# United States Patent

[11] **3,580,299**


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[54] **CONTAINER FILLING DEVICE**
**9 Claims, 9 Drawing Figs.**


[52] **U.S. Cl.** ..... **141/59,** 141/116, 141/147
[51] **Int. Cl.** ..... **B65b 31/00**
[50] **Field of Search** ..... 141/44, 45, 59, 152, 147, 115, 116, 145



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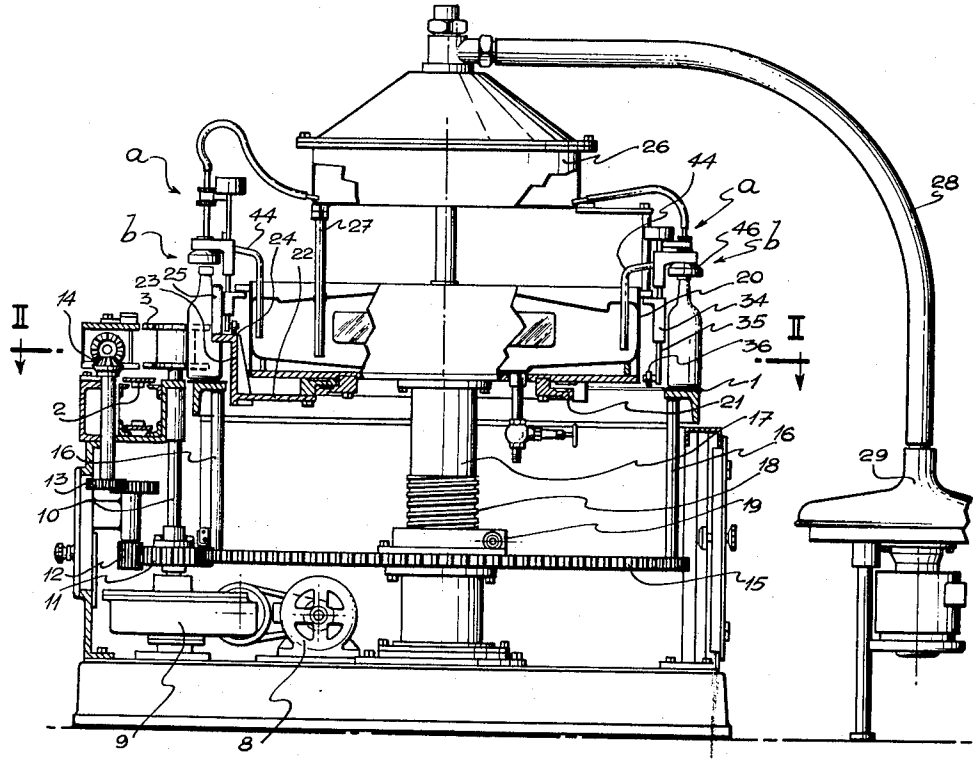
**ABSTRACT:** A vacuum operated bottle filling device which includes a rotating platform and rotating reservoir tank. Container filling heads are positioned on the circumferential surface of the tank and include upper and lower head pieces adapted to cooperate to fill each container to a desired level without the operation of internal or external valves thus increasing the efficiency and simplifying the construction in relation to prior art apparatus of this type.

Patented May 25, 1971 3,580,299

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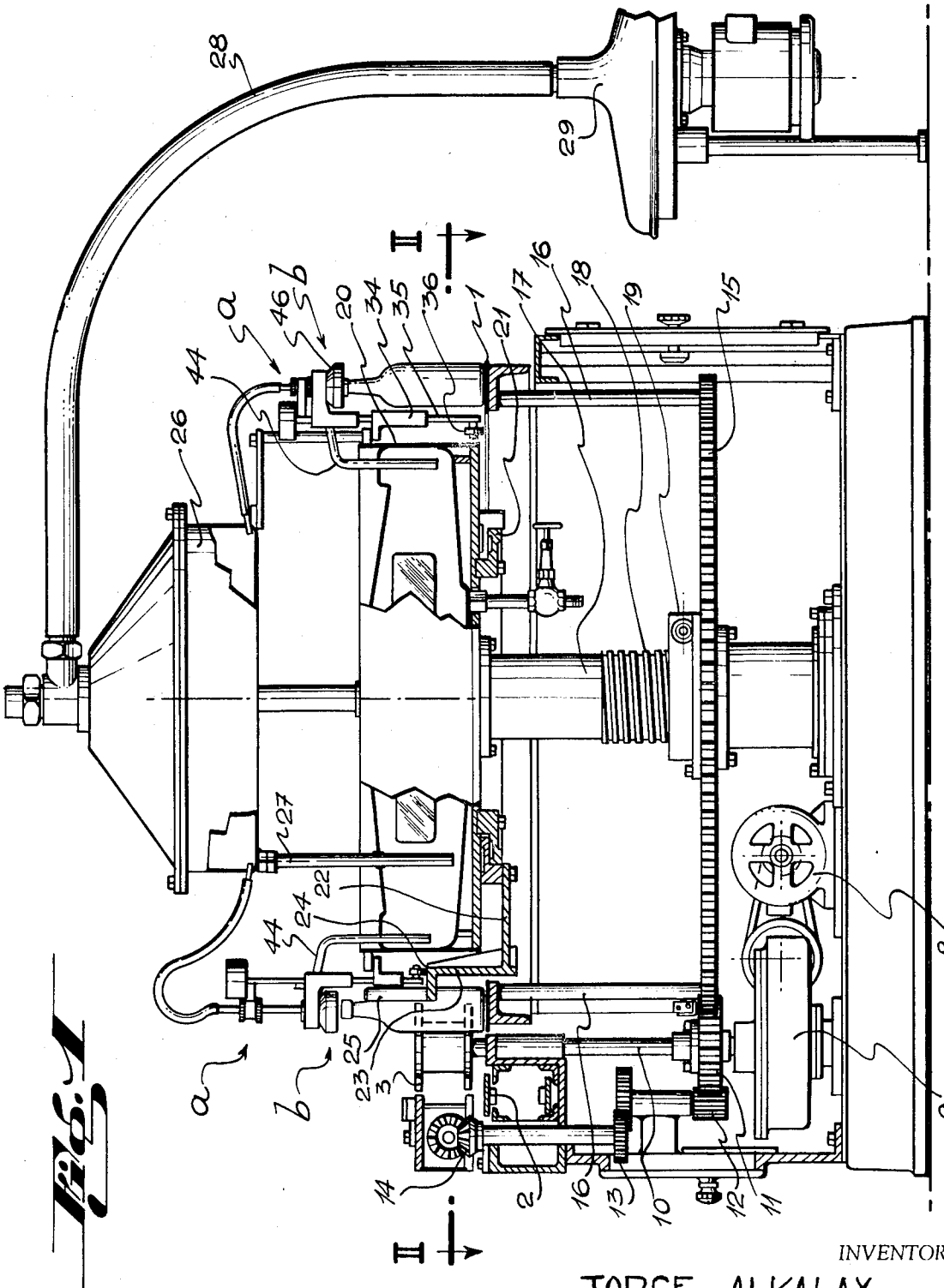


Fig. 1

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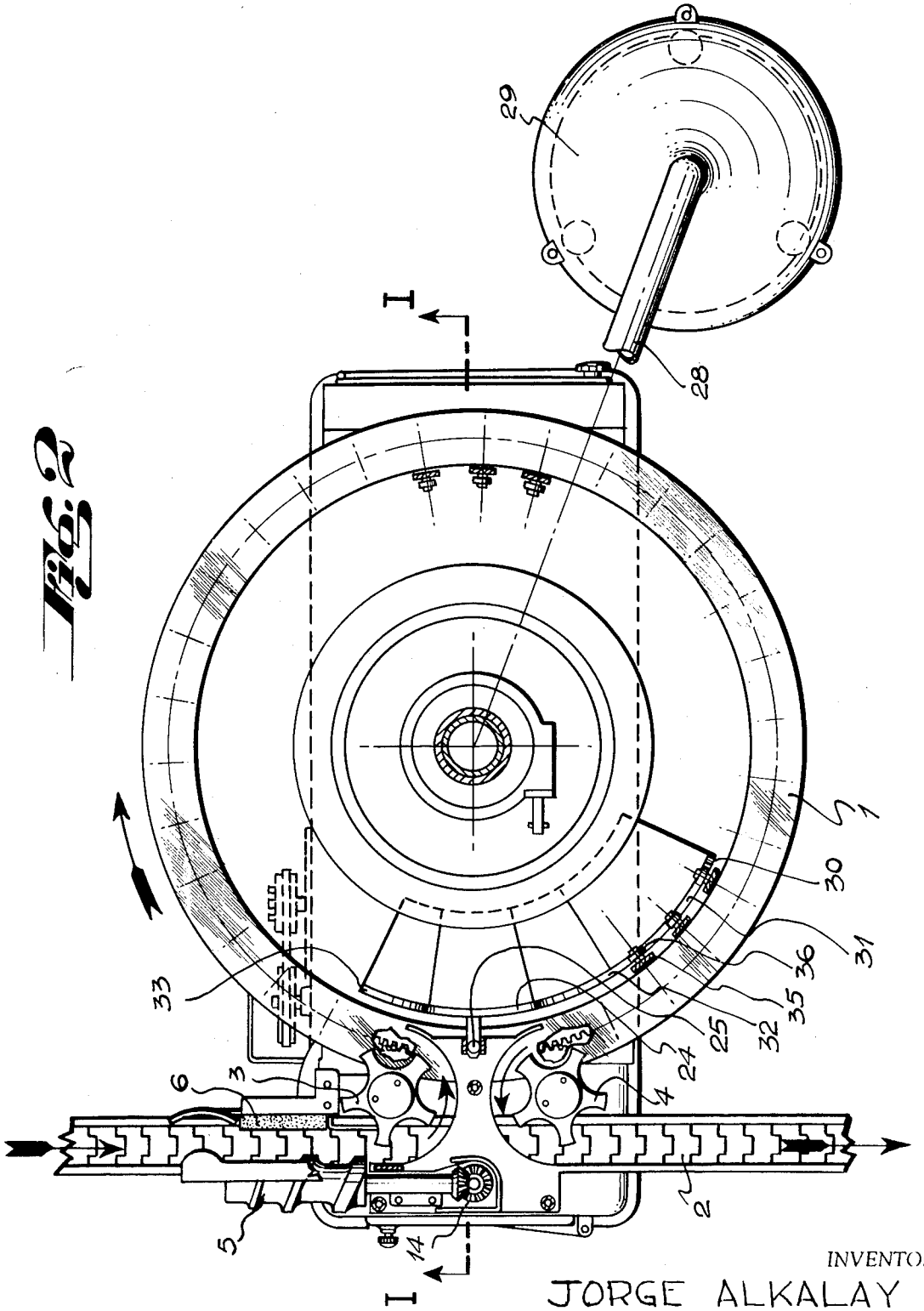


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Patented May 25, 1971 3,580,299

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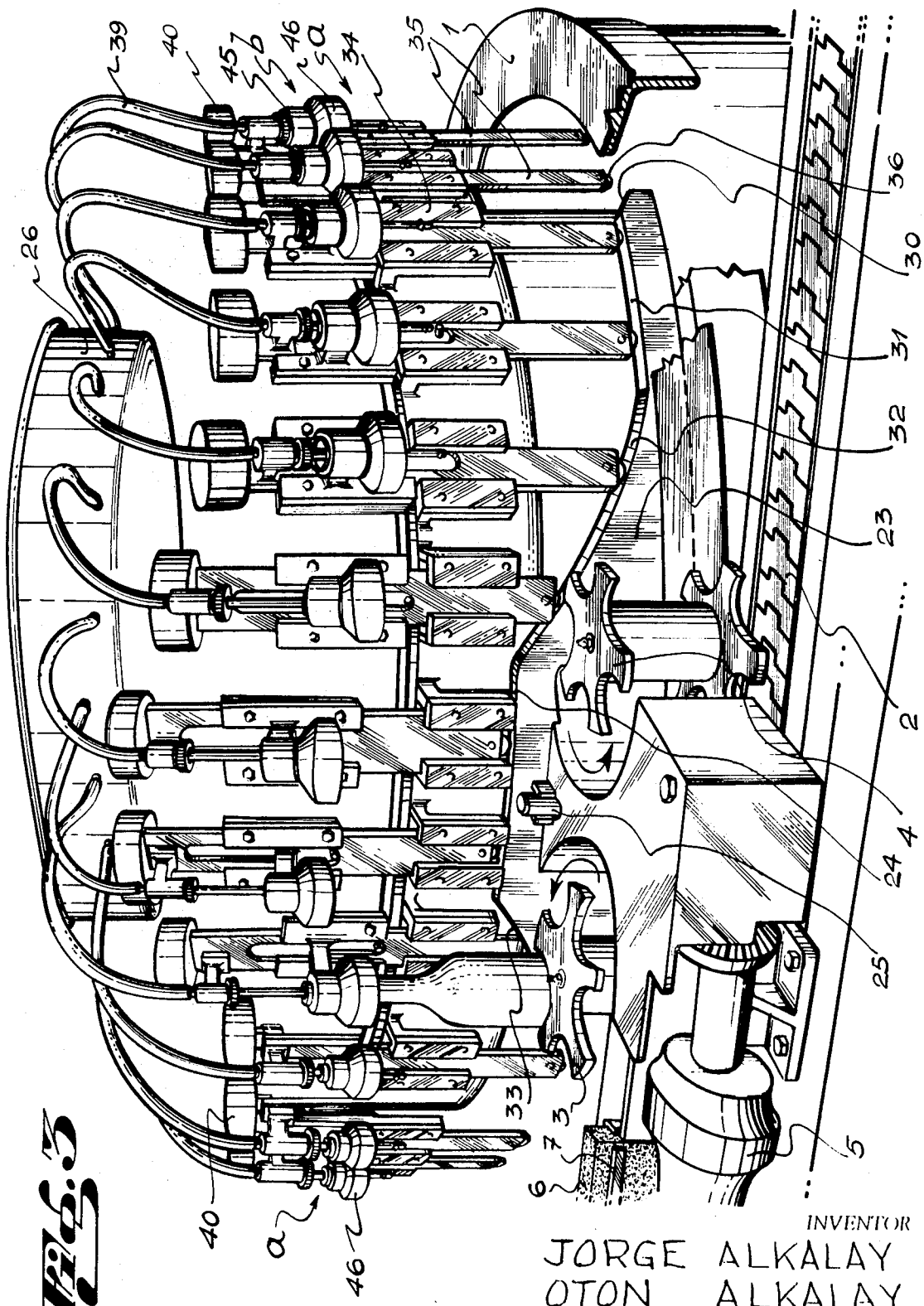


Fig. 3

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Fig. 4

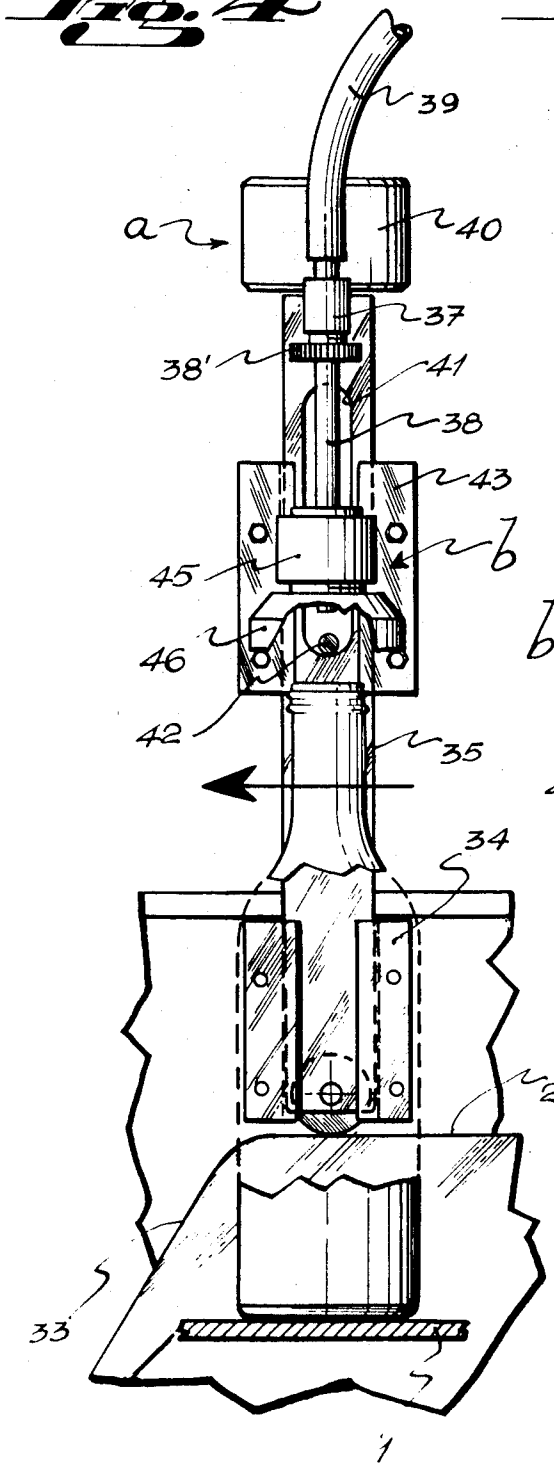


Fig. 5

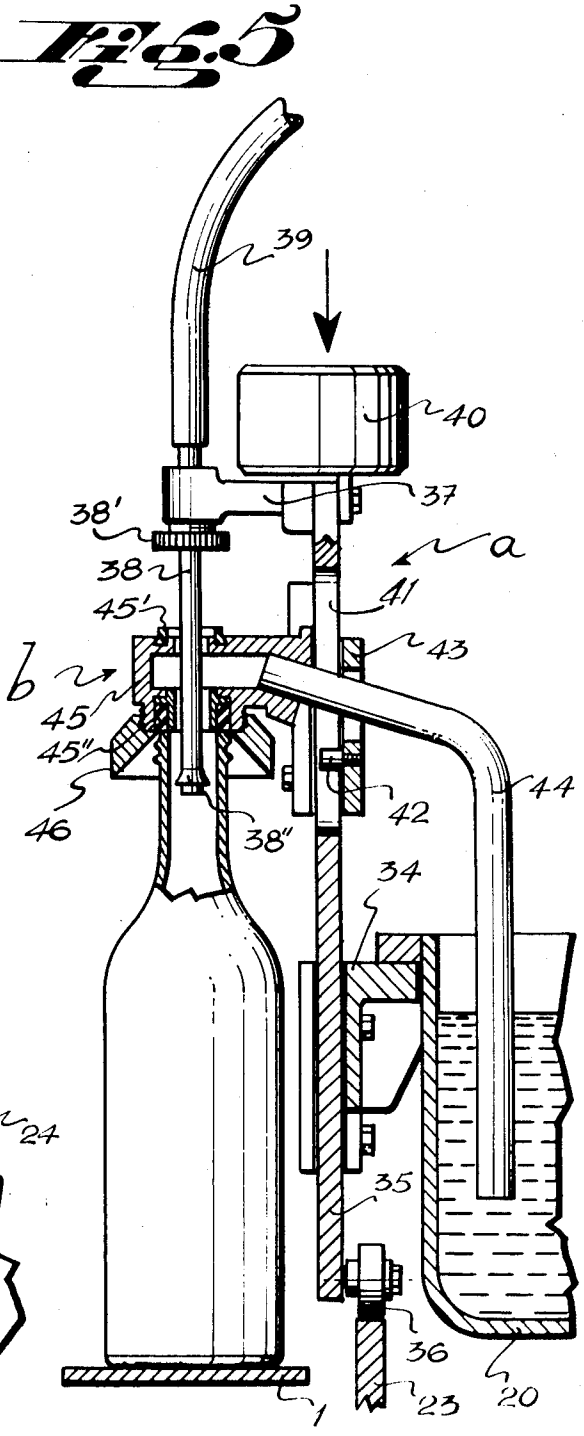


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Fig. 6

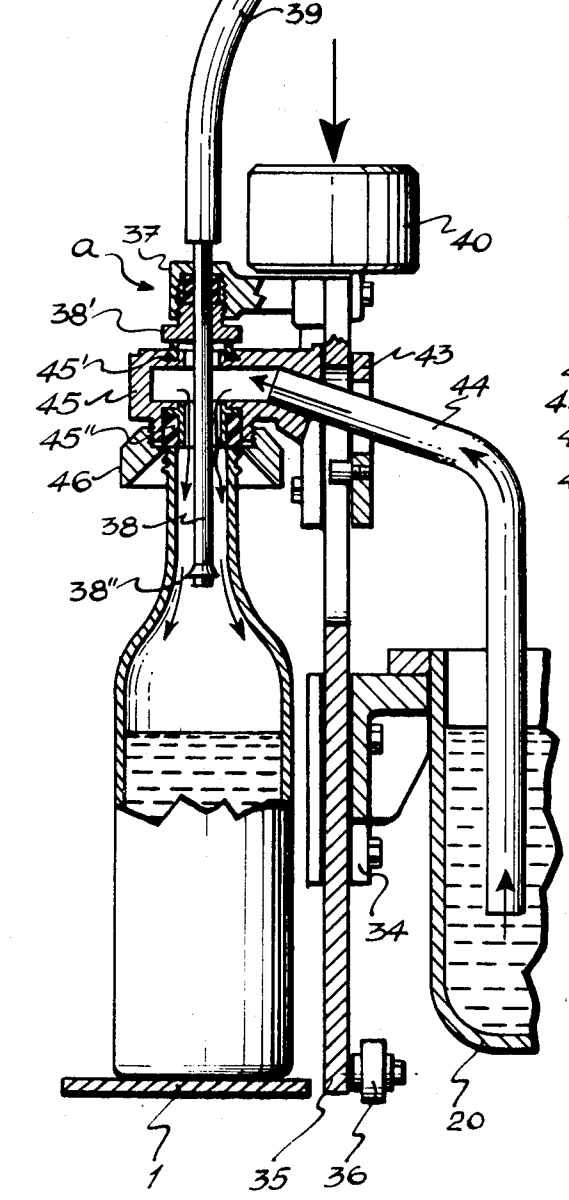


Fig. 7

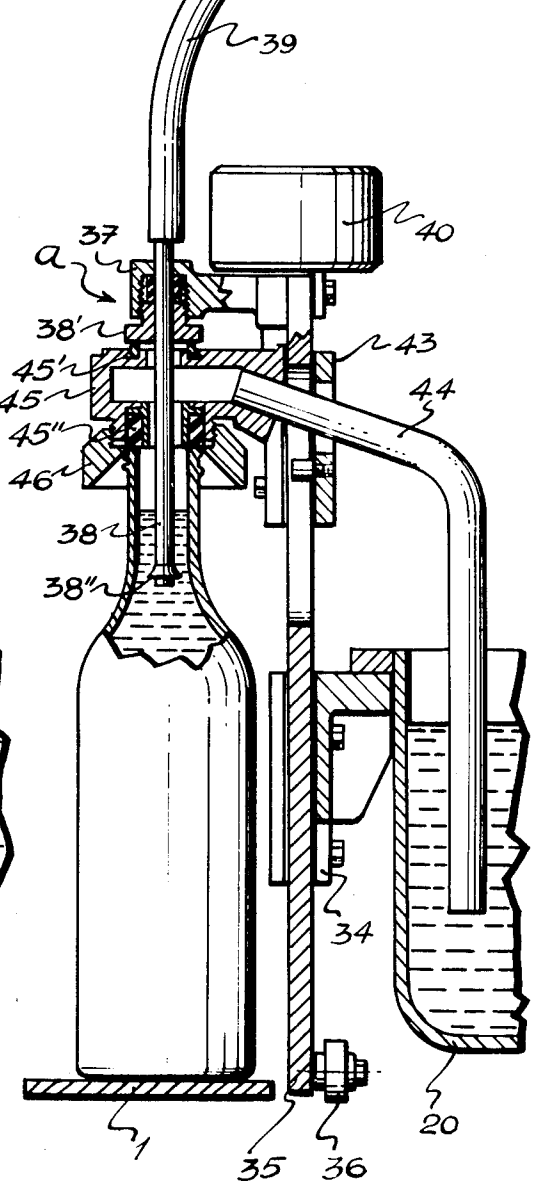


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Fig. 8

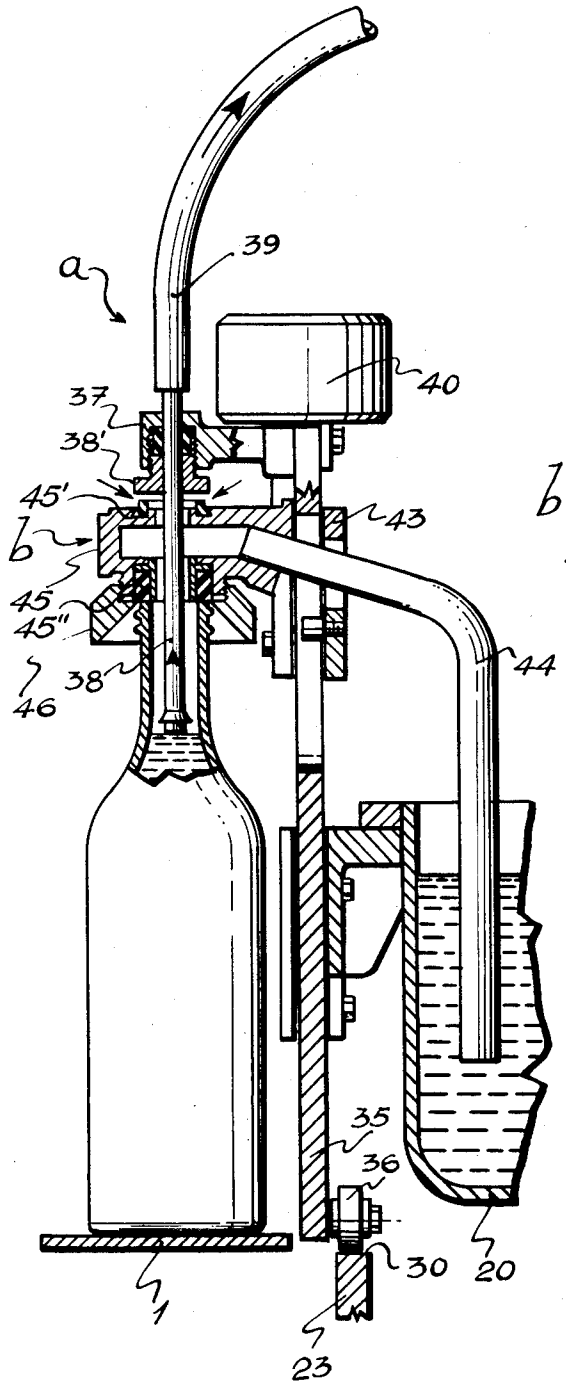
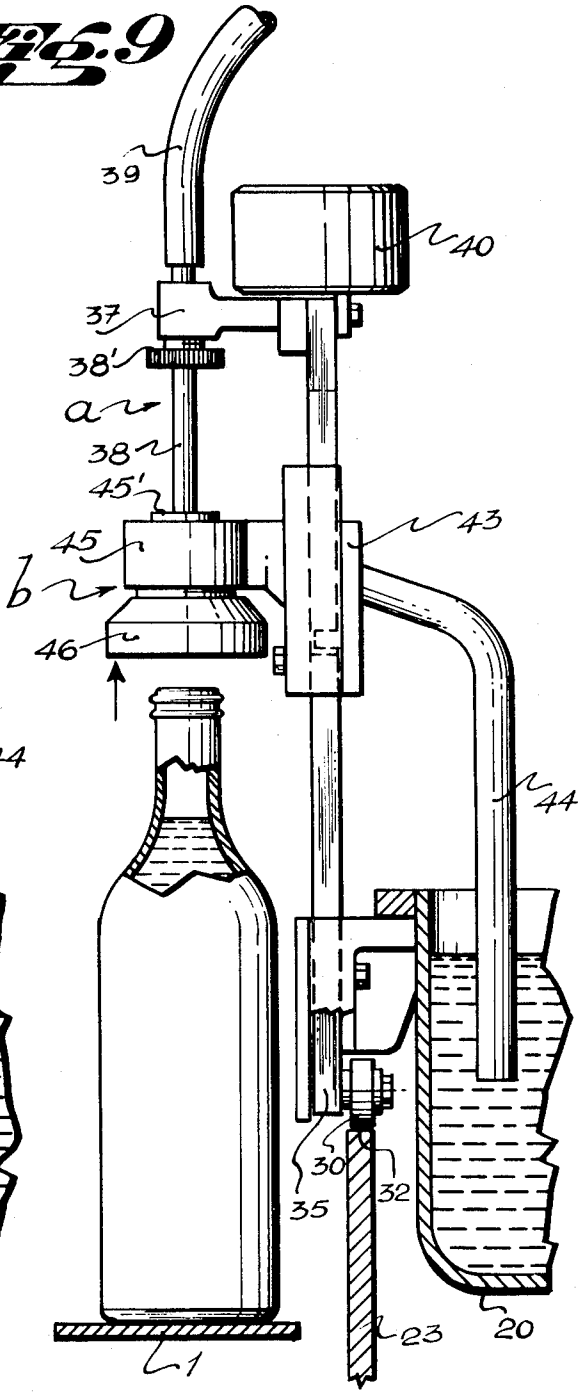



Fig. 9

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# CONTAINER FILLING DEVICE

## BACKGROUND OF THE INVENTION

The present invention relates to an automatic container or bottle filling machine in which the filling is done in a rapid and efficient manner to obtain and insure a continuous and constant level of operation.

There are presently available various systems which may be employed for filling containers, especially narrow-necked containers such as liquor bottles or the like. For example, the direct loading system is accomplished by a device having a tank of liquid above the container to be filled. The operation of this system depends upon the force of gravity on the liquid. Disadvantages of this system result because valves are required which may cause damage due to dripping of the liquor or liquid onto the containers. Such a direct loading or gravity-type system is also mechanically very complex. In addition such systems will fill broken containers thereby resulting in a loss of liquid. Such systems also have a relatively low rate of production.

A second system is known as the siphon filling system. This system calls for a tube or conduit provided from a tank of liquid, the tank being in communication with the atmosphere, to a container or bottle being filled. The level of liquid in the container is brought up to the level of the liquid within the tank. The system operates on the principle of the siphon which calls for placing a tube from the tank of liquid into the container. The tube is elevated, however, above the container and must be filled with liquid in order to discharge liquid into the container from the tank. The liquid discharge thus depends upon the operation of a valve which is opened when the container is to be filled. The valve is normally on the inside of the tube and opens when the tube enters the container at a lower level than that of the liquid in the tank. The container is then filled so that the level of the liquid in the container equals the level of liquid in the tank. An inconvenient feature of this system results because a single siphon must be provided for each of the containers which is to be filled. In addition the system also attempts to fill broken containers. Moreover, the system has a very low rate of production and also drips on filled containers.

A third system is the vacuum filling system. Filling devices operating according to the principles of this system employ a vacuum in order to force the liquid into the container. The vacuum is produced by a vacuum pump or by a fan. Nearly all these filling devices operate by positioning a tube into the container which tube leads to the liquid reservoir tank. The connection between the tube and the container is sealed. In most systems of this type it is desirable to provide a tube having the largest possible diameter. The liquid then passes through the tube into the container. A second tube which produces a vacuum within the container is also provided. The second tube thus provides a vacuum in the container while liquid flows from the first tube into the container to replace the vacuum.

These systems are very efficient and productive, but are inconvenient since they require the use of valves which in some cases are operated by contact with the container which is being filled. In other cases the valves are operated separately by some mechanical means. The valve operate to return the excess liquid to the tank through the tube producing the vacuum. The necessity of using valves is a complication in these devices as such valves require constant servicing for the proper operation of the device.

## SUMMARY OF THE INVENTION

In the embodiments of automatic filling machines of the present invention, a tube having a very small diameter is introduced into the container which is to be filled. The function of the tube is to produce a vacuum in the container and also remove by means of suction excess liquid when the container is full. The liquid for the container is provided through an annular section between the small diameter tube pulling the vacuum and the free interior diameter of the neck of the container which is being filled. In other words the neck of the container is used as the filling tube.



It is thus an object of the present invention to provide a larger fluid flow filling area for filling a container by means of a vacuum filling system and consequently increasing the filling capacity of the device while maintaining substantially the same rate of fluid flow as with prior art devices. Also with the apparatus of the present invention the vacuum tube which enters the container has a small diameter so that there is no possibility that this small diameter tube will engage with the neck of a defective container, for example. Thus, breakage can be avoided with such a construction.

Another object of the present invention is to provide for the passage of liquid from the tank of the filling machine to the container in a direct manner without passing through any valves. This provides increased efficiency of operation since there is no problem of valve service.

In prior art devices in order that a filling device might operate correctly, it was necessary that each container which was being filled also be positioned centrally so that the filling tube would penetrate into the container. This was most often provided for by elevating the container to meet the filling tube of the filling device. In order to accomplish this, it is most often necessary to provide the filling machine with as many elevating bottle carriers as there are filling device.

Alternately as provided for by this invention, there are filling machines in which the containers being filled are always kept at the same level and the filling tubes are then lowered to avoid the necessity of bottle carriers and elevators. In the present invention the filling heads descend onto the containers by means of an action of a counterweight included with the head thereby avoiding the use of springs in the device.

As a further object of the present invention, the mechanism of the device is exceptionally simple. Its operation depends upon a single cam operative to move the filling heads which control the position of the filling tubes that in turn connect to the vacuum system. The filler head carries the centering tube and the liquid discharge tube. Also provided for the filling head are means for moving the head in correspondence with the movement of the containers being filled.

As another object and feature of the present invention, the height between the mounting for the filling head on the machine and the rotating container platform which carries the containers that are going to be filled, can be easily adjusted so as to adapt the machine to fill different sizes of containers.

These and other objects, advantages and features of the invention will be set forth in greater detail below.

## BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention can be more fully appreciated through the following description of a preferred embodiment which for greater clarity and comprehension makes reference to the drawings comprised of the following FIGS.:

FIG. 1 is a cross-sectional, elevation of the apparatus of the invention taken substantially along the line I–I of FIG. 2;

FIG. 2 is a cross-sectional, plan view of the apparatus of the invention taken substantially along the line II–II of FIG. 1;

FIG. 3 is a perspective view illustrating the apparatus of the invention positioned to receive empty containers and discharge filled containers onto a continuous conveyor line;

FIG. 4 is a detailed view in elevation of a single filler head in position to descend on the neck of a container;

FIG. 5 is a detailed view of the filler head of the apparatus of the invention in position on a container;

FIG. 6 is a view similar to FIG. 5 illustrating the final position of the filling head on a container during the liquid filling operation;

FIG. 7 is similar to the view shown in FIG. 6 with the container being filled with fluid above the level of the centrally disposed vacuum tube in the container;

FIG. 8 is yet another similar view of the filling head wherein the centrally disposed vacuum tube is slightly raised to withdraw excess liquid from the container; and

FIG. 9 is a view of the filler head completely withdrawn from the container which has been filled allowing the container to be removed from the apparatus of the invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the FIGS. like reference numbers and letters represent corresponding parts in each of the FIGS. Now referring to the drawings, the apparatus of the invention comprises an annular platform **1** which is adapted to rotate and which is positioned to cooperate with a conveyor belt **2** which carries containers that are to be filled. Mounted also to cooperate with the apparatus of the invention is an entrance star wheel **3** and an exit star wheel **4** which are coordinated with the movement of the platform **1**.

Parallel to the incoming run of the conveyor **2** there is mounted a worm screw **5** on the side of the conveyor **2** opposite the apparatus of the invention. Mounted to cooperate with the worm screw **5** and also disposed in parallel relation to the conveyor **2** is a plate or band of elastic material having disposed on its front face a strip or covering **7** also parallel to the incoming run of the conveyor **2** and containers thereon. The covering **7** may be displaced against the elastic material **6** thereby deforming it elastically. The elastic material **6** and covering **7** do not engage the containers when the material **6** and covering or strip **7** are in an inoperative position. When the are, however, in an operative position they provide a means for differing the coefficient of friction against the containers on the conveyor **2** and act with the worm screw **5** to correct the position of containers on the conveyor **2** since the containers which engage the covering or strip **7** and the material **6** receive a braking effect which causes them to be properly engaged by the threads of the worm screw **5** and properly spaced for entry into the star wheel **3**.

The apparatus of the invention includes a motor **8** which drives gears in a speed-reducing gearbox **9** which, in turn, transmits movement to the shaft **10**. The shaft **10** acts through a spur gear **11** to drive the worm screw **5** by means of power transmitted through a pinion gear **12** connected with spur gear **13**. Movement is then transferred to conical gears **14** and ultimately to the screw **5**. Spur gear **11** also drives the large central spur gear **15** which is attached by means of a series of circumferentially positioned columns or rods **16** to the rotating platform **1**. The gear **16** is mounted on a central shaft **17** which supports the central part of the apparatus.

The central shaft **17** includes threads **18** which cooperate with the interior hub or sleeve **19** of the gear **15** to thereby permit extension or reduction in the height of the shaft **17** and connected parts of the apparatus in respect to the platform **1**.

Attached to the central shaft or column **17** is a tank **20** into which the liquid, for example, wine, liquor or the like, is stored prior to loading into containers. Positioned on the bottom of the tank **20** is a flange retention ring **21** which being fixed to the tank **20** rotates with the tank **20** and the central shaft **17**. Riding on the flange or retention ring **21** is a mounting member **22** which connects with a vertically extending arcuate member **23** positioned between the platform **1** and the tank **20** adjacent the star wheels **3** and **4**. The top surface of the member **23** defines a cam **24** which operates the filling heads as will be described below. The member **23** is locked into position by means of a rod **25** which is retained between the star wheels **3** and **4** as illustrated in FIGS. **1**, **2** and **3**. Thus, while the tank **20**, platform **1** and associated parts of the apparatus rotate, the arcuate member **23** and cam **24** remains in a fixed position in relation to the shaft **17**.

Rigidly connected to the tank **20** and rotating with the tank **20** is a vacuum tank **26** located on top of the tank **20**. Tank **26** is in communication with the tank **20** through the tube **27** extending from the bottom of tank **26**. The tube **27** provides a means for return of excess liquid from containers which have been filled. Note that tube **27** passes below the liquid level in tank **20** to maintain proper vacuum operation.

Extending from the top part of the tank **26** is a conduit **28** which connects with a vacuum device **29**. The conduit **28** connects with the tank **26** by means of a connector at the top of the tank **26** which permits rotation of the tank **26** while the conduit **28** remains stationary.

Arcuate member **23** which is positioned on the inside of the platform **1** and held in that position by means of the rod **25** adjacent the star wheels **3** and **4** operates to define the path of travel of the filling heads. The cam **24** begins with a bevel **30** for intersection with the lower end of the filling heads, then has a run **31** at a substantially uniform level in relation to the platform **1**, and then continues in an ascending step or run **32** until the top of the cam **24** is reached, the top of the cam **24** also being substantially horizontal and defining the maximum elevation position of the filling heads or devices. From the top of the cam **24** there is a descending step or run **33** until the filling head devices are no longer intercepted by the cam **24**.

Arranged around the circumference of the tank **20** is a regular and evenly aligned array are the filler or filling heads or filling devices comprised of an upperhead generally indicated at *a* and a lower head generally indicated at *b*. To hold and guide the head pieces *a*, links or guide members **34** are evenly stationed around the periphery of the tank **20** so that sliding runners **35** of the upper heads *a* may be vertically displaced between the links **34**. The lower ends of the runners **35** are provided with rollers **36** adapted to engage the cam **24** of the arcuate member **23**. As shown in FIGS. **4** et seq each head *a* includes an arm **37** extending substantially at right angles to the sliding runner **35**. The arm **37** provides support for a tube **38** which is parallel to the runner **35**. The tube **38** is connected by means of a flexible conduit **39** with the vacuum tank **26**. Resting on the arm **37** and connected with the top part of the runner **35** is a counterweight **40**.

Positioned below the supporting arm **37** in the top part of the runner **35** is a vertical slot **41** adapted to receive a short rod **42** extending from crossmember **43** slidably positioned against runner **35**. The member **43** thus slides in relation to runner **35** and constitutes the base of the lower head generally indicated at *b*. A liquid loading conduit **45** passes from the filling tank **20** to the interior of the member **43** by passing through the slot **41**.

The head *b* includes a body section **45** which receives the tube **38** therethrough. When the tube **38** is in filling position as illustrated in FIG. **6**, an adjustable disc **38'** fixed to the tube **38** provides an upper seal against the ring seal **45'** fixed in the body **45**.

The body **45** includes an interior chamber which connects with the conduit **44** and also with a centering funnel or tulip **46** which is adapted to fit over the mouth of a container. The frustoconical walls of the tulip **46** seal in an airtight relation with the opening of the container. This airtight seal is facilitated by means of the seal **45''** attached to the lower side of the body **45**.

The extreme lower end of the tube **38** includes an external peripheral flange or spreader **38''** which prevents dripping of liquid during operation of the device.

The operation of the entire apparatus is automatic to provide quick filling and effective operation. The operation is described as follows. Empty containers such as one-fifth gallon liquor bottles enter the apparatus through the entry wheel **3** and move onto the platform **1** of the apparatus. The roller **36** on the lower end of the runner **35** passes along the top of the cam **24** causing the filling device and its upper head *a* and its centering means or lower head *b* to be positioned above the mouth of a container.

The roller **36** begins descent along the cam run **33** and at the same time the upper head *a* and the lower head *b* also descend with the counterweight **40** acting to insure the descending movement of all parts. The lower or centering head *b* and in particular the interior of the tulip **46** seats against the mouth of the container. Up until this point in the

operation the centering head *b* is in its lower position in the groove or slot **41** of the runner **35** with the guiding rod **42** at the bottom of the slot **41**. The lower end of the tube **38** is thus placed in the interior of the tulip **46** over the top of the mouth of the container as shown in FIG. **4**.

When the tulip **46** is resting on the top of the container, however, the centering head *b* is positioned over the mouth of the container as shown in FIG. **5** as the roller **36** continues to descend. The upper head *a* of the filling device continues to be displaced downward carrying the counterweight **40** while the centering head *b* does not descend any further since it already rests on the mouth of the container. The displacement of the upper head *a* in respect to the centering and filling head *b* is made possible because of the vertical slot **41** which permits displacement of the upper portion or head *a* in respect to the lower head *b* to the extent that the rod **42** may travel in the slot **41** or until the sealing disc **38'** reaches the closing position against the seal **45** as shown in FIG. **6**. When in this position the container begins to be filled.

In the position shown in FIG. **6** there is provided between the tank **20** and the vacuum tank **26** a direct vacuum channel that does not include valves but which is fashioned by the tube **44**, hollow body **45**, the interior of the container being filled, the tube **38**, flexible conduit **39** leading from the tube **38** and the vacuum tank **26**. Thus, the liquid from the loading tank **20** passes through the tube **44** and enters the body **45** before entering the container through the annular channel defined between the inner walls of the container and the tube **38**.

When the liquid inside the container reaches the lower end of the tube **38**, the removal of air from the interior of the container ceases and liquid from the loading channel or conduit **44** and body **45** enters the container to cause the fluid to rise above the lower end of the tube in the container as shown in FIG. **7**. As all of this is happening the platform **1** is rotating as are the corresponding parts to the platform and successive containers are entering through the star wheel **3** and exiting from the star wheel **4** onto the conveyor **2**.

The filled container as shown in FIG. **7** then reaches the position in which the roller **36** meets with the bevel **30** and begins a short ascending step. While sliding upward runner **35** elevates the sealing disc **38'** out of sealing engagement with the body **45** thus leaving the interior of the body **45** open to the atmosphere and in this manner permits the entrance of air into the container through the annular mouth as shown in FIG. **8**. This establishes a pressure equilibrium with the atmosphere while the roller **36** passes through the horizontal run **31**. At this same time the tube **38** is maintained in position as shown in FIG. **8**.

Since the vacuum is continuous, the entrance of air into the container through the top annular opening of the body **45** causes the liquid which exists above the lower end of the tube **38** to be drawn up through the tube **38** to be discharged through the conduit **39** into the tank **26**, and to pass through tube **27** into tank **20**. Liquid is withdrawn until the level in the container reaches the lower end of the tube **38**. To regulate the height of liquid level in the container, one need only to unscrew or loosen the sealing disc **38'**, then move the tube **38** up to the desired height in the container and again tighten the disc **38'** onto the tube **38**.

The roller **36** then engages the ascending run **32** lifting the runner **35** and arm **37** to extract the tube **38** from the interior of the container as shown in FIG. **9**. The lower end of the groove **41** engages the rod **42** to cause the centering head *b* to separate from the mouth of the container to thereby position the device in its original position on top of the cam **24**. The filled container is then removed from the platform **1** to the conveyor **2** by means of the star wheel **4**.

We claim:

**1**. In an automatic liquid filling apparatus of the type utilizing means for producing a vacuum in the container to be filled to provide for the filling of liquid into the container, the improvement of a filling head comprising, in combination:

a lower head piece adapted to communicate with the container to be filled and also to communicate directly with a reservoir of liquid to be filled into the container; and

a top head piece carrying a tube for producing vacuum within the container, said tube being in communication with a means for providing said vacuum, each of said head pieces being mounted to slide independently of each other and also operative to move vertically in response to a cam, both head pieces adapted to join together in a sealed relationship when in operative position to provide filling of the container in an annular space existing between the inner diameter of the throat of the container and the outer diameter of the tube producing the vacuum, the top head piece of said apparatus being directly responsive to said cam so that said cam produces movement to elevate said top piece and separate said top piece from said lower piece in order to establish atmospheric pressure within said filled container without removing said lower head piece from said container and to simultaneously remove the excess of liquid from said container through said tube as said top piece and connected tube are removed from said lower head piece, said top piece being subsequently further vertically removed from said container by action of said cam to cause said top head piece to engage said lower piece and raise said lower head piece completely from said container to allow the discharge of said container from said apparatus and the acceptance of an incoming empty container.

**2**. An apparatus as set forth in claim **1** including a reservoir tank for said liquid, said reservoir tank having at least one filler head mounted thereon, said top piece including a runner operative to respond to said cam, said runner being slidably retained by runner retainer members on said tank.

**3**. The apparatus of claim **2** including a vertical guide slot in said runner, said runner rigidly fixed to top head piece, said lower piece including an arm having a pin mounted thereon passing through said slot, said arm responsive to movement by reaction of said rod with the ends of said slot to raise and lower said lower head piece in response to movement of said runner.

**4**. An improved container filling apparatus comprising, in combination:

a reservoir tank;

a vacuum tank above said reservoir tank, said vacuum tank including means for creating at least a partial vacuum;

a fluid line connecting the bottom of said vacuum tank with said reservoir tank to a level beneath the fluid level in said reservoir tank;

a plurality of container filling heads intermediate said vacuum tank and said reservoir tank, said filling heads movable on a track about said reservoir tank, each of said heads including a separate top head piece having a vertical center tube connected with said vacuum tank and a lower head piece with a vertical passage therethrough, said tube being substantially centered in said passage, said passage of said lower head piece also connected by a fill line tube with fluid in said reservoir;

said apparatus also including means for moving containers beneath of said filling heads; and

cam track means for separately raising and lowering said top and lower head pieces in sequence by first lowering said lower head piece into sealing contact with the fill opening of said container, said passage of said lower head piece being connected to said container fill opening and subsequently lowering said top head piece to sealingly engage with said lower head piece and seal said vertical passage at its upper end, said center tube extending into said container, next filling said container through said fill line tube and finally removing said top head piece from sealing engagement with said lower head piece and then removing said lower head piece from said container opening.

5. The apparatus of claim 4 wherein said top head piece includes an attached counterweight adapted to drive said top head piece downwardly into sealing engagement with said lower head piece whenever said cam track means permits said top head piece to engage said lower head piece.

6. The improved apparatus of claim 4 wherein said lower head piece includes a body having an interior chamber, said chamber comprising a part of said vertical passage, said chamber being connected to said fill line tube, said body also including a centering funnel adapted to fit over the mouth of a container, the sides of said funnel adapted to sealingly engage the mouth of said container to said passage, and said body including an upper surface to sealingly engage said top head piece.

7. The apparatus of claim 4 wherein said top head piece is comprised of a rigid center tube adapted to pass through said lower head piece, said center tube connected by means of a flexible tube to said vacuum tank, the outside of said center tube also made to sealingly engage said lower head piece at approximately the upper end of said center tube.

8. An improved container filling head for use with a vacuum type filling machine comprising, in combination:

a separate top head piece and a separate lower head piece cooperable with each other to provide a single filling head whenever said container is being filled with fluid and to otherwise provide two separate head pieces, said top head piece including a vertical center tube connected with a source of vacuum, said lower head piece including a body having a vertical passage therethrough of greater diameter than said center tube and also for receiving said center tube, said body including sealing means at each end of said passage, the upper sealing means adapted to engage and seal with said top head piece and the lower sealing means adapted to engage the neck of a container and seal thereto, said passage being directly connected by a fluid filling tube with a liquid reservoir such that liquid passes through said fluid filling tube into said central passage of said lower body piece and thence into a container upon which said filling head is sealed, said center tube providing a vacuum within said container to initiate passage of fluid through said filling tube whenever said top head piece is sealed to said lower head piece, said lower head piece and said upper head piece providing a complete operable filling head whenever said head pieces are positioned in sealing engagement with each other and said lower head piece is placed in sealing engagement with said container.

9. The filling head of claim 8 including means for driving said head pieces separately in a vertical direction to seal together said head pieces when a container is being filled and to separate said head pieces when said container is not being filled.