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PUMP SURGE CHAMBER AND SECONDARY LIQUID FEEDER

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Fig. 1.

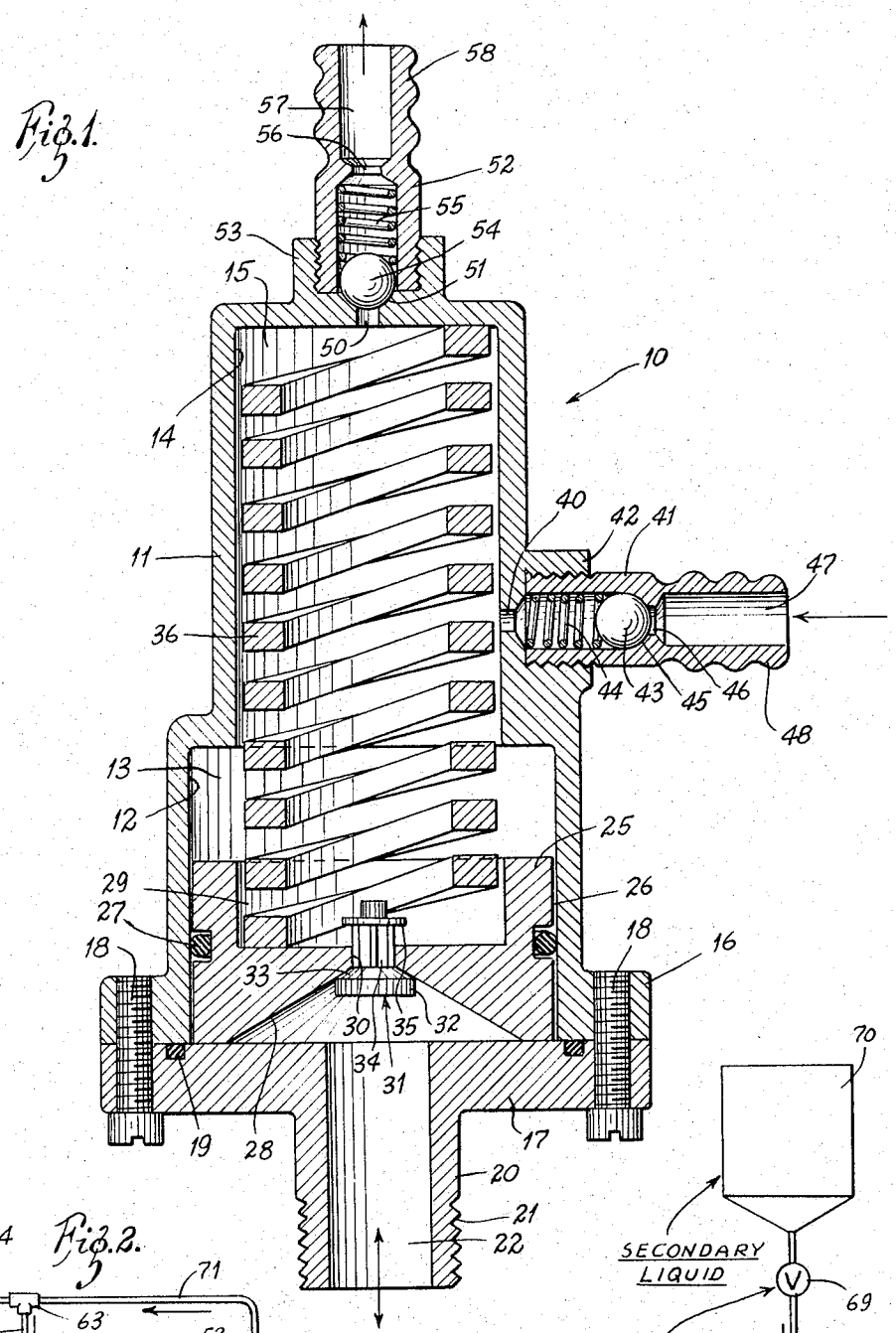
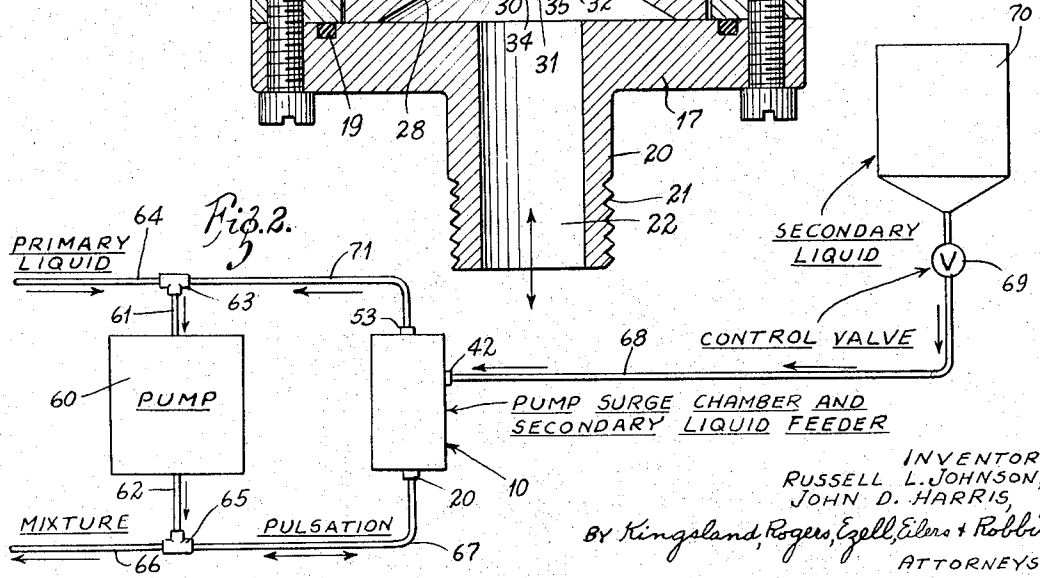


Fig. 2.



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PUMP SURGE CHAMBER AND SECONDARY LIQUID FEEDER

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This invention relates to a surge chamber and secondary liquid feeder for connection into a pump circuit. The pump circuit is one which uses a pulsating pump of any conventional design and which discharges a mixture of a primary liquid and a secondary liquid. Uses for such a pump circuit include car wash machines, chemical spray machines, and others in which a secondary liquid, usually a concentrate, is to be mixed with a primary liquid, such as water. Important results accomplished by the surge chamber and secondary liquid feeder are effective reduction in the amplitude of pulsations on the output from the pump and positive feeding of the secondary liquid.

In the pump circuit, the primary liquid is supplied to the pump inlet. A pipe or hose leads from the pump outlet and has a branch connected to a pumping chamber in the surge chamber and secondary liquid feeder. As the pump operates to draw the primary liquid into the pump to force that primary liquid through the outlet from the pump, the changes in outlet pressure are transmitted as pulsations to the pumping chamber. In response to these pulsations, a piston reciprocates in the pumping chamber against the action of the compression spring to relieve some of the surges produced in the outlet pipe of the pump.

A second function of the surge pump and secondary liquid feeder is to positively feed a secondary liquid to the pump inlet for mixture with the primary liquid. A chamber is defined on the side of the piston opposite the one which is exposed to pump outlet pulsations. This inlet is connected to supply liquid from a secondary liquid source. Reciprocation of the piston drives the secondary liquid through the surge chamber into mixture with the primary liquid being fed to the pump. One-way valves assure that the secondary liquid will flow in only one direction.

The principal object of this invention is to provide a surge chamber and secondary liquid feeder that operates to moderate pulsations in a pumping circuit, and at the same time to positively feed a secondary liquid for mixture with the primary liquid pumped by the pump.

Another object is to provide a surge chamber for a pulsating pump to moderate the pulsations of the pump, wherein the surge chamber has a piston which reciprocates in response to pulsations from the pump, and which itself operates as a secondary pump for a secondary liquid.

Other objects and advantages will be apparent to those skilled in the art.

In the drawing:

FIGURE 1 is a view in longitudinal medial section through the center of the surge chamber and secondary liquid feeder; and

FIGURE 2 is a schematic diagram showing the surge chamber and secondary liquid feeder connected in a pump circuit in which it might typically be used.

Referring now to FIGURE 1, the surge chamber and secondary liquid feeder **10** comprises a housing **11** having an inner side wall **12** defining the side wall of a pumping chamber **13** and an inner side wall **14** defining a spring chamber **15**. The pumping chamber **13** and the spring chamber **15** are in coaxial communication with one another.

The housing **11** has an annular flange **16** surrounding

the pumping chamber end and against the face of which an end cover **17** is held by a plurality of studs **18**. An O-ring gasket **19** provides a fluid-tight seal. There is a connector extension **20** on the cap **17** having external threads **21** to facilitate the attachment of a hose or pipe, and having a passage **22** through it.

A piston **25** is slidable within the pumping chamber **13** toward and away from the passage **22**. The piston **25** has a cylindrical side wall **26** with an O-ring gasket **27** or other sealing means to provide a fluid-tight seal between the side of the piston **26** and the inner side wall **12** of the pumping chamber **13**.

The piston member **25** has a beveled face **28** in its lower side and a recessed spring seat **29** in its upper side. An opening **30** through the center of the piston member receives a small poppet valve member **31**. The poppet valve member **31** has a valve head **32** with a beveled upper side **33** that is movable against the beveled face **28** to provide a fluid-tight seal. A stem **34** extends through the opening **30** and a snap ring **35** prevents the stem **34** from dropping through the opening **30**.

A compression spring **36** bears against the spring seat **29** and against the upper end of the housing **11** at the upper end of the spring chamber **14**. The compression spring biases the piston toward the position shown in FIGURE 1.

There is a liquid inlet port **40** through the side of the housing **11**. The inlet opening **40** is positioned to open into the spring chamber **14**. A small valve housing **41** is threaded into a boss **42** surrounding the port **40**. Within the valve housing **41**, a ball **43** is biased by a compression spring **44** against a valve seat **45** surrounding a valve opening **46**. A passage **47** through a hose connection extension **48** communicates with the valve passage **46**.

A secondary liquid outlet port **50** extends through the top of the housing **11**. A valve seat **51** surrounds the port **50**. A small valve housing **52** is threaded into a boss **53** extending upwardly from the housing **11**. A ball **54** is biased against the valve seat **51** by a compression spring **55**. An opening **56** leads to the passage **50** and establishes communication with an opening **57** in a hose connection extension **58**.

FIGURE 2 shows how the surge chamber and secondary liquid feeder **10** is connected into a pump circuit. In this circuit, a pump **60** of any suitable conventional design has a pipe **61** connected to its inlet and a pipe **62** connected from its outlet. The pipe **61** is connected through a T **63** to another pipe **64** leading from a source of primary liquid (not shown). The primary liquid may be any liquid to be pumped, such as water. The outlet pipe **62** is connected through a T **65** to another pipe **66** leading to an outlet or dispensing nozzle (not shown).

A hose or pipe **67** is connected from the T **65** to the connector extension **20** on the cover **17**. Accordingly, pulsations from the output of the pump **60** are transmitted through the hose **67** to the pumping chamber **12** below the piston member **25**.

A hose or pipe **68** is connected to the hose connection extension **47** and is also connected through a control valve **69** to a source of secondary liquid **70**. Another hose or pipe **71** is connected from the hose connection extension **58** to the T **63**.

Operation

In its function in operating as a surge chamber, the surge chamber and secondary liquid feeder **10** receives pulsations through the pipe **67**. These pulsations are produced during the normal action of the pump **60** which, as it operates, pumps primary liquid from the hose **64** through the pump to the outlet hose **66**. The pulsations are transmitted as alternate compression and suction pres-

sures to the face 28 of the piston member 25. During a pumping stroke of the pump 60, pressure against the face 28 of the piston 25 pushes the piston upwardly against the force of the compression spring 36. At this time, the pressure against the head 32 of the poppet valve member 31 presses the beveled face 33 against the beveled surface 28 and seals the opening 30.

During an intake stroke of the pump 60, the pressure is reduced against the face of the piston member 25, and the spring 36 pushes the piston member 25 downwardly to the position illustrated in FIGURE 1. This operation continues rapidly as the pump 60 operates, and the changing volume of the chamber defined by the face 28 of the piston member 25 moderates the pulsations of the pump 60.

As the piston 25 reciprocates, the secondary liquid is alternately drawn into the spring chamber 14 past the ball valve member 43 and discharged past the ball member 54 to the opening 57 and the pipe or hose 71. Thus, on downward movement of the piston member 25, during an intake stroke of the pump 60, a reduced pressure is created in the spring chamber 14 and the pumping chamber 13 above the piston member 25, and liquid from the secondary liquid source 70 presses the ball valve member 43 away from the valve seat 45 and admits secondary liquid into the spring chamber 14 and the pumping chamber 12. This secondary liquid tends to fill the chamber before the piston member 25 begins an upstroke. When the pumping stroke of the pump 60 occurs, the piston member 25 moves upwardly, compressing the secondary liquid and closing the ball valve member 43 against the valve seat 45. At the same time, the ball valve member 54 is moved upwardly away from its valve seat 51 and the secondary liquid is pumped by the piston member 25 to the pipe or hose 71 and to the T 63 where the secondary liquid joins with the primary liquid and both are drawn into the pump 60.

The poppet valve 31 operates to purge air from the pumping chamber 12 below the piston member 25. When that position of the chamber is not under pressure, the poppet valve can drop until the snap ring 35 rests against the spring seat 29, and air can be forced from the pumping chamber through the opening 30 into the spring chamber. As soon as the pumping operation begins and the pump 60 causes a higher pressure to be established in the pumping chamber 12 below the piston member 25, the poppet valve member 31 is pressed against the beveled surface 28 to close the opening 30. Also, when the pump is not in operation, secondary liquid can flow through the opening 30 to prime the pumping chamber 12 below the piston member 25. Thus, the poppet valve member eliminates the lost time at the beginning of operation normally required to purge the chamber of air.

Various changes and modifications may be made within the purview of this invention as will be readily apparent to those skilled in the art. Such changes and modifications are within the scope and teaching of this invention as defined by the claims appended thereto.

What is claimed is:

1. A liquid mixing system including a primary pump and a secondary pump, the primary pump being of greater capacity than the secondary pump, the secondary pump comprising a surge chamber and secondary liquid feeder including a housing, a pumping chamber within the housing, a spring chamber within the housing, an inlet opening to the pumping chamber, a wall reciprocable within the pumping chamber, means providing a liquid seal to block the flow of liquid past the reciprocable wall and to thereby block liquid communication between the pumping chamber and the spring chamber, a compression spring within the spring chamber biasing the wall in a direction tending to reduce the volume of the pumping chamber, the primary pump being a pulsating pump having an inlet and an outlet, means to connect the pulsating pump inlet to a source of primary liquid thereby causing the primary liquid to be pumped from the inlet to the outlet of the pulsating pump, means for connecting the inlet opening of the secondary pump to the outlet from the pulsating pump thereby causing the wall to move in response to pulsations of the pulsating pump and dampen surges at the primary pump outlet caused by such pulsations, inlet and outlet ports opening through the secondary pump housing to the spring chamber, means to connect the inlet port to a source of secondary liquid, means to connect the outlet port to the inlet side of the pulsating pump, whereby reciprocations of the wall caused by pulsations of the pulsating pump cause flow of liquid from the secondary liquid source through the spring chamber to the primary pump inlet for mixture with liquid from the source of primary liquid, and one-way valve means in the inlet and outlet ports to permit flow in one direction only from the secondary liquid source toward the pulsating pump inlet, the secondary pump deriving its pumping energy solely from the pulsations of the primary pump.

2. The combination of claim 1 wherein the reciprocable wall comprises a piston, an opening through the piston, a valve for alternately opening and closing the opening, the valve having a valve head responsive to increases in pressure on the piston face side of the piston to close the opening and responsive to decreases in such pressure to open the opening.

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