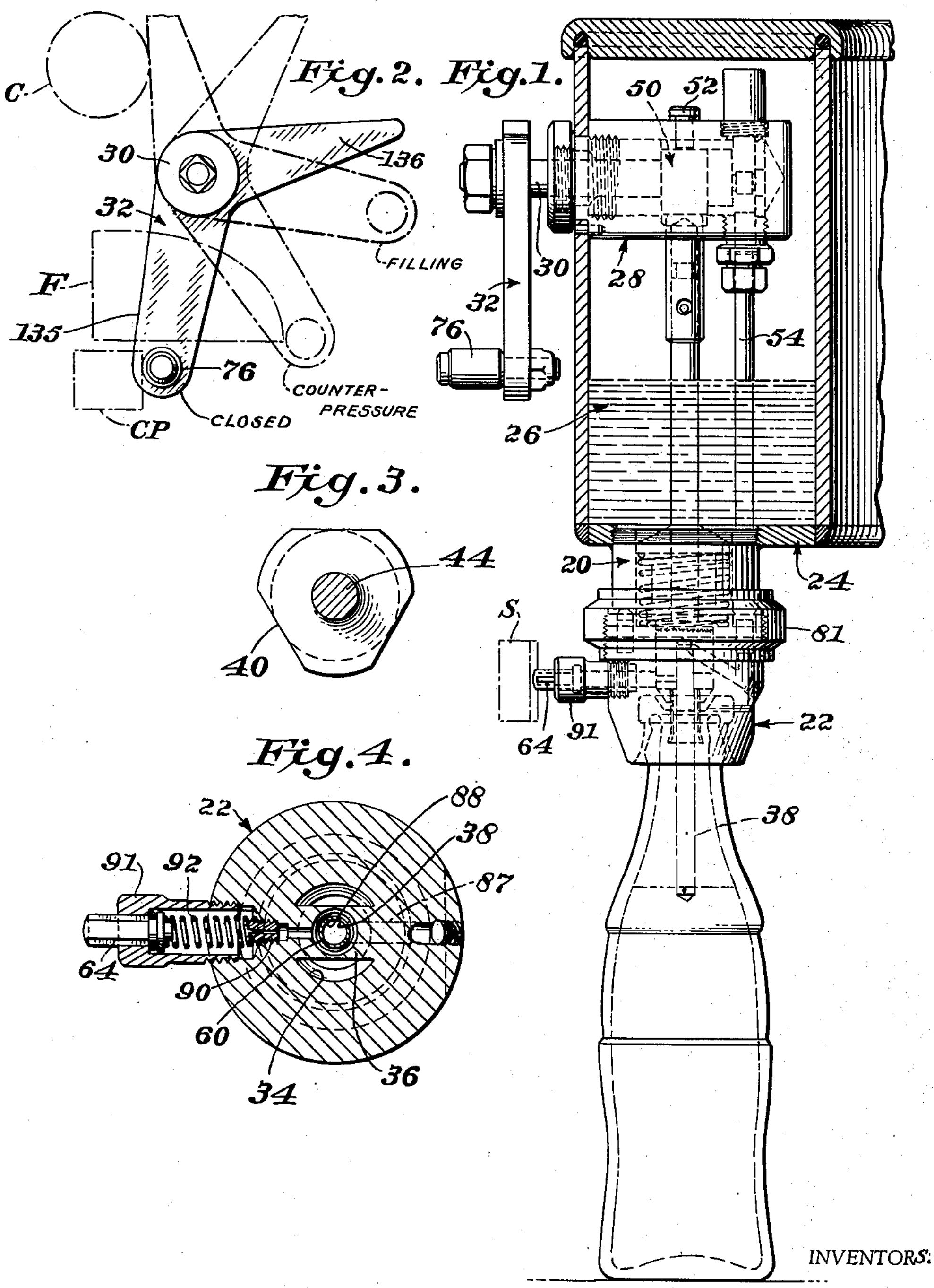
March 5, 1957 C. L. DAY ET AL 2,783,785

FILLING HEAD

Original Filed May 22, 1950 5 Sheets-Sheet 1



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Original Filed May 22, 1950 5 Sheets-Sheet 2

Fig. 5.

CLOSED STAGE

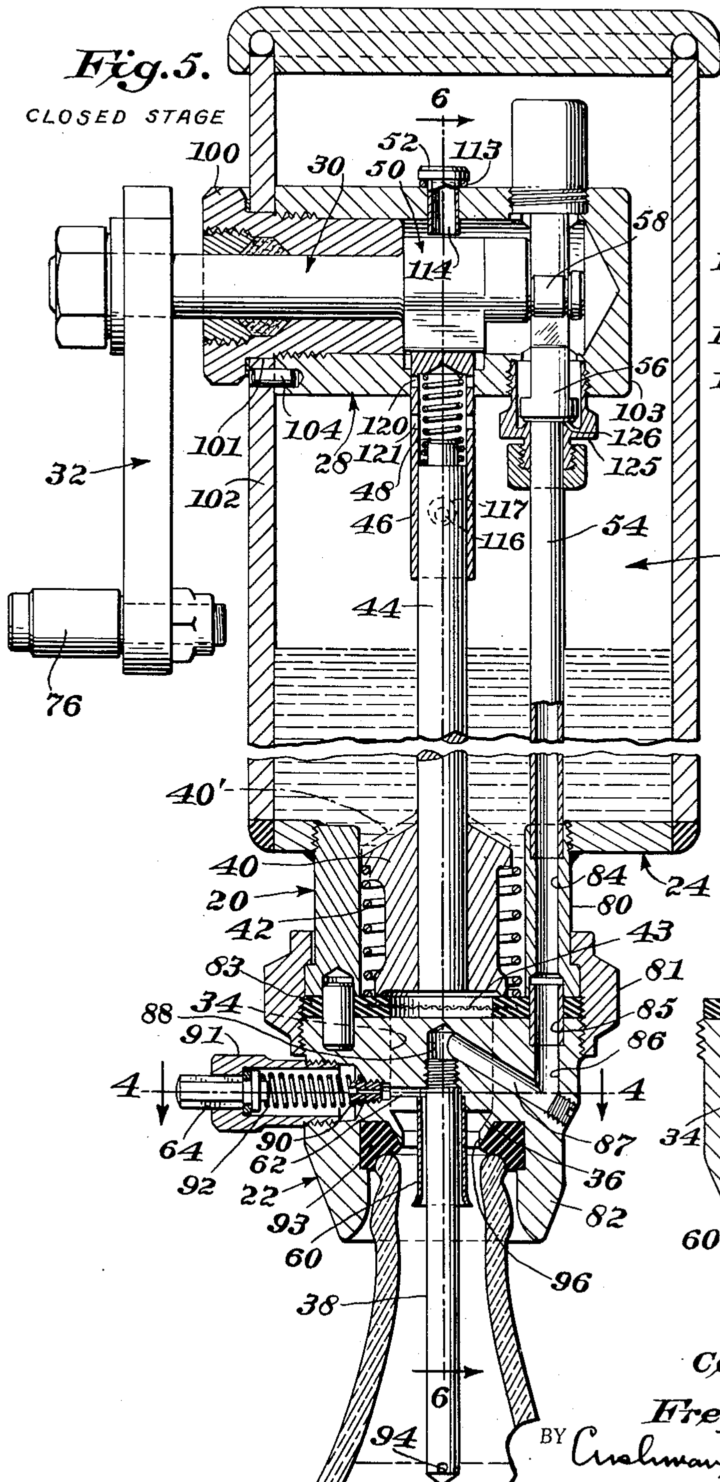

Fig. 6.

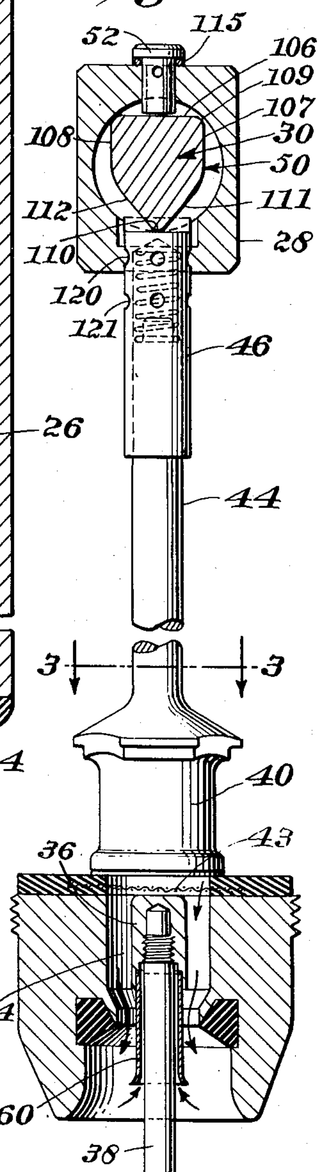

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Fig. 7.

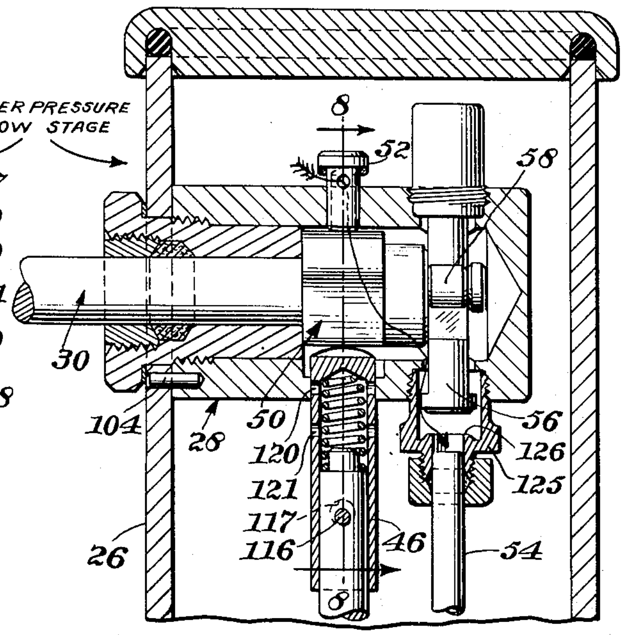

Fig. 8.

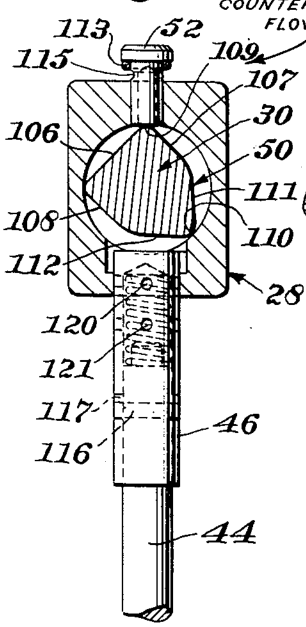

Fig. 9.

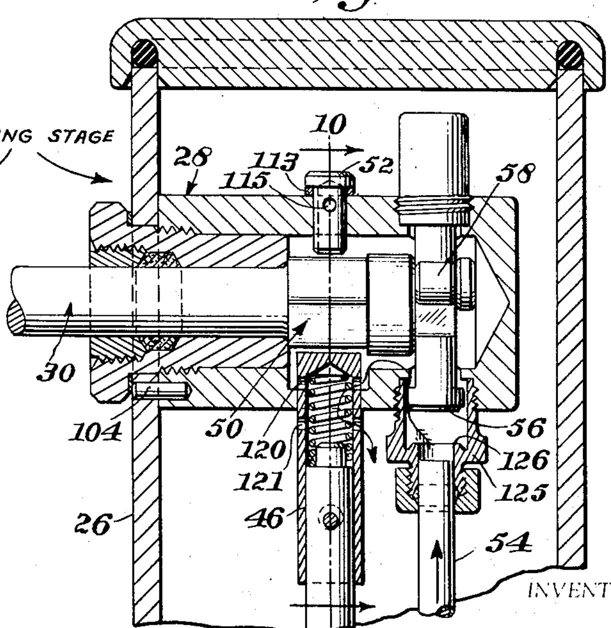

Fig. 10.

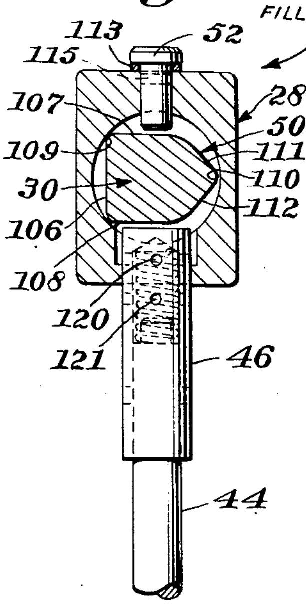

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Fig. 11.

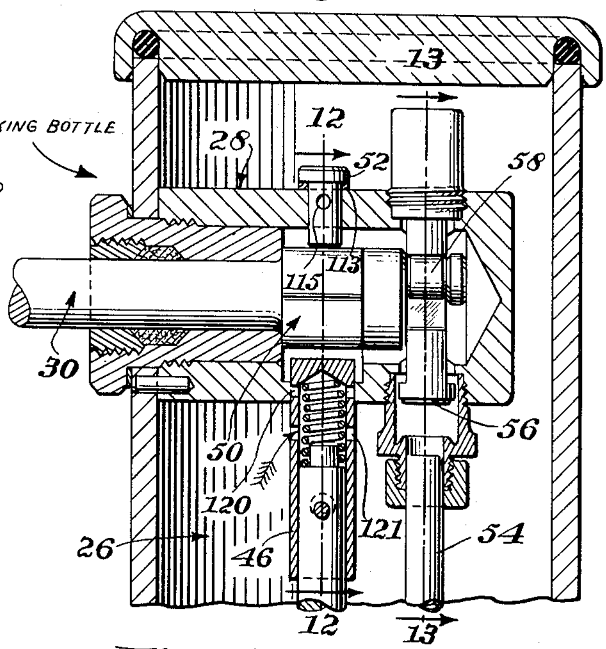

Fig. 12.

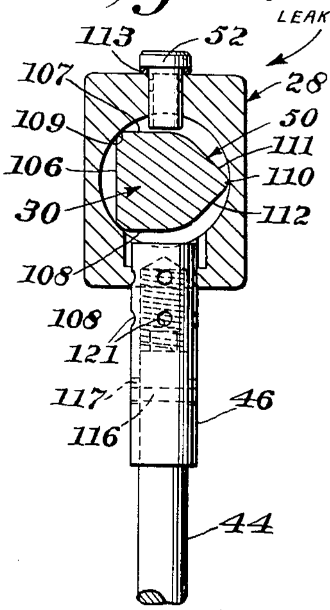

Fig. 15.

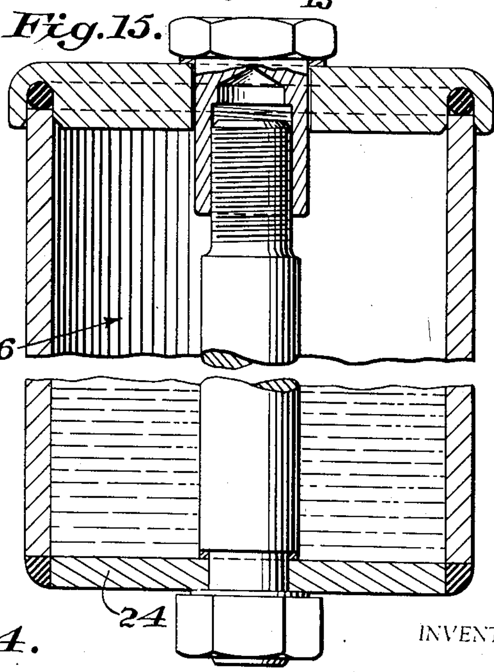

Fig. 13.

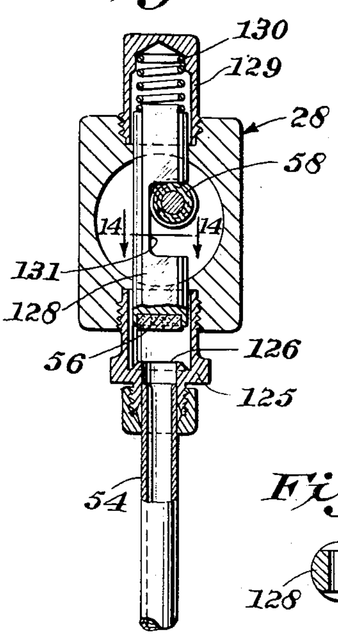

Fig. 14.

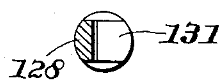

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Fig. 16.

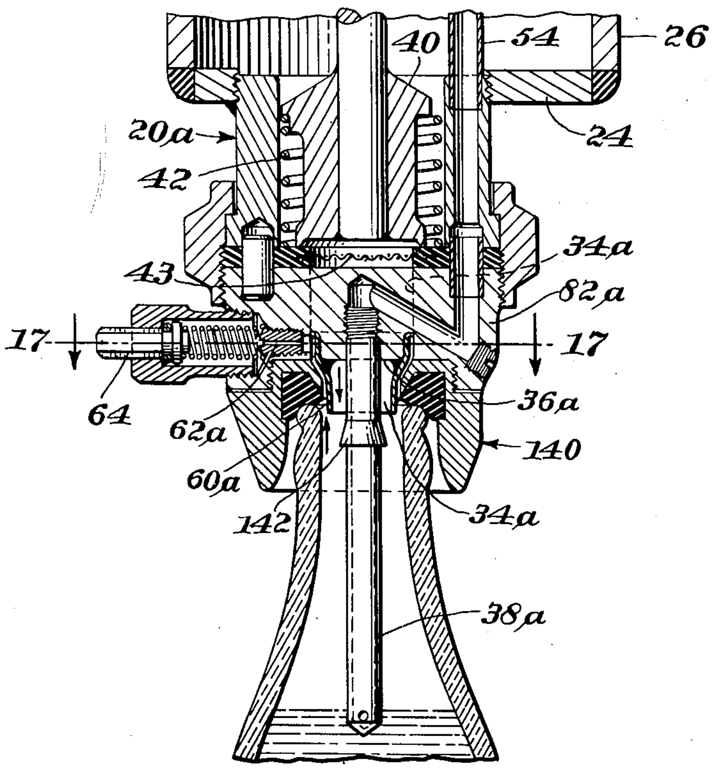
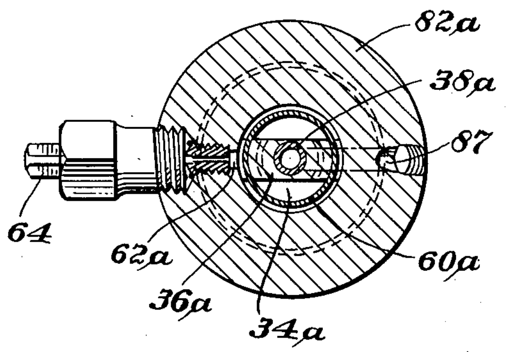


Fig. 17.



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United States Patent Office

2,783,785

Patented Mar. 5, 1957

2,783,785

FILLING HEAD

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Continuation of abandoned application Serial No. 163,436, May 22, 1950. This application April 28, 1954, Serial No. 426,108

44 Claims. (Cl. 141—48)

The present invention relates to filling heads and, more particularly, to filling heads of the counter-pressure type used for flowing carbonated liquids into bottles or other containers. The application is a continuation of our application for Filling Head, filed May 22, 1950, Serial No. 163,436, now abandoned.

It has been found that highly satisfactory filling of carbonated beverages can be obtained if the liquid is flowed into the bottle at a maximum flow rate, instead of holding the flow rate to a minimum with the idea of thereby reducing the possibility of foaming during flow. In more detail, with the filling trip and snifting trip of a rotary machine spaced apart approximately the usual distance, and if the liquid is flowed into the bottle at optimum rate, the bottle will be filled to the desired height a few seconds before the snifting trip operates the filling head to snift pressure from the bottle headspace to atmosphere. Hence, a rest period is provided during which the liquid in the bottle can become quiescent before snifting and which reduces the tendency to foam during snifting. By flowing the liquid into the bottle though a liquid passage of ample section there is no substantial tendency to foam during liquid flow, and, in any event, such tendency will be offset by the rest period before snifting.

An object of the invention is to provide a filling head of such design as to include a liquid flow passage of optimum cross-sectional area.

In previous filling heads designed to include a liquid passage of optimum area, the liquid passage has surrounded the counterpressure gas nozzle or tube. However, in such prior designs, the counterpressure tube has not been firmly supported in the filling head. It is desirable to have the counterpressure and venting tube firmly supported so that it cannot be broken or deflected by a rising and non-centered bottle.

Another object of the invention is to provide a filling head including a liquid passage of optimum area and wherein the counterpressure tube is rigidly supported.

During the snifting of a bottle, liquid may be drawn into the snifting passage. Because snifting passages are of small diameter, the presence of liquid therein tends to block free snifting.

A further object of the invention is to provide a filling head of such construction that the possibility of liquid blocking the snift passage will be minimized.

Another object of the invention is to provide a filling head of such design that all of the valves and other moving parts thereof will be operable with a minimum degree of friction, which is of simple design, and can be produced at relatively low cost.

Other objects and advantages of the invention will be apparent from the following specification and accompanying drawings.

Referring to the drawings,

Figure 1 is a vertical, radial section through the reservoir of a rotary filling machine and shows the filling head in elevation.

Figure 2 is a fragmentary view showing the various positions of the trip lever of the filling head and diagrammatically showing trips to operate the lever.

Figure 3 is a transverse section on the line 3—3 of Figure 6.

Figure 4 is a transverse section on the line 4—4 of Figure 5.

Figure 5 is an axial section through the filling head, the view showing the head with its valves in closed position.

Figure 6 is a section on the line 6—6 of Figure 5.

Figure 7 is a view similar to Figure 5 but showing the filling head valves positioned for counterpressure flow stage.

Figure 8 is a section on the line 8—8 of Figure 7.

Figure 9 is a view similar to Figure 5 but showing the valves of the filling head positioned for filling stage.

Figure 10 is a section on the line 10—10 of Figure 9.

Figure 11 is a view similar to Figure 5 but showing the filling head valves in the position they assume during filling stage in the event a bottle leaks.

Figures 12 and 13 are sections on the lines 12—12 and 13—13 of Figure 11.

Figure 14 is a transverse section on the line 14—14 of Figure 13.

Figure 15 is a radial section through the filling machine reservoir, the section being taken on such a line as to illustrate the means for securing the tank cover in position.

Figure 16 is an axial section showing the filling head provided with a modified form of snifting passage, and

Figure 17 is a transverse section on the line 17—17 of Figure 16.

The general construction and operation of the filling heads of the invention is as follows:

The filling head **20** of Figures 1 to 15 and the filling head **20a** of Figures 16 and 17 are identical except for the manner in which their snifting passages communicate with the headspace of a bottle. Therefore, the following general description of the construction and operation of the filling head **20** of Figures 1 to 15 is applicable to the filling head **20a** except for the snifting passage arrangement.

As best shown in Figure 5, each filling head **20** includes a filling nozzle or bottle engaging portion **22** which depends from the lower wall **24** of the reservoir **26**. Each filling head also includes a chamber **28** which extends radially of the upper portion of reservoir **26** and in which an operating shaft **30** is rotatable. Shaft **30** is rotated through stages by contact of its trip lever **32** with trips spaced about the path of movement of its filling head with the rotating reservoir and filling table. The chamber **28** of each filling head is provided with suitable valves controlled by its shaft **30** whereby gas flow through chamber **28** between the filling nozzle **22** and reservoir **26** is controlled.

The filling reservoir **26** is of annular or doughnut form, and the filling heads are spaced about the reservoir in circumferential series so as to be aligned with bottle supporting platforms vertically movable in a filling table rotatable with the reservoir. Reservoir **26** will be supplied with carbonated liquid, usually water, from a suitable source through connections such as customarily provided on a counterpressure bottle filling machine of the rotary type. A body of gas or air at suitable pressure will be present in the upper portion of reservoir **26**, the pressure of the gas being maintained at the desired pressure by usual control means.

The nozzle or bottle engaging portion **22** of filling head **20** includes a liquid outlet passage **34** enlarged at its upper portion to accommodate a diametrically extending web or bridge **36** from which a counterpressure gas tube **38** depends. A liquid valve **40** of poppet type is provided at the upper end of liquid passage **34**. Valve **40** is urged upwardly to open position by a spring **42**, but is normally held closed by the pressure of liquid and gas acting downwardly upon the valve. A fine mesh screen **43** extends across liquid passage **34** immediately below the seat for the liquid valve **40**.

Liquid valve **40** includes an upwardly projecting stem **44** having a cap sleeve **46** mounted on its upper end to project through the wall of the housing **28**. Cap sleeve **46** is urged upwardly with respect to stem **44** by a spring **48** and includes a plurality of ports to control flow of gas between reservoir **26** and chamber **28**. Hence, sleeve **46** is a gas valve.

The position of the gas valve **46** is primarily controlled by a cam **50** secured to operating shaft **30**. Cam **50** also controls a valve **52** mounted in the upper wall of chamber **28** to control flow of gas between chamber **28** and reservoir **26**.

The counterpressure gas and venting passage of the filling head includes the depending gas tube **38**, the angled passages **87** and **88** of the filling nozzle shown in Figure 5 as well as a tube **54** which opens to the lower portion of chamber **28**. Flow through this gas passage is controlled by a spring-seated gas valve **56** operated by a second cam or eccentric **58** secured to the inner end of the operating shaft **30**.

As best shown in Figure 5, a relatively short tube **60** surrounds the central gas tube. A passage **62** leads from the upper end of tube **60** to a spring-closed snift valve **64**. Snift valve **64** is of poppet type and is adapted to be moved inwardly to open position by brushing contact with a cam such as indicated at S in Figure 1 and arranged in the path of movement of the filling head with the rotating reservoir and filling table.

In the modified form of Figures 16 and 17, the snifting passage **62*a*** opens to a space which is inwardly defined by a sleeve **60*a***. Sleeve **60*a*** is spaced outwardly from the gas tube **38*a*** so that the interior of the sleeve defines the liquid flow passage **34*a***. The filling head of Figures 16 and 17 is otherwise identical with that of Figures 1 to 15.

Referring to the general operation of a filling head **20**, Figure 5 shows the position of the various valves when the flow passages are in closed position. With the valves in this position, a bottle will be moved upwardly into sealed engagement with the filling head as shown in Figure 5. Shortly thereafter, rotation of the filling table and reservoir of the machine will cause the roller **76** on the lower arm of trip lever **32** to contact with a trip CP as indicated in Figure 2 so that the filling head will be operated from closed stage position to counterpressure flow stage position. Shaft **30** will thereby be turned to the position illustrated in Figures 7 and 8. Hence, cam **50** will raise upper gas valve **52** to the position shown in Figure 7, and cam **58** will raise the gas valve **56** to the position shown in the same figure. Although cam **50** will also move out of engagement with the gas valve **46**, the freeing of this valve for upward movement will have no effect upon flow conditions. With the valves **52** and **56** open, gas may flow from the interior of reservoir **26**, through valve **52** and chamber **28**, and past valve **56** into the tube **54** of the gas passageway and thence to the gas tube **38** which extends into the bottle. Therefore, gas will flow from the reservoir **26** to establish the same pressure in the bottle as exists in the reservoir.

When the pressure in the bottle has thus become equalized with the pressure above the liquid in reservoir **26**, liquid valve **40** will lift to the dotted line position indicated at **40'** in Figure 5 so that liquid will now flow downwardly into the bottle through the liquid passage **34**. At about the same time that liquid valve **40** opens due to this equalization of pressure, the trip arm roller **76** will contact with a filling trip F positioned in the path of rotation of the filling reservoir so that the trip arm **32** will be turned to the filling stage position illustrated in Figure

2. Shaft **30** will thereby be rotated to the position shown in Figures 9 and 10. With cam **50** in this position, the gas valve **46** carried by the liquid valve stem will be free to move upwardly and the upper gas valve **52** will drop to closed position by its own weight and by the reservoir pressure acting on its enlarged upper end. Cam **58** will lift gas valve **56** to a slightly further extent. As a result, gas may now be vented from the bottle as liquid flows into the bottle, the gas moving from the bottle through gas tube or nozzle **38** and into gas tube **54** to then follow the course indicated by the arrow in Figure 9 so as to reach the reservoir **26**.

When the level of the liquid in the bottle rises to cover the ports in the lower end of gas tube **38**, the return flow of gas to reservoir **26** will cease, and the pressure then built up beneath the screen **43** will prevent the liquid level from rising in the bottle. An instant later, the upper arm of the trip lever **32** will be returned to closed position. This will return the operating shaft **30** to the position shown in Figure 5, thereby closing the liquid valve **40** as well as the gas valve **45** and **56**. Shortly thereafter, the snift valve will have brushing engagement with a snifting trip S such as indicated in dotted lines in Figure 1 so that the snift valve will open to release headspace pressure from the bottle. Then the bottle will be lowered from the filling head.

If desired, after the bottle has been moved out of alignment with the filling head and before a second bottle has been placed beneath the filling head, operating lever **32** may be briefly moved to a sufficient extent to slightly lift the gas valves **52** and **56** to cause gas to blow from reservoir **26**, chamber **28** through nozzle **38** to thereby expel any liquid which may have moved into the gas passages during filling stage.

As is hereinafter described, the gas valve **46** is so operable as to prevent the filling head from delivering liquid to a bottle which leaks.

The detailed construction and operation of the filling head is hereinafter described.

The filling nozzle or bottle engaging portion of each filling head **20** is of generally tubular or sleeve-like form and includes a collar **80** welded to the bottom wall **24** of reservoir **26**. Collar **80** is outwardly shouldered at its lower end to support a ring nut **81**, and the ring nut serves to clamp a sleeve-like fitting **82** upwardly against a gasket **83** positioned beneath collar **80**. Gasket **83** has a circular opening therethrough of the same size as the liquid passage **34** and the fine mesh screen **43** is secured in the gasket to extend across this opening. The upper surface of gasket **83** also serves as a seat for the liquid valve **40**. The lower end of spring **42** bears on gasket **83**. It will be perceived that collar **80** thus encloses the liquid valve **40**.

Collar **80** has a bore **84** extending vertically through its wall and the gas tube **54** leading from chamber **28** extends into this bore. At its lower end, bore **84** opens to a bushing **85** countersunk in a bore **86** formed in the fitting **82**. A generally radial bore **87** extends upwardly from the lower end of bore **86** to a central recess **88** in the cross piece or web **36**. Recess **88** is threaded to receive the upper end of the gas nozzle **38**. The lower portion of the recess **88** is counterbored, and snift tube **60** is welded to web **36** to fit within the counterbore. The snifting passage **62** extends radially into web **36** to open to the upper end of snift tube **60**. A nipple **90** provided with a small aperture is threaded at the outer end of passage **62**. A small housing **91** is threaded in a counterbore formed outwardly of nipple **90**, and a spring **92** positioned within housing **91** serves to urge snift valve **64** to closed position.

It will be observed that the snifting tube **60** is relatively short so that it extends only slightly below the gasket **93** of the fitting **82** with which the mouth of a bottle will engage. The gas nozzle or tube **38** extends somewhat below snift tube **60** and has one or more ports

94 at its lower end through which counterpressure gas may move into a bottle, and by which gas may be vented from the bottle to chamber 28 and reservoir 26.

The snifting tube 60 is of only slightly greater diameter than the gas tube 38 so that a maximum area for liquid flow will be provided in the liquid passage 34. The portion of liquid passage 34 alongside of web 36 is of increased outside diameter so that this portion of the liquid passage will have at least the same cross-sectional area as the portion of the liquid passage immediately above the mouth of the bottle. It will be noted from Figure 5 that the extreme lower end 96 of the liquid passage has a diameter closely approximating the diameter of the bottle mouth.

The form of the chamber 28 associated with each filling head is best shown in Figures 5 and 6, from which it will be observed that each chamber is held in position in reservoir 26 by means of a hollow stud 100 extending through an aperture 101 in the outer wall 102 of the reservoir. In more detail, each stud 100 is exteriorly threaded to engage threads formed in the outer end of the circular bore of the corresponding chamber 28. Each chamber 28 is of substantially cup-like form to include a closed inner end wall 103. The operating shaft 30 is journalled in the stud bore and a sealing gasket is clamped in the bore about shaft 30. Chamber 28 will be located in proper position with respect to the reservoir by means of an aligning pin such as 104.

Inwardly of stud 100, shaft 30 has the cam 50 either secured thereto or formed integrally therewith. The cross-sectional form of cam 50 is shown in Figure 6, from which it will be observed that the cam includes a flat or dwell 106 which, when the filling head is in closed position, will lie beneath the valve 52 so that valve will be held seated and closed by its own weight and the pressure of gas upon its enlarged head. As shown in Figure 6, the dwell 106 is of substantial width, and two dwells 107 and 108 lie at right angles thereto. The adjoining ends of the dwells 106 and 107 form a rise 109 which, upon rotation of cam 50 in a counterclockwise direction as viewed in Figures 6 and 8, will lift valve 52 to open position. Beyond the rises 107 and 108, the cam 50 is of triangular form to provide a pointed rise 110. The walls of rise 110 form dwells 111 and 112. The rise 110 is adapted to engage the gas valve 46 to hold the latter closed, but when cam 50 is rotated in a counterclockwise direction as viewed in Figure 6, either dwell 112 or dwell 108 will be above gas valve 46 so that the latter may open as hereinafter described.

The bore of chamber 28 is slightly oversize with respect to the cam 50 to provide space within the bore for gas flow through the chamber.

The gas valve 52 is hollow to include a central recess 114 opening to chamber 28 as shown in Figure 5 and carries a sealing ring 113 immediately below its enlarged and closed head, the sealing ring being arranged to bear upon the upper exterior surface of chamber 28 when valve 52 is in closed position. A pair of diametrically arranged ports 115 best shown in Figure 11 are provided in the skirt of valve 52 to open to recess 114 immediately below sealing ring 113.

The stem 44 of liquid valve 40 is provided with a cross pin 116 adjacent its upper end, this pin extending into slightly larger apertures 117 in the lower portion of the cap sleeve or valve 46. The upper end wall of valve 46 is closed and is adapted to engage cam 50. However, valve 46 is provided with two vertically spaced series of apertures between its upper and closed end and the extreme upper end of valve stem 44. The upper series of apertures is designated 120 and the lower series is designated 121. The series 120 and 121 of ports are so spaced apart that, as shown in Figure 9, when the upper series 120 is within the bore of chamber 28, the lower series 121 will be open to reservoir 26. At least the ports of the upper series 120 have a diameter smaller than the thickness of the chamber wall adjacent valve 46. Hence, as shown in Figure 11, when the ports of this series lie entirely between the bounding edges of the chamber wall, they will be completely closed.

The spring 48 is adapted to urge valve 46 upwardly with respect to stem 44, this movement of the sleeve being limited by the engagement of the cross pin 116 in the sleeve apertures 117.

The upper end of the gas tube 54 has a gas-tight connection with a collar 125 threaded in the lower wall of chamber 28. Collar 125 includes an upwardly facing seat 126 surrounding the upper end of tube 54 and against which the gas valve 56 is adapted to close. The form of the gas valve 56 is best shown in Figure 13 from which it will be observed that it is provided with a downwardly facing resilient sealing element and has a shank 128 extending upwardly through the chamber 28 and into a cap 129 threaded in the upper wall of chamber 28. A spring 130 is positioned within cap 129 to bear upon shank 128 to thereby urge valve 56 to closed position. The shank 128 is cut away at one side edge as indicated at 131 and the eccentric or cam 58 extends through this cut-out portion so that rotation of shaft 30 will bring cam 58 against the upper wall of cut-out 131 to thereby lift and open valve 56.

It will be observed from Figure 2 that the trip lever 32 is of usual form to include a lower arm 135 and that the roller 76 projects outwardly from the lower end of this arm. The other arm 136 of trip lever 32 is arranged at an obtuse angle to lower arm 135.

As has been indicated above, the form of filling head illustrated in Figures 16 and 17 primarily differs from that of Figures 1 to 15 in that the Figures 16 and 17 form has the lower portion of the liquid passage 34*a* exteriorly bounded by a sleeve or tube 60*a* and the snifting passage is positioned outwardly of sleeve 60*a*. In more detail, the fitting 82*a* of the Figure 16 form includes a lower collar 140 which is threaded to the upper portion of the fitting. The crosspiece or web 36*a* is notched at its lower portion to receive the upper end of sleeve 60*a*, and the sleeve is welded to the lower surface of the web. The upper end of sleeve 60*a* is outwardly flanged to closely engage the bore of the liquid passage 34*a* to prevent any liquid from moving downwardly on the outer side of the sleeve. The snifting passage 62*a* opens to the exterior of the sleeve immediately below the flange.

It will be observed that beneath web 36*a*, the sleeve closely follows the outline of the liquid passage 34*a* so that the lower portion of the liquid passage is only slightly reduced in cross-sectional area as compared to the lower portion of the liquid passage of the Figures 1 to 15 form.

The central gas tube 38*a* may be provided with a conical deflector 142 immediately below sleeve 60*a* to direct liquid toward the wall of the bottle mouth.

It will be observed that with the form of Figures 16 and 17, the snifting passage is baffled with respect to the liquid passage. Thus, even if any liquid is present on the interior walls of tube 60*a* at the instant snifting occurs, such liquid cannot be entrained into the snifting passage. Therefore, the possibility of liquid being blown into the snift passage to block the small bore of that passage is eliminated.

OPERATION

As has been indicated above, a series of filling heads of the present invention would be provided in association with the annular filling reservoir 26, and reservoir 26 would be supplied with carbonated liquid and gas by any system usual to a rotary counterpressure filling machine. Suitable means would be provided to maintain a substantially constant level of liquid in the reservoir.

Closed stage

Figures 5 and 6 illustrate the position the filling head valves will occupy during closed stage. The filling head ordinarily would be in this condition after a bottle or other container has been moved downwardly from the head and the head is moved with the filling reservoir to a position to receive an unfilled bottle.

When a syruped or empty bottle has been elevated to bring its mouth into sealed engagement with the gasket **93** by the lifting of the bottle supporting platform, the bottle and filling head will be in sealed relation.

Counterpressure flow stage

With the bottle now sealed to the filling head, the rotation of the filling reservoir and filling table will bring the roller **76** of trip lever **32** into contact with the counterpressure trip CP (Figure 2) so that operating shaft will be rotated approximately 60° counterclockwise from the position illustrated in Figures 5 and 6 to the position illustrated in Figures 7 and 8.

The above described rotation of lever **32** will cause the rise or point **110** of cam **50** to move clear of the upper end of the cap sleeve or gas valve **46** associated with liquid valve stem **44**. Hence, the dwell **112** will be opposite and above valve **46**. However, the only effect of this movement of cam **50** will be to permit spring **48** to move the cap sleeve slightly upwardly with respect to the stem **44**. This movement will be insufficient to bring the upper series of ports **120** of valve **46** within the bore of chamber **28**.

The above described rotation of cam **50** from the Figure 6 position to that of Figure 8 will also cause the rise **109** of the cam to move beneath the upper gas valve **52** to lift and open the valve. The same movement of shaft **30** will cause cam **58** to lift and open the gas valve **56** to the extent indicated in Figure 7. That is, the cam or eccentric **58** will rotate into engagement with the upper edge of the notch **131** of valve stem **128** to lift this valve against the action of the spring **130**.

As the result of the above opening of the gas valves **52** and **56**, the gas in reservoir **26** will flow into the upper end of gas tube **54** along the path indicated by the long arrow of Figure 7. In other words, gas will enter chamber **28** through open valve **52** and then move through the chamber past open valve **56** to tube **54**. The gas flowing down through tube **54** will enter passages **84**, **86**, **87** to move into the nozzle gas tube **38** and thence into the bottle through the ports **94**. This flow of gas requires only a brief interval of time to cause the pressure in the bottle to become equalized with the pressure above the liquid in the reservoir.

Filling stage

When counterpressure has been established in the bottle, i. e., the pressure in the bottle becomes substantially equal to that above the liquid in the reservoir **26**, spring **42** will lift the liquid valve **40**. Hence, liquid will now move through the liquid passage **34** and downwardly into the bottle by gravity flow. The slight flare at the lower end of snifting tube **60** will deflect the liquid outwardly upon the wall of the mouth of a bottle so that foaming will be held to a minimum.

The above-mentioned lifting of the liquid valve **40** is made possible, because, as shown in Figure 8, during counterpressure flow stage, the dwell **112** of cam **50** came opposite the gas valve **46** so that stem **44** can lift to at least a slight extent.

Either simultaneously with establishment of balanced pressure in the bottle, or an instant thereafter, the roller **76** of trip lever **32** will contact with the filling trip F (Figure 2) so that the trip lever **32** and operating shaft **30** will be turned substantially 90° from closed stage position. This rotation of shaft **30** will cause cam **50** to assume the position illustrated in Figures 9 and 10 so that gas valve **46** and stem **44** of liquid valve **40** can rise to the extent illustrated in these two figures. Simultaneously, the rise **109** of cam **50** will move from beneath valve **52**, and dwell **107** will move beneath that valve. Therefore, valve **52** can drop of its own weight, assisted by the pressure of gas acting upon the enlarged head of the valve. The rotation of shaft **30** will move the cam or eccentric **58** further upwardly to open the gas valve **56** to a slightly greater extent as indicated in Figure 9.

The result of the above movement of shaft **30** will be that gas may now flow from the bottle into the ports **94** of nozzle gas tube **38**, thence upwardly in that tube and into the tube **54** to return to reservoir **26** along the path indicated by the long arrow of Figure 9. In more detail, gas will flow from tube **54**, past open valve **56** and into chamber **28**. From chamber **28** the gas will flow into the upper series **120** of ports of valve **46** and through the bore of the valve to the lower series **121** of ports to enter reservoir **26**.

It will be understood that the downward flow of liquid into the bottle will cause gas to be returned to the reservoir by the path just described. This flow of liquid and gas will continue until the liquid rises in the bottle to cover the ports **94** of nozzle gas tube **38**. When these ports become covered by liquid, no more gas can escape from the bottle by tube **94**. However, because of the head of liquid in reservoir **26**, the liquid will continue to flow into the bottle until its level rises slightly above the ports **94**. This slight further flow of liquid will compress the gas in the headspace of the bottle to such an extent that little, if any, liquid can thereafter flow downwardly through the fine mesh screen **43**. In other words, screen **43** is of sufficiently small mesh that with the gas in the bottle headspace under increased pressure, the surface tension of the liquid, or the capillarity effect, will prevent downward flow of liquid through screen **43** as well as upward flow of gas through the screen. Such additional liquid as may flow into the bottle through the screen may result in upward movement of liquid through the ports **94** into the tube **38**.

The fact that the liquid passage **34** is of large diameter will enable liquid to flow into the bottle at a rapid rate, insuring that the bottle will be filled in a minimum period of time.

Leaking bottle

In the event that a bottle leaks counterpressure, as may occur by reason of a nick in the mouth of the bottle, counterpressure will not be established in the bottle during the counterpressure flow stage. Therefore, the pressure in the bottle cannot become balanced with the pressure above the liquid in reservoir **26**, and spring **42** will not be capable of lifting liquid valve **40** from closed position.

As has been stated above, in the discussion of the Filling Stage, the first turning movement given shaft **30**, viz., by counterpressure trip CP, normally permits valve **46** to lift to the position shown in Figure 9 when the liquid valve **40** lifts. However, if the bottle leaks pressure and, hence, liquid valve **40** is not lifted by spring **42**, the gas valve **46** will remain in the position it normally occupies during counterpressure gas flow. Therefore, as is illustrated in Figures 11 and 12, the upper series **120** of ports in valve **46** will not rise into the the chamber **28** and no gas can escape from reservoir **26** to chamber **28** through valve **46** during the Filling Stage. The upper gas valve **52**, of course, will close when cam **50** moves to Filling Stage position. Therefore, chamber **28** will be entirely closed to reservoir **26**. The fact that gas valve **56** is open will be of no importance because tube **54** will be out of communication with reservoir **26**.

The system of operation described above will result in closing the counterpressure path to prevent further flow of gas from reservoir **26** to the leaking bottle. Obviously, if such flow of gas could continue through the entire period of the filling stage, a substantial waste of gas from reservoir 26 could occur, thereby unbalancing conditions within the reservoir.

Snifting stage

A few seconds after the level of the liquid in the bottle has risen to close the ports 94 of gas tube 38, the upper arm 136 of trip lever 32 will contact with the closing trip C diagrammatically shown in Figure 2. During these few seconds of delay, the liquid in the bottle will rest to become quiescent. Trip C will rotate operating shaft 30 clockwise as viewed in Figures 2 and 10 to restore the cams 50 and 58 to the position shown in Figures 5 and 6. Hence, the rise 110 of cam 50 will move against the upper end of gas valve 46 to move that valve and liquid valve 40 to closed position. The simultaneous rotation of cam 58 from the position of Figure 13 to the lowered position of Figure 5 closes the gas valve 56 so that chamber 28 will be cut off from communication with the nozzle of the filling head.

After the gas and liquid valves of the filling head have been closed as mentioned in the preceding paragraph, the snift valve 64 will brush against a snifting cam such as indicated at S in Figure 1 so that snift valve 64 will briefly open to relieve some of the headspace pressure from the bottle. Then the bottle will lower from the filling head and be moved to a capping mechanism.

If it is desired, the gas tube 38 may be blown out after a filled bottle has been removed from the filling head and before a second bottle is brought into alignment therewith. For example, a trip positioned at the same height as trip CP of Figure 2 may be provided to move trip arm 32 sufficiently to partially open the valves 56 and 52. Hence, gas will flow from the reservoir 26 and through chamber 28 and into tube 54 to thereby blow any liquid from that tube and the nozzle 38. Trip lever 32 will be permitted to remain in this blow-out position for an extremely short period of time. Then it will strike a second trip positioned in the same vertical plane as the trip C of Figure 2 so that the gas valves will be returned to closed position.

As has been indicated above, the cycle of operation of the filling head 20*a* of Figures 16 and 17 is the same as that of the filling head 20 of Figures 1 to 15.

It will be observed that the structures described above attain the objects stated in the opening portion of the specification.

The terminology used in the specification is for the purpose of description and not of limitation, the scope of the invention being defined in the claims.

We claim:

1. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said reservoir, a horizontally disposed tubular element in the gas containing portion of said reservoir, the upper portion of said gas tube and the upper portion of said liquid valve actuating stem being connected to said tubular element, a gas valve mounted within said tubular element to control gas flow between the upper and gas-containing portion of said reservoir and said gas tube, a cam to control said gas valve and said liquid valve rotatable in said tubular element, and an actuating arm on said cam outwardly of said reservoir.

2. A combination of the character described in claim 1 wherein said liquid valve stem and the upper portion of said gas flow tube extend radially of said tubular element.

3. A combination of the character described in claim 1 wherein said liquid valve stem and said gas valve extend radially of said tubular element.

4. The combination described in claim 1 including spring means to open said liquid valve.

5. The combination described in claim 1 including spring means to open said liquid valve, and wherein said cam is operable to normally close said liquid valve.

6. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a first gas flow tube centrally of said liquid passage, a second gas flow tube communicating with the upper end of said first gas flow tube and extending upwardly into said reservoir, a horizontally disposed journal element in the gas containing portion of said reservoir, the upper end of said second gas flow tube and the upper portion of said liquid valve actuating stem being connected to said journal element, a gas valve mounted within said journal element to control gas flow between the upper portion of said reservoir and said second gas tube, a cam to control said gas valve rotatable in said journal element, and an actuating arm on said cam outwardly of said reservoir.

7. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a bottle engaging nozzle structure, a gas chamber within said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, a gas passage extending from said chamber to said nozzle structure, and normally closed valve mechanism in said chamber to close said chamber from said reservoir and to close said gas passage from said chamber, said valve mechanism being operable to open position to thereby place said gas passage in communication with said reservoir.

8. The combination described in claim 7 including spring means to open said liquid valve.

9. The combination described in claim 7 wherein said valve mechanism includes a first gas valve operable to open said chamber to said reservoir and a second gas valve operable to open said chamber to the gas passage.

10. The combination described in claim 7 wherein said valve mechanism includes a first gas valve operable to open said chamber to said reservoir and a second gas valve operable to open said chamber to the gas passage, and means to simultaneously open said gas valves and then close said first gas valve and hold said second gas valve open.

11. The combination described in claim 7 wherein said valve mechanism includes a first gas valve operable to open said chamber to said reservoir and a second gas valve operable to open said chamber to the gas passage, and means to open both of said gas valves independently of each other.

12. The combination described in claim 7 including a gas valve to control flow between said chamber and reservoir, means to open said liquid valve and said gas valve, and wherein said valve mechanism includes a second gas valve operable to open said chamber to the gas passage, and means to open said second gas valve.

13. The combination described in claim 7 wherein said valve mechanism includes a pair of gas valves operable to open said chamber to said reservoir and a third gas valve operable to open said chamber to the gas passage, means to simultaneously open one of said pair of gas valves and said third gas valve, and means independent of said valve mechanism to then open said liquid valve and the other of said pair of gas valves.

14. In a filling head nozzle structure, a sleeve including a circular liquid passage adapted to communicate with the liquid containing portion of a reservoir and a bottle

to be filled, a web in and extending transversely of the liquid passage, a gas tube depending from said web to extend centrally and axially of the liquid passage, said sleeve and web being provided with passages open to said gas tube and adapted to communicate with the gas containing portion of a reservoir.

15. A filling head nozzle structure of the character described in claim 14 wherein said sleeve includes a snift passage extending from the liquid passage to the exterior of the nozzle structure, and a valve in said snift passage.

16. A filling head nozzle structure of the character described in claim 14 including a second tube concentric with said gas tube, said sleeve being provided with a passage extending from the upper portion of said second tube to the exterior of said sleeve, and a snift valve in said last-mentioned passage.

17. A filling head nozzle structure of the character described in claim 14 including a second tube depending from said web concentric with and closely adjacent said gas tube, a passage extending from the interior of said second tube and through said web to the exterior of said sleeve, and a snift valve in said last-mentioned passage.

18. A filling head nozzle structure of the character described in claim 14 including a second tube depending from said web concentric with and spaced from said gas tube, a passage extending from the exterior of said second tube to the exterior of said sleeve, and a snift valve in said last-mentioned passage.

19. In a filling head nozzle structure, a sleeve including a bore therethrough, said sleeve being adapted to have its bore communicate at its upper end with a liquid reservoir and at its lower end with a bottle, a tube of less diameter than the sleeve bore, means to secure one end of said tube to the sleeve at a point intermediate the length of the bore so that the free end of the tube extends toward the bottle engaging end of the sleeve, said sleeve including a passage extending laterally from the secured end of said tube and through said sleeve to the exterior of the latter, and a snift valve in said passage.

20. A filling head nozzle structure of the character described in claim 19 including a second tube adapted to communicate at its upper end with a source of gas and means to support said second tube centrally of said bore and said first tube.

21. In a filling head nozzle structure, a sleeve including a bore therethrough, said sleeve being arranged to have its bore communicate at its upper end with a liquid reservoir and at its lower end with a bottle, a tube of less diameter than the sleeve bore, means to secure one end of said tube to the sleeve at a point intermediate the length of the bore so that the free end of the tube extends toward the bottle engaging end of the sleeve, said sleeve including a passage extending laterally from a point exteriorly of the upper portion of said tube and through said sleeve to the exterior of the latter, and a snift valve in said passage.

22. In a filling head nozzle structure, a sleeve including a bore therethrough, said sleeve being adapted to have its bore communicate at its upper end with a liquid reservoir and at its lower end with a bottle, a tube of less diameter than the sleeve bore, means to secure one end of said tube to the sleeve at a point intermediate the length of the bore so that the free end of the tube extends toward the bottle engaging end of the sleeve, said sleeve including a passage extending laterally from a point exteriorly of the upper portion of said tube and through said sleeve to the exterior of the latter, a snift valve in said passage, and a second tube supported centrally of the sleeve bore and adapted to communicate with a source of gas.

23. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, said reservoir including a liquid passage provided with an outlet, a liquid valve for the liquid passage and including a stem, said reservoir including a gas passage provided with an outlet adjacent the outlet of the liquid passage, a gas chamber within said reservoir, a first gas valve mounted on the free end of the liquid valve stem and extending through the wall of said chamber to control gas flow between the chamber and reservoir, a second gas valve in said chamber to control the gas passage, a third gas valve in the chamber to control communication between said chamber and reservoir, and an operating element for said gas valves comprising a cam rotatable within said chamber.

24. The combination described in claim 23 wherein the outlets of the gas and liquid passages are concentric.

25. The combination described in claim 23 wherein the first gas valve on the free end of the stem of said liquid valve is hollow and is provided with a pair of ports spaced lengthwise of the stem.

26. The combination described in claim 23 wherein the first gas valve on the free end of the stem of said liquid valve is hollow and is provided with a pair of ports spaced lengthwise of the stem, and a spring to urge said first gas valve toward said rotatable cam.

27. The combination described in claim 23 wherein said rotatable cam is of such conformation that it will simultaneously open said second and third gas valves.

28. The combination described in claim 23 wherein said rotatable cam is of such conformation that it will simultaneously open said second and third gas valves and is subsequently movable so that said third gas valve will be closed.

29. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a filling nozzle structure depending from the reservoir, a chamber within the reservoir, said nozzle structure including a liquid outlet passage and a gas passage, the gas passage communicating with said chamber, a liquid valve for said liquid outlet, a first gas valve in the gas passage to control flow between said chamber and nozzle structure gas passage, a second gas valve to control flow between said reservoir and chamber, and a third gas valve movable with said liquid valve to control gas flow between said reservoir and chamber, a cam device to operate said gas valves, means to actuate said cam device to simultaneously open said first and second valves to equalize the pressure in a bottle associated with the filling nozzle structure with the pressure in the chamber and reservoir, means to urge said liquid valve and said third gas valve to open flow position when pressures are thus equalized, and means to then actuate said cam device to close second gas valve and thereafter close said liquid valve and said other gas valves.

30. The combination described in claim 29 wherein the filling nozzle structure is provided with a snift passage extending from the nozzle structure liquid outlet passage to the exterior of the nozzle structure, a valve in said snift passage, and means to operate said last-mentioned valve.

31. The combination described in claim 29 wherein said cam device is rotatable within said chamber.

32. The combination in a counterpressure filler of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said reservoir, a horizontally disposed tubular element in the gas containing portion of said reservoir, a gas valve in the upper portion of said gas tube, a cam rotatable in said tubular element to control said gas valve and said liquid valve actuating stem, and an actuating arm on said cam outwardly of said reservoir.

33. A combination of the character described in claim

32 wherein said liquid valve stem and the upper portion of said gas flow tube are movable radially of the axis of rotation of said cam.

34. The combination described in claim 32 including spring means to open said liquid valve.

35. The combination described in claim 32 including spring means to open said liquid valve, and wherein said cam is adapted to close said liquid valve.

36. The combination described in claim 32 wherein said tubular element is a journal for said cam.

37. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said reservoir, a horizontally disposed annular journal element in the gas containing portion of said reservoir, a gas valve in the upper portion of said gas tube, a cam member rotatable in said journal element, said cam member having a first cam surface to control said gas valve and a second cam surface to control said liquid valve actuating stem, said liquid valve being movable between a lower closed position and an upper open position and being free to move downwardly with respect to said second cam surface when in its upper open position, and an actuating arm on said cam outwardly of said reservoir.

38. The combination described in claim 37 including spring means to open said liquid valve.

39. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said liquid reservoir, a cam member journalled in a side wall of said reservoir and rotatable about a horizontal axis, said cam member having a first cam surface to control said gas valve and a second cam surface engaging and controlling said liquid valve actuating stem, and an actuating arm on said cam exteriorily of said reservoir.

40. The combination described in claim 39 including spring means to open said liquid valve.

41. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said reservoir, a horizontally disposed tubular element in the gas containing portion of said reservoir, the upper portion of said gas tube and the upper portion of said liquid valve actuating stem engaging said tubular element, a gas valve on said gas tube to control gas flow between the upper and gas-containing portion of said reservoir and said gas tube, a cam to control said gas valve and said liquid valve rotatable in said tubular element, and an actuating arm on said cam outwardly of said reservoir.

42. The combination described in claim 41 including spring means to open said liquid valve.

43. The combination in a counterpressure filler, of a reservoir for liquid and a superposed body of gas, a container engaging nozzle structure in the lower portion of said reservoir, a liquid passage extending from said reservoir to said nozzle structure, a liquid valve in said liquid passage, said liquid valve including an actuating stem extending upwardly within said reservoir, said nozzle structure including a gas flow tube within said liquid passage and extending upwardly into said reservoir, a horizontally disposed journal element in the gas containing portion of said reservoir, the upper end of said gas tube and the upper portion of said liquid valve actuating stem being connected to said journal element, a gas valve mounted within said journal element to control gas flow between the upper portion of said reservoir and said gas tube, a cam to control said gas valve rotatable in said journal element, and an actuating arm on said cam outwardly of said reservoir.

44. The combination described in claim 43 wherein said rotary cam is operable to normally close said liquid valve but said liquid valve is movable to open and closed position independently of said cam.

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