Jan. 8, 1963 F. M. McDOUGALL 3,072,137

FLUID MIXING DEVICE

Filed April 27, 1959

FIG. 1.

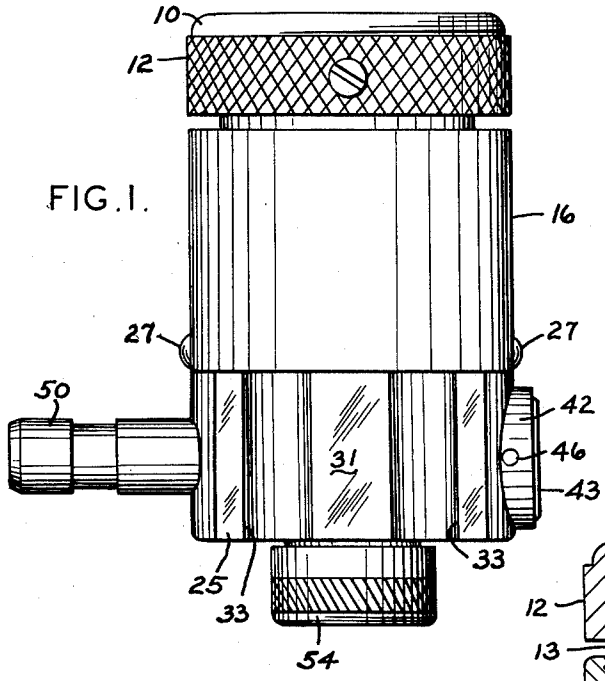


FIG. 2.

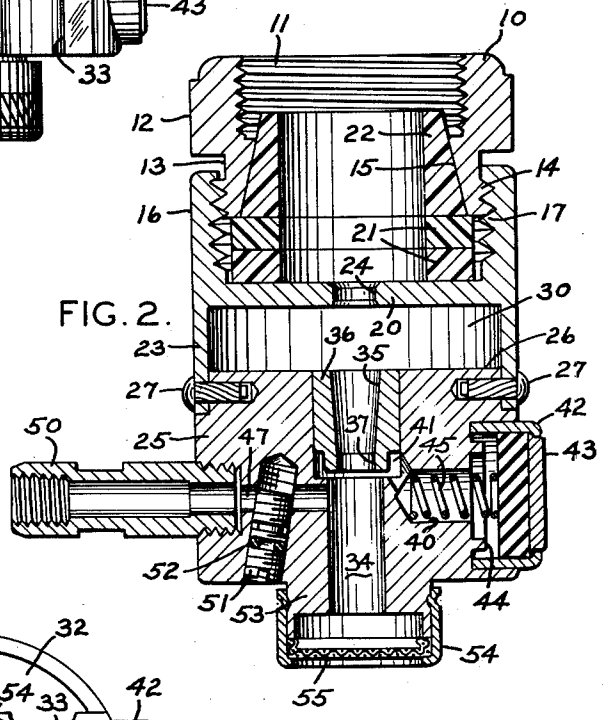
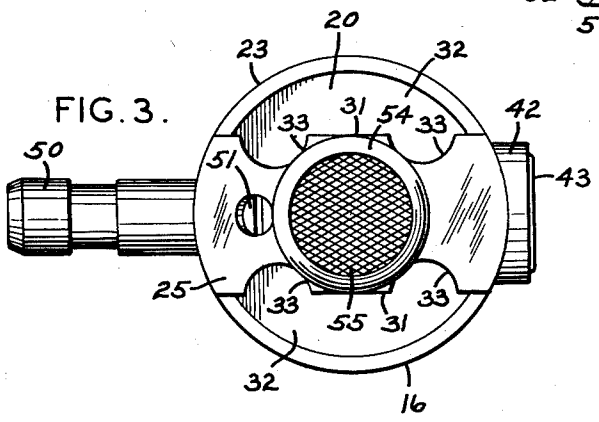


FIG. 3.



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FLUID MIXING DEVICE

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This invention relates generally to improvements in a fluid mixing device, and more particularly to an improved device of this type that enables selectively the mixing of a liquid detergent with a stream of water.

An important object is to achieve a fully automatic fluid mixing device that is adapted to induct a liquid detergent into a stream of water and to mix such detergent and water in the desired proportion.

In the conventional installation of this type of device, the proportioner is attached to the kitchen sink faucet, and a small hose connects the device to a detergent supply normally located beneath the sink. A foot valve in the hose inlet serves to keep the hose full of detergent at all times.

In most water supply systems, there is the possibility of transient conditions that could create a partial vacuum inside the water lines. During such an occurrence, there is a reverse flow through an open faucet or any other opening between the atmosphere and the inside water supply lines. This reverse flow is commonly known as back-syphonage. The use of the heretofore conventional fluid mixing device not having a protective mechanism later menttioned, could cause contamination of the water supply, as for example by the introduction of detergent under these conditions.

As a precaution against the possible contamination of the water supply, many cities require the installation of a vacuum breaker between the water supply and any attachment that is a potential source of contamination. To protect a simple faucet attachment is both cumbersome and relatively costly.

It is an important object to provide a fluid mixing device that is constructed so as to preclude detergent or other foreign or undesirable liquid matter from being introduced into the water supply upon the occurrence of a partial vacuum in the water lines. The present proportioner has means that causes the device automatically to disconnect operatively from the liquid detergent and instead causes the faucet to communicate operatively with the atmosphere upon the existence of any vacuum in the water line to which the proportioner is attached.

Another important object is realized by the provision of an air chamber open to atmospheric pressure between the inlet opening to the valve body and the faucet which provides the above mentioned protective action against back-syphonage.

Still another important objective is achieved by the structural relation and connection of the valve body with the cap that is attached to the faucet so as to provide an air chamber therebetween, and to provide a passageway communicating with the air chamber to place such chamber under atmospheric pressure.

Other important advantages are realized by the particular structure of the valve body providing auxiliary air passages communicating wtih the air chamber which are impossible to close unintentionally by a person gripping or otherwise holding the fluid mixing device, and thereby makes it impossible for the liquid detergent to be fed back into the water lines accidentally.

Yet another important objective is achieved by the provision of a skirt portion on the cap which extends downwardly around the uppermost portion of the valve body so as to provide a splash guard.

Another important object is to provide a fluid mixing device having the previously discussed advantages which

is simple and durable in construction, economical to manufacture, efficient in operation, and which is fully automatic and capable of use by anyone.

The foregoing and numerous other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment, particularly when considered in connection with the accompanying drawing, in which:

FIG. 1 is a side elevational view of the fluid mixing device. The opposite side is the same;

FIG. 2 is a cross sectional view of the device as seen in a plane passed through the vertical longitudinal axis of the device shown in FIG. 1, and

FIG. 3 is a bottom plan view of the device shown in FIG. 1.

Referring now by characters of reference to the drawing, it is seen that the fluid mixing device includes a coupling **10** provided with internal threads **11** adapting the coupling **10** to be attached to a water faucet. The coupling **10** includes a collar **12** that is knurled to facilitate attachment and disconnection of the coupling.

The coupling **10** includes a reduced lower end portion **13** provided with external threads **14**. The interior of reduced coupler portion **13** is provided with an upwardly converging seat **15**.

Attached to coupling **10** is a cylindrical cap **16** that is provided with internal threads **17** at its uppermost portion adapted to engage the threads **14** of coupling **10**. A partition **20** extends across the cap **16**. Located in the upper recess of cap **16** and seating on the partition **20** is a pair of resilient washers **21**. A conical resilient washer **22** seats on the top of washers **21** and interfits the reduced coupling portion **13** and engages the seat **15**.

The cap **16** is provided with a skirt portion **23** depending peripherally about the partition **20**. An aperture **24** is provided in partition **20** through which the water under pressure from the faucet is forcibly ejected in a jet stream.

A valve body **25** includes a reduced uppermost portion **26** that interfits the skirt portion **23** of cap **16**. A plurality of screw fasteners **27** attach the skirt portion **23** to the reduced portion **26** of valve body **25**. It is seen that the skirt portion **23** seats on a shoulder formed by the reduced valve body portion **26** and extends below the uppermost portion to provide a splash guard as will be explained in detail subsequently. The uppermost end of the valve body **25** is spaced from the partition **20** to provide an air chamber **30** therebetween.

As is best seen in FIGS. 1 and 3, the valve body **25** is provided with opposed flat surfaces **31** that are spaced from the skirt portion **23** of cap **16** to provide passageway **32** communicating with chamber **30** so as to place such chamber **30** under atmospheric pressure. For reasons which will be discussed in detail subsequently, each of the opposed side surfaces **31** of valve body **25** is provided with a pair of longitudinal grooves **33** extending from the bottom to the top of the valve body **25**, such grooves **33** being in communication with the chamber **30**.

The valve body **25** is provided with a primary passage **34**. An inlet opening **35** to the primary passage **34** is provided in an insert **36** press fitted into the top of the valve body, as is best shown in FIG. 2. The inlet opening **35** is located on the opposite side of chamber **30** from aperture **24**, and hence is maintained in spaced relation to such aperture. However, it is seen that the inlet opening **35** is directly aligned with the partition aperture **24** so that the stream of water flowing through partition aperture **24** enters the inlet opening **35** and flows through the primary passage **34**. The primary passage **34** converges slightly downwardly from its inlet opening **35** to a restricted portion **37** at which point the

stream of water has its greatest velocity and lowest pressure.

An air induction passage 40 is provided in the valve body 25, the air induction passage 40 leading to an annular groove 41 formed between the insert 36 and the wall defining the primary passage 34. Thus it is seen that the annular groove 41, and hence the air induction passage 40 communicated with the primary passage 34 at the restricted portion 37.

A button retainer 42 is attached to the valve body 25 and carries a valve button 43. A valve seat 44 surrounds the air induction passage 40 and is adapted to engage the valve button 43 when the button is depressed. Located within the air induction passage 40 is a compression spring 45 adapted to engage the valve button 43 so as to tend to hold the button 43 normally in an open position as is illustrated in FIG. 2. A pair of inlet openings 46, one of which is shown in FIG. 1, is provided on opposite sides of the button retainer 42, each of the inlet openings 46 being in communication with the air induction passage 40 when the button 43 is located in its outermost open position.

Formed in valve body 25 is a liquid induction passage 47 communicating with the primary passage 34 just below the restricted portion 37 and below the annular air outlet 41. A fitting 50 is threadedly attached to the valve body 25 and communicates directly with the liquid induction passage 47. The fitting 50 is adapted to receive and retain the hose leading from the liquid detergent supply.

A metering screw 51 is threadedly attached to the valve body 25 in a bore that intersects the liquid induction passage 47. As is best seen, the screw 51 carries an O-ring 52 that provides a seal between the screw 51 and its bore, thus preventing leakage of the liquid detergent from the liquid induction passage 47 and past the screw 51.

As is best seen from FIG. 2, the position of metering screw 51 can be regulated upon threaded adjustment so as to open or close the liquid induction passage 47 to a greater or lesser extent as desired.

The lowermost portion of valve body 25 is formed to provide a reduced nozzle portion 53 through which the primary passage 34 discharges. Retained on the nozzle portion 33 is a screen retainer 54 that carries and positions a screen 55 below the primary passage 34.

It is thought that the mode of operation and functional results have become fully apparent from the foregoing detailed description of parts, but for completeness of disclosure, it will be noted that the fluid mixing device is attached to the faucet by means of coupling 10, and the liquid detergent hose (not shown) is connected to fitting 50.

When the faucet valve is opened, the water flows through the fluid mixing device under pressure. The water streams through the coupling 10 into the upper portion of cap 16, thence through the partition aperture 24 from which it is directed into the inlet opening 35 of the primary passage 34. The water stream bridges chamber 30. As the water flows through the primary passage 34 it passes through the restricted portion 37 and is emitted through the bottom of the nozzle portion 53 through the screen 55. Because the air induction passage 40 is open to atmospheric pressure through the air outlet openings 46, there is no liquid detergent induced into the water stream.

When it is desired to mix detergent with the water, the button 43 is depressed until it engages the valve seat 44 and closes the air induction passage 40. Under these circumstances, the low pressure value existing at the restricted passage portion 37 causes the liquid detergent to flow through the liquid induction passage 47 and into the primary passage 34 where it mixes with the water stream and is discharged from the fluid mixing device. The proportion of liquid detergent mixed with the water stream can be varied upon adjustment of the metering screw 51 as described previously.

The pressure differential, that is the difference between the low pressure value existing at the air induction passage outlet 41 adjacent the restricted portion 37 and exerted on one side of the valve button 43 and the atmospheric pressure existing on the other side of button 43, causes the button 43 to remain seated in closed position automatically as long as the flow of water continues through the primary passage 34.

If it is desired to discontinue the mixing of liquid detergent with the water stream, the water faucet valve is closed so as to stop the water flow through primary passage 34. When this action is accomplished, the pressure value at restricted portion 37 and air induction passage outlet 41 is equalized to atmospheric pressure. Then, the spring 45 urges the valve button 43 to its open position illustrated in FIG. 2. Then the faucet valve can be re-opened to continue the flow of water under pressure through the primary passage 34, in which event the air induction passage 40 remains open so as to cause a flow of air through such passage 40 to mix with the water stream rather than causing any induction of liquid detergent.

In order to introduce detergent again into the water stream, the button 43 must be depressed again to close the air induction passage 40 as previously described.

If for any reason a partial vacuum would exist in the water supply lines when the fluid mixing device is used, there is provision that would preclude the introduction of liquid detergent into the reverse flow of water. In other words, this mixing device precludes any back-syphonage of detergent into the water supply lines upon the occurrence of any vacuum conditions.

For example, it is seen that if the valve button 43 were depressed to a closed position and liquid detergent were being induced into the water stream, and then a condition would occur whereby a vacuum in the water supply line would cause a reverse flow, it is seen that the existence of the air chamber 30 between the partition aperture 24 and the inlet opening 35 prevents reverse flow through passage 34 and inlet opening 35. As mentioned previously, the chamber 30 is under atmospheric pressure by reason of the passageways 32 formed between the casing skirt portion 23 and valve body 25. Reverse flow of water in the water line would merely cause air to be drawn through the passageways 32 into the chamber 30, and thence into and through the partition aperture 24 in the direction of reverse water flow. It is seen that upon the existence of a vacuum in the water line, the flow of water through primary passage 34 is stopped, resulting in an equalization of pressures. Then, there would be no chance in any event of liquid detergent entering the primary passage 34.

Persons operating the fluid mixing device sometimes have the tendency to grip the device, and particularly grip the valve body 25. When this happens, there is a possibility, however slight, that the passageways 32 between the skirt portion 23 and valve body 25 will become obstructed by the person's hand or fingers. Naturally if these passageways 32 were completely blocked so that chamber 32 were not under atmospheric pressure, there would be a tendency for the reverse water flow under vacuum conditions to cause an introduction of liquid detergent into the water stream which would move through the chamber 30, through the partition aperture 24 and into the water supply line, thus contaminating the water supply. However, the provision of the longitudinal grooves 33 on each side of the valve body 25 prevents the passageways 32 from becoming blocked by a person gripping the valve body. Therefore, liquid detergent cannot be induced into the reversed water flow and contamination of the water supply is not possible.

In the event the inlet opening 35 or the primary pas-

sage 34 becomes blocked as by dirt or other foreign matter, the water flow through partition aperture 24 will strike the valve body and splash into the chamber 30. Because the skirt portion 23 of casing 16 extends below the uppermost portion of valve body 25, such water will be directed downwardly by the skirt portion 23 through the passageways 32 and into the sink. It is seen that the skirt portion 23 of casing 16 prevents the water from splashing laterally from the chamber 30 out into the room, and assures that the water will fall downwardly into the sink.

Although the invention has been described by making detailed reference to a single preferred embodiment, such detail is to be understood in an instructive, rather than in any restrictive sense, many variants being possible within the scope of the claims hereunto appended.

I claim as my invention:

1. In a vacuum breaker for a fluid mixing device, a cap having a partition provided with an aperture, a valve body attached to the cap in spaced relation to the partition to provide a chamber therebetween, the valve body having opposed flat surfaces spaced inwardly from the periphery of the cap to provide an upwardly opening passageway communicating with said chamber, said opposed flat surfaces precluding blockage of the passageway by a person gripping the said valve body, the valve body provided with a primary passage having an inlet opening spaced from said aperture yet aligned therewith, said partition aperture being smaller than said inlet opening.

2. In a vacuum breaker for a fluid mixing device, a cap having a partition provided with an aperture, a skirt portion depending from the partition about the aperture, a valve body attached to the skirt portion and spaced from said partition to provide a chamber about said aperture between the valve body and partition, the valve body having opposed surfaces spaced inwardly from the skirt portion to provide an upwardly opening passageway communicating with said chamber, the skirt portion extending peripherally about the valve body and extending below the top of said valve body, each of said opposed surfaces being provided with at least one longitudinal groove extending from bottom to top of said valve body and communicating with said chamber so as to preclude blocking of the passageway by a person gripping the said valve body, the valve body provided with a primary passage having an inlet opening spaced from said aperture yet aligned therewith.

3. In a vacuum breaker for a fluid mixing device, a cap having a partition provided with an aperture, a valve body attached to said cap and provided with a top surface spaced from said partition to provide a chamber about said aperture between the valve body and partition, the valve body being provided with a primary passage having an inlet opening in said top surface spaced from said aperture yet aligned therewith, the top surface of the body being no higher than the inlet opening in said top surface, a skirt depending from the partition about the aperture, said skirt extending peripherally about the valve body below the top surface of said body and below the partition aperture, the valve body having opposed surfaces spaced inwardly from the peripheral skirt to provide an upwardly opening passageway communicating with said chamber at the top surface of said body in a horizontal plane below the said partition aperture so as to preclude any build up of fluid in said chamber which could be introduced by a reverse siphonage under vacuum conditions, each of the opposed surfaces of said valve body being provided with at least one longitudinal groove extending from bottom to top of the valve body and communicating with said chamber so as to preclude blocking of the passageway by a person gripping the said valve body, said groove extending through the upwardly opening passage between the body and the laterally spaced skirt.

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