Oct. 20, 1953 J. L. HEROLD 2,655,929

APPARATUS FOR CLEANSING BOTTLES

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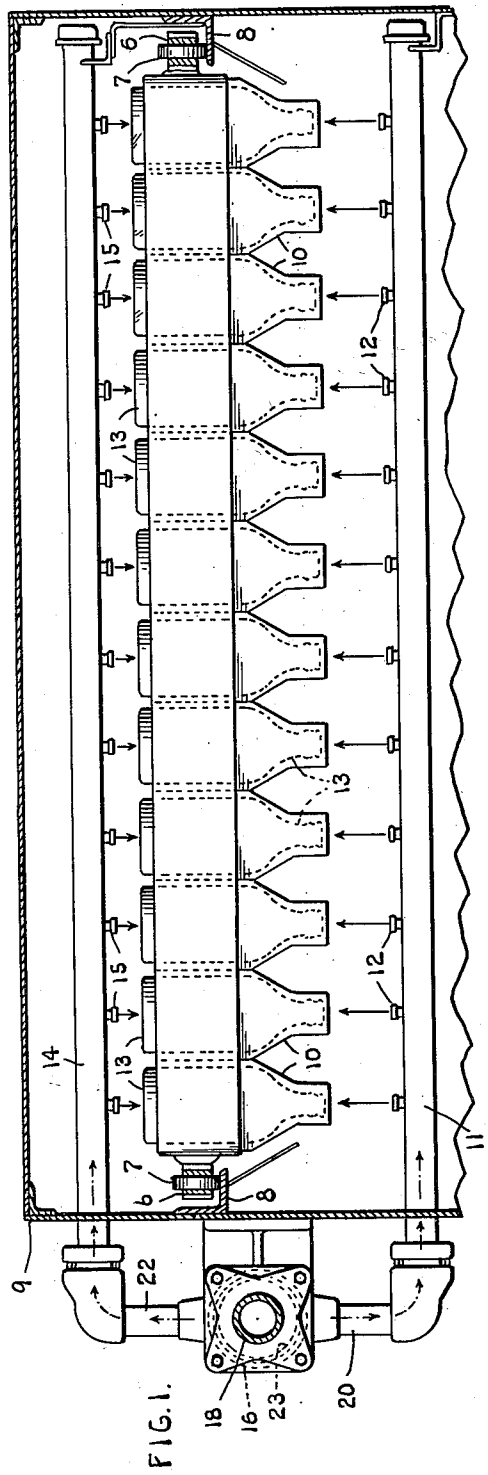


FIG. 1.

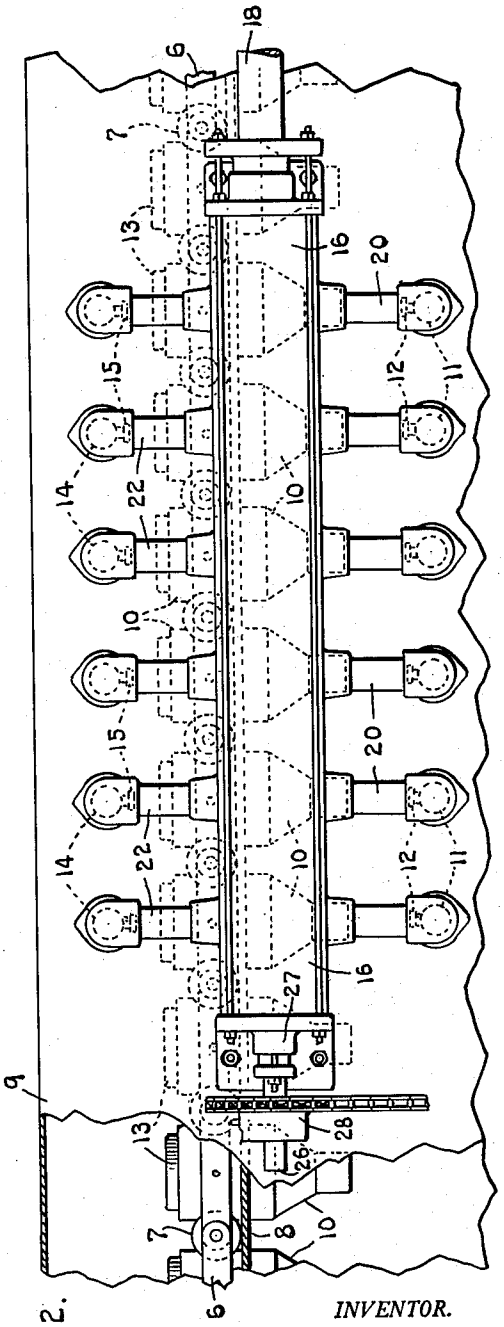


FIG. 2.

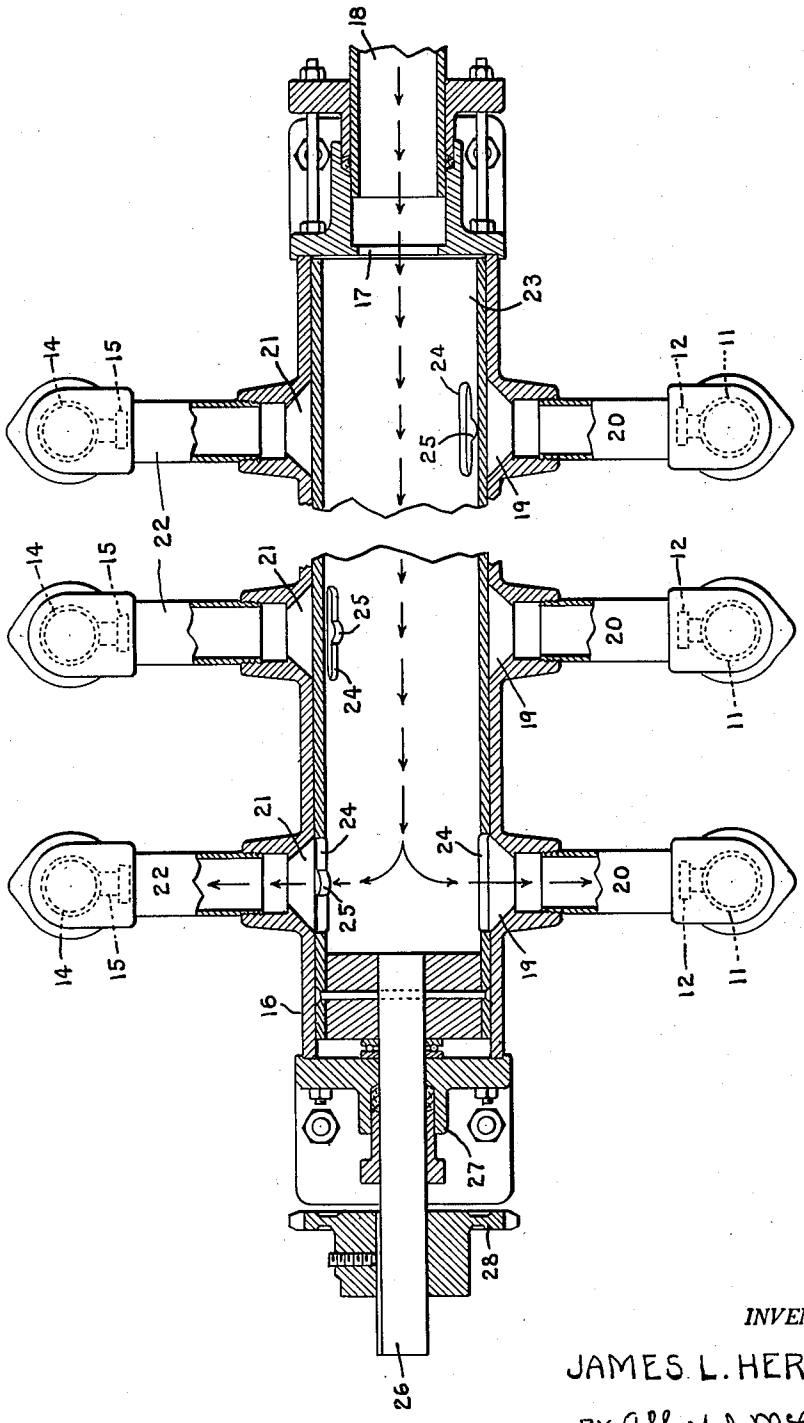
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APPARATUS FOR CLEANSING BOTTLES

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FIG. 3.



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FIG. 4.

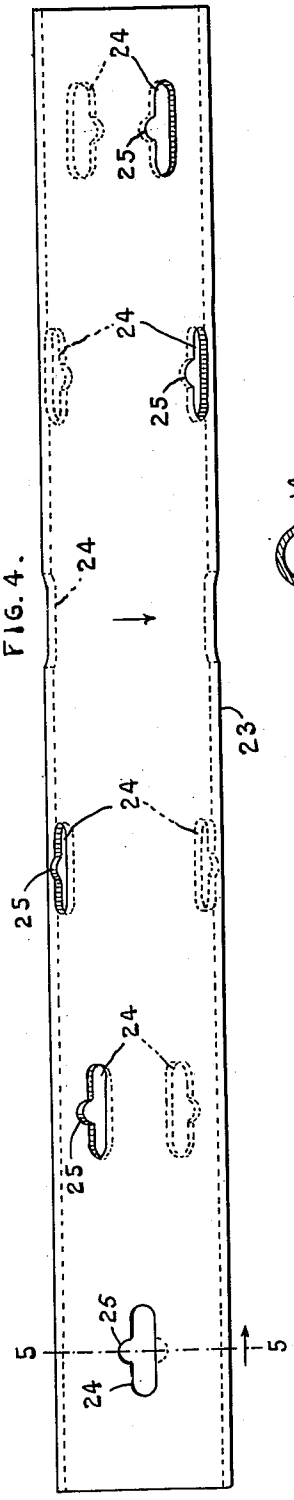


FIG. 6.

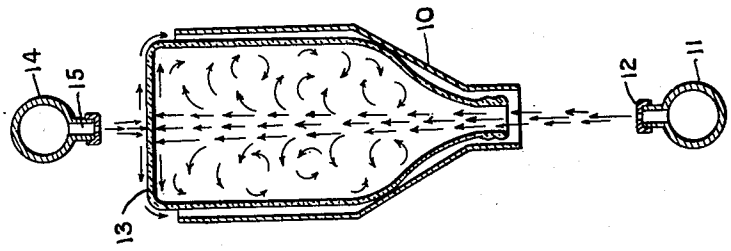
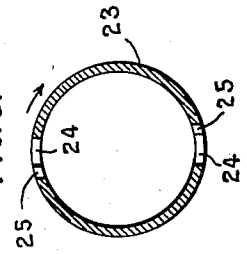


FIG. 5.



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Patented Oct. 20, 1953 2,655,929

UNITED STATES PATENT OFFICE

2,655,929

APPARATUS FOR CLEANSING BOTTLES

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Application January 11, 1950, Serial No. 138,034

7 Claims. (Cl. 134—131)

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This invention relates to apparatus for cleansing bottles, and more particularly to an apparatus wherein streams of liquid are forcibly projected through the mouths of inverted bottles so as to effectively cleanse the interiors of the bottles.

Prior to this invention elongated nozzles, or spindles, have been reciprocated by means of mechanical devices, so as to pass into inverted bottles and discharge cleansing liquid onto inner faces of the bottles. Mahcines of this kind involve the costs of manufacturing and operating the mechanical devices which include moving parts exposed to and injuriously affected by the water, or caustic solution, falling from the inverted bottles.

An object of the present invention is to forcibly discharge streams of cleansing liquid into inverted bottles under specific conditions which provide for thorough cleansing of the interiors of the bottles, without requiring the use of mechanical devices for moving nozzles into and out of the bottles. Study of this problem will show that ample cleansing liquid should be forcibly projected into direct contact with inner faces of the bottles. This result can not be accomplished by merely discharging large streams through the mouths of the inverted bottles for prolonged periods, because under such conditions the mouths of the bottles would be promptly clogged by the used liquid tending to drain by gravity from the inverted bottles, thus preventing effective continued use of the fresh streams from the nozzles.

The invention provides for rapid forcible injections of rather large volumes of cleansing liquid through the mouths of inverted bottles, and into forcible direct contact with inner faces of the bottles, without any objectionable interference due to liquid escaping at the mouths of the bottles. More specifically stated, numerous inverted bottles in a suitable conveyor may be advanced step by step through a cleansing zone to locate the bottles in successive cleansing positions above a plurality of nozzles from which streams of cleansing liquid are discharged through the mouths of the bottles.

For large scale operations, several rows of inverted bottles may be at rest in the cleansing zone, to receive cleansing liquid from rows of nozzles. However, instead of discharging a continuous stream into each bottle during the period of rest, I subject each bottle to a number of successive injections from one of the nozzles, while providing a special cyclic distribution of the cleansing liquid to the nozzles, so that a rather large volume of liquid is quickly projected into a bottle, and then allowed to drain therefrom by gravity. In this manner each bottle, or each row of bottles, is efficiently cleansed by rapid forcible injections of the liquid, and allowed to drain during a relatively long period wherein other bottles are subjected to the rapid forcible injections. The successive cleansing streams are thus projected into empty bottles, where there is no large body of used liquid to interfere with the incoming streams. During each injection, a copious volume of fresh cleansing liquid is projected into direct contact with the inner face of the bottom of the inverted bottle, and then caused to splash with a whirling motion into forcible cleansing contact around the inner side faces of the bottle when the incoming stream meets a descending portion of the fresh liquid. Thereafter, the body of used liquid is naturally agitated during a relatively long period in which it is allowed to freely "gurgle" through the mouth of the inverted bottle.

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The rising streams of liquid are rather violently discharged into the lower ends of the inverted bottles, and the resultant upward thrusts tend to forcibly project the bottles from their holders. However, as a separate and distinct feature I preferably provide nozzles above the bottle holders to forcibly discharge streams of cleansing liquid downwardly onto the upper ends of the inverted bottle, the opposing upward and downward streams being discharged simultaneously so as to provide counterbalancing thrusts tending to retain the bottles in their holders.

With the foregoing and other objects in view, the invention comprises the novel combination and arrangement of details herein shown and described to illustrate a specific form of the invention. However, it is to be understood that the scope of the invention extends to variations and modifications more broadly described by terms employed in the claims hereunto appended.

Fig. 1 is a transverse section through a portion of the housing of a bottle cleansing apparatus, with the cleansing elements shown in elevation.

Fig. 2 is a side elevation of the apparatus shown in Fig. 1.

Fig. 3 is a longitudinal section, drawn to a larger scale, showing end portions of a cyclic valve device for distributing the cleansing liquid to various nozzles, portions of said valve device being broken away.

Fig. 4 is a top view of a rotary distributing valve member.

Fig. 5 is a vertical section on the line 5—5 in Fig. 4.

Fig. 6 is a diagrammatical vertical section showing how the cleansing liquid may be projected onto inner and outer faces of a bottle.

The apparatus herein shown includes a conveyor provided with rows of bottle holders adapted to support rows of inverted bottles, and rows of nozzles below said bottle holders to project successive streams of cleansing liquid into the rows of bottles. The term "nozzle" as herein used extends to any suitable element having a discharge port or passage from which the cleansing liquid is forcibly discharged. Substantial advantages of the new cleansing system are gained by arranging the bottles in successive rows above

corresponding rows of nozzles, and moving the bottles step by step to successive cleansing positions above the rows of nozzles. However, the invention is not limited to these conditions, except as specified in the claims.

As an illustration of portions of a conventional type of bottle conveyor, Figures 1 and 2 show a pair of sprocket chains 6 provided with rollers 7 supported on tracks 8 at opposite sides of a housing 9, and rows of bottle holders 10 carried by said chains. Conveyors of this type are usually moved intermittently, step by step, in an endless course, so it appears unnecessary to show or describe all of the details of a suitable conveyor.

Figures 1, 2 and 3 show a series of horizontal supply pipes 11 extending across the apparatus, each of said pipes 11 being provided with a row of nozzles 12 located directly below a row of bottle holders 10 (Fig. 1) to discharge liquid into a row of bottles 13. As a desirable supplemental condition I have shown a similar series of supply pipes 14 arranged above the bottle holders, each of said pipes 14 having a row of nozzles 15 to discharge cleansing liquid downwardly onto the upper ends of the inverted bottles. The conveyor is movable step by step to locate each row of bottles in successive cleansing positions directly between the upper and lower rows of nozzles 15 and 12. During each period of rest between the step by step movements of the conveyor, successive streams of liquid may be discharged from each nozzle, so as to subject each bottle to a number of cleansing operations, as will be presently described.

To illustrate a suitable means for distributing the cleansing liquid to the rows of nozzles, I have shown a cyclic valve device including a valve housing 16 in the form of a cylindrical manifold having an inlet 17 at one end (Fig. 3) to receive cleansing liquid under pressure from a main supply pipe 18. This valve housing 16 is provided with a row of discharge ports 19 communicating with short pipes 20 connected to the respective supply pipes 11. In this arrangement (Fig. 3) each discharge port 19 is always in communication with one of the supply pipes 11 and its row of nozzles 12. However, the delivery of liquid through said ports 19 is regulated in a peculiar manner to be hereinafter described.

When the upper rows of nozzles 15 are employed, the valve housing 16 may be also provided with a row of discharge ports 21 communicating with short pipes 22 connected to the respective supply pipes 14. Each discharge port 21 can be thus placed in constant communication with one of the upper supply pipes 14 and its row of nozzles 15.

I will now describe specific details of a suitable valve member adapted to open and close the several discharge ports 19 and 21. As shown in Figures 3, 4 and 5, this valve member may be in the form of a cylinder 23, rotatably fitted to the inner face of the valve housing, and provided with peripheral outlet ports 24 adapted to register with the discharge ports 19 and 21.

To create a cyclic distribution of the liquid to the various nozzles, the series of outlet ports 24 may be arranged spirally around the periphery of the valve member 23, as shown in Fig. 4. In this specific arrangement, each outlet port 24 lies diametrically opposite a companion port 24, as shown in Figures 3, 4 and 5, so that a pair of diametrically opposite ports 24 in the rotary valve member can register with a pair of diametrically opposite discharge ports 19 and 21 of the valve

housing. A condition of this kind appears at the left portion of Fig. 3, wherein oppositely disposed ports are open to provide for simultaneous delivery of liquid under pressure to oppositely disposed upper and lower rows of nozzles 15 and 12. Since the opposing upward and downward streams from these nozzles are discharged simultaneously, they produce counterbalancing thrusts tending to retain the loose bottles in their holders 10.

When the cylindrical valve member 23 is rotated, the pairs of diametrically opposite outlet ports 24 move in circular zones between the companion discharge ports 19 and 21. However, owing to the arrangement of these ports, when one pair of discharge ports 19 and 21 is open, all of the other discharge ports 19 and 21 are closed. Study of the manner in which the outlet ports 24 are arranged around the rotary valve member 23 (Fig. 4) will show that they provide for successive opening of the pairs of discharge ports 19 and 21 (Fig. 3). More specifically stated, when there are six pairs of upper and lower delivery pipes 14 and 11 arranged above and below six rows of bottles 13 (Figures 1 and 2), there are six pairs of diametrically opposite outlet ports 24 in the rotary valve 23 (Fig. 4) arranged to provide for successive delivery of liquid to the six pairs of upper and lower pipes 14 and 11. When the outlet ports 24 of each pair are located diametrically opposite each other (Figures 3, 4 and 5), each pair of discharge ports 19 and 21 (Fig. 3) will be opened twice during a complete revolution of the valve 23.

In commercial practice, the valve is preferably turned several revolutions during each period in which the bottle conveyor is at rest, thereby providing for repeated cyclic distribution through the several discharge ports. During each of these cleansing operations, a rather large volume of liquid under pressure is quickly projected from each active nozzle. Thereafter, the liquid is successively distributed to the other rows of nozzles. In this manner, I provide for rapid, forcible injection of ample cleansing liquid into each inverted bottle during a brief period, and also provide a relatively long period for the gravity discharge of used liquid from each row of inverted bottles while fresh liquid is being projected into several other rows.

Fig. 6 is a diagram showing one of the nozzles 12 located below an inverted bottle 13 to project a stream of cleansing liquid through the mouth of the bottle. During each of the numerous cleansing operations, a copious body of fresh liquid is quickly discharged through the mouth of a bottle, and forcibly projected into direct contact with the inner face of the bottom of the bottle. The resultant impact causes the liquid to splash into forcible cleansing contact with inner side faces of the bottle. During each injection, the incoming stream meets a descending portion of the liquid, thereby creating a forcible whirling motion inside of the bottle, so as to more effectively cleanse the entire area inside of the bottle. The volume of liquid is sufficient to provide these outstanding cleansing conditions, but each cleansing period is so short that the descending liquid does not clog the mouth of the bottle, or otherwise interfere with the cleansing value of the incoming stream. After each rapid cleansing injection, the body of used cleansing liquid is naturally agitated during a relatively long period in which it freely gurgles through the mouth of the inverted bottle. During this drainage period, cleansing liquid is discharged into other bottles

until the distributing cycle is completed, at which time the first bottle is empty and ready to receive its next charge of cleansing liquid, the cycle being then repeated a number of times, so as to rapidly subject each bottle to successive cleansing operations during each period in which the bottle conveyor is at rest.

In the drawings I have shown six rows of nozzles 12, the bottle holders being movable step by step from one row of nozzles to the next adjacent row, so that each row of bottles can be subjected to numerous rapid cleansing operations at each of the six rows of nozzles.

Fig. 6 also shows one of the upper nozzles 15, which may be employed to cleanse the outer faces of the bottle, while imparting a desirable downward thrust, tending to counterbalance the violent upward thrust of the stream projected from the lower nozzle 12.

The distributing ports in the cyclic valve device are preferably elongated to conveniently provide relatively large areas for the rapid discharge of rather large volumes of liquid under pressure. However, to avoid excessive shocks that may be due to sudden or abrupt closing of these large ports, one set of said ports is preferably provided with reduced extensions. For example, each of the ports 24 may be formed with reduced extensions 25 at their closing sides.

To illustrate a suitable means for rotating the valve member 23, Fig. 3 shows a shaft 26 secured to said valve member and extending through a stuffing box 27 at one end of the valve housing, said shaft being provided with a driving sprocket 28 which may be operated continuously at any speed desired for the cyclic distribution of cleansing liquid to the various nozzles.

In addition to the remarkable efficiency of these rapid, cyclic cleansing operations, an outstanding advantage appears in the extreme simplicity and low operating cost of the mechanical elements. In commercial practice, it is usually desirable to merely impart a continuous rotary movement to the cyclic valve device which provides for the unique distribution of cleansing liquid to rows of stationary nozzles.

The unique distribution of cleansing liquid in large slugs of short duration provides for large orifices in the nozzles, thereby practically eliminating clogging of the nozzles, and avoiding the usual requirement for careful straining of the cleansing solution. Because all of the nozzles are not active at the same time, the size of the pump and horsepower of its motor are relatively low, and this is an important economical factor.

When the discharge ports 19 and 21 are located diametrically opposite each other, as shown in Fig. 3, the thrusts of the liquid under pressure are balanced, thereby reducing wear at the valve and also reducing the power requirement for operation of said valve.

While I have conveniently referred to step by step movements of a conveyor which transmits bottles through a cleansing zone, it is to be understood that the invention is not limited to such movements, and that in so far as this invention is concerned, various types and shapes of containers may be substituted for the bottles herein shown and described.

I claim:

1. In an apparatus for cleansing bottles, a bottle conveyor having bottle holders to receive inverted bottles, nozzles below said bottle holders to forcibly project streams of cleansing liquid through the mouths of the inverted bottles, said conveyor being movable step by step to locate the inverted bottles in successive cleansing positions above said nozzles, and a cyclic valve device for distributing the cleansing liquid to said nozzles, so as to provide intervals for discharge of liquid from the inverted bottles between successive injections, said cyclic valve device comprising a valve housing in the form of a manifold having an inlet for the cleansing liquid and a row of peripheral discharge ports communicating with the respective nozzles, a cylindrical valve rotatable in said valve housing to open and close said discharge ports, said cylindrical valve having a spirally arranged series of peripheral distributing ports adapted to successively register with the discharge ports of said valve housing to provide for successive delivery of cleansing liquid to the nozzles, and means for rotating said valve to repeatedly deliver cleansing liquid to each of said nozzles, said rotary valve providing for repeated cyclic distribution of liquid to the several nozzles, with a relatively long period for discharge of used liquid from each of the inverted bottles while fresh liquid is being injected into the other bottles.

2. In an apparatus for cleansing bottles, rows of bottle holders to receive rows of inverted bottles, rows of nozzles below said bottle holders to forcibly project streams of cleansing liquid through the mouths of the inverted bottles, and a cyclic valve device for distributing the cleansing liquid to said rows of nozzles, so as to provide intervals for discharge of liquid from the inverted bottles between successive injections, said cyclic valve device comprising a valve housing in the form of a manifold having an inlet for the cleansing liquid and a longitudinal row of peripheral discharge ports communicating with the respective rows of nozzles, a cylindrical valve rotatable in said valve housing to open and close said discharge ports, said cylindrical valve having a spirally arranged series of peripheral outlet ports adapted to successively register with the discharge ports of said valve housing to provide for successive delivery of cleansing liquid to the rows of nozzles, and means for rotating said valve to repeatedly deliver cleansing liquid to each row of nozzles.

3. In an apparatus for cleansing bottles, a bottle conveyor having rows of bottle holders to receive rows of inverted bottles, rows of nozzles below said bottle holders to forcibly project streams of cleansing liquid through the mouths of the inverted bottles, said conveyor being movable step by step to locate the rows of inverted bottles in successive cleansing positions above said rows of nozzles, and a cyclic valve device for distributing the cleansing liquid to said rows of nozzles, so as to provide intervals for discharge of liquid from the inverted bottles between successive injections, said cyclic valve device comprising a valve housing in the form of manifold having an inlet for the cleansing liquid and a longitudinal row of peripheral discharge ports communicating with the respective rows of nozzles, a cylindrical valve rotatable in said valve housing to open and close said discharge ports, said cylindrical valve having a spirally arranged series of peripheral outlet ports adapted to successively register with the discharge ports of said valve housing to provide for successive delivery of cleansing liquid to the rows of nozzles, and means for rotating said valve to repeatedly deliver cleansing liquid

to each row of nozzles, said rotary valve providing for repeated cyclic distribution of liquid to the several rows of nozzles, with a period for discharge of used liquid from each row of inverted bottles while fresh liquid is being injected into the other bottles.

4. In an apparatus for cleansing bottles, a bottle conveyor having rows of bottle holders to receive rows of inverted bottles, lower rows of nozzles arranged below said bottle holders to forcibly project streams of cleansing liquid upwardly through the mouths of the inverted bottles, upper rows of nozzles arranged above said bottle holders to forcibly discharge streams of cleansing liquid downwardly onto the upper ends of the inverted bottles, said upward and downward streams being discharged simultaneously at a row of bottles, said conveyor being movable step by step to locate the rows of bottles in successive cleansing positions between said upper and lower rows of nozzles, liquid supply conduits connected to said upper and lower nozzles, and a cyclic valve device connected to said conduits for distributing the cleansing liquid to said upper and lower rows of nozzles, said cyclic valve device comprising a valve housing having an inlet for the cleansing liquid and a plurality of pairs of discharge ports communicating through said conduits with said upper and lower rows of nozzles, a cylindrical valve rotatable in said housing, said valve having spirally arranged pairs of outlet ports adapted to open successive pairs of housing ports simultaneously to provide for successive delivery of cleansing liquid to the upper and lower rows of nozzles, and means for rotating said valve to repeatedly deliver cleansing liquid to each row of bottles, said rotary valve providing for repeated cyclic distribution through the several pairs of housing discharge ports, to provide periods for discharge of used liquid from a row of inverted bottles while fresh liquid is being projected into the other rows.

5. In an apparatus for cleansing bottles, a bottle conveyor having rows of bottle holders to loosely receive rows of inverted bottles, lower rows of nozzles arranged below said bottle holders to forcibly project streams of cleansing liquid upwardly through the mouths of the inverted bottles, upper rows of nozzles arranged above said bottle holders to forcibly discharge streams of cleansing liquid downwardly onto the upper ends of the inverted bottles, said upward and downward streams being discharged simultaneously at a row of bottles, so as to provide counterbalancing thrusts tending to retain the loose bottles in their holders, said conveyor being movable step by step to locate the rows of bottles in successive cleansing positions between said upper and lower rows of nozzles, liquid supply conduits connected to said upper and lower nozzles, and a cyclic valve device connected to said conduits for distributing the cleansing liquid to said upper and lower rows of nozzles, said cyclic valve device comprising a valve housing having an inlet for the cleansing liquid and discharge ports arranged in pairs communicating with said upper and lower rows of nozzles through said conduits, said pairs of discharge ports being diametrically opposite each other, a cylindrical valve rotatable in said housing, said valve having spirally arranged pairs of peripheral outlet ports adapted to open successive pairs of discharge ports in said valve housing simultaneously to provide for successive delivery of cleansing liquid to the upper and lower rows of nozzles, said spirally arranged pairs of outlet ports being located diametrically opposite each other in circular zones between said rows of discharge ports in the valve housing, and means for rotating said valve to repeatedly deliver cleansing liquid to each row of bottles, said rotary valve providing for repeated cyclic distribution through the several discharge ports, with relatively long periods for discharge of used liquid from a row of inverted bottles while fresh liquid is being projected into the other rows.

6. Apparatus for cleansing bottles comprising a conveyor movable step by step through a bottle cleansing zone, rows of bottle holders on said conveyor for relatively loosely locating the bottles in an inverted position in the cleansing zone, lower rows of cleansing fluid injection nozzles, the nozzles in each row being aligned with the bottles in a row thereof to direct slugs of cleansing fluid into the bottles for short periods of time, upper rows of fluid nozzles, with the nozzles in each upper row corresponding with the nozzles in a row below whereby fluid from said upper nozzles impinges on the opposite ends of the bottles, and distributor valve means connected with both said lower and upper nozzles, corresponding rows of nozzles of the lower and upper rows being simultaneously connected for the discharge of fluid, the impinging fluid from the upper nozzles opposing the slug injection from the lower nozzles to prevent escape of the bottles from said holders, said valve means regulating the distribution of the fluid to each of said corresponding rows of lower and upper nozzles in successive order.

7. Apparatus for cleansing bottles comprising a conveyor movable in successive steps through a bottle cleansing zone, rows of bottle holders on said conveyor for holding the bottles inverted in said cleansing zone, a plurality of spaced upper and lower aligned rows of nozzles corresponding with sucessively adjacent rows of bottle holders, the bottles and aligned nozzles in the successively corresponding rows being in spaced alignment whereby slugs of cleansing fluid are directed simultaneously at the bottles from opposite ends for short duration periods to provide for fluid drainage from the interior and exterior, and distributor valve means for regulating the duration of fluid distribution successively to said upper and lower rows of nozzles to provide relatively longer fluid drainage time periods, said valve means including a housing having a first row of ports corresponding with said rows of lower nozzles and a second row of ports corresponding with said rows of upper nozzles, and a rotary valve cylinder in said housing having diametrically opposite rows of ports arranged in a spiral progression along said valve cylinder for simultaneously opening the ports in said housing in successive pairs selected one from each of said first and second rows of ports.

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