

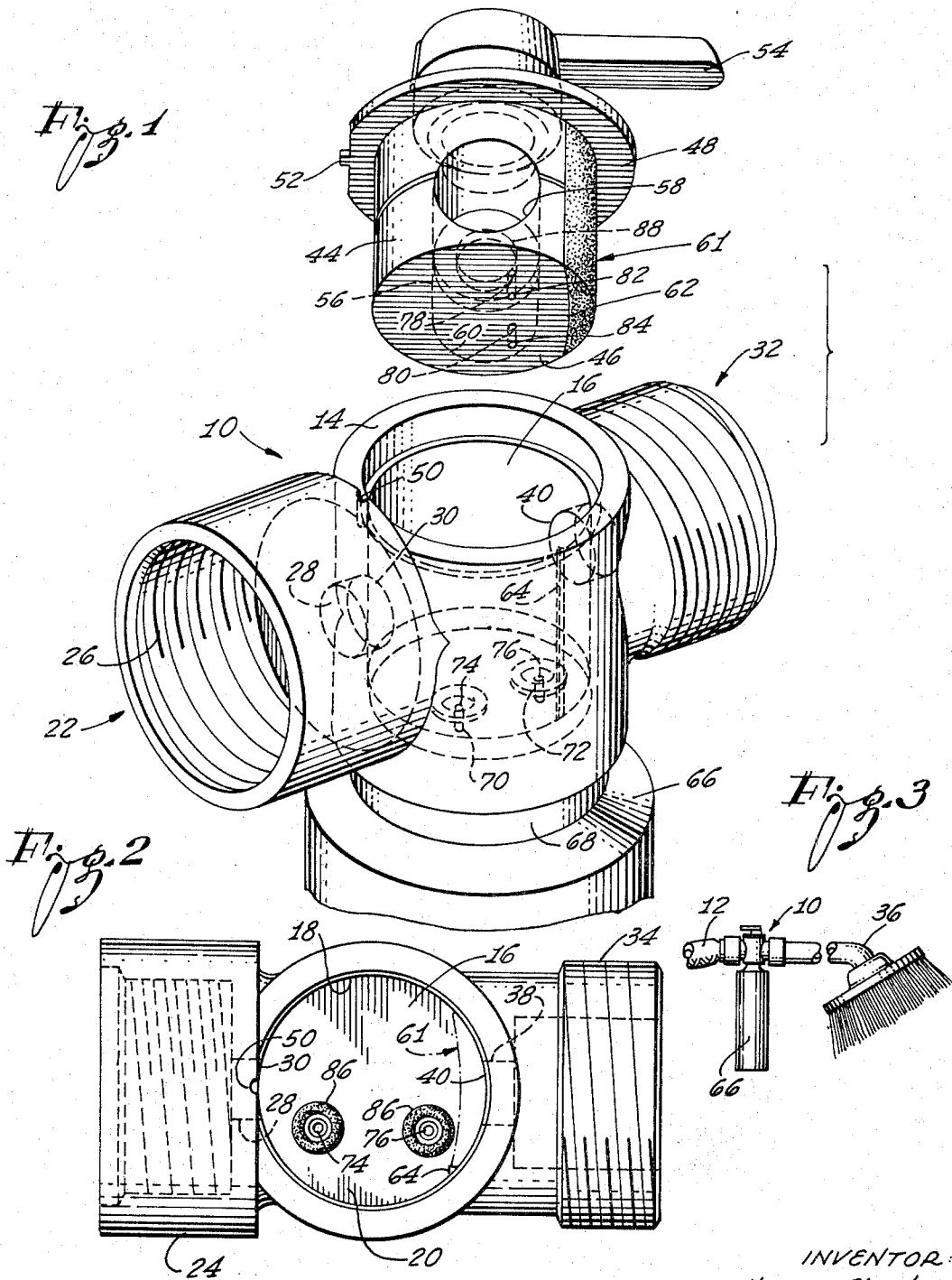
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FLUID MIXER WITH VALVING

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FLUID MIXER WITH VALVING

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ABSTRACT OF THE DISCLOSURE

This invention relates to a mixing valve having first, second and third positions. In the first position of the valve all flow of fluid is inhibited. In the second position of the valve a flow of fluid is provided. In a third position of the valve the fluid is mixed with a material such as soap.

The present invention relates to mixing means and more particularly to means for mixing a secondary material with a primary material.

The present invention provides a light weight mixer which is adapted to be hand-held and used with a conventional garden hose for mixing a secondary material such as a soap or detergent with a primary material such as water. The mixer is not only inexpensive and easy to use, but is also reliable in operation.

In one operative embodiment, the mixer includes a valve housing having a cylindrical chamber in the center thereof and an inlet and an outlet on the opposite sides that communicate with the chamber. The inlet is adapted to be connected to a source of a primary fluid such as the discharge end of a garden hose. The outlet is, in turn, adapted to be connected to a utilization device such as a brush for dispensing and using a mixture of water and detergent. A rotor is disposed in the cylindrical chamber and is movable between three positions, the first position permits clear water to flow directly through the mixer. In the second position, the rotor acts as a seal which completely blocks the flow of any water. In the third position, the rotor is effective to cause a secondary material such as soap or detergent to flow from a container attached to the valve housing and be mixed with the water through the mixer.

These and other features and advantages of the present invention will become readily apparent from the following detailed description of a single embodiment thereof particularly when taken in connection with the accompanying drawing wherein:

FIGURE 1 is an exploded perspective view of one operative embodiment of a mixer employing one form of the present invention;

FIGURE 2 is a plan of a valve housing employed in the mixer of FIGURE 1; and

FIGURE 3 is a view of a mixer operatively connected between a garden hose and a utilizing device for mixing a secondary material such as soap or detergent with the water from the hose and supplying the resultant mixture to the utilizing device.

Referring to the drawings in more detail, the present invention is especially adapted to be embodied in a

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mixer 10 for combining a secondary material with a primary material. Although the mixer 10 may be employed for any desired purpose, in the present instance, it is especially useful for being interconnected with a conduit such as a conventional garden hose 12. Moreover, the mixer 10 may be employed to combine a wide variety of materials to form a wide variety of resultant mixtures. However, in the present instance, the mixer 10 is particularly intended to combine a small amount of a secondary material such as a soap or detergent with a large volume of a primary material such as clear water from a garden hose 12.

The mixer 10 includes a housing 14 that supports the various portions of the mixer 10. Although the housing 14 may be fabricated by any desired means, it has been found advantageous to mold the housing 14 out of a plastic material.

The center of the housing 14 includes an enlarged chamber 16 which extends downwardly into the housing 14. This chamber 16 preferably has a substantially cylindrical inner surface 18. The upper end of the chamber 16 forms an enlarged opening in the top of the housing 14 while the lower end is formed by a substantially planar end wall 20 that is normal to the axis of the cylindrical surface 18.

One side of the housing 14 includes a suitable inlet 22 for being interconnected with a source of the primary material. By way of example, this inlet 22 may be in the form of a fitting 24 adapted to be attached to the discharged end of a conduit containing the primary liquid. More particularly, the fitting 24 is internally threaded at 26 so as to be capable of being screwed directly onto the outlet end of a conventional garden hose 12. A restricted passage 28 is provided in the inner end of the inlet 22. This passage 28 extends axially of the fitting 24 and forms a small opening 30 into one side of the cylindrical chamber 16.

The opposite side of the housing 14 includes an outlet 32 for being connected with a device for utilizing a mixture of the primary material and the secondary material. By way of example, this outlet 32 may be in the form of a fitting 34 adapted to be attached to a complementary inlet on the utilizing device 36. More particularly, the fitting 34 is externally threaded so as to be capable of being screwed into the end of a tubular handle of a brush 36 for washing cars, etc. A small passage 38 extends axially through the fitting 34 so as to form a small opening 40 into one side of the cylindrical chamber 16.

It will thus be seen that when the inlet 22 is threaded onto a discharge end of a garden hose 12 and the outlet 32 is threaded into the handle of the brush 36, a material such as clear water may flow through the opening 30 formed by the inlet passage 28, across the chamber 16, through the opening 40 formed by the outlet 32 and then into a tubular handle of the brush 36.

The flow of the liquid through the mixer 10 may be controlled by a suitable valve member disposed in the chamber 16. In the present instance, this valve member is a rotor 44 that revolves inside of the chamber 16. The exterior surface of the rotor 44 is substantially cylindrical, but has an outside diameter slightly less than the inside diameter of the chamber 16. This will provide

a substantially uniform clearance space between the exterior of the rotor 44 and the interior of the chamber 16. Preferably, this clearance space is just sufficiently large to permit easy movement of the rotor 44 inside of the chamber 16. The inner end 46 of the rotor 44 is substantially planar and normal to the axis of the rotor 44. The end 46 of the rotor 44 slidably engages the end wall 20 at the inner end of the chamber 16.

A cap 48 may be attached to the end of the housing 14 so as to extend across the open end of the chamber 16 and seal the rotor 44 inside of the chamber 16. It has been found desirable to provide a key way 50 on the housing 14 for receiving a key 52 that projects from the cap 48. This will insure the cap 48 being properly positioned on the housing 14.

A stem may be provided on the end of the rotor 44 so as to project through an opening in the center of the cap 48. A knob or control lever 54 may be attached to this stem. This will permit the operator to control the position of the rotor 44 inside of the chamber 16. It has been found desirable to provide a sealing member such as an O ring on the end of the rotor 44 concentric with the stem. The O ring will ride against the inside of the cap 48 and prevent leakage between the stem and cap 48.

A passage 56 is provided which extends transversely across the rotor 44. This passage 56 extends completely through the rotor 44 so as to form enlarged openings 58 and 60 on the diametrically opposite sides thereof.

When the lever 54 is disposed in a first position, the openings 58 and 60 formed by opposite ends of the passage 56 will be aligned with the openings 30 and 40 formed by the inlet 22 and outlet 32. As a consequence, the liquid may freely flow from the inlet 22 through the passage 56 to the outlet 32. If the control lever 54 is rotated 90° from the foregoing or first position, the passage 56 will be rotated by the same amount and disposed at right angles to the diameter between the inlet 22 and outlet 32. The openings 58 and 60 on the rotor 44 will then no longer be in registry with the openings 30 and 40 formed by the inlet 22 and the outlet 32. As a consequence, the flow of liquid will be blocked and it will be impossible for the liquid to flow from the inlet 22 to the outlet 32. Under these circumstances, even though the liquid at the inlet 22 is under a high pressure, it will not reach the outlet 32.

If the control lever 54 is rotated an additional 90° into a third position, the openings 60 and 58 formed by the opposite ends of the passage will again be aligned with the openings 40 and 30 formed by the inlet 22 and outlet 32. As a consequence, the liquid may flow from the inlet 22, through the opening 30, through the passage 56, through the opening 40, and into the outlet 32. It should be noted that under these circumstances, the flow of liquid through the passage 56 will be in a direction opposite to that when the control lever 54 is in the first position.

Placing the handle 54 in the second position disposes the passage 56 normal to a diameter between the inlet 22 and outlet 32 and blocks the flow of water. However, it has been found that the clearance space between the exterior of the rotor 44 and the cylindrical surface 18 on the inside of the chamber 16 permits some of the liquid to leak around the rotor 44. To prevent such leakage reaching the outlet 32, it has been found desirable to provide one or more seal members that will block the flow. Although a seal member may be provided for each of the openings 30 and 40, in the present instance, a single sealing member 61 is provided for blocking just one of the openings. The sealing member 61 is disposed on the rotor 44. In order to provide a clearance space for the sealing member 61, the side of the rotor 44 may be relieved at a location between the openings 58 and 60. The inner surface of the seal member 61 fits against the surface 62 of the relieved surface. The exterior of the seal 61 is substantially cylindrical so as to form a smooth

cylindrical continuation of the exterior of the rotor 44 whereby the seal 61 will be substantially crescent shaped. The exterior of the seal 61 is adapted to fit snugly against the cylindrical surface 18 and slide therealong when the rotor 44 revolves.

It may be seen that when the handle 54 is in the first or third position, the opposite ends of the passage 56 will be aligned with the openings 30 and 40 formed by the inlet 22 and outlet 32. Under these circumstances, the seal 61 will be disposed between the openings 30 and 40 and out of the path followed by the liquid. As a consequence, the seal member 61 will not interfere with the flow of the liquid between the inlet 22 and outlet 32.

However, when the handle 54 is in the second position, the passage 56 will be normal to the inlet 22 and outlet 32 so that no liquid can flow through the passage 56. At the same time, the seal member 61 will be disposed in alignment with one of the openings 30 or 40 formed by the inlet 22 or the outlet 32. This will be effective to block the flow of liquid and completely stop the flow.

It has been found desirable to position the seal member 61 so that it will be aligned with the opening 40 to the outlet 32 when the handle 54 is in the second position. The water leaking around the exterior of the rotor 44 will accumulate behind the seal member 61 and the pressure in the liquid will force the seal member 61 into the outlet opening 40. The liquid pressure will thereby be effective to increase the effectiveness of the sealing action.

To further insure an effective sealing action, a stop such as a small rib 64 may be provided on the cylindrical surface 18. The rib 64 projects radially inwardly so as to ride against the exterior of the rotor 44. As the rotor 44 moves into the second position and the seal 61 moves across the outlet 32, the seal member 61 will come into contact with the stop 64 and be retained in alignment with the opening 40. The surface 62 of the relieved section may be contoured to form a cam. As the rotor 44 moves slightly past the second position, the seal member 61 will be restrained against further movement and the cam surface 62 will be effective to further compress the sealing member 61.

It will be seen that although the foregoing sealing arrangement is extremely simple, it is also extremely reliable and effective to completely block the flow of fluid to the outlet 32.

A container 66 may be provided for containing the secondary material which is to be mixed with the primary material. The container 66 may be of any desired variety; however, it is preferably adapted to be attached directly onto the mixer 10 so as to be carried therewith. By way of example, the container may be a relatively small size plastic bottle having a restricted neck.

The bottom of the housing 14 may include an internally threaded opening or fitting 68 into which the neck of the container 66 may be threaded. This fitting 68 is preferably immediately adjacent to the end wall 20 that defines the bottom of the chamber 16.

Suitable passage means may be provided which extend through the end wall 20 so as to interconnect the interior of the container 66 with the chamber 16. For reasons that will become apparent subsequently, it is preferable that a pair of passages 70 and 72 be provided that are displaced from a diameter of the end wall 20. These passages 70 and 72 form a pair of correspondingly placed openings 74 and 76 in the end wall 20.

A pair of complementary passages 78 and 80 may be provided in the rotor 44. The inner ends of the passages 78 and 80 communicate with the transverse passage 56 in the rotor 44. The outer ends of the passages 78 and 80 form openings 82 and 84 in the bottom 46 of the rotor 44. These openings 82 and 84 are positioned to register with the openings 74 and 76 in the end wall 20 when the handle 54 is disposed in a third position. However, when the handle 54 is disposed in the first or second position, the openings 74, 76, 82 and 84 will not register and the

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passages 70, 72, 78 and 80 will be isolated from each other. As a consequence, the transverse passage 56 will not be interconnected in any way with the interior of the container 66 except when the control lever 54 has been moved into the third position. In order to insure a complete isolation of the passage 56 from the interior of the container 66, it has been found desirable to provide suitable seals such as O rings 86 in the end wall 20. The rings 86 surround the openings 74-76 and slide across the end 46 of the rotor 44 as it revolves.

Means for creating a pressure differential may be disposed in the passage 56 between the two passages 78 and 80. By way of example, this means may include a radially inwardly projecting flange 88. The flange 88 is provided in the center of the passage 56 so as to be disposed between the two passages 78 and 80. It will be seen that when the liquid is flowing through the passage 56, the pressure on the upstream side of the flange 88 will be higher than the pressure on the downstream side. As a consequence, the pressure in the first passage 78 will be greater than the pressure in the second passage 80.

If the handle 54 is in the third position, the openings 82 and 84 are aligned with the openings 74 and 76 in the end wall 20. The higher pressure will cause a small portion of the fluid on the upstream side of the flange 88 to flow through the two passages 78 and 70 and into the container 66. The lower pressure on the downstream side of the flange 88 will allow a corresponding quantity of the material in the container 66 to flow through the other pair of registering passages 72 and 80 into the transverse passage 56 where it will mix with the primary liquid.

In order to employ the present invention, a secondary material such as a soap or detergent may be loaded into the container 66 so as to fill it to capacity. Following this, the container 66 is threaded into fitting 68 on the bottom of the housing 14. The inlet fitting 24 is then threaded onto the discharge end of the hose 12. The handle of the utilizing device or brush is threaded onto the outlet 32. The faucet to which the garden hose 12 is connected, then turned on whereby the water will flow under pressure to the mixer 10.

If it is desired to prevent the flow of any fluid through the mixer 10, the handle 54 is set in the second position. The sealing member 61 will be aligned with the opening 40 formed by the outlet 32. The cam surface 62 on the rotor 44 and the water pressure will maintain the seal member 61 tightly compressed across the opening 40. As a consequence, no water will be discharged.

In the event that it is desired to allow clear water to flow, the handle 54 is placed in the first position. The water will then flow from the opening 30 formed by the inlet 22, axially through the passage 56, through the opening 40 and into the outlet 32. During this flow, a pressure differential will be created between the opposite sides of the flange 88 and in the two passages 78 and 80. However, the openings 82 and 84 formed by the two passages 78 and 80 will not be in registry with the openings 74 and 76 formed by the two passages 70 and 72 in the end wall 20. As a consequence, there will be no flow into or out of the container 66 and only clear water will be discharged.

In the event it is desired to provide a mixture of water and the soap or detergent, the handle 54 is placed in the third position so that the opposite ends of the passage 56 will be aligned with the inlet 22 and outlet 32. This will permit a flow of the water axially of the passage 56 and between the inlet 22 and the outlet 32. This flow will produce a pressure differential between the two passages 78 and 80. However, the openings 74 and 76 will now be aligned with the openings 82 and 84. As a consequence, the pressure differential will produce a flow of water through the passage 70 and into the container 66. At the same time, the soap or detergent will then flow out of the container 66, through the passage 72 and into the pas-

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sage 56 so that the second liquid will mix with the primary liquid.

While only a single embodiment of the present invention is disclosed and described herein, it will be readily apparent to persons skilled in the art that numerous changes and modifications may be made without departing from the scope of the invention. Accordingly, the foregoing disclosure and description thereof are for illustrative purposes only and do not in any way limit the invention which is defined only by the claims which follow.

What is claimed is:

1. A device of the class described including the combination of:

- a housing having a cylindrical chamber therein,
- an inlet on one side of said housing forming a port communicating with said chamber for supplying a primary fluid to the chamber,
- an outlet on one side of said housing forming a port communicating with said chamber,
- a plug-type valve rotor disposed in said chamber for rotating between three different positions,
- a passage extending radially through said rotor and forming openings on the opposite sides of the rotor, said openings being positioned to register with said ports only when the rotor is in either the first or second position to allow the primary fluid to flow through the rotor,
- a restriction in said passage to produce a pressure differential that is a function of the flow of the primary fluid through the passage,
- a pair of passages in said rotor and extending substantially parallel to the rotor axis and offset to one side of the axis of the first passage and communicating with the first passage on the opposite sides of said restriction and terminating at the lower face of the rotor,
- a pair of passages in said housing and communicating with the chamber and arranged to communicate with the pair of passages in the rotor only in the first position of the rotor.

2. The device set forth in claim 1

wherein the valve rotor is relieved at a particular position and wherein sealing means are disposed on the valve rotor at the relieved position and wherein the resilient means are provided with resilient characteristics and wherein the sealing means become stressed in the third position of the valve rotor by the pressure of the fluid to prevent the flow of fluid through the chamber.

3. A device of the class described, including the combination of

- a housing having a chamber therein,
- an inlet on one side of said housing, the inlet forming a port communicating with said chamber for supplying a primary fluid to the chamber,
- an outlet on one side of said housing, the outlet forming a port communicating with said chamber,
- a plug-type valve rotor disposed in said chamber for rotating between at least two different positions,
- a first passage extending through said rotor in a first direction and forming openings on the opposite sides of the rotor in the first direction, the openings being positioned to register with the ports only when the rotor is in either of the two positions to allow the primary fluid to flow through the rotor,
- a restriction in said first passage to produce a pressure differential that is a function of the flow of the primary fluid through the first passage,
- a pair of passages in the rotor and extending in a direction transverse to the first direction and offset to one side of the axis of the first passage and communicating with the first passage on the opposite sides of the restriction and terminating at an end face in the rotor, and
- a pair of passages in said housing and communicating

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with the chamber and arranged to communicate with the pair of passages in the rotor only in the first position of the rotor.

4. The device set forth in claim 3 wherein the valve rotor is movable to a third position and wherein the valve rotor is relieved at a particular position and wherein sealing means are disposed on the valve rotor at the relieved position and wherein the sealing means become stressed in the third position of the valve rotor by the pressure of the fluid to prevent the flow of fluid through the chamber.

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