United States Patent [19]

Cunningham

[11] **3,857,422**

[45] **Dec. 31, 1974**

[54] **AEROSOL CONTAINER FILLING APPARATUS AND METHOD**

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[73] Assignee: **Barr-Stalfort Company, Division Pittway Corporation,** Niles, Ill.

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[21] Appl. No.: **223,646**

[52] **U.S. Cl.** **141/3,** 74/37, 141/129, 141/165, 141/177, 141/186, 141/388, 198/162

[51] **Int. Cl.** **B65b 3/04**

[58] **Field of Search** 74/37; 198/162; 141/1, 141/129, 135, 137, 165, 168, 177, 181, 186, 250, 387, 388, 152, 3

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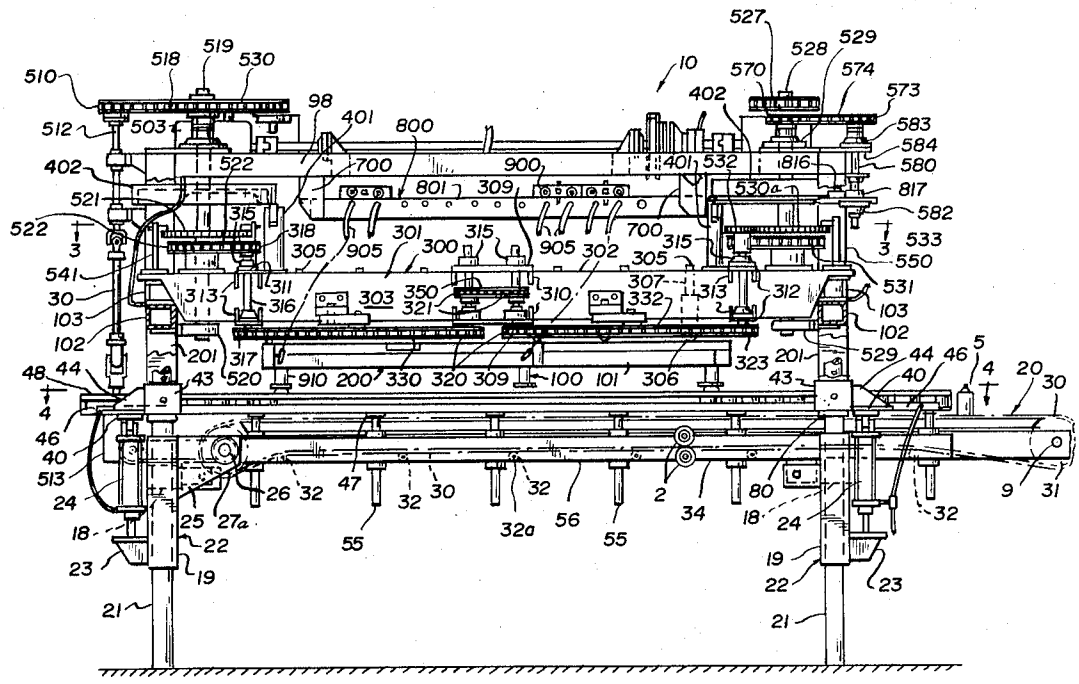
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Primary Examiner—Houston S. Bell, Jr.
Assistant Examiner—Charles Gorenstein
Attorney, Agent, or Firm—Merriam, Marshall, Shapiro & Klose

[57] **ABSTRACT**

Disclosed is a method and apparatus for performing the method, wherein a plurality of containers conveyed in a linear path are simultaneously filled by a multioutlet filling means which travels in an orbital path. A portion of the orbital path lies parallel to and above the linear path of the containers.

24 Claims, 26 Drawing Figures



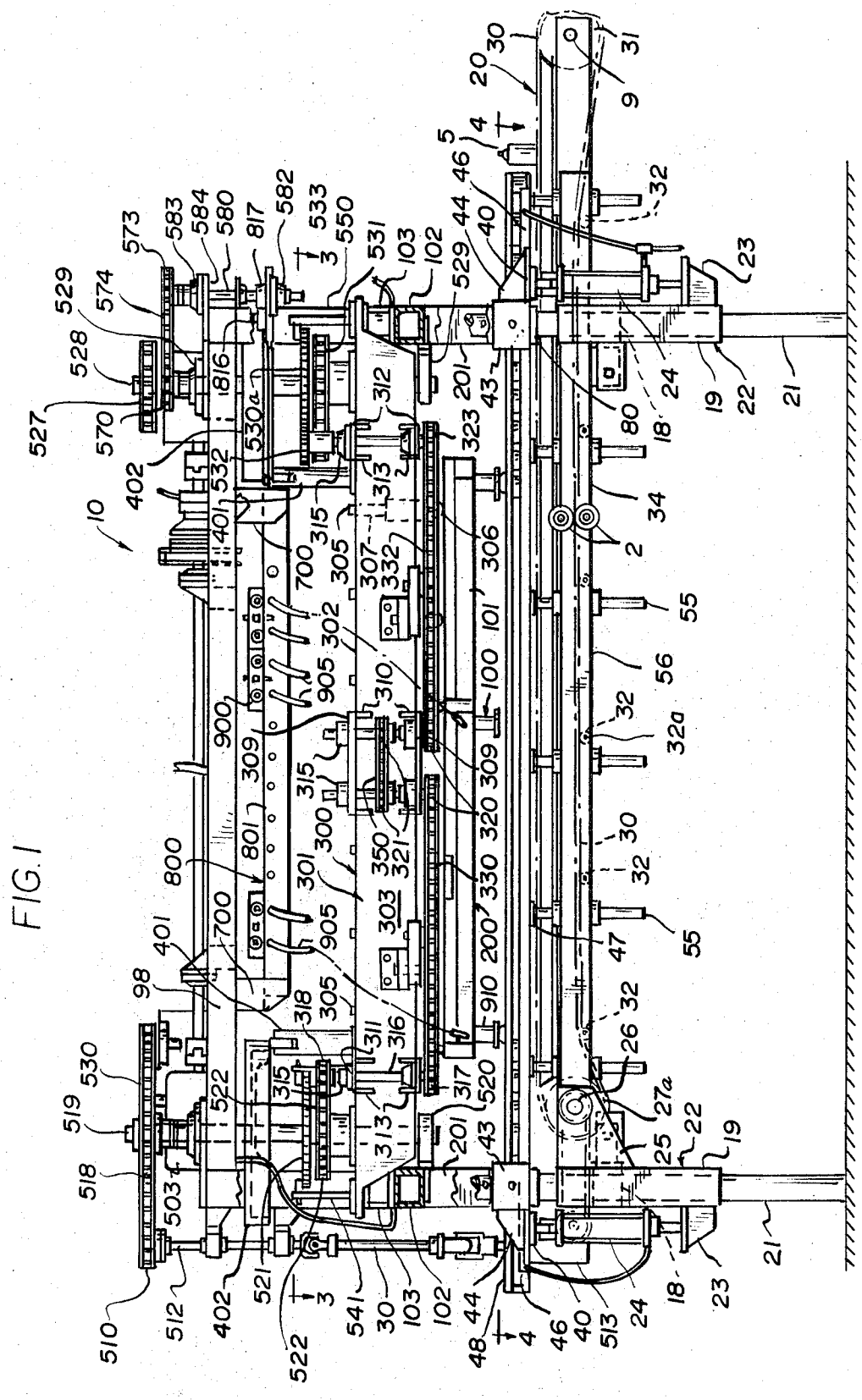


FIG. 1

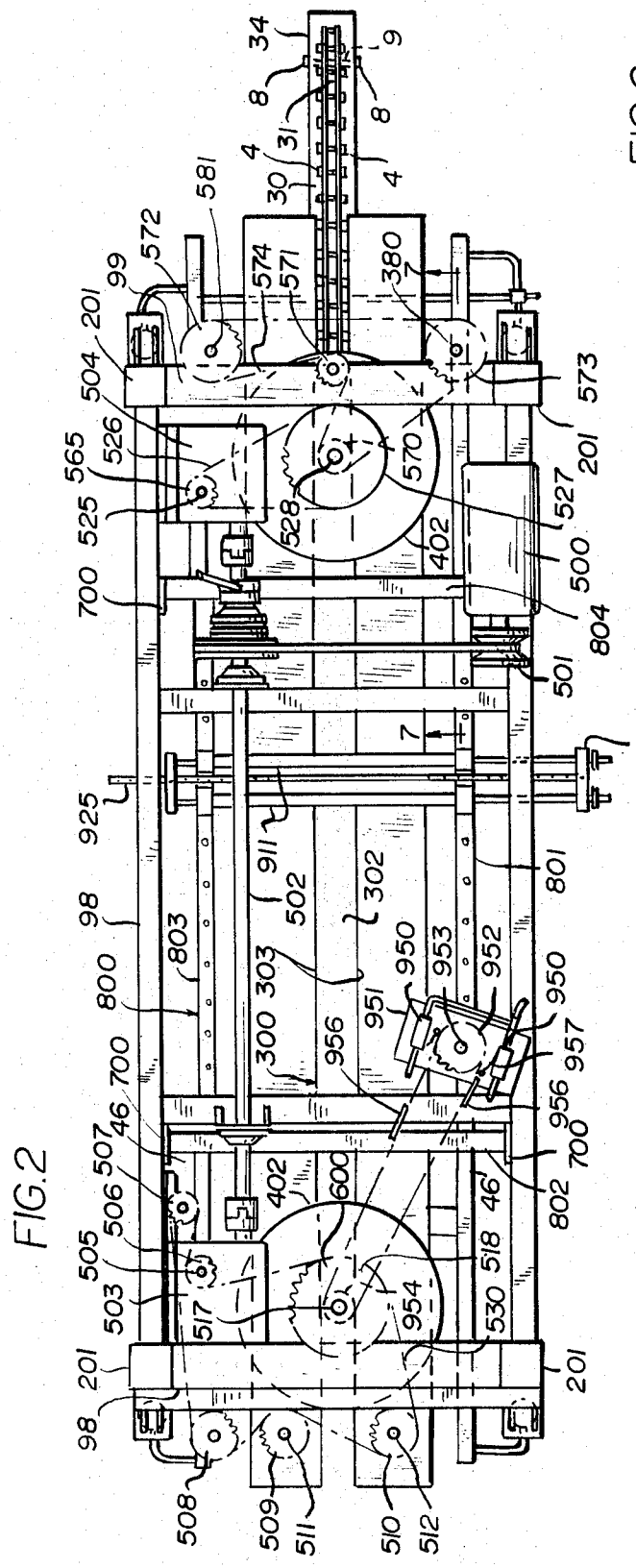


FIG. 2

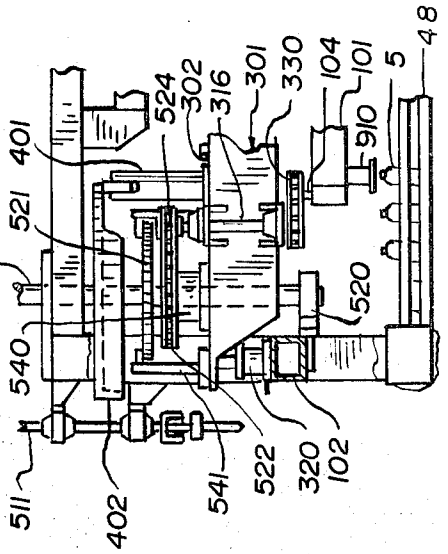


FIG. 6

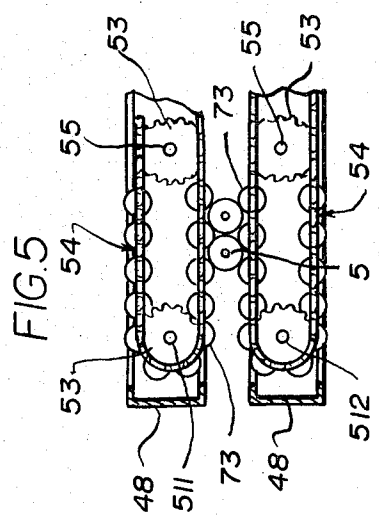


FIG. 5

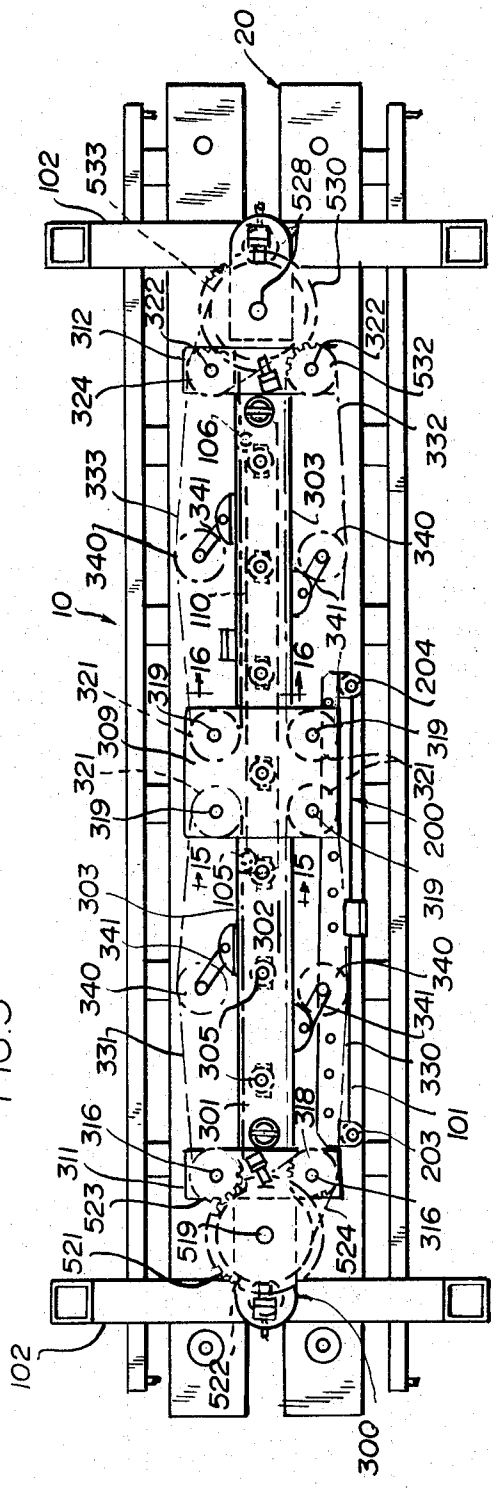


FIG. 3

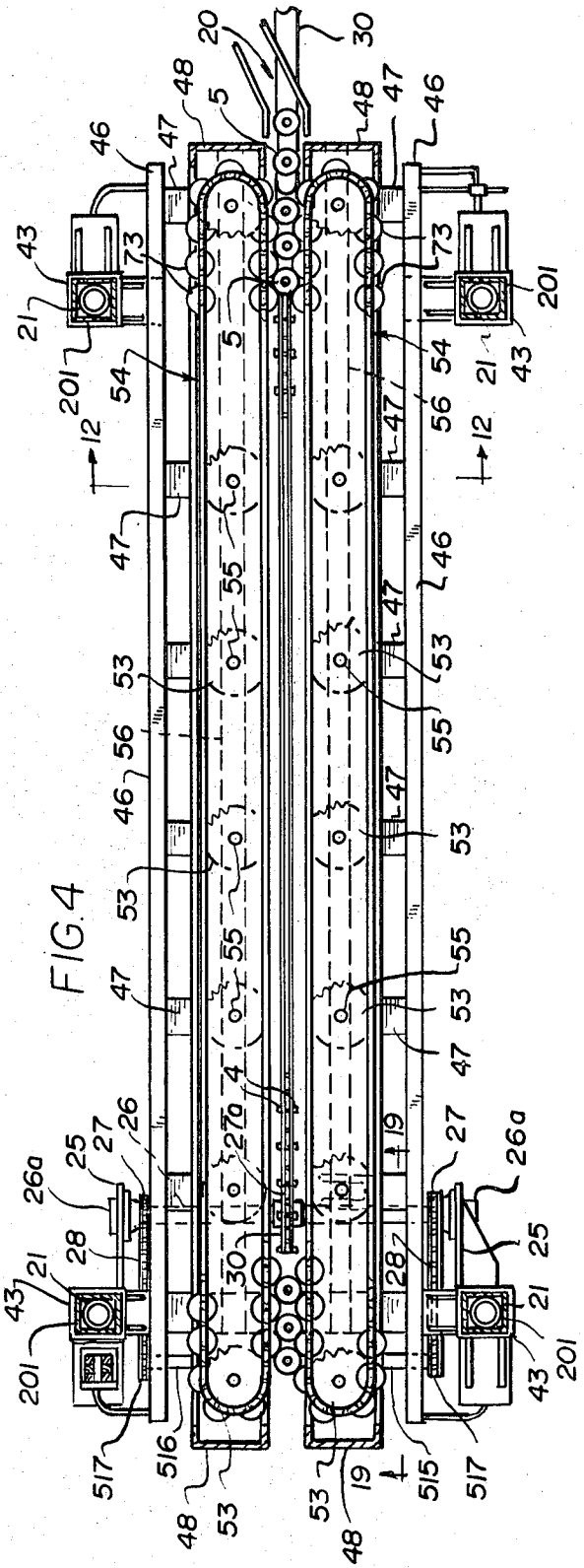


FIG. 4

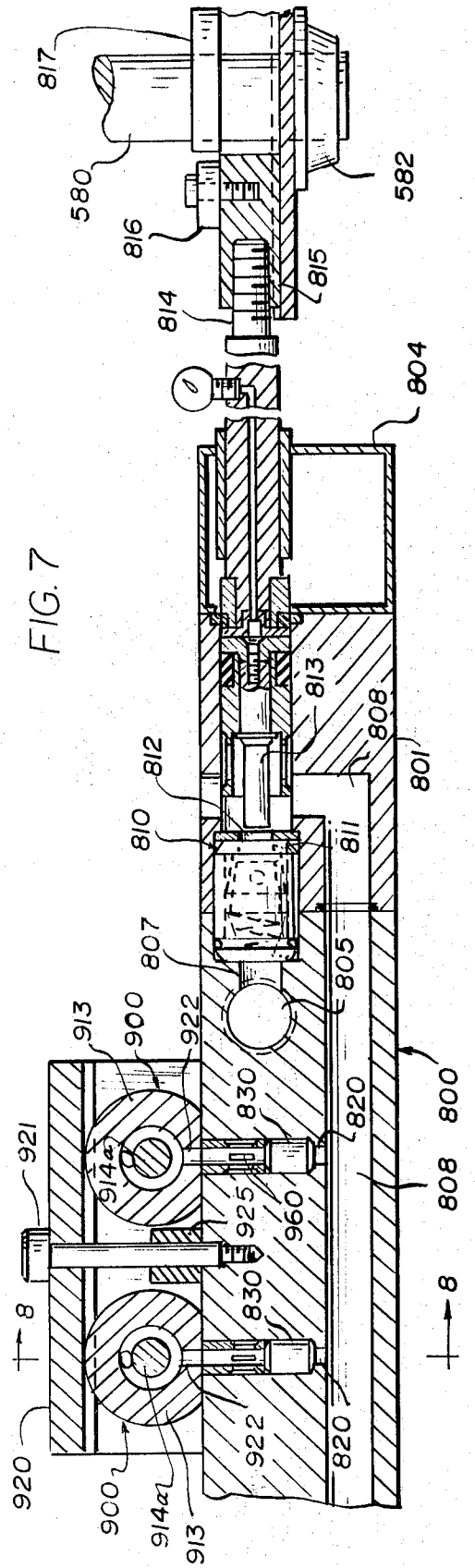

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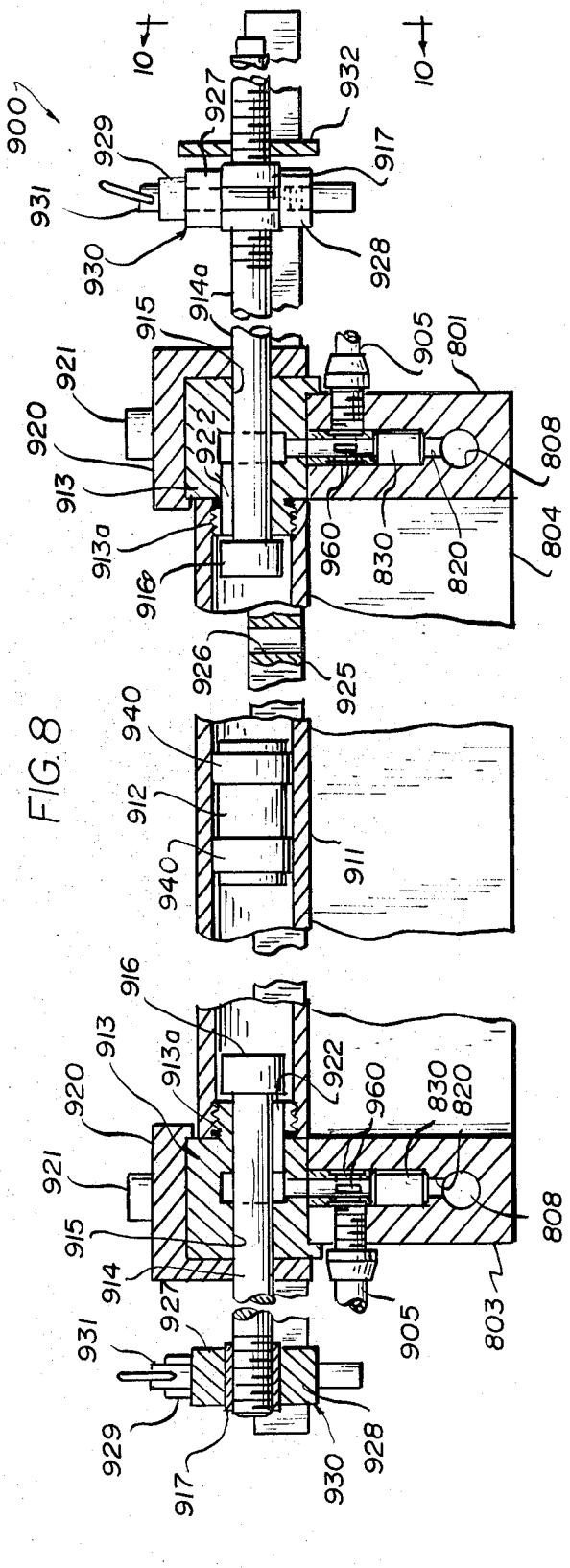

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FIG. 8

FIG. 9

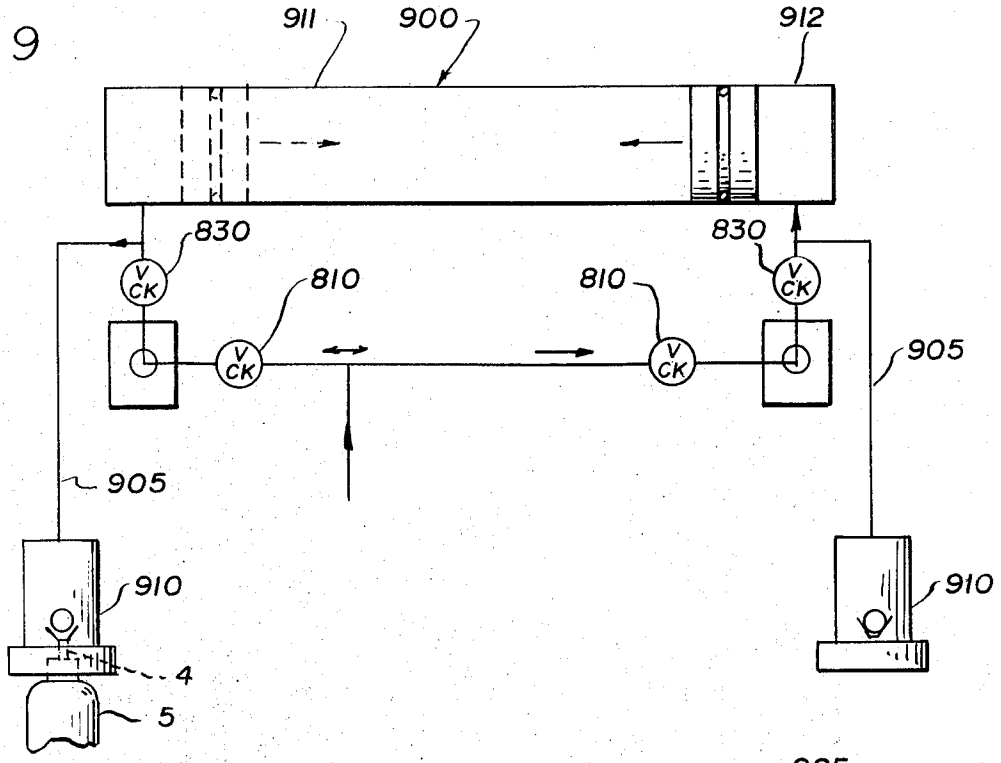


FIG. 11

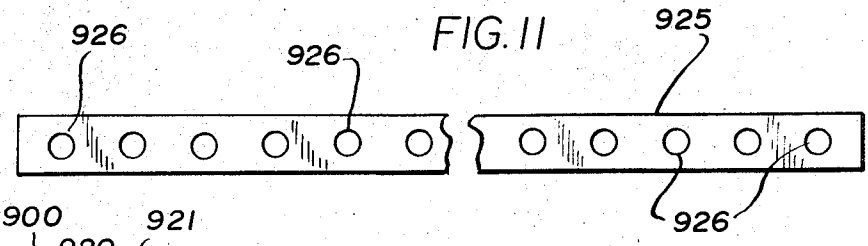


FIG. 10

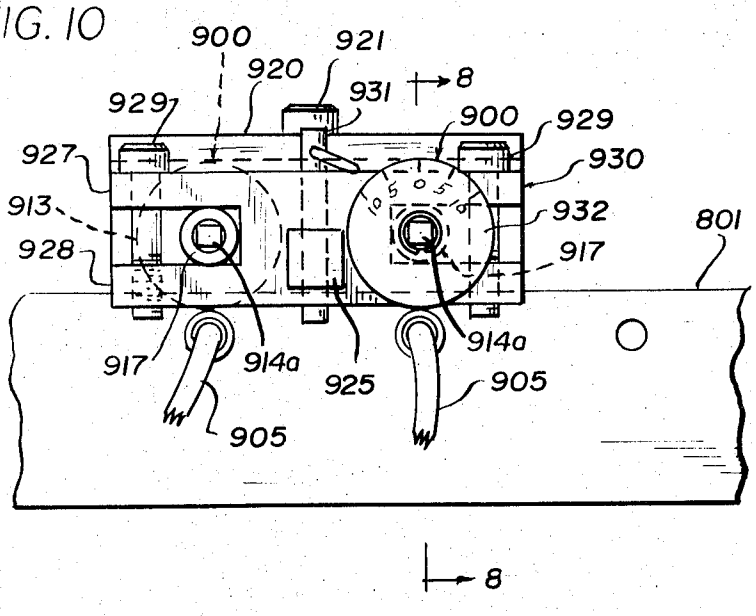


FIG. 14

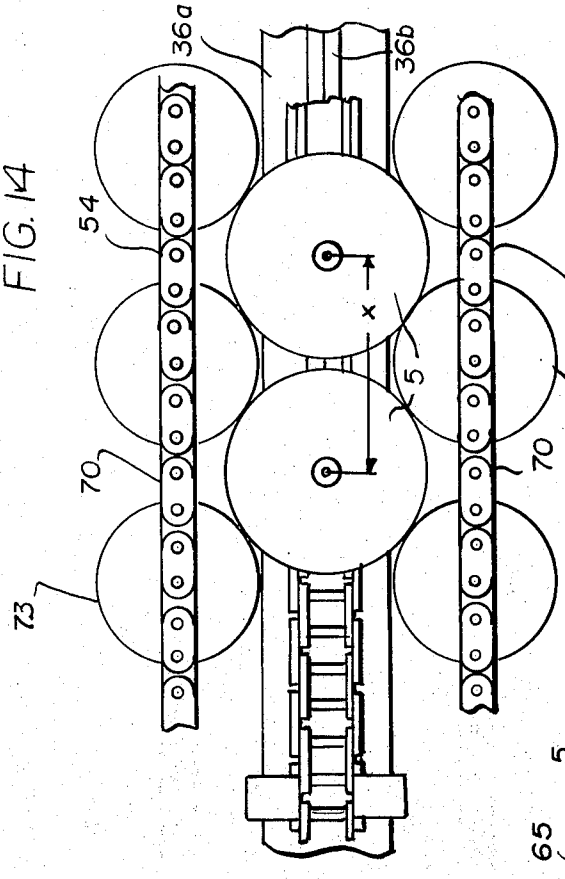


FIG. 13

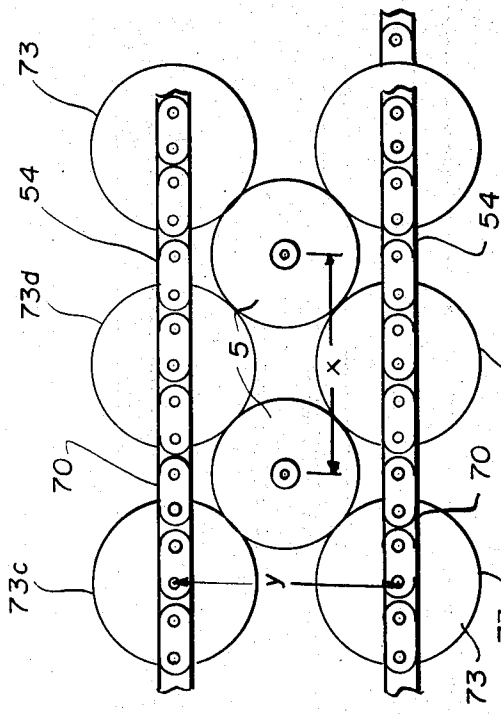


FIG. 12

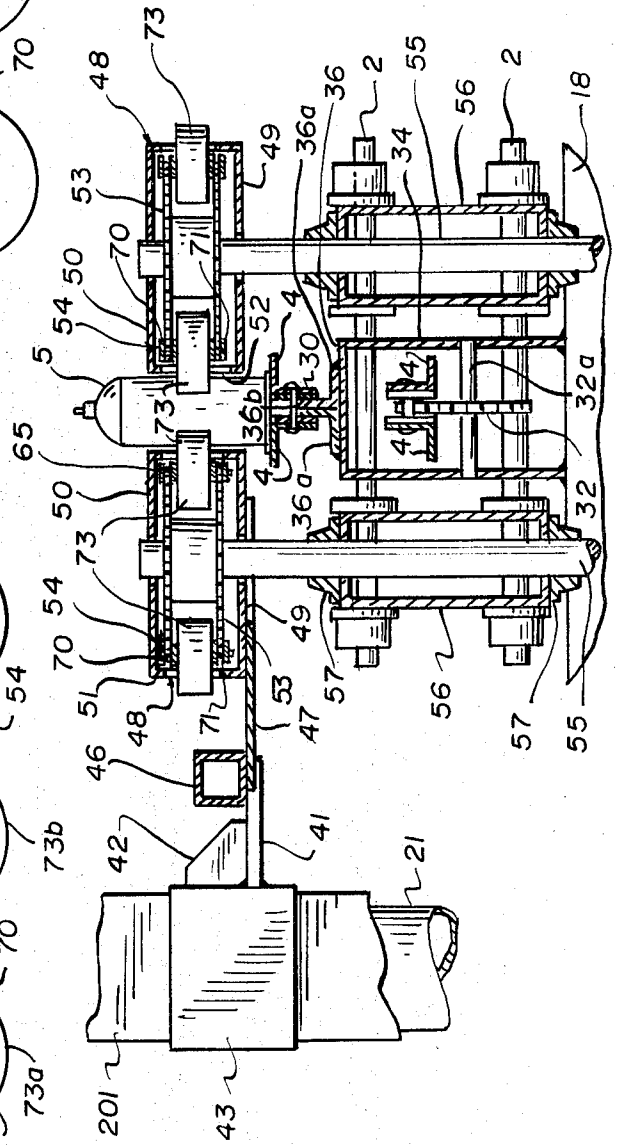


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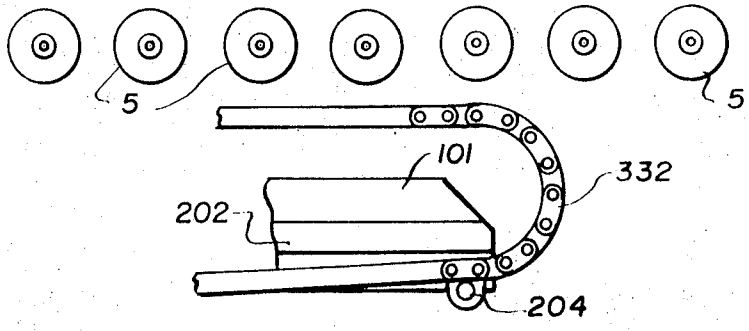


FIG. 18

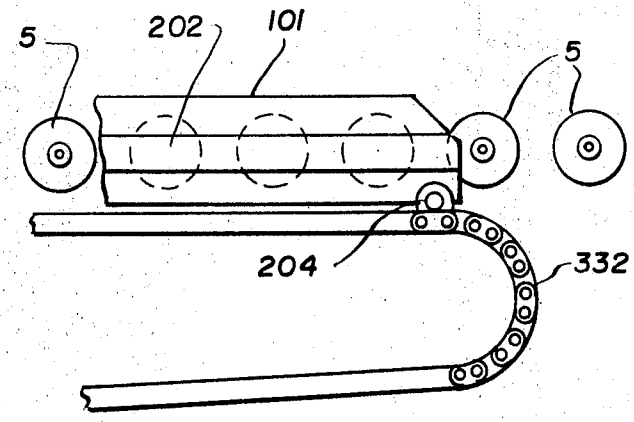


FIG. 15

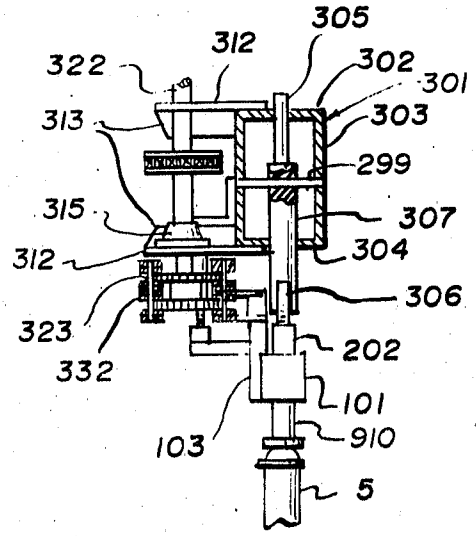


FIG. 16

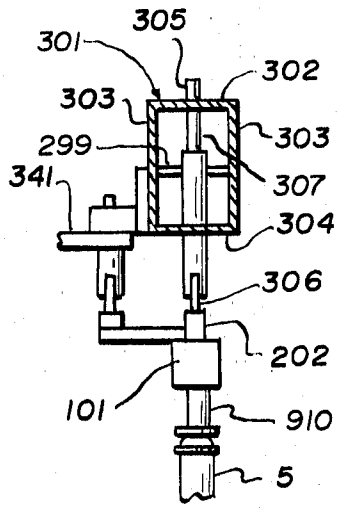


FIG. 19

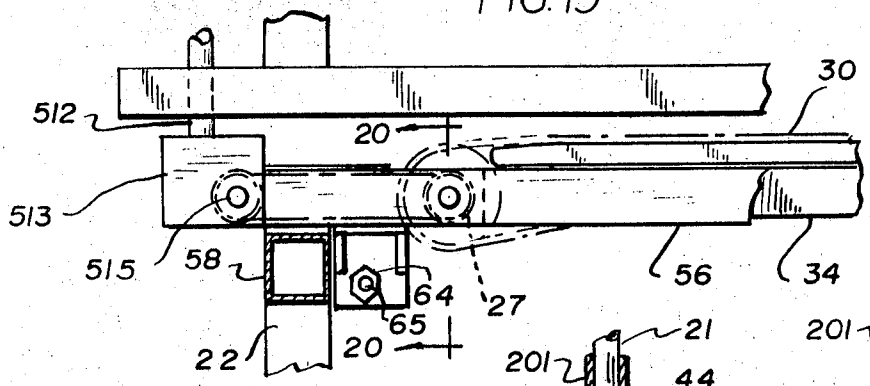


FIG. 20

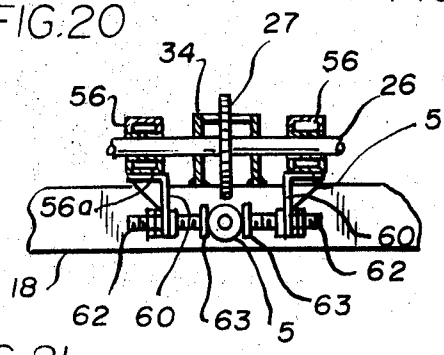


FIG. 23

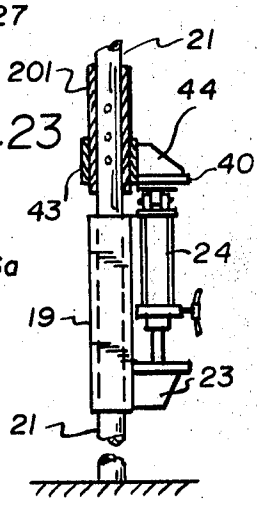


FIG. 24

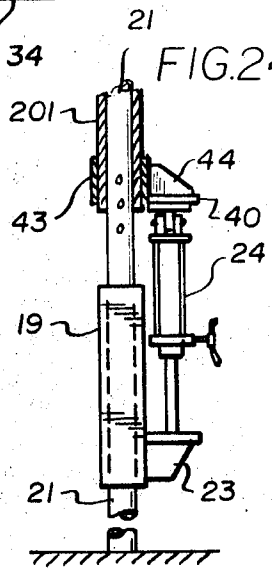


FIG. 21

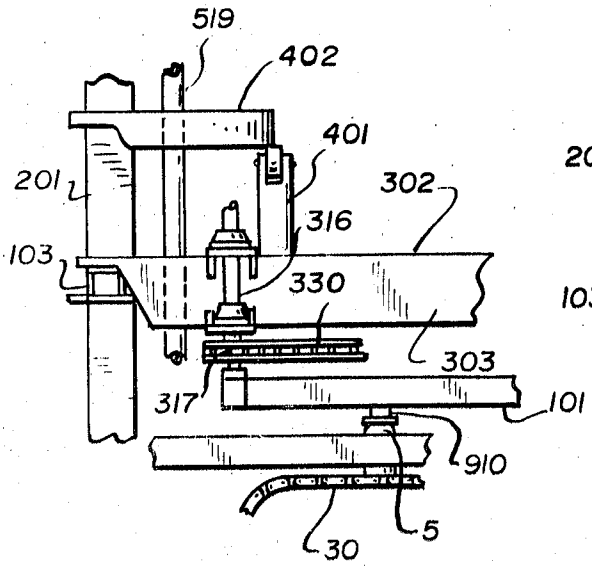


FIG. 22

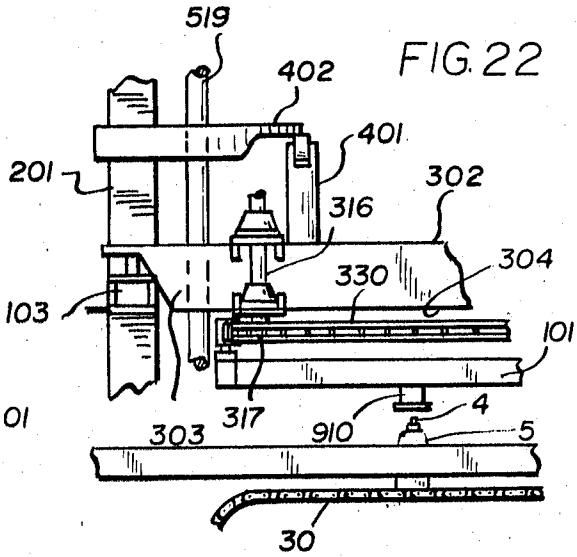


FIG. 25

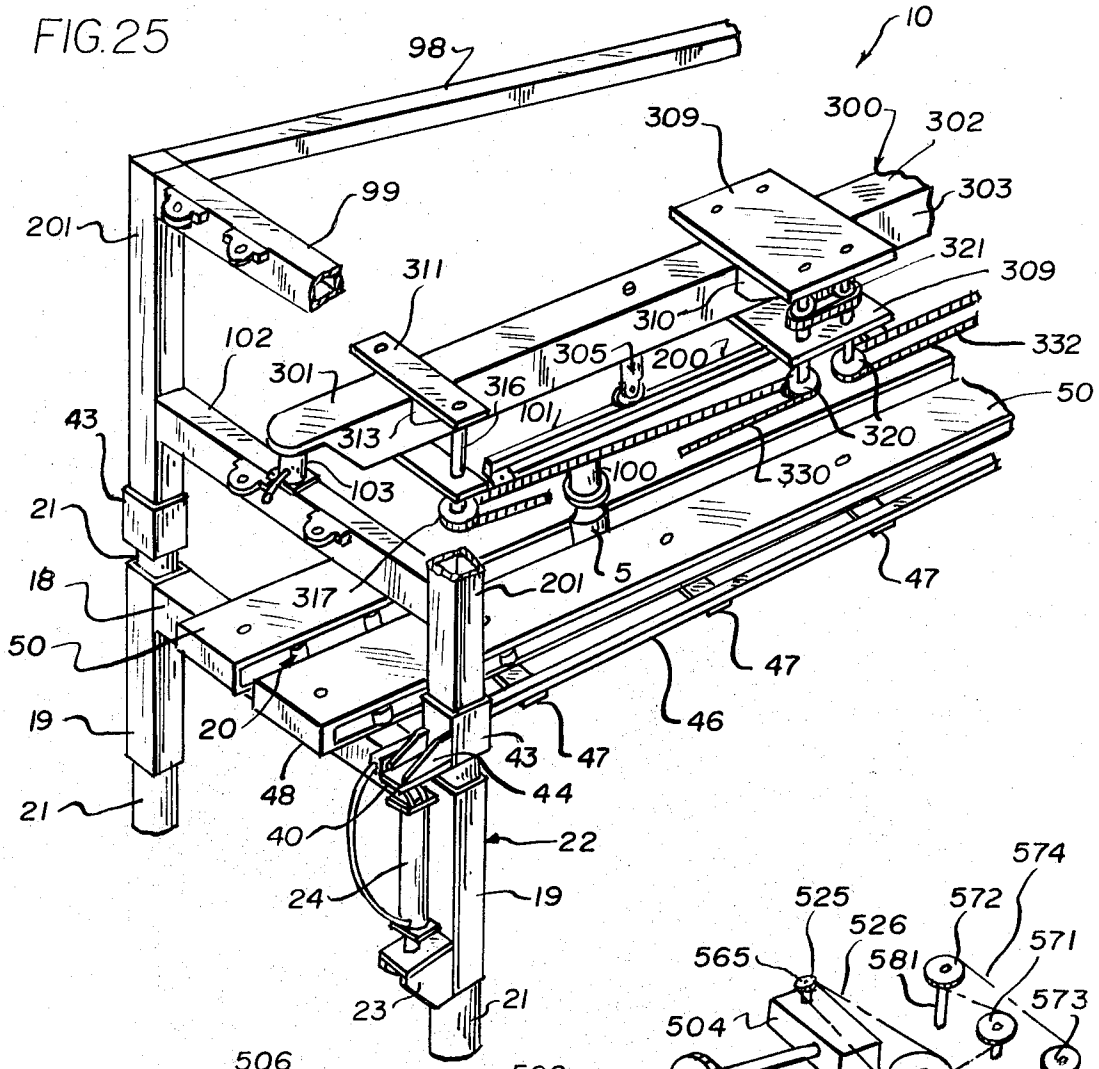
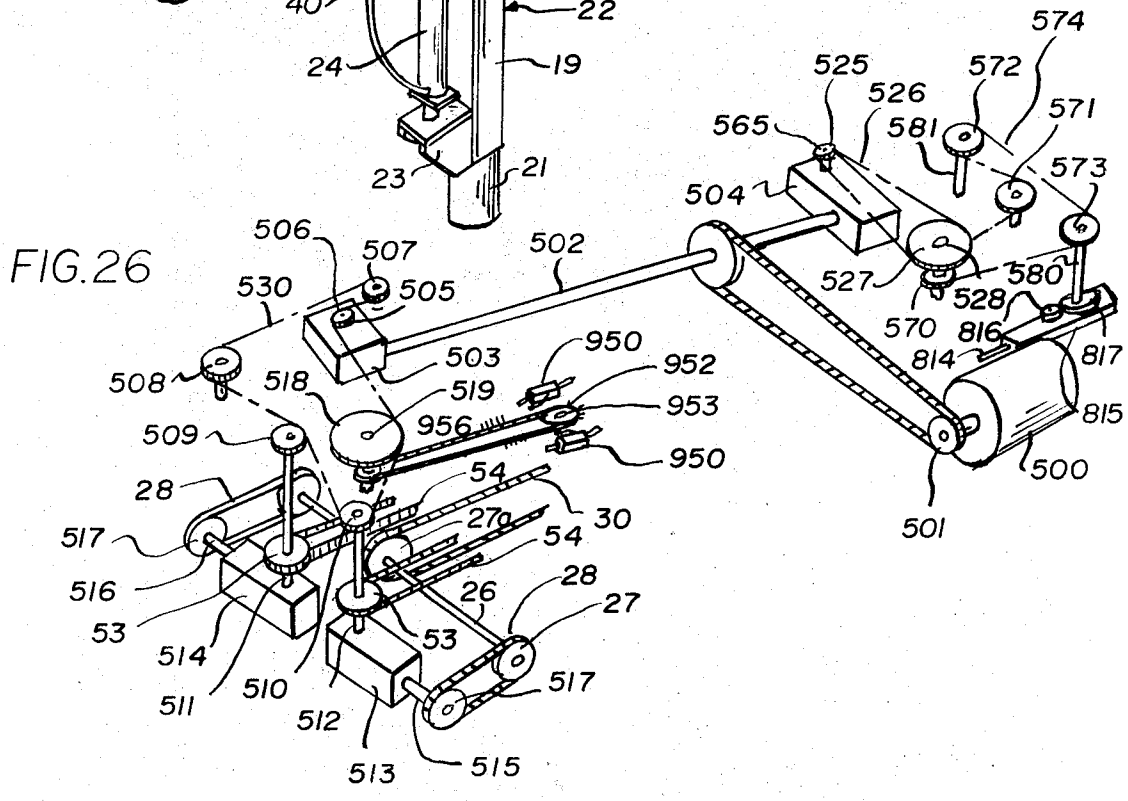

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FIG. 26


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AEROSOL CONTAINER FILLING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

This invention relates to a new and improved method and apparatus for filling open and/or closed containers such as cans and bottles. The apparatus is equally adaptable to liquid filling of open containers and the filling of closed pressurized aerosol type containers having a filling opening or valve. The machine can fill compressed gases such as N_2O and CO_2 or emulsified products saturated with such compressed gases.

In aerosol container filling, wherein powder, gaseous and/or liquid products are pressure packaged with a liquified or compressed gas propellant, three different methods are presently employed for filling the assorted containers and packaging the different types of products.

One is termed the "cold fill" method of filling. The product and liquified propellant are individually refrigerated prior to their introduction into an open container. This refrigeration lowers the propellant vapor pressure so that it can be handled in the liquid state. This delays liquid to vapor transition of the propellant for a period sufficient to permit insertion and crimping of a valve assembly in the container to effect closure of the can. The cold fill method is not satisfactory for some products due to the product formulation. For example, water base products freeze in the refrigeration step of the filling operation. Additionally, it has been found that some propellant is wasted in this type of filling operation in that some propellant will vaporize and escape from the container before closure of the container can be completed.

A second method employed for filling aerosol type containers is commonly referred to as the "under cap" method. In this operation, the product (at room temperature) is initially introduced into the container by a conventional liquid product filling machine and a valve is loosely inserted into the can. Generally a vacuum is then drawn on the container after which a liquid propellant is injected therein at high pressure (e.g., approximately 750 psig). Subsequently, the valve cup is crimped to the container by means of an internally expanding collet. However, in the time between the injection of the propellant into the container and the subsequent crimping operation, a portion of the liquid propellant is trapped between dual seals contacting the container and valve cup and around the curl of the can opening and valve cup over-lip. This propellant is lost in the filling operation. The loss of propellant for a single can is in excess of 5 grams. This loss becomes quite significant in production line operations where many hundreds of containers are being filled with fluorocarbon propellant by the "under cap" method.

The under cap method while relatively high speed has inherent losses due to trapped volume between the dual seals. Attempts to reclaim these losses through scavenging systems have been largely unsuccessful. The reclaim systems are often ponderous in design and fail to recover all propellant losses. The net effect is an expensive system which recovers only a portion of the loss.

A third method employed for filling aerosol containers is known as "pressure filling." In this operation the product is put into a container at room temperature, after which a valve assembly is inserted, a vacuum may be drawn, and the valve crimped. A propellant injector machine is then mated with the valve pedestal and propellant is supplied at high pressure and forced into the container through the valve assembly. The primary advantage of the pressure-fill method is a reduced loss of propellant as compared to either of the previously described methods of filling.

Presently, there are several methods employed for pressure filling containers. One system utilizes apparatus wherein a container to be filled is moved with intermittent motion under stationary filling heads. An alternate system moves containers in a circuitous path through a rotary filling operation. Certain disadvantages are attendant with each system. Initially, production rates of intermittent motion type systems are limited by the dynamics of can handling. Moreover the filling cost associated with this particular method of filling is quite high.

Where the pressure filling method is employed such systems have generally utilized rotary fillers. The use of timing screws feeding a star wheel positioning cans under a plurality of circularly rotating filling head takes the container through a circuitous path. This necessitates very accurate radial and circumferential positioning of the containers.

An added disadvantage inherent with equipment now available for either system is the "down-time" incurred in converting the system to fill different sizes of containers.

What is desired is a high-speed filling system with low propellant losses, which can quickly be converted to accept a full range of commonly used aerosol containers.

SUMMARY OF THE INVENTION

The invention disclosed and claimed herein relates to a filling apparatus and method which serve to obviate the disadvantages which are associated with many of the systems and apparatus presently available. In the filling apparatus and method of the present invention, containers travel with continuous motion and in a linear path synchronous with a portion of the orbital path of filling head stations wherein one or more containers are filled.

In liquid filling, the nozzle of a filling head is positioned over or inserted into the container opening. In the pressure fill method, a head contacts the closed container and seals to the container leaving the valve stem and the immediate area exposed to the pressure system.

Discharge of the dispensed medium can be controlled by either of two methods, a poppet type valve and/or pressure relief type valve acting in conjunction with a metering pump.

The apparatus of the present invention is designed to readily accommodate containers of different heights, diameters and shapes with a minimum conversion time required to change from one container size (diameter and/or height) to another.

The rate of production achieved with the filling apparatus disclosed and claimed herein is increased substantially as compared to production rates procured with filling apparatus presently available. Moreover, the utilization of a pressure operated positive displacement metering system delivers an accurate volume independent of viscosity, constant speed of the containers. In

addition to moving the containers to be filled in a straight or linear path as contrasted with intermittent motion or the circuitous route of containers filled by a rotary pressure filler apparatus. The present system permits a substantial reduction of parts in the filling apparatus.

Additionally, whereas in conventional systems a separate unit is employed for putting the product into a container and another different type of unit is employed for injecting propellant into the container, the filling apparatus of the present invention can be readily adapted to fill either the product or propellant into a container. As a consequence, the adjustable filling apparatus of the present invention with its continuous motion, linear path, container movement, is readily available in a production run to fill either product or propellant. This is quite advantageous because unlike conventional units where the product fill station and propellant fill station, each comprise substantially different units; the present system utilizes the same apparatus at the propellant and product fill stations, requiring only a change of the filler head units. Utilizing the filling head disclosed in U.S. Pat. No. 3,745,741 multiple operations are sequentially performed in addition to gassing. The container is evacuated using a vacuum system. The valve is then simultaneously crimped and gassed.

Other features and advantages are inherent in the subject matter disclosed and claimed herein, as will become apparent to those skilled in the art from the following detailed description, including the accompanying illustrative drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevation of the aerosol container filling apparatus of the present invention with the aPparatus being shown in a container filling position;

FIG. **2** is a plan view of the aerosol container filling apparatus showing the drive means, piston pump metering means and vacuum means of the present invention;

FIG. **3** is a plan view taken along line **3—3** of FIG. **1** and shows the drive means for the walking beam assemblies of the present invention;

FIG. **4** is a plan view taken along line **4—4** of FIG. **1** and shows the container transporting, roller conveyor means and container support conveyor means;

FIG. **5** is a fragmentary view of FIG. **4** and shows the can or container transporting roller conveyor means of the present invention adjusted for the passage of containers through the filling apparatus of the present invention;

FIG. **6** is a fragmentary view of one of the two duplicate cam means associated with filling containers which pass through said apparatus, with the cam means of FIG. **6** being shown in a non-fill position;

FIG. **7** is a view taken along line **7—7** in FIG. **2** and shows one of the two cam actuated valve means of the present invention for allowing fluid to pass to the fluid metering pumps of the present invention;

FIG. **8** is a view taken along line **8—8** of FIG. **7** and along line **8—8** in FIG. **10** showing an enlarged section of one of the adjustable fluid metering piston pumps of the present invention;

FIG. **9** is a flow diagram showing the fluid flow means from the cam actuated valve means through the fluid metering pump of the present invention to a container passing through the filling machine of the present invention;

FIG. **10** is an end view of a pair of fluid metering pumps of the present invention and more particularly the piston rod, minute incremental fluid metering adjustment gauges and clamping means for retaining a pair of adjustable pump piston rods;

FIG. **11** is a plan view of a metering bar used in association with the piston rod means for providing major incremental fluid metering adjustments in the metering pump means of the present invention;

FIG. **12** is a section view taken along line **12—12** in FIG. **4** showing a container located and supported by the container transporting, roller conveyor means and container bottom support conveyor means;

FIG. **13** is an enlarged fragmentary view of the container transporting, roller conveyor means positioning a small diameter container in the filling apparatus of the present invention;

FIG. **14** is an enlarged fragmentary view of the container transporting, roller conveyor means positioning a large diameter container in the filling apparatus of the present invention with the container resting on the bottom supporting conveyor means;

FIG. **15** is a fragmentary section view taken along line **15—15** of FIG. **3** and shows a walking beam attached to the walking beam chain drive and the support to procure stability of the walking beam when it is in a container filling position;

FIG. **16** is a fragmentary section view taken along line **16—16** in FIG. **3** and shows an idler arm and adjustable cam follower which provides desired vertical alignment of the walking beam.

FIG. **17** is a schematic fragmentary view of a walking beam of the present invention positioned prior to a filling operation wherein the walking beam is spaced from containers passing through the filling apparatus;

FIG. **18** is a schematic fragmentary view of the walking beam of FIG. **17** after the beam has moved in an orbital path to a position over containers passing through the filling apparatus for a filling operation;

FIG. **19** is a fragmentary view taken along line **19—19** in FIG. **4** showing a vertical drive means, a gear box means and a horizontal drive means for driving the container, bottom support conveyor means of the present invention;

FIG. **20** is a fragmentary view taken along line **20—20** in FIG. **19** showing the adjusting means for providing the horizontal and centering adjustment required for the container transporting roller conveyor means whereby containers of different diameters (see FIGS. **12–14** inclusive) can be utilized with the filling apparatus of the present invention;

FIG. **21** is a fragmentary view showing the dancer beam of the present invention positioned in a downward, fill position with cam follower means attached to the dancer beam;

FIG. **22** is a fragmentary view showing the dancer beam of FIG. **21** raised pneumatically to an upward, non-fill position with the cam follower at a high point on the dancer beam cam assembly;

FIGS. **23** and **24** show vertical adjusting means for raising and lowering the dancer beam, walking beams, container transport roller conveyor means and drive means to accommodate the filling of containers having different height dimensions;

FIG. 25 shows a fragmentary, perspective view of the container transport roller conveying means, dancer beam assembly and walking beam assembly; and,

FIG. 26 shows a schematic view of the drive means for the various assemblies of the container filling apparatus of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, FIGS. 1, 3 and 25, there is shown a container filling apparatus 10 through which containers 5 (FIG. 25) pass to be filled by a "pressure fill" method to be described.

Apparatus 10 comprises container conveyor means 20, container filling means 100, walking beam assembly 200 associated with the filling means and a vertically movable dancer beam assembly 300 from which the walking beam assembly is supported.

Apparatus 10 is supported by four tubular posts 21. Disposed about posts 21 are conveyor support members 22. Each member 22 is made up of two legs 19 which are adapted to be slidably disposed about posts 21. Legs 19 are connected together by a cross beam 18 (FIGS. 1 and 25). Each member (FIGS. 23, 24) is suitably fastened to post 21 to provide the desired height location of hydraulic lifting means 24 which are disposed on support members 23 which are welded to legs 19 as shown in FIGS. 1, 23 and 25.

CONTAINER TRANSPORT CONVEYOR MEANS

Box beam 34 is disposed midway between legs 19 on cross beam 18. (FIG. 12) Beam 34 is welded to the top surface of cross beams 18 with one end of beam 34 extending beyond the member 22 as shown in FIG. 1.

Conveyor shaft support arms 25 which support conveyor shaft 26 (FIG. 4), extend from the two legs 19 at one end of apparatus 10. Bearing assemblies 26a support the ends of shaft 26 in arms 25. Sprocket 27 is located near each end of shaft 26, each sprocket 27 being connected by chain 28 to drive means to be described. A third sroket 27*a*, enclosed within box beam 34, is located midway of shaft 26.

At the remaining end of beam 34 is located a second support roller conveyor shaft 9 which is disposed within bearings 8. (FIG. 2) Bearings 8 are fastened to the side walls of cross beam 34 as seen in FIG. 2. Sprocket 31 is fastened to shaft 9 and transport conveyor chain 30 is employed to connect sprocket 27*a* and sprocket 31. (FIG. 1)

Located between sprockets 27*a* and 31 are a plurality of sprockets 32. Each sprocket 32 is mounted on a shaft 32*a*, the ends of which are located in the side walls of beam 34. (FIG. 12) As can be seen more clearly in FIG. 1, conveyor chain 30 extends around sprocket 27*a* and 31 and over sprockets 32. Chain 30 has a plurality of lugs 4 attached thereto, (FIG. 12) the lugs 4 extending at right angles to chain 30 to provide a support for containers 5 which are carried through the apparatus over chain 30.

Two angle members 36*a* are bolted to the top surface 36 of beam 34. (FIG. 12) Angle members 36*a* are fastened together on the top of beam 34 to provide a top surface 36*b* over which conveyor chain 30 rides.

CONTAINER SUPPORT CONVEYOR MEANS

Referring to FIGS. 1 and 12, movable plate 41 is supported by piston means 24 which is joined to a guide 43 which is adapted for vertical movement relative to post 21. Plate 41 is welded to guide 43 and reinforcing member 42 is employed to strengthen the connection of plate 41 to guide 43.

Extending radially outward from guide 43 and at right angles to members 42 is a second reinforcing member 44 (FIG. 1) which is welded to guide 43.

Two hollow members 46 extend along the length of apparatus 10 and are attached at their respective ends to plates 41. Each member 46 serves as an air supply means which are suitably fastened by hose or the like to pneumatic air springs 103 to be described. A plurality of flat plates 47 are fastened to the underside of each member 46, plates 47 extending inward toward conveyor chain 30 as shown more clearly in FIGS. 4, 12 and 25.

Box members 48 are located and supported by plates 47, along the length of the box member. Each box member 48 (FIG. 12) comprises bottom and top walls 49, 50 respectively, and inner and outer side walls 51, 52, the sidewalls being slotted or provided with an opening along their respective length of a size greater than the thickness of discs or rollers 73 which extend through the box member sidewall openings as seen in FIG. 12.

A plurality of sprockets 53 (FIGS. 4, 5 and 12) are spaced along the length of each box member 48. A container guide conveyor chain assembly 54 is located in each box member 48, chain 54 being connected to sprockets 53. Each sprocket 53 is positioned on a vertical shaft 55. (FIGS. 1 and 12) Shafts 55 extend downward from sprocket 53 where they are slidably mounted by bearing members 57 to box beam 56. (FIGS. 1 and 12)

Each beam 56 extends along a major portion of the length of conveyor chain 30. The beams 56 are adjustably connected to beam 34, the beams 56 being supported by shafts 26 and 2 (FIGS. 1 and 12). Suitable bearing members are attached to each box beam 56 with shafts 26 and 2 being inserted in the bearings. Beams 56 are suitably fastened to shafts 26 and 2 so that each box beam 56 can be moved inward and outward on the shafts relative to fixed beam 34.

CONTAINER SIZE HORIZONTAL ADJUSTING MEANS

Referring to FIG. 20, at each end of each box beam 56, a plate 60 is welded to and extends downward from the bottom wall 56*a*. Threaded in each plate 60 is a bolt 62, to the end of which is fastened a second plate 63. As shown in FIG. 20, threading bolts 62 inward or outward can result in movement of plates 63 toward or away from each other.

By placing a container 5 of the size to be filled in apparatus 10 between plates 63, box beams 56 can be moved along the lengths of horizontal shafts 26 and 2 which in turn move shafts 55, sprockets 53, box members 48 and chain assemblies 54 relative to each other. Movement of bolts 62 relative to each other causes the distance between the centerlines of the container guide conveyor chains 54 to be enlarged or decreased thereby providing the adjustment necessary to allow different size containers to pass through apparatus 10.

The effects of adjusting the container guide conveyor chain assemblies 54 are demonstrated in FIGS. 13 and 14 where containers of different sizes are shown being transported along the length of apparatus 10 by con-

tainer transport conveyor **30.** The containers are supported, guided and held in the desired spaced position along the length of apparatus **10** by container guide conveyors **54.**

Referring to FIGS. **4, 5** and **12** each, container guide conveyor chain assembly **54** comprises top **70** and bottom **71** roller chains which are pinned together in a spaced relationship by means of pins **65.** Elastomeric discs **73** which are substantially larger in diameter than the width of the chains **70, 71** are securely fastened to pins **65.** In operation, discs **73** serve to contact the side wall of a container to retain the container in a stable position during a filling operation. FIGS. **13** and **14** illustrate the movement of discs **73** in relation to different size containers. Discs **73** are preferably mounted on 3 inch centers. Four discs **73,** i.e., two discs on each of the conveyor chains **54** serve to form a pocket to position and guide a container **5** as it is transported along the length of apparatus **10** by conveyor **30.** In other words, as illustrated in FIG. **13,** discs **73**(*a*) and **73**(*b*) pinned to a conveyor chain assembly **54** will mate with corresponding discs **73**(*c*) and **73**(*d*) located on the other conveyor chain assembly **54** to position and guide container **5.**

By adjusting beams **56** inwardly and outwardly as discussed with respect to FIG. **20,** conveyor chain assemblies **54** and discs **73** are also moved inwardly and outwardly. As the conveyor chain assemblies **54** are moved toward each other, FIG. **13,** discs **73** also move inward toward each other in the *y* direction thereby reducing the space between a set of four discs **73** although the center line between containers will not change. Accordingly, if containers **5** are being conveyed in a filling operation with a center line spacing between containers of 3 inches, the center line spacing *x* will remain constant irrespective of the size of containers which are passed through filling apparatus **10.** Maintaining constant centerline spacing *x* is important with respect to the filling means of the invention as will be discussed more fully. Yet while the spacing *x* is maintained substantially constant along the length of the apparatus, the spacing *y* can be varied to permit different size containers to be employed. FIG. **14** shows containers **5,** which are larger in diameter than the containers shown in FIG. **13.** To accommodate the larger size containers, the distance *y* between the centers of discs **73** is increased. Note however that the centerline spacing *x* remains the same.

CONTAINER HEIGHT VERTICAL ADJUSTING MEANS

Positioned about supports **21** and above guide **43** (FIGS. **1, 23, 24** and **25**) is a second tubular member **201** which is welded or attached by suitable fastening means to guide **43** so that as guide **43** is lifted vertically upward or downward on posts **21** by hydraulic lift means **24,** member **201** also moves vertically. Movement of hydraulic lift means **24** vertically (FIGS. **23, 24**) serves to move dancer beam **301,** walking beams **101, 110** and filling heads **910** vertically. This vertical movement serves to permit the filling of containers having different heights. For example if apparatus **10** has been employed to fill containers **5** of one size and it is desired to fill taller containers lift means **24** can be actuated to lift dancer beam **301,** walking beams **101, 110** and filling heads **910** upward until the desired height is reached which will allow the taller containers to pass through apparatus **10** and be filled.

DANCER BEAM ASSEMBLY

Moving up on members **201,** there is a transverse beam **102** which extends across the width of the apparatus with the ends of beam **102** being attached by welding or other suitable means to members **201.**

Disposed on top of and midway of each of the cross beams **102** is an air spring **103.** Each end of dancer beam **301** rests upon a spring **103.** As seen in FIG. **1,** beam **301** extends substantially along the length of apparatus **10** and is positioned to be disposed over container conveyor means **30.** Dancer beam **301** comprises top and bottom surfaces **302, 304** and side walls **303.**

Spaced along the length of dancer beam **301** are a plurality of roller bearing walking beam stabilizer assemblies **305.** As shown in FIGS. **1, 16,** each assembly comprises a roller **306** which is pinned to shaft **307** which extends through and is connected to beam **301** by any suitable means.

Plate **309** (FIGS. **1, 3** and **25**), is located at the center of beam **301** and extends out beyond the side walls **303** of beam **301.** Plate **309** can be welded or attached by other suitable means to the top and bottom walls **302, 304** of beam **301.** Gussets **310** are employed to retain plate **309** in position.

Two additional plates **311** and **312** are also located on beam **301** and are spaced from plate **309.** These plates are located near the ends of the beam and like plate **309,** extend out beyond the side walls of dancer beam **301.** Gussets **313** are used to securely retain plates **311** and **312** to beam **301.**

Located on plates **309, 311** and **312** are bearings **315** which hold chain drive shafts. Viewing FIGS. **1** and **3** and plate **311,** vertical shafts **316** extend through the plate and are held in bearings **315.** Sprockets **317** are attached to the bottom end of each of the two shafts **316** while a sprocket **318** is fastened contiguous to the upper remaining end of one shaft **316** and pinion gear **523** is attached contiguous to the remaining end on the other shaft **316.**

Moving to plate **309,** four vertical shafts **319** are disposed at one of their ends within bearing assemblies **315** which are attached to plate **309.** Assemblies **315** are fastened to top plate **309** which is welded to the top wall of dancer beam **301.** Sprocket **320** is located at the bottom end of each of the four shafts **319** while a sprocket **321** is attached midway of each shaft **319.**

Shafts **322** are located in bearings **315** in plates **312.** Sprocket **323** is attached to the bottom end of each of the two shafts **322** while a pinion gear **532** is fastened contiguous to the upper remaining end of one shaft **532** and sprocket **324** is fastened contiguous to the remaining end of the other shaft **324.**

One set of chains **330** and **331** are fastened to sprockets **317** and **320** on dancer beam **301** while another set of chains **332, 333** are fastened to sprockets **320** and **323** on the dancer beam.

Idler sprockets **340** (FIG. **3**) which are pinned to dancer beam **301** by idler arms **341** are positioned between the sprocket locations at plates **309, 311** and **312.** These sprockets serve to assist in maintaining the chains in a taut condition in the course of operation.

Sprockets **321,** located midway on shafts **319,** (FIG. **1**) are employed to connect chains **350.** As will be dis-

cussed more fully hereafter, the chains **331, 333** and **330, 332** are employed to provide an orbital path for the container filling means of apparatus **10.**

WALKING BEAM ASSEMBLY

As illustrated in FIGS. **1, 3, 17, 18** and **25,** walking beam **101** is attached to chains **330** and **332.** Beam **101** comprises a square member which is shorter in length than dancer beam **301.** In FIGS. **15** and **16,** cam rail **202** is shown disposed on top of beam **101.** Contiguous to the ends of walking beam **101,** FIG. **3,** there are located pin connections **203, 204** at which points walking beam **101** is pinned or connected to both chains **330** and **332.** Pin connection **203** is pinned to chain **330** whereas connection **204** is pinned to chain **332.** Similarly, walking beam **110** which is similar in construction to beam **101** is pinned or pivotally connected to chains **331** and **333.** Pin connection **105** is pinned to chain **331** whereas connection **106** is pinned to chain **333.**

As chains **330, 332** are driven, beam **101** will move in an orbital path whereby the beam will move in a path a portion of which will find beam **101** moving substantially parallel to the linear path of containers **5,** FIG. **1,** and **17;** another portion of the path will find beam **101** traveling in substantially the same linear path as and aligned with containers **5,** FIG. **18;** and finally, two portions of the beam path will be curvilinear portions, one at each end of the linear travel of beam **101,** FIG. **17,** such that the beam travels in an orbital manner relative to the linear path of container **5.**

FIGS. **17** and **18** show more fully the movement of beam **101** and pin connection **204** relative to chain **332.** As the beam travels that portion of its orbital path wherein it is over and in axial alignment with containers **5,** it is extended or pivoted over containers **5** (FIG. **18**) and cam rail **202** is located over containers **5** and spaced from chain **332.** However, in that portion of the orbital path where walking beam **101** travels in a linear path substantially parallel to the linear path of containers **5,** the beam is positioned relative to chain **332** such that cam rail **202** is located adjacent chain **332** (FIG. **17**).

As shown in FIG. **15,** cam rail **202** is adapted to be contacted by rollers **306** for the purpose of stabilizing and restraining the movement of beam **101** while it travels in the same path as containers **5** during a filling operation.

Walking beam **110** has a similar path as described for walking beam **101** with beam **110** having a cam rail (not shown) which corresponds to rail **202** for the purpose of contacting the stabilizing rollers **306** during a filling operation.

Referring to FIGS. **1** and **6,** there is shown, positioned on top of and contiguous to each end of dancer beam **301,** cam followers **401** which, in association with cams **402,** provide vertical movement of beam **301** and walking beams **101** and **110.**

Beam **301** is normally urged upward by air springs **103;** however cams **402** and cam followers **401** serve to provide the desired downward movement of dancer beam **301.** Viewing FIG. **21,** cam **402** is shown in a position which urges cam followers **401,** beam **301** and walking beams **101** and **110** in a downward, container filling position. FIG. **22** shows dancer beam **301** and walking beam **101** in an upward, non-fill position due to the location of cam follower **401** relative to cam **402.**

APPARATUS DRIVE MEANS

Referring to FIGS. **1, 2** and **26,** the drive means for the filling apparatus **10** includes a motor **500** which via drive pulley **501** drives drive shaft **502.** Drive shaft **502** is connected by suitable means to gear boxes **503** and **504.** Drive shaft **505** extends from box **503** and attached thereto is drive sprocket **506.**

Idler sprockets **507** and **508** are employed to provide the desired rotation of various drive shafts in the apparatus. Sprockets **509** and **510** are attached to one end of drive shafts **511** and **512** respectively. Contiguous to the remaining end of shafts **511** and **512** are sprockets **53** which serve to drive container guide conveyor chains **54.**

Disposed below sprockets **53,** drive shafts **511** and **512** are connected to gear boxes **513** and **514** respectively. Horizontal drive shaft **515** extends from gear box **513** and drive shaft **516** extends from gear box **514.** At the ends of shaft **515** and **516** are attached sprockets **517.** Sprockets **517** are connected to sprockets **27** by means of chain **28** to provide the drive means for container chain conveyor **30.**

Sprocket **518** is attached to shaft **519.** As shown in FIGS. **1** and **6,** shaft **519** extends downward and is connected to bearing assembly **520** which is suitably connected to member **102.**

Cam **402** is fastened for rotation with shaft **519** and below cam **402,** drive gear **521** and drive sprocket **522** are fastened to shaft **519** and are adapted to slide vertically on shaft **519.**

Referring to FIGS. **1, 3** and **6,** drive gear **521** meshes with pinion gear **523** which is fastened to the upper end of shaft **316.** Attached to the other end of shaft **316** is sprocket **317** employed to drive chain **331** and walking beam **110.** Sprocket **522** is fastened by chain **524** to sprocket **318** which is fastened to shaft **316.** The other end of shaft **316** has sprocket **317** for driving chain **330** and walking beam **101.**

Referring to FIGS. **1, 2** and **26,** chain **530** is connected to sprockets **506, 507, 508, 509, 510** and **518** which in turn provide rotation for drive shafts **511, 512** and **519.**

Viewing gear box **504** (FIGS. **2, 26**), vertical drive shaft **565** extends vertically with sprocket **525** fastened at its free end. Chain **526** connects sprocket **525** to sprocket **527** which is fastened to one end of drive shaft **528.**

As shown in FIG. **1,** shaft **528** extends downward and is connected to bearing assembly **529.**

Cam **402** is fastened for rotation with shaft **528** and below cam **402,** drive gear **530** and drive sprocket **531** are fastened to shaft **528** and adapted to slide vertically upon shaft **528.**

Referring to FIGS. **1** and **3,** drive gear **530** meshes with pinion gear **532** which is fastened to the upper end of shaft **322.** Attached to the other end of shaft **322** is sprocket **323** employed to drive chain **332** and walking beam **101.** Sprocket **531** is fastened by chain **533** to sprocket **324** which is fastened to shaft **322.** The other end of shaft **322** has sprocket **323** for driving chain **333** and walking beam **110.**

It will be observed viewing FIG. **3** that a chain drive and gear drive are employed as the drive means for each of the walking beams **101, 110.** The drives are arranged to provide the desired rotational movement of the chains **330, 331, 332** and **333.**

As mentioned previously, drive gears **521** and **530** and drive sprockets **522** and **531** are positioned for vertical movement on shafts **519** and **528**. Viewing FIG. **6**, drive sprocket **522** is positioned on a slidable bushing **540** which seats upon the top wall **302** of dancer beam **301**. Drive gear **521** is seated against sprocket **522**. With the filling apparatus in the non-fill position of FIG. **6**, air spring **103** urges dancer beam **301** upward which in turn causes gear **521** and sprocket **522** to move upward. When cam **402** is rotated to a fill position (FIG. **21**) which causes follower **401** and dancer beam assembly **300** to move downward, gear **521** and sprocket **522** also move downward. Movement of gear **521** and sprocket **522** is accomplished by means of gear follower **541** which is attached to wall **302** of dancer beam **301**. As cam **402** and follower **401** causes beam **301** to move downward, gear follower **541** also moves downward in the course of which the follower forces gear **521** and sprocket **522** to move downward. When cam **401** is in a non-fill position and air spring **103** forces beam **301** upward, this in turn causes bushing **540**, sprocket **522** and gear **521** to move upward.

While the operation of the gear follower has been discussed with respect to gear **521** and sprocket **522**, a similar gear follower means **550** is employed to slide gear **530** and sprocket **531** vertically on shaft **528** during a filling operation.

CONTAINER FLUID FILLING ASSEMBLY

Referring to FIGS. **1, 2, 7** and **26**, shaft **528** has located thereon drive sprocket **570** which is located on shaft **528** between sprockets **528** and cam **402**. Drive sprocket **570** is connected to idler sprocket **571** and drive sprockets **572** and **573** by chain **574**. Sprocket **573** is fastened to one end of shaft **580** while sprocket **572** is fastened to one end of shaft **581**. The remaining ends of shafts **580, 581** are positioned for rotation in bearing assemblies **582** and bearing assemblies **583** which are attached by suitable means to a plate **584** projecting outward from cross beam **99** which connects the upper ends of beams **201** along the width of apparatus **10**. Members **98** are employed to connect members **201** together along the length of apparatus **10**.

Brackets **700** (FIG. **1**) depend from members **98** and serve to support fluid supply means **800**.

Fluid supply means **800** comprises a frame (FIG. **2**) having members **801, 802, 803** and **804**. Fluid supply entry port **805** (FIG. **7**) is located on member **801** and is connected to the desired fluid supply source. Port **805** connects with fluid passage **807**. Passage **807** is separated from fluid passage **808** by valve means **810**. Valve means **810** comprises a spring biased piston member **811** which, in a closed position, seats against exit port **812**.

Valve means **810** is opened and closed by means of a finger **813** attached to cam follower rod **814** which is attached to a slotted cam follower plate **815** to which cam follower **816** is pinned for rotation.

Cam **817** (FIG. **7**) is fastened for rotation with drive shaft **580** whereby upon rotation of shaft **580**, cam **817** is rotated. Cam follower **816** which is normally biased outwardly toward cam **817** will move horizontally back and forth following the path generated by the cam. Plate **815**, rod **814** and finger **813** will also move horizontally along with follower **816**. Movement of finger **813** against piston **811** causes valve means **810** to open thereby allowing fluid to pass through exit port **812** and passage **808**.

A valve means and valve opening cam means corresponding to that described with respect to FIG. **7** is located on the opposite side of apparatus **10** with the cam being fastened to shaft **581**.

Additional fluid passage ports **820** are tapped from passage **808**. Passages **820** lead to fluid metering pumps **900**. Check valves **830** are located in passages **820** and serve to permit the passage of fluid to either the metering pumps **900** or hoses **905** (FIGS. **1, 8**) leading to the container fluid filling heads **910**.

In those instances where a vacuum is to be drawn in a container in the course of a filling operation, vacuum valves **950** (FIG. **2**) can be suitably attached to filling heads **910** by hose or the like (not shown). Valves **950** are located on plate **951** and spaced from each other.

Sprocket **952**, located on shaft **953** which is retained in position by a bearing assembly located on plate **951** is connected to sprocket **954** on shaft **517**. Chain **955** connects the two sprockets. Lugs **956** are positioned on chain **955** and serve to selectively contact switch **957** on valves **950** thereby causing a valve to open or close. Thus, as shaft **517** rotates, chain **955** with lugs **956** moves relative to valves **950** and will cause filling head **910** to pull a vacuum on the containers passing through the apparatus. While a chain means has been illustrated for selectively operating the vacuum valves, other actuating means could be employed. For example, a cam means such as cam **400** could be utilized. Vacuum valves **950** are suitably connected to a vacuum source and to the filling heads of the unit such that, if desired a vacuum can be pulled with the filling heads on walking beam **100** during a filling operation while the vacuum valve which is connected to the filling heads on walking beam **110** is closed. When the filling heads on walking beam **110** are in a fill position, the vacuum valve **950** can be actuated to draw the desired vacuum whereas the remaining valve **950**, connected to the filling heads on walking beam **101** is closed.

FLUID METERING PUMP

Metering pumps **900** which are employed for dispensing the desired amount of fluid in containers **5** in the course of a filling operation each comprise a tubular cylindrical member **911** in which piston **912** is adapted to freely slide. Each end of member **911** is closed by a cap **913** which is threaded at **913***a* into piston member **911**. Caps **913** having an opening **915** therein for receipt of a piston stop arm **914, 914***a* which are adapted to slide in cap opening **915**. Piston stops **916** are located at the end of the arms located within piston member **911**. Nut **917** is located at the remaining end of each of the piston stop arms.

It will be observed in FIG. **8**, that piston stop arm **914***a* is threaded along more of its length than corresponding piston stop arm **914**.

Caps **913** are positioned and releasably maintained on the tops of members **801** and **803** by means of clamps **920** which are fastened to the members by means of pins **921** thereby holding caps **913** in position. FIG. **7** shows caps **913** having a fluid passage **922** which are aligned with passages **820** when caps **913** are fastened to members **801** and **803**.

Disposed between pumps **900** is a metering bar **925** which is longer in length than piston members **911**.

(FIGS. 2, 11) Bar **925**, which is held on members **801**, **803** by pins **921**, has a plurality of holes **926** for fluid metering purposes.

Viewing FIGS. **8** and **10**, it will be observed that clamps portions **927**, **928** which serve to form clamp **930** are fastened together by nuts **929** which are threaded into clamp **930**. Clamps **930** serve to hold nuts **917** of piston arm stop **914**, **914***a* rigidly, however, at the same time clamps **930** are adapted to adjustably slide along the length of metering bar **925**. In other words as clamps **930** are moved along metering bar **925** piston stop arms **914**, **914***a* will also move relative to bar **925**. Accordingly, the travel of piston **912** can be regulated by adjustment of clamps **930** along the length of the metering bar **925**. When clamp **930** is adjusted to the desired position, whereby piston stop **916** is located in the proper position, pin **931** is dropped into an opening **926** in meter bar **925**.

In order to achieve a fine adjustment in piston travel as opposed to the incremental adjustments afforded by openings **926** in bar **925**, stop **914**a can be turned a desired amount in nut **917** (FIGS. **8**, **10**). Gauge **932** serves to indicate the linear travel of rod **914***a* as it is rotated in nut **917**. Accordingly, in adjusting the travel of piston **912** in a filling operation, the large incremental adjustments will initially be made utilizing metering bar **925** and fine adjustments will be made by rotation of rod **914** in the nut **917** which is held in place by clamps **930**. While only two metering pumps **900** have been illustrated, in FIGS. **2** and **7**, additional metering pumps are employed in the apparatus as exemplified in FIG. **1**.

In a container filling operation, the entire system will initially be under fluid pressure. A pressure differential occurs (FIG. **9**) when valve stem **4** on a container **5** actuates a valve in filling head **910** which is attached to a walking beam. Upon opening of valve **910**, fluid will flow into the container and at the same time cause actuation of metering pump **900**.

For example, when walking beam **101** is in a fill position (FIG. **18**) whereby filling heads **910** are positioned on containers **5**, actuation of valves in filling head **910** by valve stems **4** causes fluid to flow into and fill containers **5**. In this filling position, finger **813** is actuated by the cam on shaft **581** which actuates valve **810** to an open position. Opening of valve **810** will cause fluid to pass through passages **808** and **820**. The fluid pressure in these passages causes valve **830** to move vertically upward where fluid passes through grooves **960** into passage **922** of cap **913** and into piston member **911**. In piston member **911**, a pressure differential exists in that as fluid enters passage **922** in one end of piston member **911**, fluid is exiting from passage **922** on the remaining end of member **911** through grooves **960** and into base **905** so that a pressure differential exists on either side of piston **912** in a filling operation. Accordingly, piston **912** moves in the direction of the reduced pressure until it meets piston stop **916**. At the moment piston **912** contacts stop **916**, the filling operation will be completed with the desired amount of fluid entering container **5**. Subsequently, when filling heads **910** on walking beam **110** are actuated by valve stems **4** on containers **5**, cam **817** on shaft **580** will actuate finger **813** causing fluid to flow into passage **922** causing piston **912** to travel the length of the piston permitted by stops **916**. It will be observed that as the valve in filling heads **910** are opened, fluid pressure in the system will drop on one side of piston **912** allowing movement of piston **912**. The pressure on the opposite side of piston **912** is maintained, however, due to the opening of valve **810** by finger **813** which is actuated by a cam **817** to allow fluid to enter into member **911**.

OPERATION

In operation, apparatus **10** is initially adjusted to the height and diameter of the container to be filled. These adjustments involve movement of bolts **62** which serve to provide horizontal adjustment and actuation of lift means **24** located on each post **21** to provide vertical adjustment.

Containers **5** pass through apparatus **10** in a linear path and at constant speed. The bottoms of the containers **5** sit on lugs **4** attached to conveyor chain **30** FIGS. **1**, **12**). The containers are supported in a desired spaced position by discs **73** attached to chains **54** (FIGS. **5**, **13**, **14**).

As the containers pass through apparatus **10**, walking beams **101**, **110**, each of which have a plurality of filling heads **910** attached thereto, travel in orbital paths relative to the path of containers **5**. A portion of each path will find beams **101** and **110** located over containers **5** (FIGS. **3**, **17**, **18**) at which time cam **402** will cause followers **401** to move downward which in turn causes downward movement of dancer beam **301** and walking beams **101**, **110** and filling heads **910** (FIGS. **21**, **22**). When a beam such as beam **110** is located in a fill position (FIG. **3**) the path of cam **402** is such that it will cause valve stems **4** in containers **5** to open valves in filling heads **910** thereby allowing fluid to flow into containers **5**. As fluid flows into container **5**, piston **912** travels along the length of piston member **911** until it contacts stop **916** which regulates the amount of fluid that will flow into container **5**.

As piston **912** moves along member **911**, cam **817** on shaft **581** (FIG. **26**) causes actuation of finger **813** which opens valve **810** to allow fluid to flow into passages **808**, **820** and **922** so that the pressure on the remaining side of piston **912** is maintained as piston **912** travels along member **911**. Seals **940** on piston **912** serve to prevent fluid on one side of the piston passing to the opposite side of the piston.

After the filling heads **910** have completed their filling operation, cam follower **401** will reach a high point on cam **402** and air springs **103** will lift dancer beam **301**, beams **110**, **101** and filling head **910** upward. When walking beam **101** reaches that portion in its orbital path where it is in a filling position over containers **5**, cam follower **401** will again be forced downward by cam **402** and another filling operation will occur.

As a result, a plurality of containers are filled at one time as they travel at constant speed in a linear path through apparatus **10**. Containers of different heights and shapes can be accommodated in the apparatus of the present invention. Moreover, apparatus **10**, with minor adjustments of heads **910**, can be employed to inject both the product and the propellant into containers by utilizing an apparatus **10** to inject the product and further downstream a second apparatus **10** can inject the propellant.

While the filling head **910** of the present invention are shown connected to metering pumps **900**, they could, depending upon a particular application, be connected to a regulated gas pressure source such as car-

bon dioxide or nitrous oxide. The containers would then be filled until the pressure in the containers equals the pressure in the gas source. The filling operation can be readily regulated to occur in the time period that is required for container **5** to pass through apparatus **10.**

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom as modifications will be obvious to those skilled in the art.

What is claimed is:

1. An apparatus for fluid filling of containers traveling in a linear path and at a continuous motion, said apparatus comprising:

means for conveying containers to be filled in a linear path along the length of said apparatus;

means for supporting and maintaining each of said containers in spaced position from adjacent containers;

a dancer beam assembly means adapted for vertical reciprocating movement, said dancer beam assembly means positioned above said conveying means;

at least one walking beam means attached to said dancer beam assembly means;

said walking beam assembly means including drive means whereby said walking beam assembly means is adapted to move in an orbital path, a portion of said path being linear and in vertical alignment with the linear path of said containers when containers pass through said apparatus; and,

filling means connected to said walking beam assembly means for fluid filling containers when containers pass through said apparatus.

2. An apparatus in accordance with claim **1** further including means for adjusting said container support means whereby containers of different sizes can be passed through said apparatus.

3. An apparatus in accordance with claim **1** further including means for adjusting the vertical location of said dancer beam assembly means relative to said container conveying means whereby containers of different heights can be passed through said apparatus.

4. An apparatus in accordance with claim **1** further including metering pump means for metering the amount of fluid to be filled in a container passing through said apparatus.

5. An apparatus in accordance with claim **4** wherein said metering pump means are connected to said filling means on said first and second walking beam assembly means.

6. An apparatus in accordance with claim **1** further including a second walking beam assembly means attached to said dancer beam assembly means including drive means for walking beam assembly means whereby said second walking beam assembly means is adapted to move in an orbital path, a portion of said path being linear and in vertical alignment with the linear path of said containers; and,

filling means connected to said second walking beam assembly means for fluid filling containers when said containers pass through said apparatus.

7. An apparatus for fluid filling of container traveling in a linear path and at a constant speed, said apparatus comprising:

conveyor means for conveying containers to be filled in a linear path through said apparatus;

means adapted for supporting and maintaining containers in equally spaced relationship to each other along said linear path;

a dancer beam assembly means disposed above said container conveying means;

said dancer beam assembly means including means for providing vertical reciprocating movement to said dancing beam assembly means;

a first walking beam assembly means attached to one side of said dancer beam assembly means;

a second walking beam assembly means attached to the opposite side of said dancer beam assembly means;

drive means associated with each of said walking beam assembly means for causing each of said walking beam assembly means to travel in a substantially orbital path, a portion of said path being a linear path in vertical alignment to the linear path of said containers when containers pass through said apparatus;

filling means located on each of said walking beam assembly means for filling containers when containers pass through said apparatus.

8. An apparatus in accordance with claim **7** further including means for adjusting said container support means whereby containers of different sizes can be passed through said apparatus.

9. An apparatus in accordance with claim **8** further including means for adjusting the vertical location of said dancer beam assembly means relative to said container conveying means whereby containers of different heights can be passed through said apparatus.

10. An apparatus in accordance with claim **7** and further including metering pump means associated with said filling means on each of said walking beam assemblies for metering the fluid fill to containers to be filled.

11. An apparatus in accordance with claim **10** wherein said metering pump means includes a cylindrical piston member;

a piston disposed within and adapted to slide along the length of said piston member;

said piston having means for precluding fluid to pass from one end of said piston to the remaining end of said piston;

at least one adjustable piston stop located at one end of said piston member for limiting the length of piston travel in said piston member;

piston cap means located at each end of said piston member;

fluid passage means located in each end of said cap means for the ingress and egress of fluid in said piston member;

said fluid passage means being connected to a second fluid passage means leading to said container filling means on said walking beam assembly means and to a third fluid passage leading to a source which supplies fluid to said metering pump means.

12. An apparatus in accordance with claim **7** wherein said container supporting means comprise a first endless chain means located on one side of said container conveyor means;

a second endless chain means located on the opposite side of said container conveying means;

a plurality of disc means attached to said first and second endless chain means whereby two adjacent discs on said first endless chain means mate with

two corresponding adjacent disc means on said second endless chain means whereby said four disc means are adapted to contact a container and maintain its position as said container passes through said apparatus.

13. An apparatus in accordance with claim **12** wherein said disc means are located above said container conveyor means whereby said disc means will normally contact a container side wall.

14. An apparatus in accordance with claim **12** and further including means for moving said first and second endless chain means relative to each other whereby the space between said first and second endless chain means can be adjusted to permit containers of different sizes to be passed through said apparatus.

15. An apparatus in accordance with claim **7** wherein said filling means on each of said walking beam assembly means includes at least one filling head adapted to contact and fill a container.

16. An apparatus in accordance with claim **15** wherein each of said walking beam assembly means includes a walking beam having a plurality of filling heads spaced along the length of said walking beam.

17. An apparatus in accordance with claim **16** wherein said filling heads are evenly spaced along the length of said walking beams.

18. An apparatus in accordance with claim **7** wherein said dancer beam assembly means is biased in a normally upward position.

19. An apparatus in accordance with claim **18** wherein said dancer beam assembly means further included a dancer beam which extends along substantially the length of said apparatus, said dancer beam being positioned over and in substantial alignment with said container conveyor means;

biasing means located at each end of said dancer beam for biasing said dancer beam in an upward position;

cam means disposed above said dancer beam;

cam follower means attached to said dancer beam and associated with said cam whereby said cam means having a cam path adapted to force said cam follower means and dancer beam assembly means downward in the direction of said container conveying means.

20. An apparatus in accordance with claim **7** and further including a vacuum means associated with said filling means for drawing a vacuum on containers when containers pass through said apparatus.

21. The method of fluid filling containers according to the steps of:

conveying a plurality of containers to be filled in a linear path and at constant speed past a container filling station;

simultaneously driving a multiple outlet fluid filling means in an orbital path normally vertically spaced from said containers, a portion of said path being linear and in alignment with said linear path of said containers to be filled;

reducing the vertical distance between said filling means and containers to be filled; and,

filling said plurality of containers simultaneously while said filling means and containers have the vertical distance between them reduced.

22. The method of filling containers in accordance with claim **21** and further including the step of moving said filling means following a filling operation to return to its normal position.

23. The method of filling containers in accordance with the method of claim **22** and further including the step of metering the amount of fluid to be put into a container in the course of a filling operation.

24. The method of fluid filling containers according to claim **21** and further including the step of raising said filling means relative to said containers following a filling operation.

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