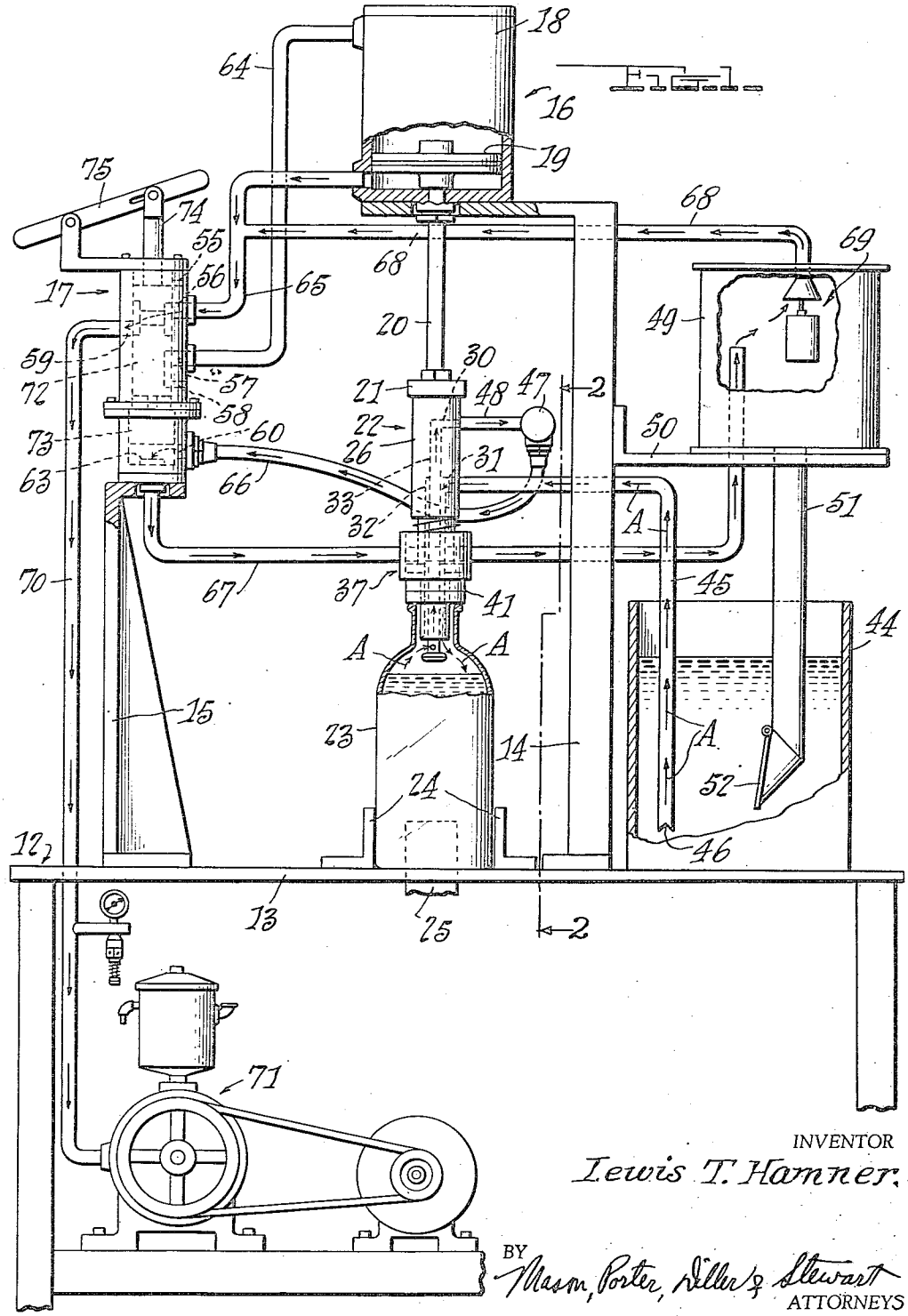
Oct. 15, 1957 L. T. HAMNER 2,809,677

BOTTLE FILLING APPARATUS

Filed July 18, 1955 4 Sheets-Sheet 1



INVENTOR
Lewis T. Hamner.

BY Mason, Porter, Diller & Stewart
ATTORNEYS

Oct. 15, 1957 L. T. HAMNER 2,809,677

BOTTLE FILLING APPARATUS

Filed July 18, 1955 4 Sheets-Sheet 2

FIG. 2

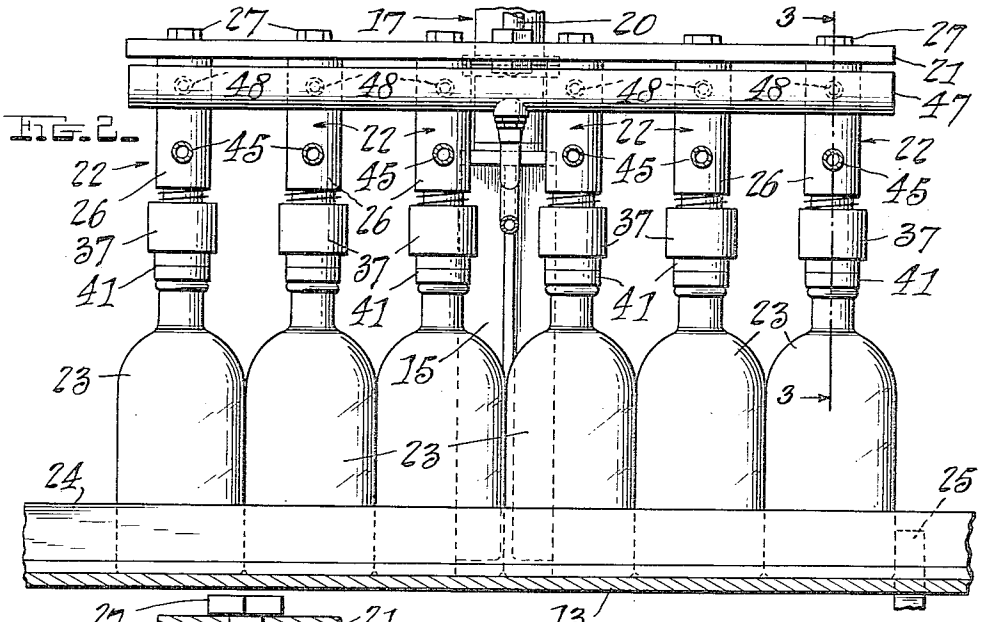


FIG. 3

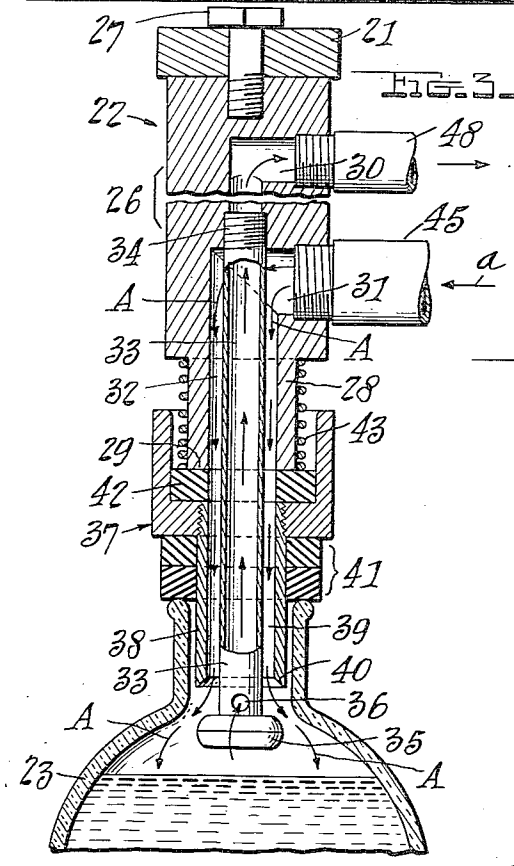
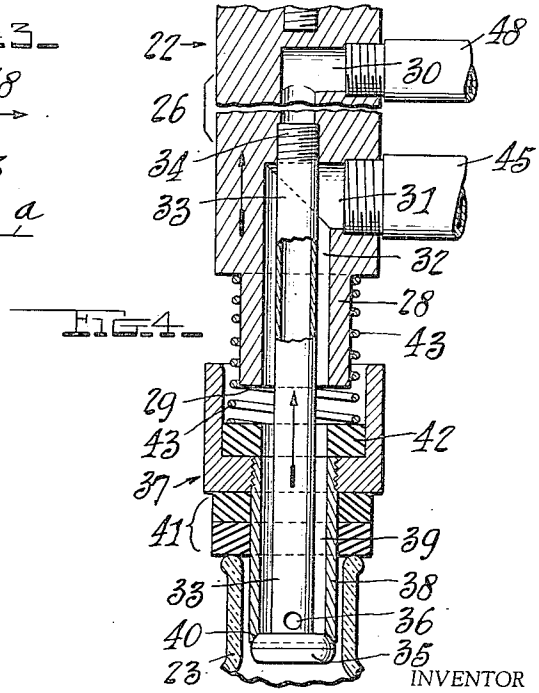


FIG. 4



INVENTOR
Lewis T. Hamner.

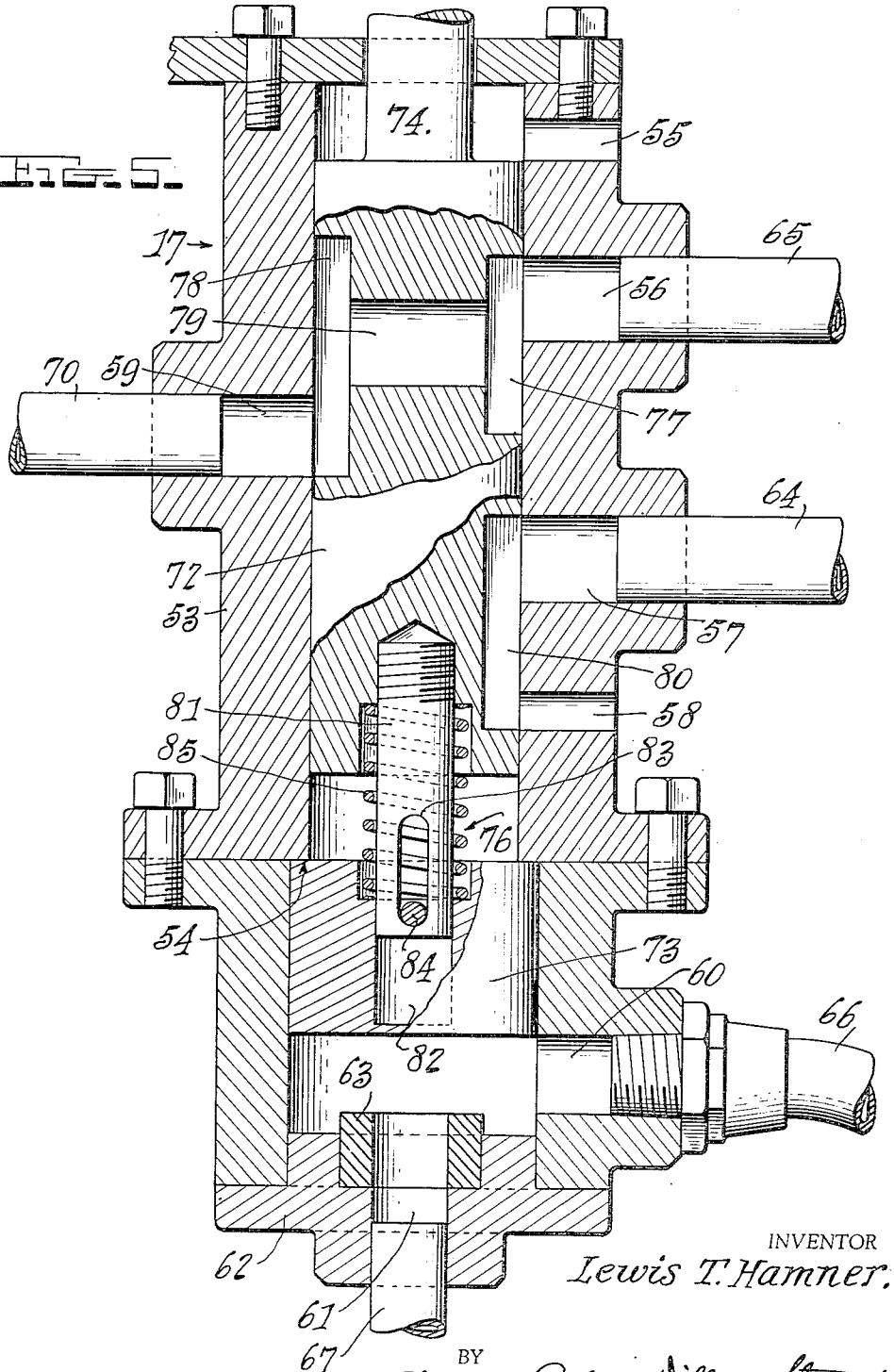
BY
Mason, Porter, Miller & Stewart
ATTORNEYS

Oct. 15, 1957 L. T. HAMNER 2,809,677

BOTTLE FILLING APPARATUS

Filed July 18, 1955 4 Sheets-Sheet 3

FIG. 5.



INVENTOR
Lewis T. Hamner.

BY
Mason, Porter, Diller & Stewart
ATTORNEYS

Oct. 15, 1957 L. T. HAMNER 2,809,677

BOTTLE FILLING APPARATUS

Filed July 18, 1955 4 Sheets-Sheet 4

FIG. 6

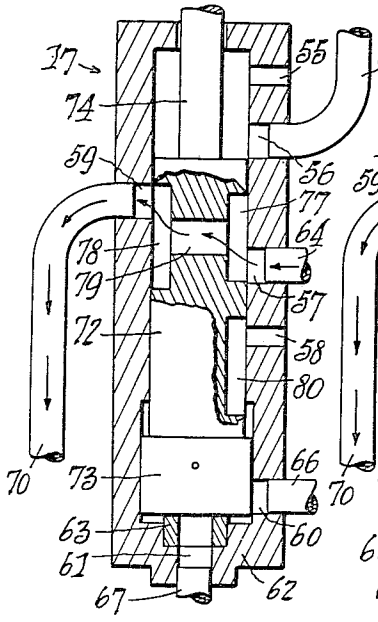


FIG. 7

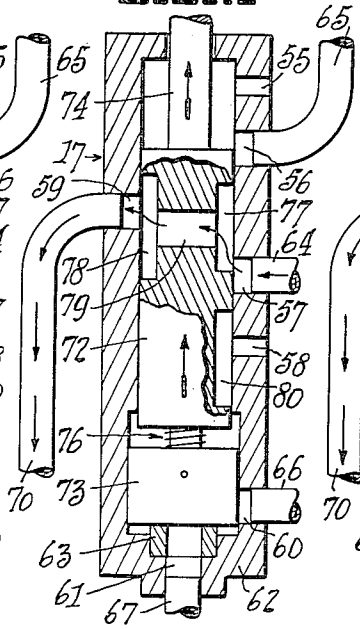


FIG. 8

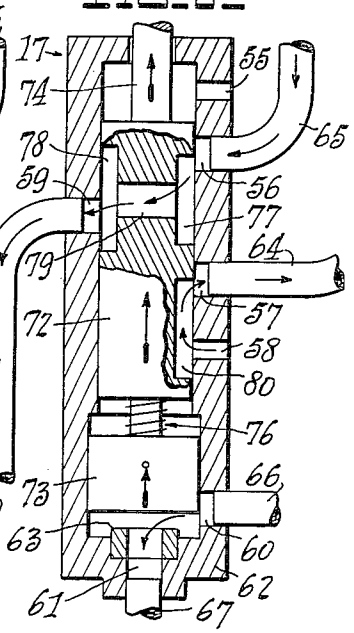


FIG. 9

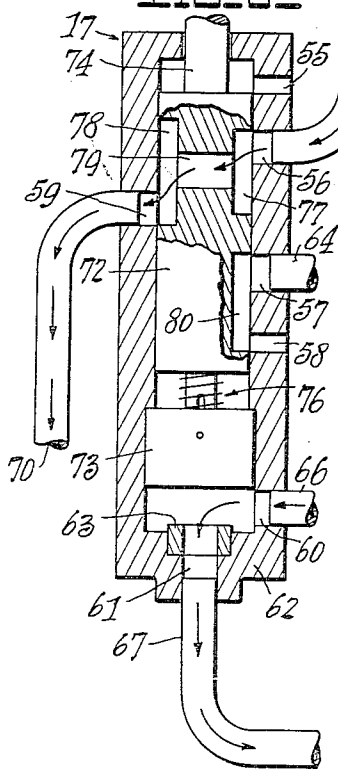


FIG. 10

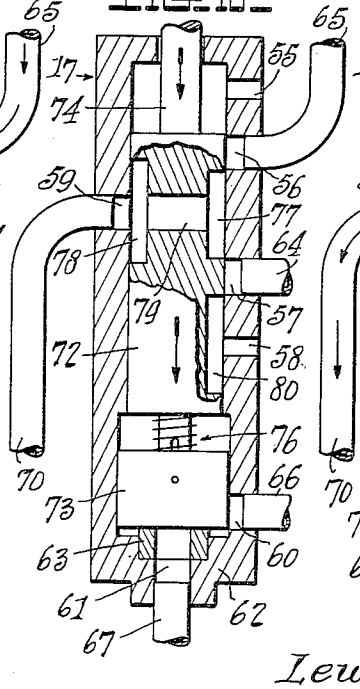
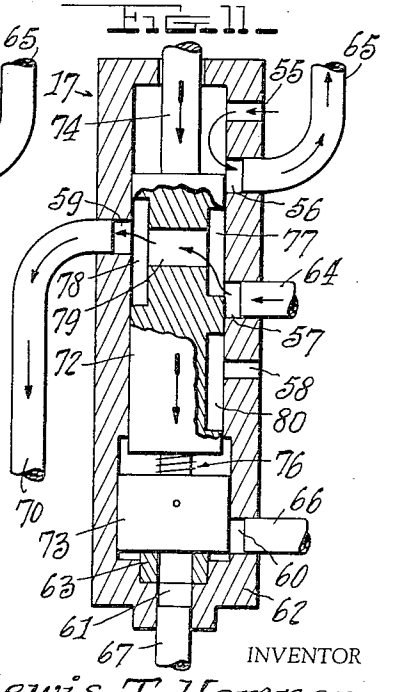


FIG. 11



INVENTOR

Lewis T. Hamner.

BY

Mason, Porter, Miller & Stewart

ATTORNEYS

United States Patent Office

2,809,677

Patented Oct. 15, 1957

2,809,677

BOTTLE FILLING APPARATUS

Lewis T. Hamner, Petersburg, Va., assignor to Vacuum Motor Corporation, Petersburg, Va., a corporation of Virginia

Application July 18, 1955, Serial No. 522,448

24 Claims. (Cl. 141—59)

This invention relates to a bottle filling apparatus of the general type in which bottle filling is induced by evacuation of air from the bottles. It also relates to an apparatus of this general type in which bottle filling means (one or more filling heads) and bottle supporting means (conveyor or other support) are relatively movable into and from bottle filling relation with each other by means of a vacuum-actuated servo-motor connected with one of said means.

One object of the invention is to provide a new and improved bottle filling apparatus in which a single control valve assembly is provided for controlling the operation of both the vacuum-actuated servo-motor and the bottle filling means regardless of the number of filling heads employed.

Another object is to provide a new and improved bottle filling apparatus in which only one valve casing is required for operatively relating all necessary vacuum lines with the valve means.

Yet another object is to provide a novel bottle filling apparatus in which one valve body is operable to control the servo-motor and in which said one valve body acts as an actuator for a second valve body which controls the operation of the bottle filling means.

A further object is to provide a novel bottle filling apparatus embodying the two aforesaid valve bodies and also embodying novel connecting means between said bodies for permitting further movement of said one valve body after the latter has moved said second body to the position at which it terminates the bottle filling operation, said further movement of said one body serving to operate the servo-motor to separate the filling means from the filled bottle or bottles.

Another object is to provide the vacuum control valve with means for admitting air to either end of the servo-motor when air is being exhausted from its other end to operate said servo-motor.

A still further object is to provide a novel bottle filling apparatus in which there will be no drip from the filling means as the latter and the filled bottle or bottles are separated at the completion of each filling operation.

Another object is to provide a novel bottle filling apparatus in which most of the liquid drawn into vacuum lines after filling of the bottle or bottles, will be vacuum-drawn to an overflow tank and will be automatically returned to the liquid supply tank.

A further object is to provide for excluding atmospheric air from any liquid left trapped in the apparatus at the end of each filling cycle, thus preventing agitation and foaming of the trapped liquid and preventing foam troubles which might otherwise occur.

A still further object is to provide a novel bottle filling apparatus in which the liquid is drawn upwardly by vacuum through a tube from a supply tank to a bottle filling passage of each filling head and is then drawn downwardly through this passage into the bottle, provision being made for automatically admitting air to said passage

before the filling head leaves the bottle, thereby allowing liquid below the air admitting means to drain into the bottle and also permitting the liquid in said tube to syphon back to the supply tank.

A further object is to provide a novel construction for each filling head, including a valve which automatically closes the liquid discharge nipple of said filling head before this nipple leaves the filled bottle, to prevent drip from said nipple.

A still further object is to provide a novel apparatus in which the filling means is movable to and from bottle filling position and in which a flexible vacuum line extends from said filling means to the control valve, said line being the only line of the apparatus which need be flexible.

Another object is to provide a bottle filling apparatus embodying the aforesaid servo-motor and overflow tank, and also including means for automatically breaking the vacuum in said overflow tank after each bottle filling operation, permitting liquid in this tank to drain back to the supply tank through a drain passage provided with a check valve for this purpose.

A still further object is to provide a generally improved and simplified apparatus which may be efficiently and rapidly operated without danger of causing any foaming of the liquid discharged into the bottles.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

Figure 1 of the accompanying drawings is an end elevation partly broken away and in section showing a simple form of the apparatus in operation.

Figure 2 is a fragmentary vertical sectional view on line 2—2 of Figure 1.

Figure 3 is an enlarged vertical sectional view through any of the filling heads of Figure 2, for example on line 3—3 of that view.

Figure 4 is a view similar to Figure 3 but showing the filling head just after its air admitting means has opened and its liquid passage valve has closed.

Figure 5 is an enlarged vertical sectional view, partly in elevation, showing the construction of the vacuum control valve.

Figures 6 to 11 inclusive are diagrammatic views showing the vacuum control valve in various positions, Figure 6 being the normal or between-filling-cycles position and Figure 9 the bottle filling position.

The embodiment of the invention shown in the drawings will be rather specifically described but attention is invited to the possibility of making variations, even such variation as to convert the hand-controlled apparatus disclosed, into an automatic apparatus.

A supporting structure **12** is provided, including a table **13** and two spaced standards **14** and **15** rising rigidly from said table. A servomotor **16** is mounted on the standard **14** and the standard **15** supports a control valve assembly **17**.

The servomotor **16** is in the form of a cylinder-and-piston-assembly, the cylinder of which is denoted at **18**, the piston at **19** and the piston rod at **20**. The lower end of the piston rod **20** is centrally secured to a horizontally elongated carrier bar **21** which carries a gang of vertically elongated filler heads **22** for descent onto bottles **23** to be filled and ascent from the filled bottles. In the present disclosure, the bottles **23** are supported by the table **13** in a row between two guide rails **24**. A suitable stop **25** is shown for the first bottle of the row and as the adjacent bottles contact with each other, said stop will suffice

for all, insuring alignment of the bottles with the filling heads 22. The stop 25 may be mounted for projection and retraction in any desired way and when said stop is retracted, the filled bottles may be slid along the table 13 and removed.

Each filling head 22 is of the construction shown in Figures 3 and 4. A vertical body 26 is provided, having its upper end secured at 27 to the carrier bar 21. The lower end of the body 26 is reduced at 28 and provided with a flat lower extremity 29. The body 26 is formed with two vertically spaced openings 30 and 31, and said body is also formed with a vertical passage 32 which communicates with the lowermost opening 31 and extends downwardly therefrom, said passage 32 opening through the lower extremity 29 of said body 26. A rigid vertical tube 33 extends through the passage 32 and is of considerably less diameter than said passage. The upper end of the tube 33 is threaded at 34 into the body 26 and communicates with the upper opening 30. The tube 33 projects downwardly beyond the lower end 29 of the body 26 and is provided with an upwardly facing valve head 35. Immediately above this valve head 35, an opening 36 extends from the interior to the exterior of the tube 33.

A collar 37 surrounds the downwardly projecting lower end portion of the tube 33 and is provided with a downwardly projecting nipple 38 for reception in a bottle neck, said collar 37 and nipple 38 having a passage 39 which surrounds said projecting lower end portion of the tube 33. The lower end of the nipple 38 is provided with a downwardly facing valve seat 40 for coaction with the valve head 35 of the tube 33.

One gasket 41 of rubber or other yieldable material, surrounds the upper portion of the nipple 38 to seat against the upper end of a bottle neck. This gasket abuts the lower side of the collar 37 and may well be formed from upper and lower sections as shown. A second yieldable gasket 42 is provided upon the upper side of the collar 37 for sealing engagement with the lower extremity 29 of the body 26.

A coiled compression spring 43 surrounds the reduced lower portion 28 of the body 26, acts downwardly on the collar 37 and reacts upon said body 26. This spring, normally (head 22 fully raised) holds the collar 37 depressed to the limit, the valve seat 40 being then seated against the valve head 35, and the gasket 42 being then spaced downwardly from the lower extremity 29 of the body 26. This depressed position of the collar 37 appears in Figure 4 although the head 22 is travelling toward normal or fully raised position in this view instead of actually occupying said position. As the head 22 descends and the gasket 41 limits descent of the collar 37 by contact with the bottle neck, further descent of the body first opens the valve head 35 and then seats the lower extremity 29 of the body 26 fluid-tightly against the gasket 42 (see Figure 3). The functions of these operations will be fully explained hereinafter.

A liquid supply tank 44 (see Figure 1) is mounted on the table 13 and liquid conducting tubes 45, equal in number to the filling heads 22, extend from said supply tank 44 to the openings 31 of the various bodies 26, respectively. These tubes 45 are of rigid form and they are bodily movable with the bodies 26, and the lower open ends 46 of said tubes extend into the liquid in the supply tank 44. As the tubes 45 conduct liquid to the passage 32, 39, this passage may be identified as a bottle filling passage.

A vacuum manifold 47 (Figures 1 and 2) parallels the carrier bar 21, and rigid nipples 48 place said manifold in communication with the openings 30 of the various filling head bodies 26. The tube 33 of each of the bodies 26 therefore constitutes an air-evacuation passage, and the evacuation of air from the bottles through the various tubes 33 induces bottle filling by way of the tubes 45 and the bottle filling passages 32, 39.

An overflow tank 49 (Figure 1) is mounted on a bracket 50 secured to the standard 14, said overflow tank 49 being disposed above the supply tank 44 and being closed to the atmosphere. A liquid return pipe 51 extends downwardly from the overflow tank 49 and is provided with a check valve 52 which opens toward said supply tank 44. The manner in which these elements function will be hereinafter explained.

The control valve assembly 17 (see more particularly Figure 5) includes a cylindrical casing 53 shown vertically disposed. This casing is provided near its lower end with a downwardly facing internal shoulder 54. Above this shoulder 54, the casing side wall has five ports 55, 56, 57, 58 and 59, port 55 being near the upper end of the casing, port 58 being near the shoulder 54, port 56 being spaced below port 55, port 57 being spaced above port 58, and port 59 being substantially mid-way between the ports 56 and 57 and preferably at the opposite side of the casing 53. Below the shoulder 54, the casing 53 has two ports 60 and 61, port 60 being in the casing side wall near the lower end wall 62, while port 61 extends through said end wall 62. This port 61 is surrounded by an upwardly facing valve seat 63 of any appropriate material to resist damage from the liquid to be bottled.

One vacuum line 64 (see more particularly Figures 1 and 5) extends from the upper end of the servo-motor cylinder 18 to the port 57, and a second vacuum line 65 extends from the lower end of said cylinder 18 to the port 56. A third vacuum line 66 extends from the vacuum manifold 47 of the filling heads 22 to the port 60, and as said manifold must ascend and descend with the filling heads, said third line 66 is flexible. A fourth vacuum line 67 extends from an above-liquid zone of the overflow tank 49 to the port 61, and a fifth vacuum line 68 extends from said above-liquid zone to the second line 65 and communicates through a portion of the latter with the port 56. A float valve 69 is preferably provided at the tank end of the line 68. A main vacuum line 70 is connected to the port 59 and extends to a vacuum pump 71 mounted under the table 13.

A novel valve means is provided in the casing 53 for controlling the various ports and vacuum lines to cause operation of the servo-motor 16 and the filling heads 22. The construction of this valve means is shown primarily in Figure 5 to which reference is now made.

An upper valve body 72 is slidable in the casing 53 for controlling communication of the main vacuum line 70 with the line 64 or with the communicating lines 65 and 68. A lower valve body 73 is also slidable in the casing 53 below the shoulder 54 for controlling communication between the lines 66 and 67. In its lowered position in which it obstructs communication between the lines 66 and 67, this lower valve body rests on the seat 63 (see Figures 6, 7, 10 and 11).

Operating means 74, 75 is connected with the upper valve body 72 for sliding it upwardly and downwardly, and an operating connection 76 is provided from said upper valve body 72 to the lower valve body 73. The upper valve body 72 thus constitutes an actuator for the lower valve body 73. However, the connecting means 73 is constructed to permit certain relative movements of the bodies 72 and 73 as will be later explained.

The upper valve body 72 is formed with one elongated peripheral port 77 selectively cooperable with the ports 56 and 57 to which the lines 65 and 64 are connected, respectively. The upper valve body 72 is also formed with another elongated peripheral port 78 which always communicates with the casing port 59 to which the main vacuum line 70 is connected. The two ports 77 and 78 communicate through a connecting port 79. The upper valve body 72 is formed also with an elongated peripheral port 80 effective to connect the two casing ports 57 and 58 when said body 72 occupies the fully raised position of Figures 5 and 9, the three communicating ports 57, 58, 80 then serving to admit atmospheric air to the line 64 as the valve body 72 is being downwardly moved (Figures 10

and 11) to its fully lowered position (Figure 6) it uncovers the casing port **56** to admit atmospheric air (see Figure 11) into the lines **65** and **68** both of which communicate with said port **56**. The admission of air to the three lines **64**, **65** and **68**, is effected for reasons which will be explained under the heading "Operation" appearing hereinafter.

The connecting means **76** between the upper valve body **72** and the lower valve body **73** is preferably constructed as seen in Figure 5. A stud **81** is threaded in and projects downwardly from the upper body **72**, the lower body **73** being formed with a socket **82** slidably receiving the projecting portion of said stud. This stud portion is formed with a longitudinal slot **83** through which a pin **84** extends, said pin being carried by the lower body **73**. A coiled compression spring **85** surrounds the stud **81**, acts downwardly on the lower body **73** and reacts on the upper body **72**. This spring **85** normally separates the two bodies **72** and **73** to the extent permitted by the slot **83** and pin **84**.

As the upper valve body **72** is being slid downwardly (Figures 10 and 11) the spring **85** pushes the lower valve body **73** downwardly until said lower body is seated on the seat **63** (see Figure 10). Then, further descent of the upper body **72** (Figure 11) to the position of Figure 6, compresses the spring **85**, and during this operation the stud **81** slides down in the socket **82**. When the upper valve body **72** is again moved upwardly (Figure 7) the spring **85** holds the lower valve body **73** against the seat **63** until the lower end of the slot **83** abuts the pin **84**. The upper body **72** then pulls the lower body **73** upwardly (Figure 8). The upward movement of the two valve bodies **72** and **73**, then traveling in unison, is limited by engagement of the lower body **73** with the internal casing shoulder **54** (see Figures 5 and 9). The further descent of the upper body **72** after seating of the lower body **73** on the seat **63** (above explained) may be limited by striking of said upper body **72** upon said lower body (see Figure 6) or by striking of the stud **81** against the lower end of the socket **82**.

Operation

Normally (before operation or between filling cycles) the control valve assembly **17** stands as shown in Figure 6. The carrier **21** and filling heads **22** then occupy fully raised position, and the elements of each filling head are in the same relative positions as in Figure 4—collar **37** down and valve seat **40** closed against valve head **35**. The vacuum pump is now exerting vacuum pull through the vacuum line **64** (Figure 6) holding the servo-motor piston **19** at the upper end of the cylinder **18**.

Empty bottles to be filled are slid between the guide rails **24** to the position determined by the stop **25**, placing their necks in substantial alignment with the nipples **38** of the filling heads **22**. The valve operating means **75**, **74** is now operated to start upward movement of the upper valve body **72** (Figure 7). During further upward movement of the valve body **72** from the position of Figure 7, it applies vacuum to the line **65** and admits air to the line **64**. Consequently, the piston **19** moves downwardly, lowering the filling heads **22**. Immediately after the nipples **38** enter the bottle necks, the lower gaskets **41** seat fluid-tightly on said necks. As the bodies **26** continue downwardly, the springs **43** compress, the lower ends **29** of said bodies approach the upper gaskets **42**, and the valve heads **35** start to open. During part of the downward travel of the piston **19**, vacuum pull has been exerted through the line **68**, the overflow tank **49** and the line **67** but has stopped here as the lower valve body **73** has remained closed. Upon more upward movement of the valve body **72** (see Figure 8), at which time the descent of the filler heads **22** is complete (**29** against **42**, and **35** fully open), the upper valve body **72** starts to lift the lower valve body **73** to the fully open position of Figure 9. Opening of this valve body **73** places the lines **66** and **67** in communication with each other so that the vacuum pull continues through line **66**, manifold **47**, nipples **48** and tubes **33** to evacuate air from the bottles (see Figures 1, 3 and 9). This evacuation of air creates a vacuum pull in the bottles, with the result that liquid flows into them from the supply tank **44** through the tubes **45** and the passages **32**, **38** as shown by the arrows A in Figures 1 and 3.

During the above explained descent of the servo-motor piston **19**, air has been admitted as required into the upper end of the cylinder **18** by way of the ports **57**, **58** and **80** and the line **64** (see Figure 8).

At the end of the bottle filling operation, the valve operating means **74**, **75** is operated to again lower the valve bodies **72** and **73**. The first part of this body lowering movement causes closing of the lower valve body **73** upon the seat **63** (Figure 10), thus cutting off the line **66** from the vacuum pull in line **67** and momentarily trapping vacuum in said line **66**, the manifold **47**, nipples **48**, passages **32**, **39** and the bottles. This induces some afterflow of liquid up the tubes **33** into the manifold **47** and into the line **66**. However, upon the next filling cycle, while some of this liquid will remain in the line **66** and possibly some in the manifold **47**, most of it will be drawn into the overflow tank **49**. As the valve bodies **72** and **73** continue their downward movement (Figure 11), the upper body **72** uncovers the casing port **56** allowing communication of the communicating lines **65** and **68** with the air admission port **55**. Thus the vacuum which has existed in the overflow tank **49** is broken and any liquid previously received in this tank may gravitate back to the supply tank **44** through the pipe **51** and check valve **52**. The admission of air to the line **65** breaks the vacuum which has been holding the servo-motor piston **19** in lowered position and thus prepares the servo-motor for operation to lift the carrier **21** and filling heads **22**. The final descent of the upper valve body **72** places the line **64** in communication with the main vacuum line **70** (see Figures 11 and 6, respectively). The result is that the servo-motor **16** starts to elevate the carrier **21** and the filling heads **22**.

As the filling heads **22** ascend, three operations successively occur. One, the valve bodies **26** leave the gaskets **42**; two, the valve heads **35** close against the seats **40**; and three, the collars **37** with their gaskets **41** and nipples **38** ascend from the bottles. Operation one separates the passages **32** and **39** and admits air to them. Consequently, liquid will drain from passages **39** into the bottle and liquid in the passages **32** and tubes **45** will siphon back into the supply tank **44**. Operation two insures that there shall be no drip from the filling heads as they continue upwardly. Operation three is followed by complete ascent of the filling heads to raised position in readiness for the next cycle of operation. The control valve assembly now again stands as shown in Figure 6.

It was above stated that some liquid will remain in the line **66** and possibly some in the manifold **47** after a bottle filling cycle. However, no atmospheric air, admitted to the overflow tank **49**, can reach this trapped liquid through the line **67**, due to the fact that the lower valve body **73** segregates the two lines **66** and **67** before the control valve admits air to said overflow tank **49**. This exclusion of atmospheric air prevents agitation and foaming of the trapped liquid and overcomes foam troubles which might otherwise occur.

From the foregoing it will be seen that a novel and advantageous apparatus has been provided for attaining the desired ends. However, attention is again invited to the possibility of making variations within the scope of the invention.

I claim:

1. A bottle filling apparatus comprising bottle supporting means, bottle filling means of a type which induces bottle filling by evacuation of air from the bottles, a vacuum-actuated servo-motor connected with said filling means for moving the same into and from a bottle engaging filling position, vacuum lines operatively connected with said servo-motor and said bottle filling means, vacuum creating means, a main vacuum line connected with said

vacuum creating means, a single valve casing supported independently of said bottle supporting means and to which all of said vacuum lines are connected, valve means in said casing and including independently movable valve body sections disposed in cooperable relation with said vacuum lines and independently movable for controlling the operation of said servo-motor and of said bottle filling means, and operating means for said valve means.

2. A bottle filling apparatus comprising bottle supporting means, bottle filling means of a type which induces bottle filling by evacuation of air from the bottles, a vacuum-actuated servo-motor connected with said filling means for moving the same into and from a bottle engaging and filling position, vacuum lines operatively connected with said servo-motor and said bottle filling means, vacuum creating means, a main vacuum line connected with said vacuum creating means, valve means operatively associated with said vacuum lines for controlling the operation of both said servo-motor and said bottle filling means, said valve means including one valve body for controlling said servo-motor, a second valve body movable relative to said one valve body for controlling the operation of said bottle filling means, operating means for said one valve body, and an operating connection from said one body to said second body and upon which said second valve body is movable relative to said one valve body.

3. A structure as specified in claim 1; said bottle filling means comprising a plurality of filling heads, and a single carrier carrying all of said heads, said servo-motor being connected with said carrier.

4. A structure as specified in claim 2; said bottle filling means comprising a plurality of filling heads, and a single carrier carrying all of said heads, said servo-motor being connected with said carrier.

5. A bottle filling apparatus comprising bottle supporting means, bottle filling means having an air evacuating passage and a bottle filling passage, a servo-motor for relatively moving said filling means into and from a bottle engaging and filling position, a liquid supply tank, a liquid line from said supply tank to said bottle filling passage, a valve casing, a first vacuum line from one end of said servo-motor to said valve casing, a second vacuum line from the other end of said servo-motor to said valve casing, a third vacuum line from the aforesaid air evacuating passage to said valve casing, a fourth vacuum line extending from said valve casing, a fifth vacuum line communicating with said fourth vacuum line and extending to said valve casing, a main vacuum line extending from said valve casing, vacuum creating means to which said main vacuum line extends, valve means in said valve casing, and operating means for said valve means, said valve means having portions for one, controlling communication between said main vacuum line and said first and second vacuum lines, two, for controlling communication between said main vacuum line and said fifth vacuum line, and three, for controlling communication between said third and fourth vacuum lines.

6. A structure as specified in claim 5; in which said second and fifth vacuum lines communicate at a common point with said valve casing.

7. A bottle filling apparatus comprising bottle supporting means, bottle filling means having an air evacuating passage and a bottle filling passage, a servo-motor for relatively moving said filling means into and from a bottle engaging and filling position, a liquid supply tank, a liquid line from said supply tank to said bottle filling passage, an overflow tank closed to the atmosphere, a valve casing, a first vacuum line from one end of said servo-motor to said valve casing, a second vacuum line from the other end of said servo-motor to said valve casing, a third vacuum line from the aforesaid air evacuating passage to said valve casing, a fourth vacuum line from said valve casing to an above-liquid zone of said overflow tank, a fifth vacuum line from said above-liquid zone to said valve casing, a main vacuum line from said valve casing, vacuum creating means to which said main vacuum line extends, valve means in said casing, and operating means for said valve means, said valve means having portions for one, controlling communication between said main vacuum line and said first and second vacuum lines, two for controlling communication between said main vacuum line and said fifth vacuum line, and three for controlling communication between said third and fourth vacuum lines.

8. A structure as specified in claim 5, in which said bottle filling means includes a self-closing valve for said air evacuating and bottle filling passages, and means for opening this valve upon engagement of said bottle filling means with a bottle.

9. A structure as specified in claim 5, in which said liquid line extends upwardly from said supply tank to said bottle filling means, said bottle filling means including means for admitting air to said bottle filling passage as said bottle filling means and the bottle separate at the end of a bottle filling operation.

10. A structure as specified in claim 7; said overflow tank being above said supply tank, a liquid return passage from said overflow tank to said supply tank, and a check valve for said liquid return passage, said check valve being arranged to open toward said liquid supply tank, said valve means having a portion effective to admit air to said fifth vacuum line after each bottle filling operation.

11. A structure as specified in claim 5; said valve means having portions for admitting air to said first vacuum line when said second vacuum line is in communication with said main suction line, and vice versa.

12. A structure as specified in claim 5; said valve means comprising one body ported to control communication of said main vacuum line with said first, second and fifth vacuum lines, a second body for controlling communication between said third and fourth vacuum lines, and connecting means between said bodies for transmitting movement from said one body to said second body, said connecting means being constructed to allow continued movement of said one body in fill terminating direction after said one body has moved said second body to the position in which the latter obstructs communication between said third and fourth vacuum lines, and to leave said second body in this obstructing position during part of the movement of said one body in bottle-filling direction, the aforesaid operating means being connected with said one body.

13. A bottle filling apparatus comprising bottle supporting means, bottle filling means having an air evacuating passage and a bottle filling passage, said bottle filling means also having a self-closing valve for said passages and means for opening said valve as said filling means reaches bottle filling position, said filling means also having means for admitting air to said bottle filling passage as said filling means and the bottle separate upon completion of a bottle filling operation, a servo-motor for relatively moving said bottle supporting means and said bottle filling means into and from filling relation with each other, a liquid supply tank, a liquid line extending upwardly from said supply tank to said bottle filling passage, an overflow tank above said supply tank and closed to the atmosphere, a liquid return passage from said overflow tank to said supply tank, said liquid return passage having a check valve which opens toward said supply tank, a valve casing, a first vacuum line from one end of said servo-motor to said valve casing, a second vacuum line from the other end of said servo-motor to said valve casing, a third vacuum line from the aforesaid air evacuating passage to said valve casing, a fourth vacuum line from said valve casing to an above-liquid zone of said overflow tank, a fifth vacuum line from said above-liquid zone to said valve casing, a main vacuum line from said valve casing, vacuum creating means to which said main

vacuum line extends, valve means in said casing, and operating means for said valve means, said valve means having portions for one, controlling communication between said main vacuum line and said first and second vacuum lines, two for controlling communication between said main vacuum line and said fifth vacuum line, three for controlling communication between said third and fourth vacuum lines, and four for admitting air to said fifth vacuum line after completion of each bottle filling operation.

14. A structure as specified in claim 13; said valve means comprising one body ported to control communication of said main vacuum line with said first, second and fifth vacuum lines, a second body for controlling communication between said third and fourth vacuum lines, and connecting means between said bodies for transmitting movement from said one body to said second body, said connecting means being constructed to allow continued movement of said one body in fill terminating direction after said one body has moved said second body to the position in which the latter obstructs communication between said third and fourth vacuum lines, and to leave said second body in this obstructing position during part of the movement of said one body in bottle-filling direction, the aforesaid operating means being connected with said one body.

15. A structure as specified in claim 13; said valve means comprising one body ported to control communication of said main vacuum line with said first, second and fifth vacuum lines, a second body for controlling communication between said third and fourth vacuum lines, and connecting means between said bodies for transmitting movement from said one body to said second body, said connecting means being constructed to allow continued movement of said one body in fill terminating direction after said one body has moved said second body to the position in which the latter obstructs communication between said third and fourth vacuum lines, and to leave said second body in this obstructing position during part of the movement of said one body in bottle-filling direction, the aforesaid operating means being connected with said one body, said second valve body being movable to said obstructing position before said one body admits air to said fifth line, to thereby prevent the admitted air from reaching any liquid trapped in said third line.

16. In a bottle filling apparatus, a filling head having an air evacuating passage and a bottle filling passage, a liquid supply tank, a liquid conducting tube extending from said liquid supply tank to said bottle filling passage, an overflow tank above said liquid supply tank, a liquid return passage from said overflow tank to said supply tank, said liquid return passage having a check valve which opens toward said supply tank, a valve casing, a vacuum line from said valve casing to said bottle filling passage, another vacuum line from said valve casing to an above-liquid zone of said overflow tank, valve-controlled means for creating vacuum in said overflow tank to effect bottle filling and for admitting air to this tank upon completion of bottle filling, and a valve in said casing for controlling communication between said vacuum lines, said valve being closable before admission of air to said overflow tank to prevent the admitted air from reaching any liquid trapped in the first named vacuum line at the termination of the filling operation, and means for vertically reciprocating the filling head to present said head in a filling position wherein the bottle filling passage and the bottle evacuating passage both are projected into a bottle to be filled and then for again removing said filling head from said filling position.

17. A bottle filling apparatus comprising a supporting structure including a support for a group of aligned bottles, a horizontally elongated carrier mounted for vertical movement above said bottle support, a servomotor mounted on said supporting structure and connected with said carrier for raising and lowering the same, a gang of filling heads carried by said carrier, each of said filling heads having an air evacuating passage and a bottle filling passage, a vacuum manifold movable bodily with said filling heads and communicating with the air evacuating passages thereof, a liquid supply tank mounted on said supporting structure in laterally spaced relation with said bottle support, liquid conducting means movable with said filling heads and communicating with the bottle filling passages thereof, said liquid conducting means extending downwardly below the liquid level of said supply tank, a valve casing mounted on said supporting structure, a first vacuum line from one end of said servo-motor to said valve casing, a second vacuum line from the other end of said servo-motor to said valve casing, a third and flexible vacuum line from the aforesaid manifold to said valve casing, a fourth vacuum line extending from said valve casing, a fifth vacuum line communicating with said fourth vacuum line and extending to said valve casing, a main vacuum line extending from said valve casing, vacuum creating means communicating with said main vacuum line and mounted on said supporting structure, valve means in said valve casing, and operating means for said valve means, said valve means having portions for one, controlling communication between said main vacuum line and said first and second vacuum lines, two for controlling communication between said main vacuum line and said fifth vacuum line, and three for controlling communication between said third and fourth vacuum lines.

18. A structure as specified in claim 17; together with an overflow tank which places said fourth and fifth vacuum lines in communication with each other, said overflow tank being mounted on said supporting structure above said supply tank, a liquid return passage from said overflow tank to said supply tank, and a check valve for this passage arranged to open toward said supply tank, said valve means having a portion effective to admit air to said fifth vacuum line when said valve means is moved to carrier-elevated position.

19. A structure as specified in claim 17; together with an overflow tank which places said fourth and fifth vacuum lines in communication with each other, said overflow tank being mounted on said supporting structure above said supply tank, a liquid return passage from said overflow tank to said supply tank, and a check valve for this passage arranged to open toward said supply tank, said valve means having a portion effective to admit air to said fifth vacuum line when said valve means is moved to carrier-elevated position, said filling heads each having a self-closing valve for its air-evacuating and bottle filling passages, and means for opening these valves as the filling heads are raised from the filled bottles.

20. A structure as specified in claim 17; together with an overflow tank which places said fourth and fifth vacuum lines in communication with each other, said overflow tank being mounted on said supporting structure above said supply tank, a liquid return passage from said overflow tank to said supply tank, and a check valve for this passage arranged to open toward said supply tank, said valve means having a portion effective to admit air to said fifth vacuum line when said valve means is moved to carrier-elevated position, said filling heads each having means for admitting air to its bottle filling passage as the filling heads are raised from the filled bottles.

21. A structure as specified in claim 17; together with an overflow tank which places said fourth and fifth vacuum lines in communication with each other, said overflow tank being mounted on said supporting structure above said supply tank, a liquid return passage from said overflow tank to said supply tank, and a check valve for this passage arranged to open toward said supply tank, said valve means having a portion effective to admit air to said fifth vacuum line when said valve means is moved to carrier-elevated position, said filling heads each having a self-closing valve for its air-evacuating and bottle

filling passages, and means for opening these valves as the filling heads are raised from the filled bottles, said filling heads each having means for admitting air to its bottle filling passage as the filling heads are raised from the filled bottles.

22. A bottle filling head comprising a body having one opening for connection with a liquid admission line, and another opening for connection with a vacuum line, said openings being vertically spaced, said body having a vertical passage which communicates with the lowermost of said openings and opens through the lower end of said body, a vertical tube of less diameter than said vertical passage and communicating with the uppermost of said openings, said tube being secured at its upper end to said body, extending downwardly through said vertical passage and projecting below the lower end of said body, the lower end of said tube having an upwardly facing valve head and a radial opening above said valve head, a collar surrounding the downwardly projecting lower end portion of said tube and having a downwardly projecting nipple for reception in a bottle neck, said collar and nipple having a passage surrounding said downwardly projecting lower end portion of said tube, this passage being communicable with the aforesaid passage, the lower end of said nipple being provided with a downwardly facing valve seat for contact with the aforesaid valve head, one gasket surrounding said nipple to seat upon the bottle neck, a second gasket at the upper side of said collar to seat against the lower end of the aforesaid body, and spring means normally holding said collar depressed to a position in which said second gasket is spaced below said lower end of said body and said valve seat is seated against said valve head.

23. A control valve for a bottle filling apparatus, comprising an elongated casing having a main vacuum port and two other vacuum ports, one slidable valve body in said casing and constructed to selectively control communication of said main vacuum port with said two additional ports, an operating stem connected with said one slidable valve body and projecting beyond one end of said casing, the other end of said casing having additional vacuum ports, a second slidable valve body within this end portion of said casing and constructed to control communication between said additional ports, and an operating connection from said one valve body to said second valve body for utilizing the former to actuate the latter.

24. A control valve for a bottle filling apparatus, comprising an elongated casing having a main vacuum port and two other vacuum ports, one slidable valve body in said casing and constructed to selectively control communication of said main vacuum port with said two additional ports, an operating stem connected with said one slidable valve body and projecting beyond one end of said casing, the other end of said casing having additional vacuum ports, a second slidable valve body within this end portion of said casing and constructed to control communication between said additional ports, spring means interposed between said valve bodies and effective to push said second valve body toward said other end of said casing when said one valve body is moved in this direction, said spring means being compressible to allow further movement of said one valve body in the same direction when said second valve body comes to rest, and connecting means between the two valve bodies and constructed to limit the expansive action of said spring means as said one valve body is moved toward said one end of said casing, whereby said second valve body will then be pulled by said one valve body.

References Cited in the file of this patent

UNITED STATES PATENTS

2,146,072	Howard	Feb. 7, 1939
2,675,951	Domenech Oriol	Apr. 20, 1954