

May 22, 1956

R. E. FARISON
CAN WASHING SYSTEM

2,746,465

Filed June 25, 1952

4 Sheets-Sheet 1

Fig. 1.

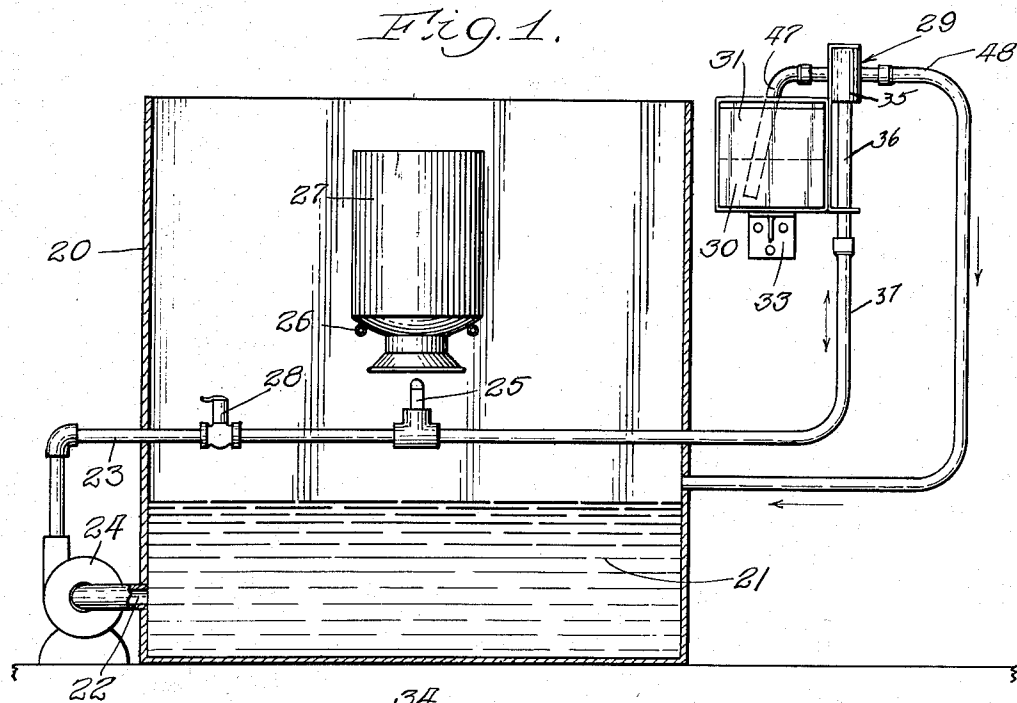


Fig. 2.

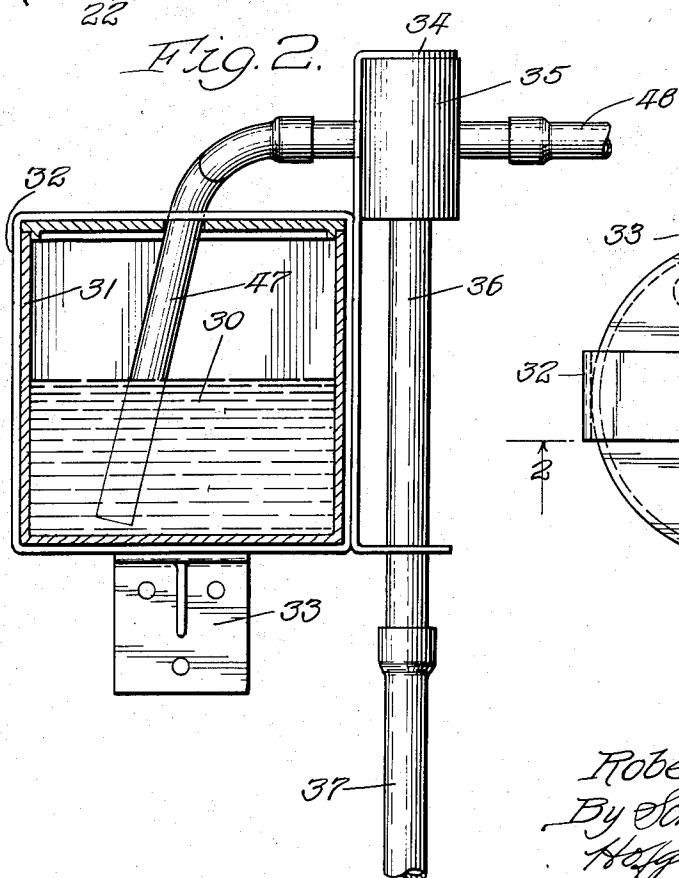
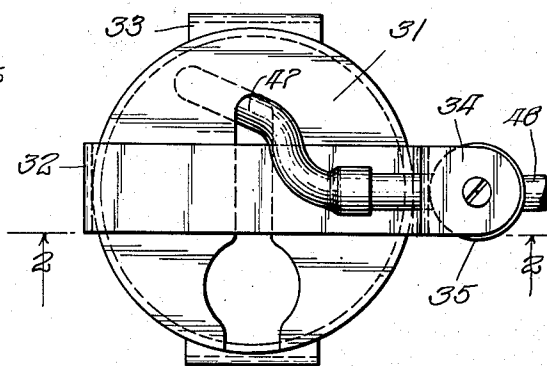


Fig. 3.



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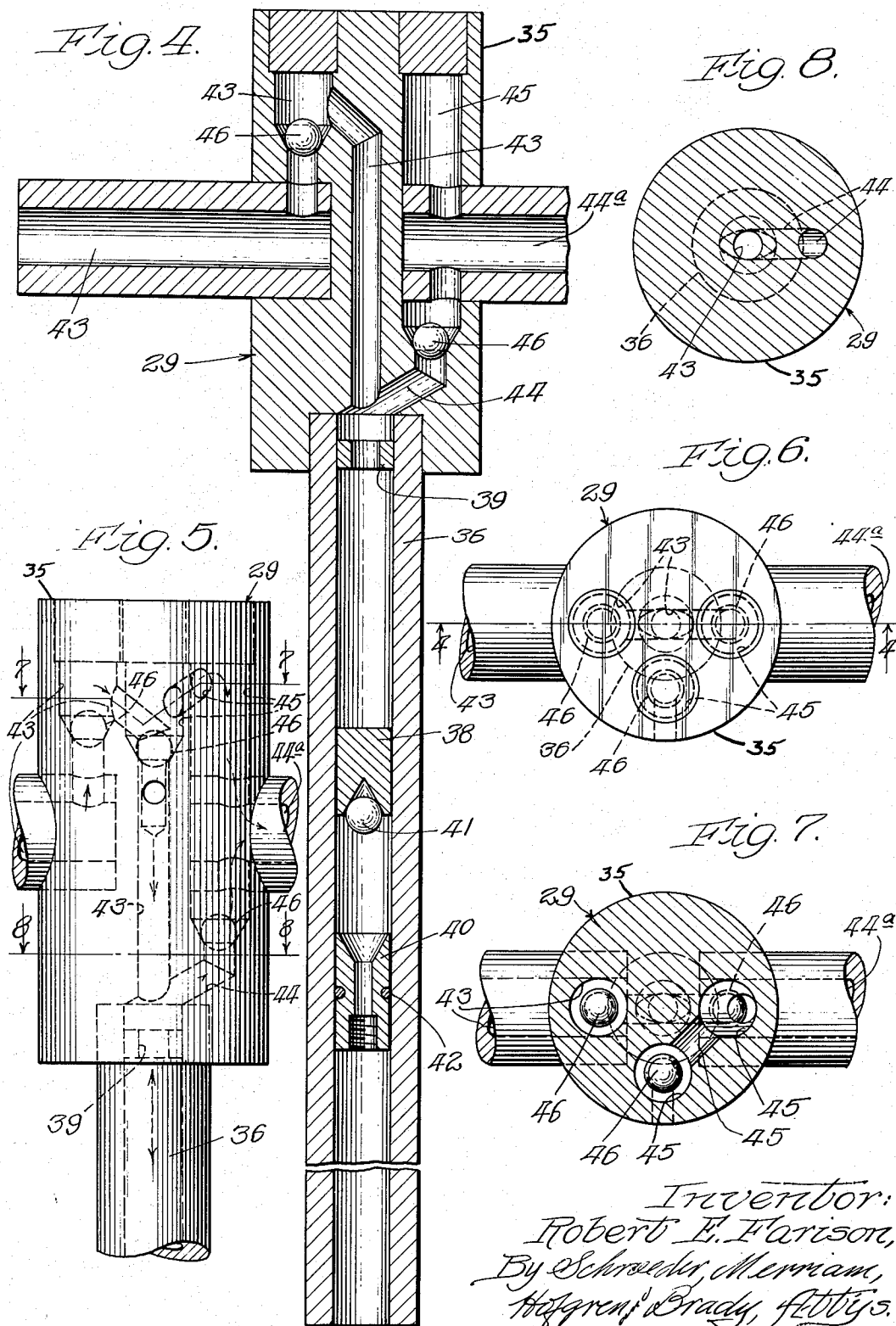
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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

Fig. 9.

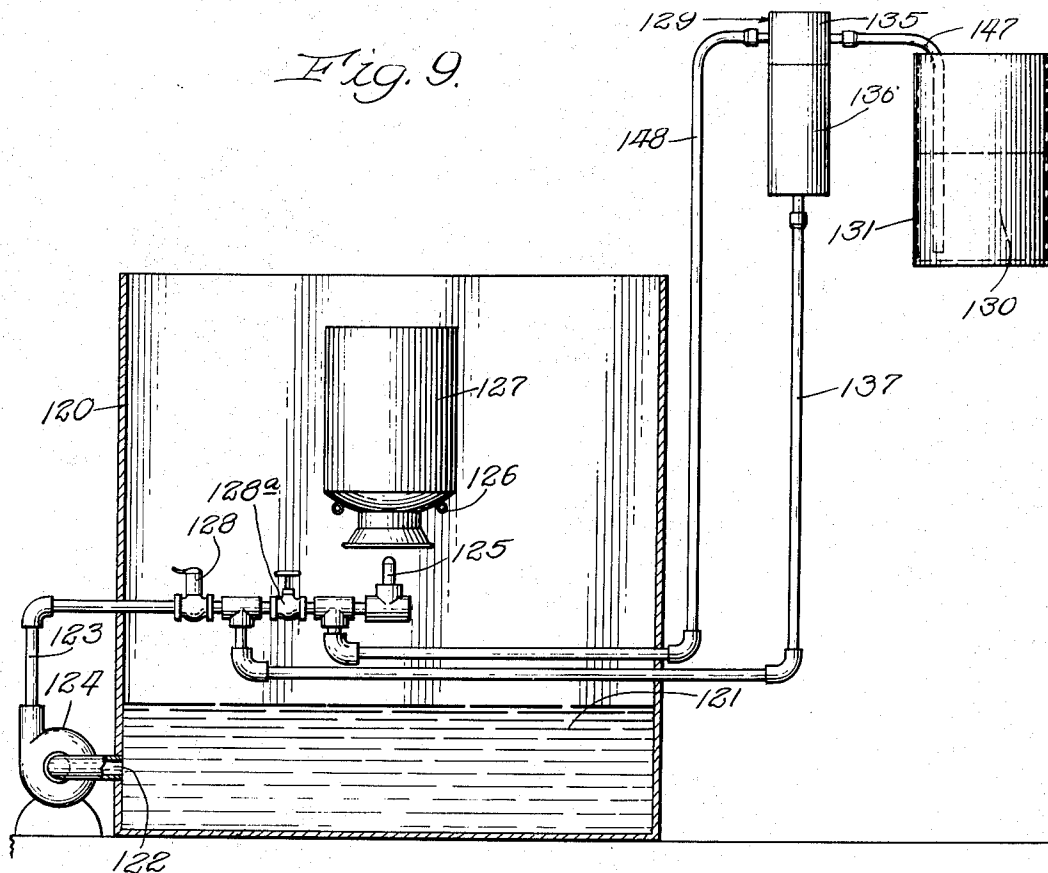
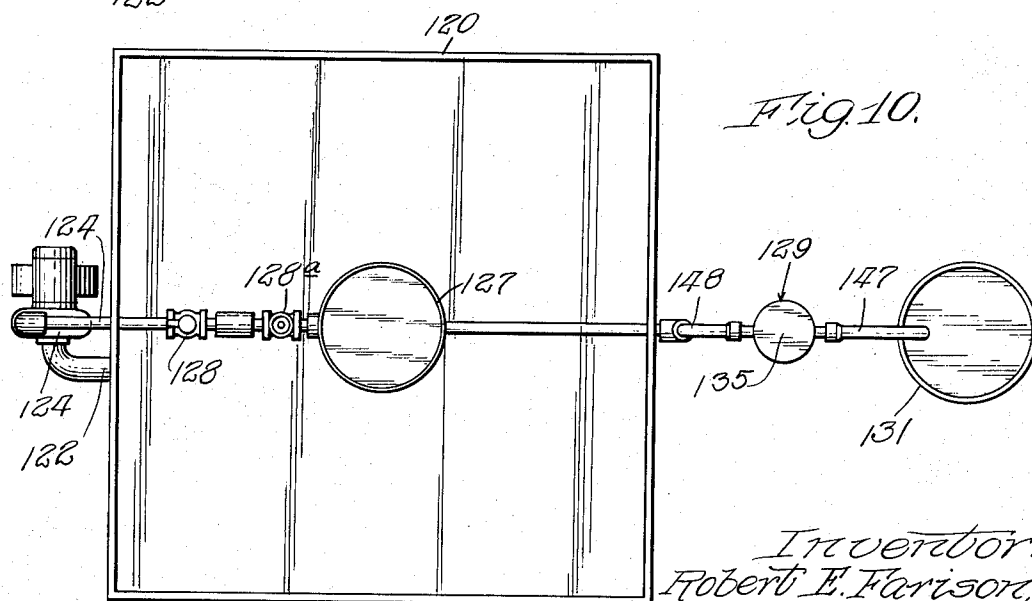


Fig. 10.



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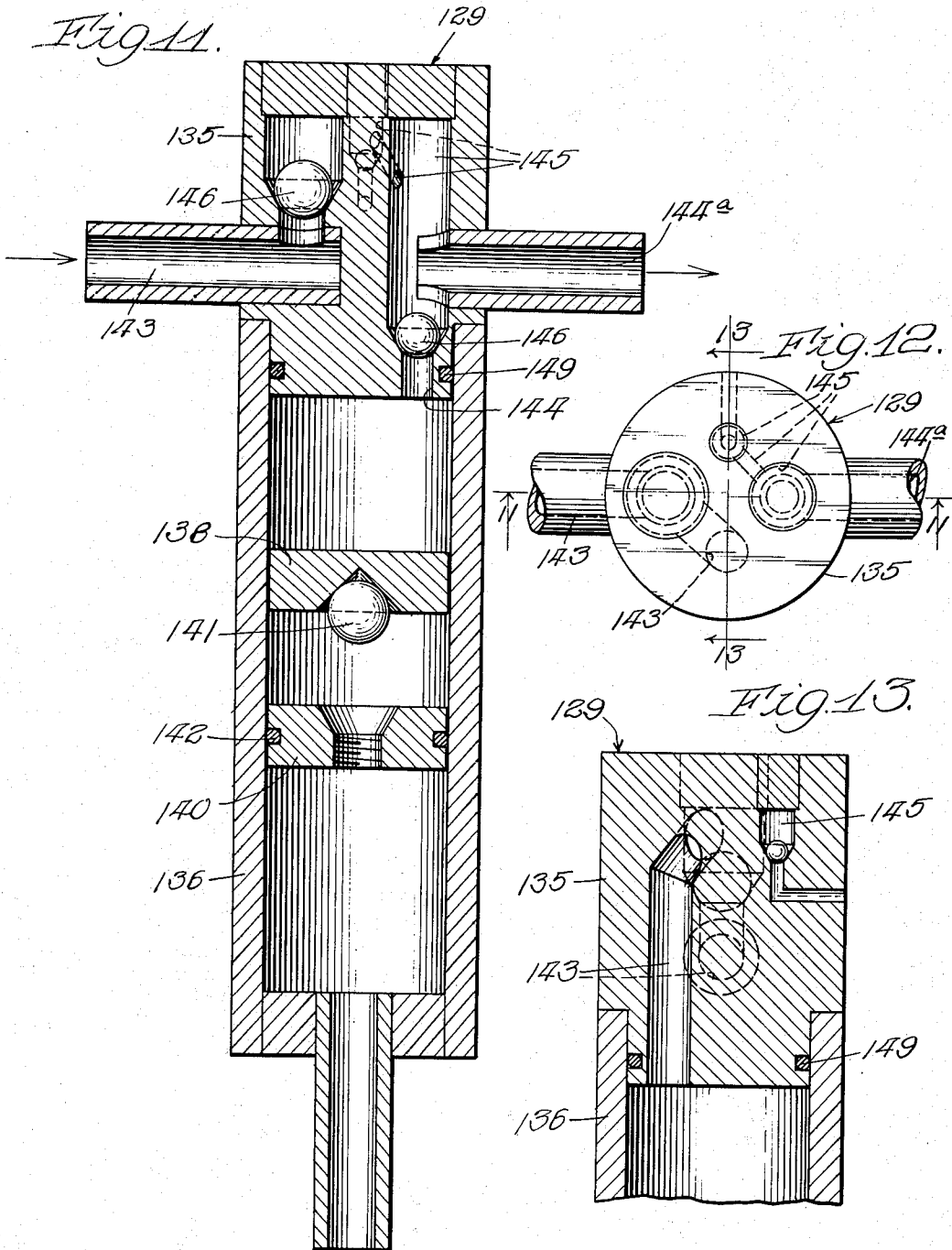
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4 Sheets-Sheet 4



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2,746,465

CAN WASHING SYSTEM

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Application June 25, 1952, Serial No. 295,446

14 Claims. (Cl. 134—56)

This invention relates to a washing system and more particularly to a liquid spray type washing system including an improved hydraulic dispenser.

In liquid washing systems and particularly the industrial types, as for example those used in dairies and bottling plants which employ spray jets or nozzles, the washing liquid is discharged from the nozzles under pressure and these nozzles are usually intermittently and repeatedly turned off and on. It is important in such systems that the washing liquid supplied to the nozzles be maintained at the desired solution strength during continued operation.

This invention provides an economical and greatly improved washing system whereby a predetermined amount of stock solution is automatically drawn into an improved liquid or hydraulic dispenser unit during the period when washing liquid is not being discharged from the spray nozzles and emptied from the dispenser unit into the washing liquid during the period when washing liquid is being discharged from the nozzles. In this way the washing liquid is maintained at the desired, constant solution strength during continued operation of the washing system.

The invention will be described with reference to an embodiment illustrated in the accompanying drawings, in which:

Fig. 1 is a side elevational view of a spray washing system embodying this invention, partially broken away to show the position of the spray nozzle and the object to be washed;

Fig. 2 is a fragmentary, enlarged side elevational view of the liquid dispenser and the stock solution container of Fig. 1, partially broken away to show the location of the inlet pipe line leading from the stock solution to the dispenser unit;

Fig. 3 is an enlarged, fragmentary top plan view of the liquid dispenser unit and stock solution container of Fig. 1;

Fig. 4 is an enlarged, fragmentary vertical sectional view of the liquid dispenser unit of Fig. 1;

Fig. 5 is an enlarged, fragmentary vertical sectional view of the head element of the dispenser unit of Fig. 1 showing the ducts and ball check valves in dotted lines;

Fig. 6 is an enlarged, fragmentary top plan view of the dispenser unit of Fig. 1;

Fig. 7 is a fragmentary, sectional view taken substantially along line 7—7 in Fig. 5;

Fig. 8 is a fragmentary, sectional view taken substantially along line 8—8 in Fig. 5;

Fig. 9 is a side elevational view of a spray washing system embodying this invention but different from the washing system in Fig. 1 and partially broken away to show the position of the spray nozzle and the object to be washed;

Fig. 10 is a top plan view of the washing system of Fig. 9;

Fig. 11 is an enlarged, fragmentary vertical sectional view of the liquid dispenser unit of Fig. 9;

Fig. 12 is a fragmentary, top plan view of the liquid dispenser unit of Fig. 10;

Fig. 13 is a fragmentary, sectional view taken substantially along line 13—13 in Fig. 12.

Referring to the drawings, the washing system as shown in Figs. 1—8 includes a tank 20 containing washing liquid 21. A side wall of this tank has an opening 22 near the bottom and one end of the supply pipe line 23 is connected to the side wall in alignment with this opening. The supply pipe line leads from the tank opening 22 to the intake side of a pump 24 and from the discharge side of this pump to a spray nozzle or jet 25 positioned within the confines of the tank side walls above the level of the washing liquid 21. A standard type whistle valve 28 is connected in the supply pipe line 23 between the pump 24 and the spray nozzle 25 to intermittently and repeatedly turn the spray nozzle off and on. The pump 24 causes washing liquid to flow from the tank 20 through the supply pipe line 23 to the spray nozzle 25 under pressure and the spray nozzle as here shown is directed upwardly so that spray therefrom is directed against an inverted metal milk can 27 mounted by means of support members 26 directly above the spray nozzle.

An hydraulic or liquid dispenser 29 automatically supplies a predetermined amount of stock solution 30 from a container 31 filled with this solution to the washing liquid 21 in the tank 20 during each period when the spray nozzle 25 is operating. As here shown, the stock solution container 31 is positioned in a frame 32 above the spray nozzle 25 but outside the washing liquid tank 20 by means of a support bracket 33 secured to the bottom of the frame. The dispenser unit 29 is held in an upright position adjacent the stock solution container 31 by a support member 34 secured to one side of the frame 32.

Referring to Figs. 1, 2 and 4, the liquid dispenser unit 29 includes an upright metering tube 36 and a head 35 fixedly mounted on the top end portion of this tube. An actuating pipe line 37 connects the bottom end of the metering tube 36 with the spray nozzle 25 so that washing liquid under pressure exerted by the pump 24 is supplied simultaneously to the spray nozzle and the bore of the metering tube. A piston 38 is slidably mounted in the bore of the metering tube and its length of stroke is determined by a piston stop 39 having a bore therethrough fixedly mounted in the bore of the metering tube near the top thereof and a seating unit 40 which is also mounted in the bore of the tube but below the piston 38. This seating unit has a hole therethrough permitting washing liquid from the actuating pipe line 37 to actuate the piston 38 upwardly. As here shown, the top portion of the seating unit hole is tapered and a ball check 41 mounted on the bottom surface of the piston fits into this tapered portion when the piston is at the bottom of its stroke, thereby sealing the hole of the seating unit.

An O ring seal 42, mounted in a grooved ring about the outer surface of the seating unit 40 also binds against the inner surface of the metering tube wall. This seal allows the tapered seating unit 40 to be moved along the bore of the metering tube and holds it in position. Thus, the piston stroke can be adjusted to the desired length. As here shown, the bottom portion of the bore in the seating unit 40 is threaded so that an adjustment rod not shown in the drawings can be inserted at the bottom of the metering tube, screwed into the threaded portion, and the seating unit 40 then moved along the metering tube 36 to the desired position. In addition, the O ring seal 42 prevents washing liquid from flowing past the seating unit 40, except through its hole.

It is important to note that the piston 38 has sufficiently close clearance with the inner wall of the metering tube 36 so that essentially no washing liquid moves past the piston from below while it is moving upwardly. However, the clearance between the piston and the inner wall of the metering tube is such as to permit a small amount

of liquid from below to flow past it when it is at rest at the top of the stroke and pressure is still being maintained by the pump 24 on the washing liquid in both the actuating and the supply pipe lines. In this way, the actuating pipe line 37 is automatically primed.

Referring to Figs. 4 to 8, the head 35 of the dispenser unit is here shown fixedly mounted on the top end portion of the metering tube 36. It contains an inlet duct 43, one end of which communicates with the bore of the metering tube 36, a discharge duct 44, one end of which also communicates with the bore of the metering tube, and a port duct 45, opening to the atmosphere and communicating with the discharge duct 44. A ball check valve, as 46, is located in each of the ducts and the ball is adapted to move vertically toward and away from its tapered valve seat, thus opening and closing the ducts in a manner described hereinafter. An inlet pipe line 47 leads from the other end of the inlet duct into the stock solution 30 located in the container 31 and a discharge pipe line 48 leads from the other end of the duct 44 into the tank 20, emptying at a point above the level of the washing liquid contained therein.

It is important that the container 31 holding the stock solution and the dispenser unit 29 be so positioned that the outlet port 44a of the discharge duct 44 is above the highest possible level of the stock solution. Thus, in the embodiment shown, the outlet port 44a is above the level of the stock solution in the container 31 and not below the level of the highest point of the inlet pipe line 47. Stock solution is thereby prevented from flowing through the dispenser head 35 into the discharge pipe line 48 irrespective of the piston action because of possible siphoning. This is readily achieved by positioning the top end of the metering tube 36 above the level of stock solution in the container 31.

The general method of operating the washing system is as follows: During operation of the washing system the pump 24 operates continuously. However, the whistle valve 28 intermittently and repeatedly opens and closes. During the period that the whistle valve is open, washing liquid under pressure exerted by the pump 24 is discharged from the spray nozzle 25 and at the same time a portion of this liquid flows past the spray nozzle into the actuating pipe line 37 and against the bottom surface of the piston 38. As a result, the piston is forced upwardly to the piston stop 39 and the amount of stock solution in the bore of the metering tube above the piston is forced through the discharge duct 44 and the discharge pipe line 48 into the washing liquid in the tank 20. During this period of operation, the inlet ball check valve remains closed and the discharge ball check valve open. If the stock solution is being discharged against any back pressure in the discharge pipe line 48, the port duct ball check valve is closed against back flow. On the other hand, if there is little or no back pressure in the discharge pipe line, but a vacuum is created in this line, as for example if any siphoning action occurs as a result of priming by the charge of stock solution discharged into the discharge pipe line from the bore of the metering tube 36, the port duct check valve opens allowing air to be drawn into the discharge pipe line, thereby breaking the resulting siphon action. It is important to prevent the occurrence of such siphoning action as stock solution would be drawn from the stock solution container 31 irrespective of the piston action.

When the piston 38 comes to rest at the top of the stroke a small quantity of washing liquid below the piston flushes past it as the pressure continues to be applied to the washing liquid in the actuating pipe line for a short period of time thereafter. In this way the actuating pipe line 37 is automatically primed.

During the period that the whistle valve 28 remains closed, pressure is no longer exerted by the pump 24 through the washing liquid in the actuating pipe line 37 and the spray nozzle 25 is not operating. In view of

this and because the stock solution container 31 is above the level of the spray nozzle 25, the washing liquid in the bore of the metering tube 36 below the piston 38 drains downwardly back through the actuating pipe line and out through the spray nozzle 25. The resulting drainback head causes stock solution in the container 31 to be drawn through the inlet pipe line 47 and the inlet duct 43 into the bore of the metering tube 36 above the piston. The discharge ball check valve remains closed against back flow during this period and the inlet ball check valve is open. The port check valve will open to the atmosphere if any vacuum is created in the discharge pipe line 48, as for example by the occurrence of siphoning action therein. The piston 38 moves downwardly with the flow of stock solution into the bore of the metering tube 36 and acts as a separator between the washing liquid below the piston and stock solution above it. When the piston comes to rest on the seating unit 40, drainback stops and no more stock solution is drawn into the metering tube. The stock solution present in the bore of the metering tube 36 above the piston 38 is then forced out through the discharge duct 44 and the discharge pipe line 48 into the tank 20 when the whistle valve opens and pressure is again applied to the washing liquid in the actuating pipe line 37. Thus, adjusting the length of the piston stroke determines the amount of stock solution which is supplied to the washing liquid for each complete cycle of the whistle valve.

The dispenser unit may be constructed of any material having suitable mechanical and corrosion resistant properties. When used in conjunction with bottle washing systems it may be made of such material as methyl methacrylate resin and the ball checks of nylon.

Another form of the washing system embodying the basic principles of this invention is illustrated in Figs. 9 to 13.

Using reference numerals 100 higher for convenience of correlation of the parts with the previous description of the washing system shown in Figs. 1 to 8, it will be seen that the system again includes a tank 120 containing washing liquid 121. A side wall of this tank has an opening 122 near the bottom and one end of a supply pipe line 123 is connected to the side wall in alignment with this opening. As in the washing system of Figs. 1 to 8, the supply pipe line leads from the tank opening 122 to the intake side of a pump 124 and from the discharge side of this pump to a spray nozzle or jet 125 positioned within the confines of the tank side walls above the level of the washing liquid 121. A standard type whistle valve 128 is connected in the supply pipe line 123 between the pump 124 and the spray nozzle 125. Unlike the previously described system, a throttling valve 128a is connected in the supply pipe line between the whistle valve 128 and the spray nozzle 125. This throttling valve is adjusted so that a pressure drop of several pounds per square inch is developed thereacross when the whistle valve is open and washing liquid under pressure is being discharged from the spray nozzle.

An hydraulic or liquid dispenser 129 automatically supplies a predetermined amount of stock solution 130 from a container 131 filled with this solution to the supply pipe line 123 at a point between the throttling valve 128a and the spray nozzle 125 during each period that the spray nozzle 125 is operating. As here shown, the stock solution container 131 is positioned above the level of the spray nozzle 125 but outside the washing liquid tank 120 and the dispenser unit 129 is held in an upright position adjacent the stock solution container 131.

Referring to Figs. 11 to 13, the liquid dispenser unit 129 is very similar to the liquid dispenser unit in the previously described washing system and operates in an identical manner. It also includes an upright metering tube 136 and a head 135 mounted on the top end portion of the tube. However, this head is mounted in such a way that it may be separated from the metering tube and the

interior portion of the tube and head readily cleaned. As here shown, this is accomplished by having the bottom portion of the head in the shape of a plug which fits inside the top bore portion of the metering tube. An O ring seal 149 about the plug shaped portion of the head binds against the inner surface of the metering tube wall and aids in rigidly holding the head in position and preventing liquid from flowing out of the metering tube between the inner wall of the tube and the plug portion of the head.

An actuating pipe line 137 connects the bottom end of the metering tube 136 with the supply pipe line 123 at a point between the whistle valve 128 and the throttling valve 128a. By adjusting the throttling tube wall so that a pressure drop of several pounds per square inch develops thereacross when the whistle valve 128 is open and the spray nozzle is operating, a sufficient pressure differential is created to cause washing liquid from the supply pipe line 123 to flow into the actuating pipe line 137 under pressure and actuate a piston 138 which is slidably mounted in the bore of the metering tube. The length of stroke of this piston is determined by the bottom of the dispenser head 135 extending into the bore of the metering tube 136 above the piston and a seating unit 140 identical in structure with that described in the previous washing system.

As in the previously described dispenser unit, the piston 138 has sufficiently close clearance with the inner wall of the metering tube 136 so that essentially no washing liquid moves past the piston from below while it is moving upwardly. However, the clearance between the piston and the inner wall of the metering tube is such as to permit a small amount of liquid from below the piston to flow past it when it is at rest at the top of the stroke and pressure is still being maintained on the washing liquid in both the actuating and supply pipe lines.

The head 135 of the dispenser unit here shown is similar to that in the previously described washing system. It contains an inlet duct 143, one end of which communicates with the bore of the metering tube 136, a discharge duct 144, one end of which also communicates with the bore of the metering tube; and a port duct 145 opening to the atmosphere and communicating with the discharge duct 144. A ball check valve, as 146, is located in each of the ducts and the ball is adapted to move vertically toward and away from its tapered valve seat. An inlet pipe line 147 leads from the other end of the inlet duct into the stock solution 130 located in the container 131 and a discharge pipe line 148 leads from the other end of the duct 144 into the supply pipe line 123 between the whistle valve 128 and the throttling valve 128a.

As in the previous washing system container 131 holding the stock solution and the dispenser unit 129 are so positioned that the outlet port 144a of the discharge duct 144 is above the highest possible level of the stock solution. Thus, in the embodiment shown, the outlet port 144a is above the level of the stock solution in the container 131 and not below the level of the highest point of the inlet pipe line 147.

The general method of operating the washing system of Figs. 9 to 13 is as follows: During operation of the washing system the pump 124 operates continuously. However, the whistle valve 128 intermittently and repeatedly opens and closes. During the period that the whistle valve is open washing liquid under pressure exerted by the pump 124 is discharged from the spray nozzle 125. By proper adjustment of the throttling valve so that a pressure drop of several pounds per square inch is developed thereacross, the resulting pressure differential is sufficient to force a portion of the washing liquid in the supply pipe into the actuating pipe line 137 and against the bottom surface of the piston 138. As a result, this piston is forced upwardly to the top of the metering tube 136 and the amount of the stock solution in the bore of the metering tube above the piston is forced through the

discharge duct and the discharge pipe line into the washing liquid in the supply pipe line. During this period, the stock solution is being discharged against back pressure in the discharge pipe line 148 and the port duct ball check valve remains closed against back flow. The inlet ball check valve also remains closed and the discharge ball check valve is open.

When the piston 138 comes to rest at the top of the stroke, a small quantity of washing liquid below the piston flushes past it as the pressure continues to be applied to the washing liquid in the actuating pipe line 137 for a short period of time thereafter. In this way the actuating pipe line 137 is automatically primed.

During the period that the whistle valve 128 remains closed, pressure is no longer exerted by the pump 124 through the washing liquid in the actuating pipe line 137 and the spray nozzle 125 is not operating. In view of this and because the stock solution container 131 is above the level of the spray nozzle 125, the washing liquid in the bore of the metering tube 136 below the piston 138 drains downwardly back through the actuating pipe line 137 and out through the spray nozzle 125. The resulting drain-back head causes the stock solution in the container 131 to be drawn through the inlet pipe line 147 and the inlet duct 143 into the bore of the metering tube 136 above the piston. The discharge ball check valve remains closed against back flow during this period, and the inlet ball check valve is open. The port check valve will open if any vacuum is created in the discharge pipe line 148, as for example by the occurrence of siphoning action therein. The piston 138 moves downwardly with the flow of stock solution into the bore of the metering tube 136 and acts as a separator between the washing liquid below the piston and the stock solution above it. When the piston comes to rest on the seating unit 140, drainback stops and no more stock solution is drawn into the metering tube. The stock solution present in the bore of the metering tube 136 above the piston 138 is then discharged into the supply pipe line during the period when the whistle valve remains open in the manner previously described.

Although not shown in the drawings, the supply pipe line 123 may be connected to a tap water outlet instead of pump 124. Under such conditions the pressure comes from the tap water supply which serves to actuate the liquid dispenser 129.

Although the liquid dispenser 129 here shown and described is actuated by pressure exerted by a pump through recycling the washing solution 121 in the tank 120, it may be actuated by a separate pressure source, as for example by a separate pump or from pressure supplied from a tap water outlet. A cycle timer and solenoid valve may be connected to the liquid dispenser in an appropriate manner obvious to those skilled in the art to cause the dispenser to operate in the manner described above.

Having described the invention as related to the embodiment shown in the accompanying drawings, it is intended that the invention be not limited to any of the details of description unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. In a washing system a source of washing liquid; means for discharging the washing liquid; a supply pipe line leading from the washing liquid source to the discharging means; means for supplying the washing liquid through the supply pipe line under pressure from the source to the discharge means; means for intermittently and repeatedly applying and then releasing the pressure exerted by the washing liquid supply means on the washing liquid in the supply pipe line; a source of stock solution positioned above the level of the discharge means; a liquid dispenser unit having a substantially upright tube element with a liquid actuated piston slidably mounted in its bore; an actuating pipe line connecting the bottom

of the tube element with the discharge means; an inlet pipe line connecting the stock solution source with the tube element; a stock solution discharge pipe line leading from the tube element above the highest possible level of the stock solution, said discharge pipe line emptying into the washing liquid; flow regulating means in said discharge pipe line and said inlet pipe line adapted to permit the flow of stock solution through the inlet pipe line into the bore of the tube element above the piston during downstroke of the piston and to permit the flow of stock solution in the bore of the tube element into the stock solution discharge pipe line during upstroke of the piston under the influence of washing liquid pressure in the actuating pipe line exerted by the washing liquid supply means.

2. The washing system as set forth in claim 1 in which the stock solution discharge pipe line empties into the washing liquid above the level of the washing liquid and in the absence of substantially any back pressure in the discharge pipe line.

3. The washing system as set forth in claim 1 in which the supply pipe line has a pressure differential means operatively connected therewith located between the discharge means and the means for intermittently and repeatedly applying and then releasing the pressure exerted by the pumping means on the washing liquid; the discharge means and the end of the stock solution discharge pipe line emptying into the washing liquid being connected to the supply pipe line on the low pressure side of the pressure differential means and one end of the actuating pipe line being connected to the supply pipe line on the high pressure side of the pressure differential means.

4. The washing system as set forth in claim 3 in which the means for intermittently and repeatedly applying and then releasing the pressure exerted by the pumping means on the washing liquid is a whistle valve connected in the supply pipe line and the pressure differential means is a throttle valve connected in the supply pipe line.

5. In a washing system a source of washing liquid; means for discharging the washing liquid; a supply pipe line leading from the washing liquid source to the discharge means; means for pumping the washing liquid through the supply pipe line under pressure from the source to the discharge means; means for intermittently and repeatedly applying and then releasing the pressure exerted by the pumping means on the washing liquid in the supply pipe line; a container for holding stock solution positioned above the discharge means; a liquid dispenser including a substantially upright tube element having a liquid actuated piston slidably mounted in its bore, a head element on the top end of the tube element, an actuating pipe line connecting the bottom end of the tube element with the discharge means, an inlet duct in the head element communicating with said bore, an inlet pipe line leading from the stock solution container to the inlet duct, a discharge duct in the head element communicating with said bore, the outlet port of said discharge duct being above the highest possible level of the stock solution, a stock solution discharge pipe line leading from the discharge duct and emptying into the washing liquid, a port duct opening to the atmosphere and communicating with the discharge duct, and a check valve operatively positioned in each of said ducts, the inlet check valve being adapted to be open and the discharge check valve to be closed during the down stroke of the piston to permit the flow of stock solution through the inlet pipe line and the inlet duct into the bore above the piston, and the inlet check valve to be closed and the discharge check valve to be open during the upstroke of the piston under the influence of washing liquid pressure in the actuating pipe line exerted by the pumping means to permit the flow of stock solution from said bore through the discharge duct, the port check valve being closed during the existence of any back pressure in the discharge

duct and open when a vacuum is created in the discharge duct.

6. A washing system as set forth in claim 5 in which the check valves are balls adapted to move substantially vertically toward and away from a valve seat to open and close the ducts.

7. A washing system as set forth in claim 5 in which means is provided for varying the length of travel of the piston in the bore of the tube element.

8. The washing system as set forth in claim 5 in which the clearance of the piston with the inner wall of the tube element is adapted to prevent the flow of substantially any washing liquid in the actuating pipe line below the piston to flow past the piston during its upstroke, and permit a small amount of the washing liquid to flow past the piston when it is at rest at the top of the stroke and pressure is still being maintained by the pumping means on the washing liquid in the actuating pipe line.

9. In a washing spray system a container for holding washing liquid; a nozzle for spraying the washing liquid against an object; a supply pipe line leading from the washing liquid container to the nozzle; means for pumping the washing liquid through the supply pipe line under pressure from the washing liquid container to the nozzle; a whistle valve connected in the supply pipe line for intermittently and repeatedly applying and then releasing pressure exerted by the pumping means on the washing liquid in the supply pipe line; a container for holding stock solution positioned above the level of the nozzle; a liquid dispenser including a substantially upright tube element with its top end above the level of the stock solution and having a liquid actuated piston slidably mounted in its bore, a head element on the top end of the tube element, an actuating pipe line connecting the bottom end of the tube element with the nozzle, an inlet duct in the head element communicating with said bore, an inlet pipe line leading from the stock solution container to the inlet duct, a discharge duct in the head element communicating with said bore; a discharge pipe line leading from the discharge duct and emptying into the washing liquid container in the absence of substantially any back pressure in the discharge pipe line, a port duct opening to the atmosphere and communicating with the discharge duct, and a check valve operatively positioned in each of said ducts, the inlet check valve being adapted to be opened and the discharge check valve to be closed during the downstroke of the piston to permit the flow of stock solution through the inlet pipe line and the inlet duct into the bore above the piston, and the inlet check valve to be closed and discharge check valve to be open during the upstroke of the piston under the influence of washing liquid pressure in the actuating pipe line exerted by the pumping means to permit the flow of stock solution from said bore through the discharge duct and the discharge pipe line into the washing liquid container, the port check valve being closed during the existence of any back pressure in the discharge duct and open when a vacuum is created in the discharge duct.

10. The washing spray system as set forth in claim 9 in which the check valves are balls adapted to move substantially vertically toward and away from a valve seat to open and close the ducts.

11. The washing spray system as set forth in claim 9 in which the bore of the tube element contains a piston seat adapted to be positioned along the length of said bore to vary the length of travel of the piston in the bore, said seat having a hole therethrough and the piston having a ball check valve secured to its bottom surface and positioned to seal said hole when the piston is at the bottom of its downstroke.

12. In a washing spray system a source of washing liquid, a nozzle for spraying the washing liquid against an object; a supply pipe line leading from the washing liquid source to the nozzle; means for supplying the washing liquid through the supply pipe line under pressure

from the washing liquid source to the nozzle; a whistle valve connected in the supply pipe line for intermittently and repeatedly applying and then releasing pressure exerted by the washing liquid supply means on the washing liquid in the supply pipe line; pressure differential means 5 operatively connected with the supply pipe line between the nozzle and the whistle valve; a container for holding stock solution positioned above the level of the nozzle; a liquid dispenser including a substantially upright tube element with its top end above the level of the stock solution 10 and having a liquid actuating piston slidably mounted in its bore, a head element on the top end of the tube element, an actuating pipe line leading from the bottom end of the tube element to the supply pipe line between the whistle valve and the pressure differential means; a port 15 duct opening to the atmosphere and communicating with the discharge duct, an inlet duct in the head element communicating with said bore, an inlet pipe line leading from the stock solution container to the inlet duct, a discharge duct in the head element communicating with said 20 bore, a discharge pipe line leading from the discharge duct to the supply pipe line between the pressure differential means and the nozzle, the nozzle and the end of the discharge pipe line connected to the supply pipe line being on the low pressure side of the pressure differential 25 means, a port duct open to the atmosphere and communicating with the discharge duct, and a check valve operatively positioned in each of said ducts, the inlet check valve being adapted to be opened and the discharge check valve to be closed during the down stroke of the piston to permit the flow of stock solution through the inlet pipe line and the inlet duct into the bore of the tube element above the piston and the inlet check valve to be 30 closed and the discharge check valve to be open during

the up stroke of the piston under the influence of washing liquid pressure in the actuating pipe line exerted by the washing liquid supply means to permit the flow of stock solution from said bore through the discharge duct and the discharge pipe line into the supply pipe line, the port check valve being closed during the existence of any back pressure in the discharge duct and open when a vacuum is created in the discharge duct.

13. The washing spray system as set forth in claim 12 in which the check valves are balls adapted to move substantially vertically toward and away from a valve seat to open and close the ducts.

14. The washing spray system as set forth in claim 12 in which the bore of the tube element contains a piston seat adapted to be positioned along the length of said bore to vary the length of travel of the piston, said seat having a hole therethrough and said piston having a ball secured to its bottom surface and positioned to seal said hole when the piston is at the bottom of its down stroke.

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