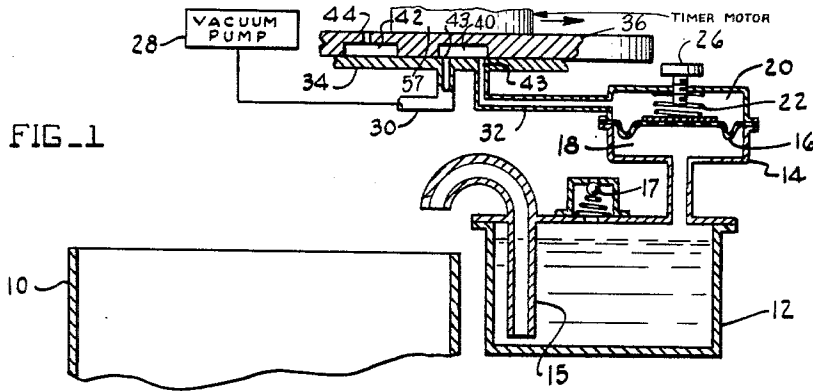
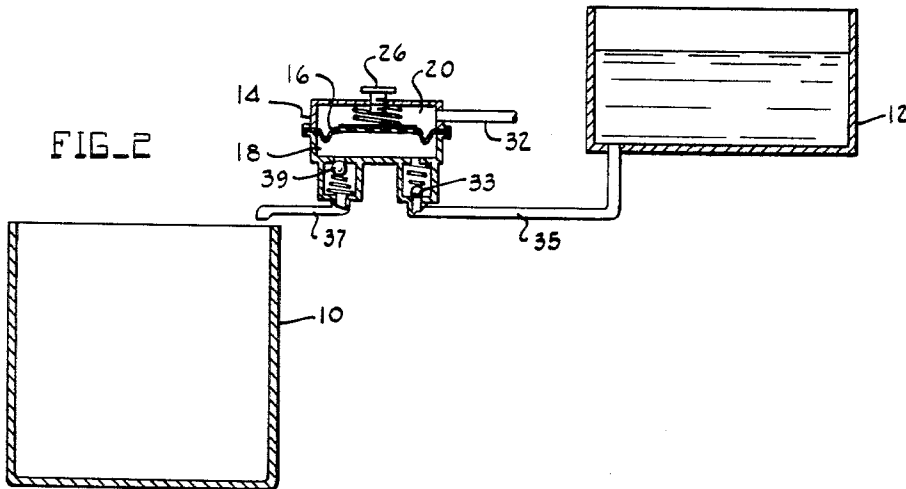
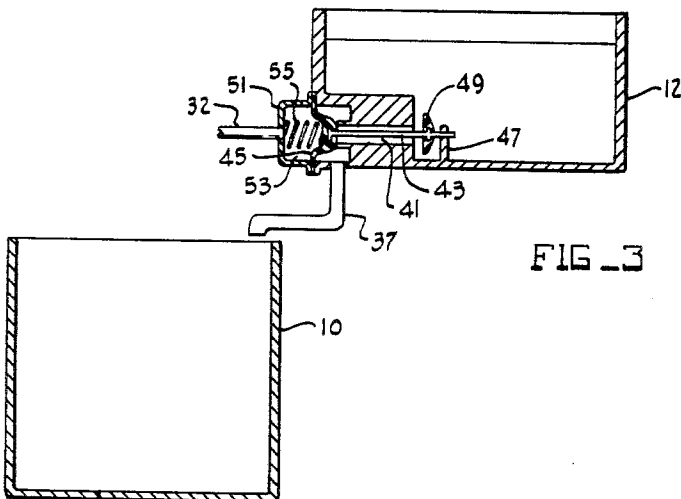


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AIR-CONTROLLED LIQUID DISPENSING
MECHANISM FOR WASHING MACHINES
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AIR-CONTROLLED LIQUID DISPENSING MECHANISM FOR WASHING MACHINES

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This invention relates to the dispensing of liquids such as washing machine detergents, rinse additives, and bleaching liquids.

One object of the invention is to provide a mechanism for dispensing liquid additives at predetermined times and time intervals, using vacuum or pressure fluid forces.

Another object is to provide a liquid dispensing mechanism which may be produced at low cost.

A further object is to provide a liquid dispensing mechanism having a relatively long service life without clogging or other malfunction.

An additional object is to provide a liquid dispensing mechanism operable to dispense precise liquid quantities.

Other objects of this invention will appear from the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a view, semi-schematic in nature, showing one embodiment of the invention;

FIG. 2 is a semi-schematic view illustrating a second embodiment of the invention; and

FIG. 3 is a semi-schematic view illustrating a third embodiment of the invention.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, particularly FIG. 1, there is schematically shown a clothes washing machine receptacle 10 and a reservoir 12 for a liquid additive such as liquid detergent, rinse additive, water softener, bleach or the like. Arranged adjacent reservoir 12 is an air-operated means which in this case takes the form of a pumping device 14. The pumping device is provided with a movable subdividing wall or diaphragm 16 for defining a pumping chamber 18 and a vacuum chamber 20. A compression spring 22 is arranged to force the diaphragm 16 downwardly when chamber 20 is vented to the atmosphere. When vacuum is applied within chamber 20 diaphragm 16 is drawn upwardly to engage the adjustable stop 26 so as to set the diaphragm for its downward pumping stroke at a desired time in the washing machine cycle. Adjustment of stop 26 varies the length of the pumping stroke and hence the amount of liquid dispensed into receptacle 10.

The flow of liquid from reservoir 12 takes place through a discharge duct 15 which preferably has a relatively small cross section in comparison to the cross section of the reservoir. During downward movement of diaphragm 16 the air in the upper portion of reservoir 12 exerts a super-atmospheric pressure on the reservoir liquid for thereby pumping a metered liquid quantity through duct 15. The subsequent upstroke of diaphragm 16 relieves any residual air pressure tendencies in the reservoir space. To prevent the possibility of vacuum being created in

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chamber 18 or reservoir 12 there may be provided a check valve 17 which is operable on the diaphragm upstroke to admit atmospheric air into the reservoir.

The vacuum force for moving diaphragm 16 may be developed from any suitable vacuum pump 28 which is connected to chamber 20 by vacuum conduits 30 and 32. Pump 28 constitutes an air pump for withdrawing air from chamber 20 when conduits 30 and 32 communicate with one another via recess 40. As shown in FIG. 1, the vacuum conduits have their proximate end portions mounted in a fixed seal structure plate 34 which is arranged beneath a movable programmer valve member 36. Member 36 is preferably, although not necessarily, a rotary disc drum or belt having two types of passage-forming recesses 40 and 42 formed on its undersurface. Each recess 40 is a blind recess arranged so that when it registers with the port-forming end portions 43 of conduits 30 and 32 the pump vacuum is effective to draw diaphragm 16 upwardly to engage stop 26. Recess 42 is a vent recess and is provided with a vent opening 44.

The general sequence of operations involves a rightward movement of programmer valve member 36 by a timer motor 57 such that a vacuum is applied to chamber 20 when recess 40 registers with conduits 30 and 32. After a predetermined time interval recess 42 registers with ports 43 so as to exhaust the vacuum from chamber 20 to allow spring 22 to move diaphragm 16 downwardly to develop a pumping pressure on the liquid in reservoir 12. In the FIG. 1 arrangement the space between recess 40 and recess 42, and the speed of programmer valve 36 determine the time interval between start of the cycle and dispensing of the liquid additive into the washing machine receptacle. This time interval is correlated with the washing machine cycle, preferably by constructing disc 36 so that its acts as a programmer for all of the washing machine components, including the water admission, spin clutch, and water draining.

Referring now to the embodiment of the invention shown in FIG. 2, there is shown a washing receptacle 10, a liquid additive reservoir 12 and an air-operated means shown as a liquid pumping device 14 having a diaphragm 16 subdividing the device into a pumping chamber 18 and a vacuum chamber 20. Chamber 20 connects with a vacuum applying conduit 32 which in practice would lead to a programmer valve structure similar to that shown in FIG. 1.

Referring to pumping chamber 18, the lower portion thereof connects with a check valve 33 which allows one way flow of liquid from reservoir connection duct 35 into chamber 18 when the diaphragm 16 is being drawn upwardly by the vacuum force in chamber 20. Chamber 18 connects with a discharge duct 37 in which is located a check valve 39 having the function of normally sealing against liquid flow out of chamber 18 but yielding during downward movement of diaphragm 16 to permit the liquid to be discharged into duct 37 and thence into washing receptacle 10.

Control of the FIG. 2 dispenser mechanism may be the same as in connection with the FIG. 1 embodiment.

Referring to the FIG. 3 embodiment, there is shown a liquid additive reservoir 12 in operative connection with a cylindrical metering chamber 41. Extending axially through chamber 41 is a valve rod 43, one end of which is embedded or otherwise secured to a vacuum-operated diaphragm 45. The other end of the rod is slidably mounted in an upstanding guide structure 47 formed integrally or otherwise affixed to reservoir 12. As shown in the drawing, rod 43 has a valve element 49 secured thereon for controlling the flow of liquid into chamber 41. The right face of diaphragm 45 forms a second valve element for controlling the flow of liquid from chamber

41 into the washing machine receptacle. The spacing between elements 45 and 49 is greater than the axial dimension of chamber 41 so that the chamber is either open to reservoir 12 and closed to discharge duct 37 or closed to reservoir 12 and open to discharge duct 37. A cup-shaped casing 51 is suitably secured to housing 12 to cooperate with diaphragm 45 in forming a vacuum chamber 53. Vacuum conduit 32 leads from chamber 53 to a programmer valve structure similar to that shown in FIG. 1.

In operation of the FIG. 3 embodiment, liquid is automatically admitted to chamber 41 when the elements are in their illustrated positions (i.e., with chamber 53 vented to the atmosphere). When vacuum is applied to chamber 53 valve element diaphragm 45 is opened and valve element 49 is closed. In this manner a metered quantity of liquid is discharged into receptacle 10. Subsequent venting of chamber 53, as by vent recess 42, permits spring 55 to move the valve elements to the illustrated positions for charging the metering chamber with liquid.

The illustrated embodiments of the invention have been described with reference to the use of vacuum air as a controlling medium. It is contemplated however that air under positive pressure can be employed as a controlling fluid. In such case the spring-diaphragm relationships would be suitably changed. Other modifications from the illustrated designs can also be made without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. In a washing machine having a washing receptacle: the combination comprising a washing machine liquid additive reservoir; a vacuum-operated means for dispensing reservoir liquid to the washing receptacle; a vacuum pump connected with the vacuum-operated means; and timer-operated valve means for permitting and halting the transfer of air from the vacuum-operated means to the pump at predetermined times in the washing machine cycle; said vacuum-operated means comprising a casing having a movable wall thereon forming a ventable vacuum chamber, and a spring operating to move the movable wall in a direction to expand the vacuum chamber when said chamber is vented to the atmosphere; said valve means comprising a traveling valve member and a co-operative fixed seal structure; said seal structure having ports communicating with the pump and vacuum chamber; and said valve member having two recesses, one of which is blind and the other of which is vented to the atmosphere; whereby movement of the valve member to locate the blind recess in registry with the ports permits the pump to evacuate the vacuum chamber, and movement of the valve member to locate the vented recess in registry with the two ports causes the vacuum chamber to be vented to the atmosphere.

2. In a washing machine having a washing receptacle: the combination comprising a washing machine liquid additive reservoir means; a vacuum-operated means for dispensing reservoir liquid to the washing receptacle; a vacuum pump connected with the vacuum-operated means; and timer-operated valve means for permitting and halting the transfer of air from the vacuum-operated means to the pump at predetermined times in the washing machine cycle; said vacuum-operated means comprising a casing having a movable wall thereon forming a ventable vacuum chamber, and a spring operating to move the movable wall in a direction to expand the vacuum chamber when said chamber is vented to the atmosphere; said valve means comprising a traveling valve member and a cooperating fixed seal structure; said seal structure having ports communicating with the pump and vacuum chamber; and said valve member having passages therein which pass over the ports to first place the vacuum chamber in communication with the pump and to thereafter place the vacuum chamber in communication with

the atmosphere to cause the vacuum chamber to be vented to the atmosphere.

3. In a washing machine having a washing receptacle: the combination comprising a washing machine liquid additive reservoir; an air-operated means for dispensing reservoir liquid to the washing receptacle; an air pump connected with the air-operated means; and timer-operated valve means for permitting and halting the transfer of air from the air-operated means to the pump at predetermined times in the washing machine cycle; said air-operated means comprising a casing having a movable wall thereon forming a ventable air chamber, and a spring operating to move the movable wall in one direction when said chamber is vented to the atmosphere; said valve means comprising a traveling valve member and a co-operating fixed seal structure; said seal structure having ports communicating with the pump and air chamber; and said valve member having two passages, one of which is blind and the other of which is vented to the atmosphere; whereby movement of the valve member to locate the blind passage in registry with the ports permits the pump to communicate with the air chamber, and movement of the valve member to locate the vented passage in registry with the two ports causes the air chamber to be vented to the atmosphere.

4. In a washing machine having a washing receptacle: the combination comprising a washing machine liquid additive reservoir means; a metering chamber means having an inlet port communicating with the reservoir and having an outlet port communicating with the washing machine receptacle; a diaphragm secured to the reservoir means in alignment with the outlet port; a valve rod extending from the diaphragm through the metering chamber; an inlet valve element carried by said rod for movement toward and away from the inlet port; an imperforate cup-shaped casing secured to the reservoir means with its periphery overlying the diaphragm periphery to secure same in place; a compression spring disposed within the cup-shaped casing to normally urge the diaphragm to a position closing the outlet port; and a ventable vacuum line connected with said cup-shaped casing whereby a vacuum condition in said line causes the diaphragm to be drawn away from the outlet port; said diaphragm and inlet valve element being spaced further apart than the spacing between the outlet and inlet ports, whereby the diaphragm is closed when the inlet valve element is open, and vice versa.

5. In a washing machine having a washing receptacle: the combination comprising a washing machine liquid additive reservoir means; a vacuum-operated liquid dispensing means comprising a liquid metering chamber means having an inlet port communicating with the liquid reservoir and an outlet port communicating with the washing machine receptacle, a diaphragm secured to the reservoir means in alignment with the outlet port, a valve rod extending from the diaphragm through the metering chamber, an inlet valve element carried by said rod for movement toward and away from the inlet port, an imperforate cup-shaped casing secured to the reservoir means with its periphery overlying the diaphragm periphery to secure same in place, a compression spring disposed within the cup-shaped casing to normally urge the diaphragm to a position closing the outlet port, and a ventable vacuum line connected with said cup-shaped casing whereby a vacuum condition in said line causes the diaphragm to be drawn away from the outlet port, said diaphragm and inlet valve element being spaced further apart than the spacing between the outlet and inlet ports whereby the diaphragm is closed when the inlet valve element is open, and vice versa; a vacuum pump; and timer-operated valve means for permitting and halting the transfer of air from the aforementioned vacuum line to the pump at predetermined times in the washing machine cycle; said timer-operated valve means com-

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prising a traveling valve member and a cooperating fixed seal structure, said seal structure having ports communicating with the pump and the aforementioned vacuum line, and said valve member having two passages, one of which is blind and the other of which is vented to the atmosphere whereby movement of the valve member to locate the blind passage in registry with the ports permits the pump to evacuate the vacuum line, and movement of the valve member to locate the vented passage in registry with the two ports causes the vacuum line to be vented to the atmosphere.

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