understood that the term cylindrical as employed herein is intended to refer primarily to right circular cylinders, but also includes cylinders having noncircular cross sections.

The chamber 48 can be of any desired cross section. It is essential however that there be a clearance between ball 12 and the inside surface walls of the chamber such that the ball can move freely, and so that fluid can flow around the ball when it is in a position off the seat 14.

The fluid emitting from the nozzle 30 should flow in a direction normal to the exit walls of the nozzle prior to deflection toward either wall 32 or wall 42. The aspirating action causes the fluid to attach to the wall 32 as is well known in the art, and the cessation of the aspiration action will allow

the fluid to attach to the more proximate wall 42. Similarly fluid can be injected or withdrawn through a port proximate nozzle 30, to provide equivalent results, as is well known in the art.

Although the invention has been described in its preferred forms with a certain degree of particularity, it is understood that the present disclosure of the preferred forms has been made only by way of example, and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

I claim:

1. A fluid valve mechanism comprising in combination:

A. a control chamber having,

- a. a first outlet leg,
- b. a second outlet leg,
- c. a primary fluid inlet, and
- d. a control fluid port; and

B. a valve chamber having,

- a. a first inlet at one end, said valve chamber inlet being in communication with said control chamber second outlet leg,
- b. valve chamber outlet at the other end,
- c. a second inlet intermediate said first valve chamber inlet and said valve chamber outlet, said second valve chamber inlet being in communication with said control chamber first outlet leg,
- d. first valve means in said valve chamber, said valve means being responsive to flow through said first valve chamber outlet, to move toward said valve chamber outlet at said other end, thereby closing said valve chamber outlet, and being biased in the closed position by fluid in both said first outlet leg and said second outlet leg.

2. The structure of claim 1, wherein said first valve means is a ball valve having a seat at said first outlet.

3. The structure of claim 1, wherein said control port is positioned proximate said primary fluid inlet.

4. The structure of claim 1, wherein said valve chamber comprises a restraining means for restricting the movement of said first valve means between a first closed position, in sealing engagement with said first valve chamber outlet and a second position, proximate said first valve chamber inlet.

5. The structure of claim 1, wherein said valve chamber comprises a restraining means for restricting the movement of said first valve means between a first closed position, in sealing engagement with said first valve chamber outlet and a second position, proximate said first valve chamber inlet.

6. The structure of claim 1, further comprising a second valve means for controlling the flow through said control fluid port.

7. The structure of claim 6, wherein said second valve means is a ball valve.

8. The structure of claim 7, further comprising a second valve chamber housing said second valve means, said chamber having an inlet passage at one end and an outlet passage at the other end, and a ball valve seat at said inlet end.

9. The structure of claim 8, further comprising a flexible conduit connected to said inlet end of said second valve chamber.

10. A fluidic valve mechanism comprising in combination:

A. a control chamber having,

- a. first flow passage means
- b. second flow passage means, said second flow passage means diverging from said first flow passage means
- c. primary fluid inlet
- d. control fluid port
- e. primary fluid outlet, said second flow means providing fluid communication between said primary fluid inlet and said primary fluid outlet, and said first flow passage means is positioned between said primary fluid inlet and said primary fluid outlet.

B. a valve chamber, said valve chamber being positioned between said primary fluid outlet and both said first flow passage means and said second flow passage means and having

- a. a first end, said first end being intermediate said first flow means and said primary fluid outlet
- b. a second end, said second end being intermediate said second flow means and said primary fluid outlet
- c. first valve means, said first valve means permitting flow from said primary fluid inlet through said second flow passage means and out said primary fluid outlet when positioned at said first end and being movable from said first end to said second end in response to flow through said first flow passage means of said control chamber to close said primary fluid outlet, thereby terminating all fluid flow.

11. The structure of claim 10, wherein said first valve means is a ball valve having a seat at said first outlet.

12. The structure of claim 10, wherein said control port is positioned proximate said primary fluid inlet.

13. The structure of claim 10, wherein said valve chamber first end is upstream of the downstream end of said second flow passage means and said valve chamber second end is downstream of the downstream end of said second flow passage means.

14. The structure of claim 10, further comprising a second valve means for controlling the flow through said control fluid port.

15. The structure of claim 14, wherein said second valve means is a ball valve.

16. The structure of claim 15, further comprising a second valve chamber housing said second valve means, said chamber having an inlet passage at one end and an outlet passage at the other end, and a ball valve seat at said inlet end.

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