March 20, 1956 J. J. GOODRIE 2,738,962

FLUID MIXING DEVICE

Filed Sept. 21, 1950

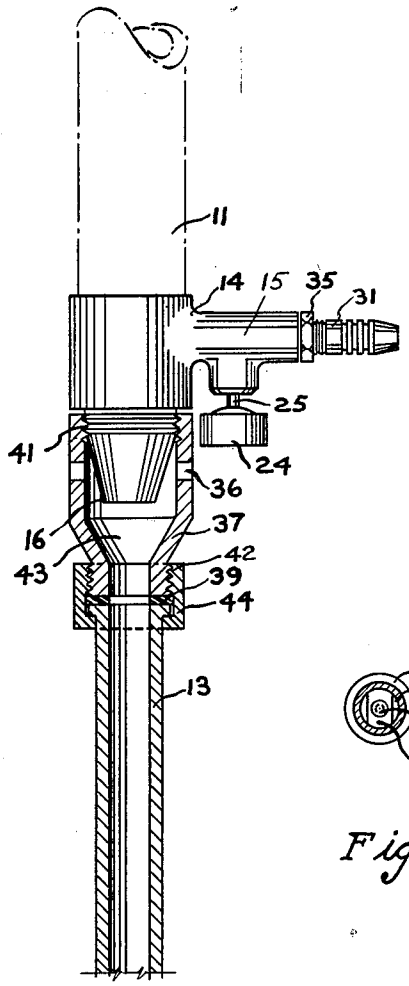


Fig. 6.

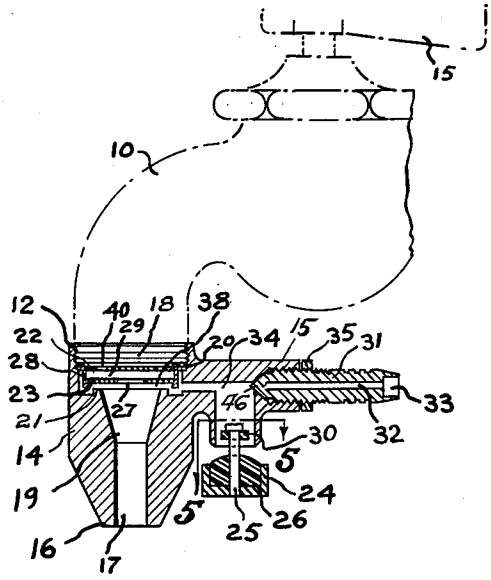


Fig. 1.

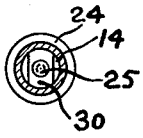


Fig. 5.

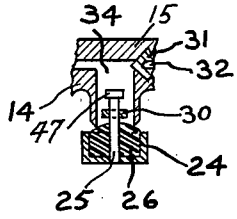


Fig. 2.

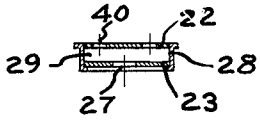


Fig. 4.

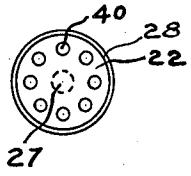


Fig. 3.

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FLUID MIXING DEVICE

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Application September 21, 1950, Serial No. 186,096

10 Claims. (Cl. 261—18)

This invention relates to an improved fluid mixing device and has for one of its principal objects the provision of a mechanism of the class described which will automatically combine a predetermined amount of fluid, such as a detergent, with a current of water or other liquid, gas or fluid.

One of the important objects of this invention is to provide a device for mixing two or more liquids of either the same or varying viscosities and at the same time include a vacuum breaking construction whereby the flow of one liquid will be automatically cut off whenever the mixing operation is completed or discontinued, so that only a single liquid or fluid will subsequently pass through the device upon the commencement of the next operation.

A still further important object of the invention is to provide, in a fluid mixing device, a simple, yet efficient and positive means for initiating the flow of mixed liquids in desired proportions, which operation, once begun, will continue until the flow of the main liquid ceases or until the supply of the secondary liquid is manually shut off.

The construction of the device of this invention is predicated upon some of my earlier patents relating to vacuum breakers and fluid mixing devices, for example, my U. S. Patent No. 2,134,182, granted October 25, 1938 entitled "Unitary Flush Valve Connection," and my Patent No. 2,151,200, granted March 21, 1939, entitled "Fixed Vacuum Breaker for Flush Valves." This invention is also based in part upon my two patents granted June 6, 1950, Nos. 2,510,395 and 2,510,396, entitled "Water and Air Mixing Device" and "Aerating Device," respectively.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawing and the following specification.

The invention, in a preferred form, is illustrated in the drawing and hereinafter more fully described.

In the drawings:

Figure 1 is a sectional view of a preferred embodiment of my invention, showing the same as attached to a faucet or some other source of liquid or fluid.

Figure 2 is a detailed view of the closure for the air inlet, showing the same in closed position as distinguished from the open position shown in Figure 1.

Figure 3 is a top plan view of the element for producing a desired turbulence of the incoming main liquid at the point adjacent to the faucet connection.

Figure 4 is a sectional view of the element shown in Figure 3.

Figure 5 is a sectional view, taken on the line 5—5 of Figure 1, looking in the direction indicated by the arrows.

Figure 6 is a view, partly in section, illustrating a modified form of the invention.

As shown in the drawings:

The reference numeral **10** indicates generally a water faucet or other source of liquid or fluid employed in the mixing device of this invention. The outlet end of the faucet is preferably screw threaded as shown at **12** for a

corresponding connection with the mixing device of this invention, but some other connecting means may be employed if desired or convenient.

The apparatus comprises essentially a casing **14**, composed of some suitable material, preferably metal, but a plastic may be employed with good results. The casing is provided with a central longitudinal opening, as shown at **17**, which flares upwardly and outwardly at **19** whereby a Venturi effect results when a liquid or fluid under pressure passes through the casing **14**. The upper end of the casing is internally screw threaded as shown at **18** for connection with the screw threads **12** of the faucet.

The outer portion of the lower end of the casing **14** is constructed in a diminishing taper as illustrated at **16** and a lateral extension **15** is provided for the casing at **14**, which may be either integral therewith or a separate piece fastened thereto in any suitable manner.

The upper end of the casing **14** is enlarged just below the faucet connection to provide a mixing chamber for the two or more fluids which are admitted thereto. In this chamber there is positioned a turbulence producing element, whereby an effective and very thoroughly commingling of the two or more liquids or fluids results.

This turbulence producing element is shown in more detail in Figures 3 and 4 and comprises essentially a flat cylindrical casing **28**. This casing is flared outwardly at its upper edge and is flared inwardly at its lower edge. The upper edge or flange rests on a shoulder **20** in the upper end of the casing **14** and the lower edge supports a disc **23** which has a single central opening **27** therein. A perforated disc **22** is fitted into the upper end of the cylindrical casing **28** and is on the same plane with the outwardly turned edge or flange which rests in the internal shoulder **20** of the casing **14**. This plate **22** has a number of openings **40** therein as best shown in Figure 3.

The lower end of the mixing chamber communicates with the passage **17—19** in the casing **14**, but is slightly separated therefrom and is internally defined by an annular integral ledge **21** as best shown in Figure 1.

The extension **15** has an opening **34** therein which communicates with the mixing chamber **38** in the upper end of the casing **14** and the outer end of this extension **15** is internally screw threaded for the reception of the combination inlet pipe and needle valve **31**. This valve and pipe element is best shown in Figures 1 and 6 and its outer end may fit into the end of a length of tubing which leads to a supply of secondary fluid to be mixed with the main fluid or liquid passing through the faucet **10**. The faucet **10** is provided with the usual shutoff valve controlled by handle **45**.

The needle valve **31** has a longitudinal passage **32** therethrough, which terminates at its inner end in an angular cross passage **46** whereby the amount of liquid or fluid drawn in through the passageway **32** can be accurately regulated by simply rotating the needle valve connection element **31** to a desired position. This adjusted position can be fixed by lock-nut **35**.

The outer end of the passageway **32** is enlarged at **33** to insure a sufficient supply of fluid or liquid at that point and this eliminates clogging.

The opening **34** in the extension **15** is enlarged downwardly as shown in Figures 1 and 2, and a support or cross bar **30** is positioned adjacent the end opening. This supporting cross bar **30** has a central opening therein, in which is positioned a pin **25** provided with a head **47**.

A cup shaped receptacle **24** is fastened onto the lower end of the pin **25**, and in this receptacle there is fixed a block of some suitable resilient material **26**, such as rubber, which acts as a valve or closure element when the cup **24** and stem **25** are in a raised position as shown in Figure 2.

Whenever it is desired to mix two fluids or liquids, such as a detergent or germicide with water or the like, the device of this invention is fastened onto a water faucet as shown in Figure 1 and a tube or other pipe is fastened onto the needle valve extension 31. This tube leads to a supply of liquid soap, germicide, detergent or some other liquid which is to be mixed in a pre-determined ratio with the water or other liquid or fluid flowing through the faucet 10. The amount of detergent to be mixed with the water is controlled by an adjustment of the needle valve 31 and the flow of water or other liquid is controlled by the handle at 45.

Water or other liquid through the faucet 10 strikes the turbulence producing element of Figures 3 and 4 and passes through the openings 40 in the plate 22, then entering the space in the turbulence producing element 29 and thence flows out through the bottom opening 27 in a sort of whirling motion and finally into the mixing chamber 38. When the water or other liquid exits through the passageway 17—19, an aspirating effect is produced due to the Venturi action and this creates a suction in the passageway 34. Such suction would ordinarily draw liquid from the secondary source of supply through the passageway 32 in the needle valve 31 except for the fact that the valve 24—26 is in its lowermost position and allows a considerable quantity of air to enter chamber 34, thereby breaking any vacuum existing in the chamber and preventing any flow of detergent or other secondary liquid through the valve 31—32.

However, a simple upward push of the valve element 24—26 will close the opening which admits air to the chamber 34, whereupon liquid or fluid will immediately be drawn in through the passageway 32. This secondary liquid will be thoroughly mixed in the chamber 38 with the liquid which flows in from faucet 10, thereby effecting a desired solution or mixture which may be composed of various ingredients, such as soap solutions for washing dishes or the like, or a mixing of an insecticide or germicide with a carrying liquid, or some other material. The device may be employed in many and varied aspirating and mixing operations.

Due to the suction or vacuum created in the passage 34 the valve 24—26 will remain in closed position as shown in Figure 2 until it is deliberately opened by a downward pull or until the flow of liquid through the faucet 10 is shut off, whereupon it will automatically drop until it reaches the position shown in Figure 1. This condition will continue even though the flow of liquid through the faucet 10 is later reinstated by opening the handle 45. In this event the valve 24—26 will remain in an opened position and no detergent or other fluid can flow from the valve 31—32 thereby positively eliminating any danger of contaminating the water or other liquid passing through faucet 10.

It will be evident that herein is provided a highly desirable mixing means for water and another liquid for a preliminary washing or other operation with the further and automatic assurance of a fresh supply of rinsing water for washing dishes or other utensils which have been preliminarily cleansed and disinfected by a solution of soap, germicide or the like.

In Figure 6 a slightly modified form of the invention is shown wherein the parts 14—16—24—31, etc., are the same as those previously described. This particular embodiment is designed for use with dish washing machines, wherein a supply of detergent of any pre-determined strength or in solution is to be introduced into such machine. In this embodiment the casing 14—16 is slightly reduced in size and is screw threaded at 41 to provide for the reception of an extension 37. This extension is provided with an air inlet in the form of open ports 36 which are in juxtaposed relation to the extension 16. These openings provide a vacuum breaking effect which prevents back-siphoning, while in no way deterring from the desired fluid mixing operation.

The extension 37 is reduced as shown at 43 thereby providing a more coherent jet of aerated liquid flow and the outer end of this extension is screw threaded as at 42 for the reception of an internally screw threaded coupling element 44. A sealing gasket 39 is provided for this connection and a piece of pipe or tubing 13 leads to the washing machine or other operating structure. This piece of tubing may be a flexible hose for a more direct and individual washing operation.

It will be evident that herein is disclosed a novel and useful mixing device which is particularly adapted for supplying a pre-determined amount of detergent or other material to a constantly flowing source of water whereby the detergent or germicide in solution can be used for many and varied cleansing and washing operations, for example, in hotels, restaurants, taverns and the like, and even in the ordinary household, such as in connection with a clothes washing machine or a dish washing machine. After the detergent or germicide solution is employed to the desired extent, all that is necessary to shift to a source of clean rinsing water is to shut off, for no more than an instant, the supply of water or other main liquid, whereupon the aspirating effect will immediately cease and any vacuum existing in the system will be automatically broken. A resumption of flow of the water or main supply of fluid will merely result in a continuation of such flow without any undesired injection of detergent, germicide or secondary fluid and this condition will prevail until the air intake between the needle valve and the aspirating inlet is closed, whereupon the injection of the detergent or the like will be immediately resumed and will continue in effective operation until again stopped.

I claim as my invention:

1. A liquid mixing device comprising a mixing chamber, a passageway therethrough, means for connecting one end of the chamber to a source of main liquid under pressure, spaced perforated discs for creating a turbulence of the entering liquid, a conduit connected to the chamber adjacent so said turbulence producing discs for the admission of a second liquid, an air inlet in said conduit, means for manually controlling the supply of air to said inlet, and a valve in the conduit for the secondary liquid for controlling the supply of said liquid, wherein the control for the air inlet is automatically opened when the supply of the main liquid is shut off.

2. A fluid mixing device comprising a main casing, an inlet at one end of the casing for liquid under pressure, an inlet at the side of the casing for another liquid to be mixed with the first liquid, a fluid mixing chamber in the casing, an air intake adjacent the second inlet, manually controlled means for closing said air intake, a second casing connected to the first casing at its outlet end, another air inlet in said second casing and an anti-splash guard forming part of the first casing adjacent said second air inlet.

3. A liquid and air mixing device as described in claim 2, wherein a flexible pipe is connected to said second casing.

4. A device as described in claim 2, wherein the outlet end of the main casing is restricted for supplying the mixed liquids under reduced pressure to the second casing.

5. A device as described in claim 4, wherein the fluid mixing chamber includes a pair of spaced perforated discs.

6. A device as described in claim 5, wherein a retaining cylinder is provided for the spaced discs.

7. A device as described in claim 6, wherein an integral annular trough forms part of the mixing chamber.

8. A device as described in claim 7, wherein said trough is adjacent the upper end of the restricted passage in the casing.

9. In a mixing attachment for water faucets comprising a body having a water passage therethrough, a portion of said water passage forming a Venturi tube, and a

detergent passage in said body communicating with said water passage adjacent the throat of said Venturi tube, the improvement comprising, an atmospheric vent in said detergent passage, and normally open valve means for closing said vent, said valve means including a valve seat surrounding said vent and a valve body closeable in said seat, said valve body having inner and outer faces respectively exposed to said passage and the atmosphere when said valve body is closed against said seat, said surfaces being proportioned and arranged so that said valve body is held closed by atmospheric pressure when water flow in said Venturi tube causes a pressure reduction in said detergent passage on the opposite side of said valve means.

10. A device of the character described comprising a body member adapted for attachment to a source of fluid under pressure, said body being formed to provide a primary passage having an intermediate portion of restricted cross section, a liquid induction passage communicating with said restricted portion, an air induction passage communicating with said restricted portion, and normally open valve means in said air induction passage including a valve seat and a valve element movable from

a closed position against said valve seat to an open position spaced therefrom and means for manually moving said valve element to closed position, said valve element being retained in closed position solely by suction created in said restricted portion due to the passage of fluid therethrough.

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