Sept. 14, 1965 J. M. COZZOLI ETAL 3,205,920

APPARATUS FOR CHARGING CONTAINERS WITH LIQUID

Filed July 18, 1962 2 Sheets-Sheet 1

Fig. 1.

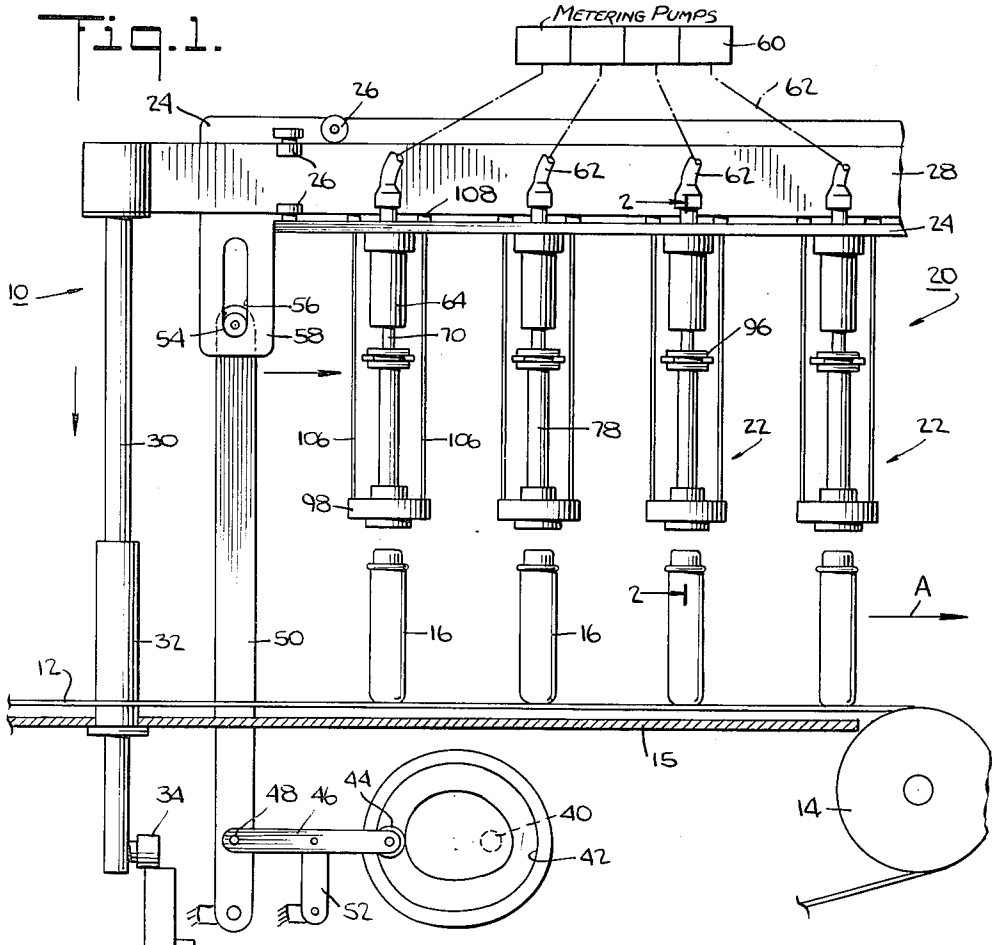


Fig. 6.

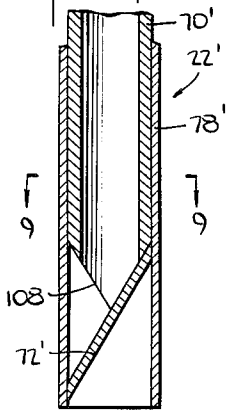


Fig. 7.

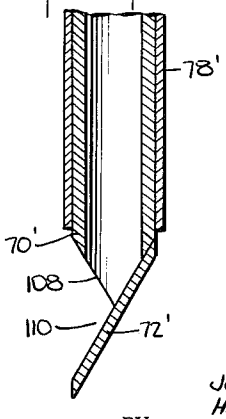
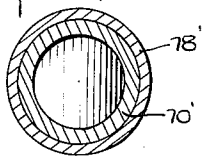


Fig. 9.



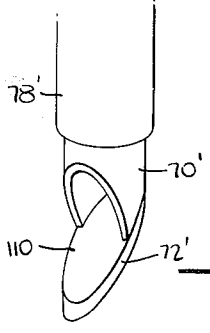


Fig. 8.

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APPARATUS FOR CHARGING CONTAINERS WITH LIQUID

Filed July 18, 1962 2 Sheets-Sheet 2

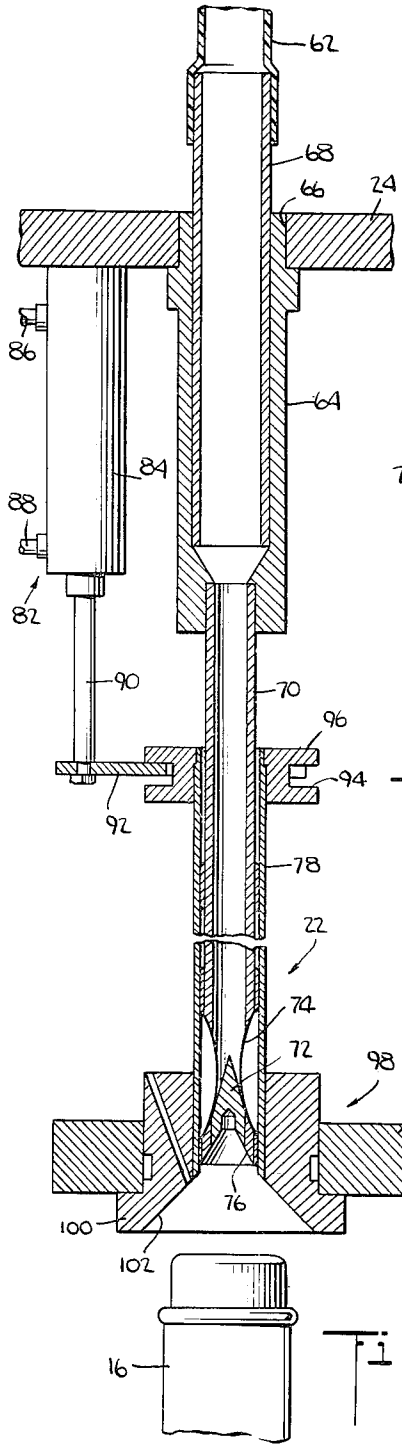


Fig. 2.

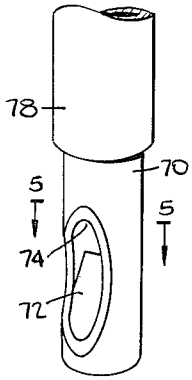


Fig. 4.

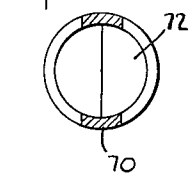


Fig. 5.

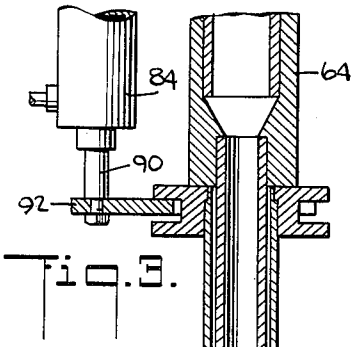


Fig. 3.

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3,205,920

APPARATUS FOR CHARGING CONTAINERS WITH LIQUID

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Filed July 18, 1962, Ser. No. 210,801
13 Claims. (Cl. 141—90)

This invention relates to a liquid charging apparatus, that is to say, an apparatus for delivering a measured quantity of a liquid into a container. Although the invention will be described in detail hereinafter with respect to a multiple line-filler, to wit, a machine in which all the bottles in a moving group of bottles are filled simultaneously by a flying multiple filling head (a multiple filling head which moves at the same speed as the group of bottles), wherein the head experiences vertical movement relative to the bottles and also movement in a fixed horizontal path along with the bottles, it is to be understood that the invention is not necessarily limited to such example and is equally useful in simpler charging machines, e.g., machines in which bottles are stationary during charging, machines in which bottles are charged one at a time, and machines in which the bottles rather than the filling heads are moved vertically.

One of the difficulties that has plagued liquid charging apparatuses and was aggravated in an apparatus of such character which had a flying vertically-movable filling head was the drip of liquid from a filling nozzle after the nozzle was withdrawn from a container and after the forced flow of liquid to the nozzle from a metering unit had been cut off. Despite such cutoff a drop or two, or more, of accumulated liquid tended to fall from the nozzle because at least a portion of a surface over which liquid discharge took place remained exposed after the forced flow of liquid had ceased and the liquid remaining thereon tended to coalesce into an overheavy mass from which portions detached themselves under the influence of gravity. Horizontal and vertical movement of the nozzle encouraged this difficulty because of inertial forces generated by starting or stopping movement of the nozzle. Moreover, since, as often was the case, the nozzle was connected by a flexible feed tube to a metering device, e.g., a positive dispacement measuring pump, any movement of the nozzle (either vertical or horizontal) flexed the feed tube and created a mild pumping action that led to an unwanted discharge of liquid from the nozzle. Such discharge of liquid was undesirable from the point of accuracy of fill and of economy where the liquid to be charged into the container was costly. The post terminal discharge also dirtied the apparatus and when it was permitted to accumulate and harden, interfered with proper operation of the apparatus. Even further when the liquid was viscous it would not cut off cleanly and would string out over a row of containers and would make it necessary to clean the exteriors of the containers before they were saleable.

Various suggestions have been made to overcome these drawbacks. For instance, anti-drip devices have been proposed that included metering cutoffs, subatmospheric liquid pullbacks and foot valves but none of these has been wholly satisfactory. The metering cutoffs still allowed liquid drops to accumulate at and around the discharge orifice of the discharge nozzle and did nothing to prevent the pumping action of a flexing feed tube. Subatmospheric liquid pressure applicators by reducing the pressure in the feed tube overcame the said unwanted pumping action and tended to pull remnant liquid back into the discharge nozzle and even into the feed tube. However they could do nothing for liquid which accumulated at and around the discharge orifice and they robbed

fluid from the discharge nozzle and from the feed tube, thus destroying accuracy of fill. Moreover these applicators were costly and bulky, required additional equipment (e.g., a suction pump, additional tubing and valves) and added considerably to the upkeep of the filling apparatus. Foot valves (valves at the outflow terminals of filling nozzles) have thus far been ineffectual because they permitted liquid to flow over a surface which was exposed after the valve was closed and this liquid accumulated on the exterior of the valve from where it would drip or would shake off when the nozzle started and stopped.

It is an object of the present invention to provide for an apparatus of the character described an anti-drip device which is not subject to the foregoing drawbacks.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which is simple and positive in operation and requires very little maintenance.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which constitutes relatively few parts and is inexpensive to make and use.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which minimizes accumulation of liquid on the exterior surface of the discharge nozzle and is unaffected by the pumping action of a flexing feed tube.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which requires no auxiliary pump or additional tubing.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which constitutes a foot valve that has when closed no exposed surface over which liquid flow took place when the valve was open.

It is another object of the invention to provide for an apparatus of the character described an anti-drip device which constitutes a special form of foot valve that removes as by wiping the exterior remnant (post terminal) liquid each time that the filling nozzle is closed.

It is another object of the invention to provide for an apparatus of the character described a device that will cut off cleanly and sharply the final portion of the discharge and which is particularly useful in conjunction with viscous fluids since it thereby is able to prevent the formation of hanging strings.

Other objects of the invention in part will be obvious and in part will be pointed out hereinafter.

The invention accordingly consists in the features of construction combinations of elements and arrangements of parts which will be exemplified in the anti-drip devices hereinafter described and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings in which is shown one of the various possible embodiments of the invention,

FIG. 1 is a fragmentary elevational view of a multiple line filler which includes a group of filling nozzles that have anti-drip devices constructed in accordance with the present invention;

FIG. 2 is an enlarged vertical central sectional view through one of the nozzles shown in FIG. 1, the same being taken substantially along the line 2—2 of FIG. 1 and illustrating the nozzle in closed (shut off) position above a container;

FIG. 3 is a view similar to FIG. 2 but showing the nozzle open and inside the container;

FIG. 4 is a perspective view of the lower end of the filling nozzle in open position;

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 4;

FIG. 6 is a vertical central sectional view of the lower

end of a closed filling nozzle embodying a modified form of the invention;

FIG. 7 is a view similar to FIG. 6 but showing the nozzle in open position;

FIG. 8 is a perspective view of the lower end of the nozzle shown in FIG. 7; and

FIG. 9 is a sectional view taken substantially along the line 9—9 of FIG. 6.

In general the several objects of the invention are achieved by providing a filling nozzle that includes an inner discharge tube telescopically ensheathed in an outer valve sleeve, the tube and sleeve being relatively movable and experiencing joint movement relative to a container. The joint movement enables the nozzle to be inserted into and withdrawn from a container to be filled. The relative movement shifts the parts of the nozzle between open and closed condition. The lower end of the discharged tube has an imperforate bottom wall that completely closes said lower end so that there is no chance for any liquid to flow therethrough. Adjacent and preferably immediately above this bottom wall the discharge tube is provided with at least one, and optionally more, laterally outwardly facing discharge openings. It is a unique and important feature of the present invention that the aforesaid bottom wall has a plan contour (a contour in a plane perpendicular to the length of the discharge tube) which closely matches the inner transverse contour of the lower end of the valve sleeve, the latter being of uniform cross-section. Said valve sleeve thus is snugly (closely) slidable on the discharge tube. Moreover the relative movable relationship between the discharge tube and the valve sleeve is such that the discharge tube is fully, that is to say entirely, received within the valve sleeve when the nozzle is shifted from open to closed position so that as this occurs, the valve sleeve will wipe off the outer peripheral surface of the bottom wall of the discharge tube so as to minimize the presence of external liquid on the nozzle when it is in closed position. In order to achieve the aforesaid purpose of the invention, the lower end of the valve sleeve must be inperforate and cover the discharge opening in closed position and must be raised above the discharge opening when the nozzle is open so that the liquid discharge from the nozzle takes place below the valve sleeve and the valve sleeve accordingly is not exposed to and therefore does not accumulate liquid on its outer surface each time discharge from the nozzle takes place. It is to be observed that with this arrangement the lower end of the filling nozzle consitutes a foot valve that has when closed no exposed surface over which liquid flow took place when the valve was open.

In a particularly preferred form of the present invention the imperforate bottom wall of the discharge tube has a concave lower surface and indeed this surface desirably is upwardly concave to localize any liquid about its lower peripheral margin where it is wiped off so as to fall within the container each time the valve is closed.

Referring now in detail to the drawings, the reference numeral **10** denotes a multiple line filler. Except for the special anti-drip device which is the subject of the instant invention, the multiple line filler may be of any conventional construction. Typical fillers of this type are illustrated, for example, in United States Letters Patent 1,700,494 for a Filling Machine issued January 29, 1929, and 1,992,464 for Straight Line Multiple Filling Machine, issued February 26, 1935. Another typical machine of the same nature and which is essentially similar to the multiple line filler **10** depicted in the accompanying drawings, is shown, described and claimed in application Serial No. 45,089 filed July 25, 1960, now Patent No. 3,100,513, issued August 13, 1963 for Multiple Line Fillers by Joseph M. Cozzoli and Harold F Scribner. The particular details of the multiple line filler **10** are not a part of the present invention; nevertheless the following simple description of the basic elements of such a filler will assist in understanding the operation of the within unique anti-drip device.

The multiple line filler **10** includes a frame (not shown) from which the various moving parts are supported. One of the moving parts constitutes an endless conveyor such, for instance, as a belt **12** trained about guide and drive pulleys of which only one pulley **14** is shown. Said pulleys lead and move the endless conveyer **12** through a path which includes a horizontal reach that is supported on a horizontal plate **15** which constitutes a part of the stationary frame of the machine. Containers, such, for instance, as bottles **16**, are located on the horizontal reach and are moved without stopping at a constant speed of travel through the illustrated filling station of said machine. The placement of the bottles on the conveyer and their removal therefrom is being performed either automatically or manually. Said bottles are located on the conveyer in uniformly spaced and predetermined positions. The containers move in the direction indicated by the arrow A. The only containers that have been shown are those directly below the filling nozzles. The remainder of the containers have been omitted for simplicity of illustration.

The containers are adapted to be filled (charged) by a flying filling head **20**. Said head includes a group of filling nozzles **22**, four being shown in the drawings. The actual number will depend upon the design of the machine. Suitable means is included to reciprocate the flying filling head in two different directions. One direction is vertical for insertion of the group of filling nozzles into a corresponding group of bottles **16** and subsequent withdrawal from the bottles. The other direction is horizontal to match the speed of movement of the filling head to the speed of movement of the bottles with the conveyor during the discharge cycle of the metering pumps and then to return the filling heads to a position above the next succeeding group of bottles.

More particularly the flying filling head **20** includes a platform **24** to which the filling nozzles are secured. The platform is provided with wheels **26** that slidably mount said platform on a horizontal elongated bar **28** for reciprocating movement restricted to a direction parallel to the length of the bar. The bar **28** is attached at its opposite ends to vertical posts **30** slidable in vertical journals **32** (only one of which is shown) that are fast to the frame of the machine. The lower end of each post **30** is provided with a follower **34** that rides on a cam **36** fixed on a horizontal cam shaft **38**. The cam is eccentric with respect to the shaft **38** and is so configured that for each revolution of the cam shaft posts **30**, and therefore the bar **28**, will be raised once and lowered once. In the uppermost position the tips of the filling nozzles are higher than the bottles and in lowermost position the tips of the filling nozzles are inside the bottles. Since the platform **24** rides on the bar **28** said platform likewise will be raised once and lowered once for each revolution of the cam shaft **38**. Each such revolution constitutes one cycle of operation of the multiple line filler.

Another cam shaft **40** is kinematically connected, e.g., by gearing, to the cam shaft **38** so as to turn synchronously therewith. The two shafts are connected in a one-to-one turns relationship. The shaft **40** has mounted thereon a closed cam track **42** in which there rides a cam follower **44**. Said cam follower is mounted on one end of a connecting link **46** the other end of which is pivoted by a pin **48** to an actuating link **50** the lower end of which is pivoted to the frame. A guide link **52** pivoted to the connecting link **46** and to the frame holds the link **46** in proper position during its operation. The upper end of the actuating link has mounted thereon a roller **54** that rides in a vertically elongated slot **56** formed in a depending arm **58** functionally integral with the platform **24**.

By virtue of the foregoing construction, as the two shafts **38**, **40** rotate in synchronism, the platform **24** will be raised and lowered and will be horizontally shifted to

and fro. The two cam tracks are so relatively and independently configured and synchronized to movement of the conveyor that the filling head will experience the following movement for each cycle of the machine.

After filling a group of bottles the head, while still moving with and at the same speed as the bottles, is raised to lift the filling nozzles from the bottles. As soon as the nozzles have been withdrawn the flying filling head is moved in a direction opposite to the arrow A until the filling nozzles reach a fresh group of bottles just behind the group of bottles that last has been filled. Then the filling head is lowered to insert the filling nozzles into the necks of the fresh group of bottles. The filling head, as this occurs, has its direction of travel reversed and is moved forward with and at the same speed as the bottles while the metering pumps are actuated to force liquid through the filling nozzles into the bottles. Since the present invention is not concerned with all of these details reference is made to the aforesaid patents and application to more fully explain the mechanism for moving the filling head and synchronizing it to the conveyor.

Each of the filling nozzles 22 is connected to a separate metering means schematically illustrated as a group at 60 by a different flexible tube 62. The metering means may be of any standard construction as, for example, they may constitute a series of metering pumps which are adjustable so that during the discharge portion of each cycle a predetermined, i.e., measured, amount of liquid will be forced through the flexible tubes to each discharge nozzle and thence into the bottle in which the nozzle then is located. The tubes, for example, may constitute a flexible synthetic plastic such, for instance, as a polyvinyl plastic or rubber. The flexibility is desired in order to permit the flying filling head to reciprocate vertically and horizontally as it performs its previously indicated functions. However because the tubes experience changes in curvature upon the movement of the filling head, said tubes tend to constrict and expand creating a mild pumping action which as noted previously might cause undesired post terminal discharge of liquid from the nozzles after the metering means are cut off and during a non-filling portion of the cycle unless, of course, this discharge is prevented, as it is, by the anti-drip device which is the subject of the present invention.

All of the filling nozzles are alike and therefore only one such nozzle will be described in detail, this being best shown in FIGS. 2–5. At its upper end each filling nozzle includes a thimble 64 which is tightly but removably fitted in a vertical through opening 66 in the platform 24. A thin-walled vertical pipe 68 is tightly fitted into the thimble 64 and extends upwardly from the thimble where it is coupled to the associated flexible tube 62. Fast on the lower end of the thimble and in communication with the bore through the thimble and therefore in communication with the pipe 68, is a straight vertical dependent discharge tube 70. The lower, i.e., bottom, end of the discharge tube is completely blocked by an imperforate bottom wall 72. Immediately adjacent said bottom wall the sides of the discharge tube are formed with a pair of diametrically opposed laterally outwardly facing discharge openings 74.

The bottom wall 72 may be shaped to encourage lateral deflection of liquid leaving the discharge tube through the openings 74. For this purpose the bottom wall is formed to an upwardly projecting inverted dihedral V-shaped configuration with the plane sides of the V respectively facing toward the two discharge openings. Moreover, for a purpose which will be explained hereinafter, the external surface of the bottom wall including the lower end of the external surface of the discharge tube is upwardly concave whereby to form an upwardly extending well 76.

Telescopically ensheathed around the outside of the discharge tube is an outer valve sleeve 78 having an open bottom end, the sides of which adjacent said open end are imperforate. The lower end of the bore of the valve sleeve is uniform and closely matches in cross-section and configuration the external cross-sectional configuration of the bottom wall of the discharge tube. Thereby this bottom wall functions as a closely fitting sliding journal to support the valve sleeve. The fit is so close that liquid will not flow between the two sliding surfaces unless the liquid is under substantial pressure.

Although the entire length of the discharge tube 70 may precisely match the uniform internal configuration of the valve sleeve this develops an unnecessarily great friction opposing the relative sliding movement of the two parts. Therefore in the preferred form of the invention only a few, desirably only two, zones of the discharge tube engage the inside of the valve sleeve with a close sliding fit. One of these zones is, of course, the closed bottom end of the discharge tube so that this closed bottom end in combination with the valve sleeve will constitute a foot valve. Preferably, moreover, the aforesaid zone includes the portion of the discharge tube up to the upper level of the discharge openings so as to prevent accumulation of liquid within the valve sleeve when said sleeve is in its lowermost position. The other zone may be at any upper portion of the discharge tube. Except for these two zones therefore the remainder of the discharge tube may be of slightly lesser cross-sectional dimensions so as to provide more than a sliding clearance between the discharge tube and the valve sleeve. It has been found that the aforesaid two zones where the close sliding fit is provided can most readily be constructed by increasing the diameter of the discharge tube thereat as by plating. More specifically, the discharge tube is enlarged slightly (a few thousandths of an inch in diameter) at its bottom end and at a second zone 80 by depositing hard chrome plate at such two zones. After deposit of the chrome plate these two zones of the discharge tube are precisely ground down to provide a close sliding fit with the bore of the valve sleeve.

Operating means also is included to cause the valve sleeve 78 to experience relative movement with respect to the discharge tube 70. Such operating means may be motivated in any manner whatsoever and is actuated in synchronism with the movement of the filling nozzle, it being understood that the timing will be such that the valve sleeve will be in raised position when the metering means is operative (the filling nozzle is located within a bottle) and will be in lowered position after the metering means is cut off. Said operating means for each valve sleeve is here shown to comprise a pneumatic actuator 82 that includes a cylinder 84 in which there is slidable a piston (not shown). Air under pressure is selectively admitted to either the upper or lower end of the cylinder through one or the other of tubes 86, 88 the other tube being connected to the atmosphere. Obviously when air under pressure is admitted to the upper end of the cylinder the piston will be driven down and when pressurized air is admitted to the lower end of the cylinder the piston will be driven up.

The piston is connected to a piston rod 90 the lower end of which carries a fork 92 the twin arms of which ride in an annular horizontal groove 94 formed in the periphery of a ring 96 fast on the upper end of the valve sleeve 78. The stroke of the pneumatic actuator is such that in its lower position the valve sleeve wholly contains the lower end of the discharge tube as shown in FIG. 2 and in its upper position the valve sleeve fully exposes the discharge openings 74; this latter position is the flow position of the discharge nozzle and in it the valve sleeve is clear of the outflowing liquid. It now will be apparent that in closed position the foot valve has no exposed surface over which flow of fluid takes place when the valve is open.

It is desirable to include in conjunction with each filling nozzle a centering device 98 that will center the open mouth of a bottle concentric with the tip of the associated filling nozzle. Such centering device may comprise, as shown, a heavy plug 100 slidable on the valve sleeve and having a downwardly facing flaring conical recess 102

adapted to rest on the mouth of a bottle and to exactly center the same with respect to the associated filling nozzle. The plug has a circular retainer **104** secured thereto. The retainer is provided with a pair of upwardly extending parallel spindles **106** that are slidable in matching openings in the platform **24**. The upper ends of the spindles are headed as at **108** so that when the filling nozzles are in elevated position the plug will not drop freely. The length of the spindles **106** is such that when the headed upper ends engage the platform the small end of the conical recess in the plug **100** will be at the level of the lower end of the discharge tube. When the filling head is aligned with a group of bottles and descends, the walls of the conical recesses will rest on the mouths of the associated bottles and center the same with respect to the discharge nozzles before the discharge nozzles are inserted in said mouths.

In the operation of the filler **10**, as each filling nozzle descends in vertical alignment with the mouth of the associated bottle, the valve sleeve of such nozzle is in its lowermost position relative to the discharge tube and therefore functions as a foot valve to prevent accidental discharge of liquid. After the lower end of the filling nozzle has entered the bottle and is properly positioned therein or as this entry and positioning is effected, the associated pneumatic actuator **82** is energized to lift the valve sleeve on the discharge tube and thereby expose the discharge ports **74**. Simultaneously with the opening of the discharge opening the metering means is energized to cause a measured amount of liquid to flow through the associated flexible tube **62** and filling nozzle into the bottle as the bottle is moved by the conveyor. After a proper amount of liquid has been introduced into the botle the metering means is cut off and the filling nozzle is raised, and before, or shortly after, the filling nozzle is raised but after or when the metering means is cut off, the pneumatic actuator **82** is reversely energized to lower the valve sleeve with respect to the discharge tube so that the sleeve fully telescopically receives the lower end of the discharge tube as shown in FIG. 2. This lowering of the valve sleeve causes the valve sleeve to wipe off the exterior lateral surface of the discharge tube around the discharge openings and to wipe off the exterior lateral surface of the closed bottom end and of the discharge tube so that there will be no tendency for liquid to accumulate on the exterior of the discharge nozzle from which it subsequently can be shaken loose because either of the inertial forces developed during movement of the discharge nozzle or because of the mild internal pressure developed by flexing of the tubing **62** during movement of the flying filling head.

As the valve sleeve is lowered it will wipe off any liquid on the discharge tube around the discharge openings and also will wipe off the exterior lateral surface of the enclosed bottom end of the discharge tube. All this remnant liquid will be transferred to the periphery of the bottom wall by such wiping action. The upwardly concave shape of the undersurface of said bottom wall prevents the liquid from flowing up such bottom wall so that the liquid concentrates at the periphery of the bottom wall. Such concentration of the liquid over a small area provides very little support for the liquid whereby the pendulous liquid will drop off into the bottle. Indeed, the wiped off liquid must hang from the knife edge configuration of the bottom wall thereby providing no real support for the liquid so that when the foot valve constituted by the valve sleeve and the discharge tube closes, the remnant pendulous mass of liquid will drop into the bottle providing a sharp cut-off upon descent of the valve sleeve. This sharp cut-off is very useful for accurate dispensing of liquid and for preventing post-terminal discharge. It is of additional utility in connection with viscous liquids because the sharp cut-off prevents the formation of hanging strings that tend to dirty the filling machine or bottles beneath the filling nozzles.

Although the invention functions satisfactorily with the construction as above described, improved results are obtained where the valve sleeve is of small wall thickness, e.g., in the order of from about 0.01 to about 0.06 inch. Moreover depending upon the nature of the liquid handled it sometimes is desirable to provide an inside or an outside chamfer for the lower end of the valve sleeve. The drawings illustrate the internal chamfer which obtains excellent results with watery (light) liquids. The external chamfer is preferred for use with syrupy (heavy) liquids.

A modified form of the invention is shown in FIGS. 6–9, the modification entailing a different configuration of the bottom end of the discharge tube which provides only a single lateral direction of flow for liquid discharge. In this modified embodiment of the invention the discharge nozzle **22'** includes a straight vertical discharge tube **70'** which is telescopically ensheathed in a matching valve sleeve **78'**. Suitable means such, for instance, as a pneumatic actuator (not shown) is included to provide relative movement between the discharge tube and valve sleeve. The discharge tube includes an imperforate bottom wall **72'** of plane configuration that is inclined to the horizontal so that one end thereof is considerably lower than the other. Thus this bottom wall acts as a deflector plate that causes liquid leaving the discharge tube to flow outwardly to one side only of the discharge nozzle. The discharge tube is cut away as at **108** above the lower end of the bottom wall to form a discharge opening **110**. The bottom wall is configured and dimensioned to provide a close sliding fit with the inside of the valve sleeve. Accordingly said bottom wall is of oval configuration. Said discharge nozzle **22'** operates in the same fashion as the discharge nozzle **22**.

It thus will be seen that there are provided devices which achieve the several objects of the invention, and which are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments set forth, it is to be understood that all matter herein described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, there is claimed as new and desired to be secured by Letters Patent:

1. An elongated filling nozzle assembly for an apparatus for charging an upright container with liquid, said filling nozzle assembly comprising a discharge tube having a lateral discharge opening adjacent to its bottom end, the bottom end of said tube being completely closed, an outer valve sleeve telescopically ensheathing said tube and longitudinally slidable thereon, means to support the nozzle with its longitudinal axis vertical, means to move the tube and sleeve as a unit vertically from an elevated position above a container disposed beneath the same to a lowered position in which the bottom of the unit is within the container and then back to the elevated position, and means operable with the tube stationary in lowered position to move said sleeve up on said tube from a first extreme position fully receiving the closed bottom end of the tube to a second extreme position exposing the discharge opening and then back to said first extreme position, the sides of said sleeve adjacent the bottom end thereof being imperforate and having a close sliding fit with the entire exterior surface of the closed bottom end of the tube whereby the sleeve as it approaches the first extreme position wipes off the periphery of the tube at the bottom end and in conjunction with the tube functions as a closed foot valve and whereby such foot valve when closed has no exposed surface over which liquid flow takes place when the foot valve is open.

2. A filling nozzle assembly as set forth in claim **1**

wherein the discharge tube has two opposite lateral discharge openings adjacent to the bottom end thereof and wherein a deflector is disposed between said openings to split the flow of liquid.

3. A filling nozzle assembly as set forth in claim 1 wherein the bottom wall of the tube is sloped with respect to the longitudinal axis of said tube and wherein the discharge opening has a lower edge defined by said bottom end.

4. A filling nozzle assembly as set forth in claim 3 wherein the bottom end is flat.

5. A filling nozzle assembly as set forth in claim 1 wherein the discharge tube has two zones slidably engaging the interior of the sleeve, one of the zones constituting the periphery of the bottom end of the tube, the other of said zones being an annular band spaced above said first zone, said tube between said zones being slightly smaller than at said zones so as to clear the sleeve.

6. A filling nozzle assembly as set forth in claim 5 wherein the two zones constitute hard chrome plating on the discharge tube.

7. A filling nozzle assembly as set forth in claim 1 wherein the sleeve moving means comprises an actuating member having two power-displaceable members, one of which is secured to the tube and the other to the sleeve.

8. A filling nozzle assembly as set forth in claim 1 wherein the under surface of the bottom end of the tube is concave.

9. A filling nozzle assembly as set forth in claim 1 wherein the under surface of the bottom end of the tube is conically concaved.

10. A filling nozzle assembly as set forth in claim 9 wherein the periphery of the well meets the sides of the discharge tube in a knife edge configuration.

11. A filling nozzle assembly as set forth in claim 1, which further includes an intermittently operable stationary metered supply of liquid, and a flexible tube connecting said nozzle to said supply, said tube being flexed when the tube and sleeve are moved vertically, said nozzle being closed when the supply is idle so as to prevent post terminal discharge of liquid therefrom when the nozzle is moved and the flexing of the tube reduces the volumetric capacity thereof to create a pumping action.

12. A filling nozzle assembly as set forth in claim 11 wherein the means for moving the tube and sleeve as a unit is constructed and arranged to reciprocate the tube and sleeve as a unit horizontally and vertically.

13. A combination comprising an intermittently operable stationary metered supply of liquid, a filling nozzle having a foot valve that is closed when the nozzle is idle, means to move the nozzle relative to a container to be filled, and a flexible tube connecting the nozzle to the said metered supply, said tube being flexed when the nozzle is moved, said foot valve preventing post terminal discharge of liquid from the nozzle when the nozzle is moved with the supply idle and the flexing of the tube reduces the volumetric capacity thereof to create a pumping action.

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