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(71) Applicant *(for all designated States except US)*: **GEORGIA CROWN DISTRIBUTING CO.** [US/US]; 100 Georgia Crown Drive, McDonough, GA 30253 (US).

(71) Applicant and
(72) Inventor: **BELL, James, Clayton** [US/US]; 55 Tamme Road, Blue Ridge, GA 30513 (US).

(74) Agent: **SOVINSKI, Sandra**; Kaplan Ward & Patel LLC, 3100 Cumberland Blvd., Suite 1400, Atlanta, GA 30339 (US).

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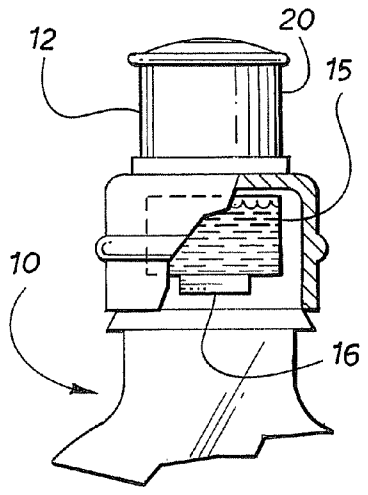
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Fig. 8



(57) Abstract: A packaged bottle beverage has a base component of the beverage in a container under vacuum separate from an additive in a sealed compartment of an ingredient release closure. Upon opening the sealed compartment, suction is created forcing the additive to quickly and thoroughly exit the ingredient release closure, a region of relatively higher pressure, and flow into the base component in the container, a region of relatively lower pressure.

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A PACKAGED BOTTLE BEVERAGE HAVING AN INGREDIENT RELEASE CLOSURE WITH IMPROVED ADDITIVE RELEASE AND METHOD AND APPARATUS THEREOF

PATENT COOPERATION TREATY APPLICATION IN THE RECEIVING OFFICE OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

Be it known that I, James Clayton Bell, a citizen of the United States of America, have invented certain new and useful improvements in a packaged bottle beverage having an ingredient release closure with improved additive release and method and apparatus thereof, of which the following pages comprise the specification.

PRIORITY CLAIM AND CROSS REFERENCES

To the fullest extent permitted by law, the present application claims priority to and the benefit as a patent cooperation treaty application to U.S. non-provisional application, serial no. 12/103,916, entitled A PACKAGED BOTTLE BEVERAGE HAVING AN INGREDIENT RELEASE CLOSURE WITH IMPROVED ADDITIVE RELEASE AND METHOD AND APPARATUS THEREOF, and filed April 16, 2008, on behalf of inventor James Clayton Bell and Assignee Georgia Crown Distributing Co.

TECHNICAL FIELD

The present disclosure relates generally to packaged bottled beverages, and, more particularly, to such packaged

bottled beverages having closures which contain compartments therein with additives for release into the bottles upon latter opening of the bottles by consumers and methods and apparatuses for same.

BACKGROUND

Consumers have become increasingly particular with respect to the freshness of food and beverage products. As a result, food and beverage manufacturers have developed packaging which provides such freshness by allowing consumers to mix additional ingredients immediately prior to consumption. For example, yogurt containers are provided with lids having sealed compartments for storing additives such as granola, dried fruit, sugared confections and the like. The consumer opens the sealed compartment and mixes the additives with the yogurt immediately prior to consuming.

Beverage manufacturers are desirous of providing the same experience for consumers with respect to incorporating additives, such as flavors, vitamins, natural ingredients and the like, to base components of beverages immediately prior to consumption. Numerous closures for packaged bottled beverages have been developed which contain a compartment for storing additives. These ingredient release closures have various mechanisms to release the additives. For example, some

ingredient release closures contain a frangible seal which may be broken, such as by puncturing, cutting or tearing, to release the ingredient. The frangible seal is typically designed to be broken before the closure is detached from the container, thus allowing the additive stored within the ingredient release closure to combine with the base component of the beverage with minimal spillage of the additive onto a nearby surface or the consumer. Other ingredient release closures utilize plunger type mechanisms which seal an opening between the body of the container and the compartment containing the additive. Upon moving the plunger, the additive is released into the base component of the beverage.

Regardless of the mechanism for releasing the additive into the container, the additive must be sufficiently and quickly eliminated from the ingredient release closure to insure a quality product for the consumer. Sufficient elimination depends in part on construction of the ingredient release closure. The ingredient release closure should be designed to have minimum obstructions between the opening of the compartment and the body of the container, allowing for open flow of the additive from the ingredient release closure into the container. The viscosity of the additive also plays a role in elimination because of its effect on the flow of the additive. Higher viscosity additives, such as those with a syrupy consistency, may have a slower flow rate as compared to

lower viscosity additives, such as those with a watery consistency. Problems in managing the flow rate are complicated if the ingredient release closure has an obstructive configuration.

Thus, there exists a need in the art to develop a solution for improving the flow rate of additives such that, when released from an ingredient release closure, such additives may be sufficiently and quickly eliminated so as to immediately mix with the base components in containers.

BRIEF SUMMARY

Briefly described, in a preferred embodiment, the present device overcomes the above-mentioned disadvantages and meets the recognized need by providing a packaged bottled beverage with superior additive delivery having a base component of the beverage in a container under vacuum and separate from an additive in a sealed compartment of an ingredient release closure. Upon opening of the sealed compartment, suction is created forcing the additive to quickly and thoroughly exit the ingredient release closure, a region of higher pressure, and flow into the base component in the container, a region of lower pressure.

Accordingly, one feature and advantage of the present disclosure is its ability to provide a method of improving the delivery of an additive contained within a sealed compartment of an ingredient release closure into a base component of a beverage contained within a vessel of a container by applying compression to the outer surface of the vessel during the capping process to create a vacuum in the container.

Another feature and advantage of the present disclosure is its ability to provide a container closing apparatus in a filling plant that efficiently applies compression to a container during capping, thus creating vacuum within the sealed container.

Yet another feature and advantage of the present disclosure is its ability to provide a system and method for sanitizing of a container cap, wherein cleanliness of a pre-filled cap is assured without any adverse affect to the quality or taste of a packaged bottle beverage.

These and other features and advantages of the present disclosure will become more apparent to those ordinarily skilled in the art after reading the following Detailed Description and Claims in light of the accompanying drawing Figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Accordingly, the present disclosure will be understood best through consideration of, and with reference to, the following drawing Figures, viewed in conjunction with the Detailed Description referring thereto, in which like reference numbers throughout the various Figures designate like structure, and in which:

Fig. 1A is a side view of a container of the present disclosure;

Fig. 1B is a side view of a packaged bottled beverage of the present disclosure;

Fig. 2 is a cross-sectional view at line 2-2 of the container of **Fig. 1A;**

Fig. 3 is a cross-sectional view at line 3-3 of the packaged bottled beverage of **Fig. 1B;**

FIG. 4 is a schematic illustration of a capper star wheel mechanism employed in the apparatus and method of the present disclosure;

Fig. 5 is a perspective view of a container entering a container closing apparatus according to the apparatus and method of the present disclosure;

FIG. 6 is a top perspective view of an adjustable rail employed in the apparatus and method of the present disclosure;

Fig. 7 is a perspective view of a container in contact with the adjustable rail of the container closing apparatus according to the apparatus and method of the present disclosure;

Fig. 8 is a cut away view of an ingredient release closure sealed to the top of a container;

Fig. 9 is a schematic illustration of a metering pump and treatment storage unit for use with the cap treatment mechanism of **Figs. 10** and **11**;

Fig. 10 is a schematic illustration of a cap treatment mechanism employed in the apparatus and method of the present disclosure; and

Fig. 11 is a side view of a portion of the cap treatment mechanism of **Fig. 10**, showing treatment being dispensed into a cap.

It is to be noted that the drawings presented are intended solely for the purpose of illustration and that they are, therefore, neither desired nor intended to limit the invention to any or all of the exact details of construction

shown, except insofar as they may be deemed essential to the claimed invention.

DETAILED DESCRIPTION

To the fullest extent permitted by law, the present application claims priority to and the benefit as a patent cooperation treaty application to U.S. non-provisional application, serial no. 12/103,916, entitled A PACKAGED BOTTLE BEVERAGE HAVING AN INGREDIENT RELEASE CLOSURE WITH IMPROVED ADDITIVE RELEASE AND METHOD AND APPARATUS THEREOF, and filed April 16, 2008, on behalf of inventor James Clayton Bell and Assignee Georgia Crown Distributing Co.

In describing preferred embodiments of the present device and method illustrated in **FIGS. 1-11**, specific terminology is employed for the sake of clarity. The disclosure, however, is not intended to be limited to the specific terminology so selected, and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner to accomplish a similar purpose.

The present disclosure addresses the performance of packaged bottled beverages that have the additional feature of ingredient release closures containing additives providing consumers with freshly mixed beverages immediately prior to consumption. To insure quality performance of such packaged

bottled beverages, the delivery outcome should result in sufficient and quick elimination of the additive from ingredient release closures. Regardless of the structure of ingredient release closures, this outcome may be achieved by providing in one preferred embodiment of the invention a packaged bottled beverage comprising: (a) a beverage comprising a base component and an additive; (b) a container comprising an opening for receiving an ingredient release closure and a vessel containing the base component; (c) the ingredient release closure comprising a sealed compartment containing the additive, a release mechanism for dispensing the additive and attaching means for attachment to the opening of the container; and (d) the attaching means of the closure attached to the opening of the container to form a packaged bottled beverage; wherein the base component is contained under vacuum in the container. In operation, the vacuum in the container creates a pressure differential between the base component and the additive in the ingredient release closure. Upon releasing the additive from the ingredient release closure using the release mechanism and prior to opening the packaged bottle beverage for drinking, the vacuum sufficiently and quickly pulls or draws the additive out of the ingredient release closure to provide a freshly mixed beverage with no spilling or leaking of the base component or additive. A pressure differential between a region of relatively higher pressure, i.e. the additive in the ingredient release closure,

and a region of relatively lower pressure, i.e. the base component under vacuum in the container, enables a suction force between the ingredient release closure and the container to pull or draw the additive from the ingredient release closure into the base component in the container. Further, the additive preferably efficiently discharges from the ingredient release closure whereby minimal residual additive remains in the ingredient release closure.

The base component of the beverage may be water, tea, juice, energy drink or the like. The additive may be one or more flavors, vitamins, energy enhancements, natural ingredients or the like and may be in liquid or powdered form. The container may be metal, glass, plastic or the like. Preferably, the container is made from a flexible plastic such as polyethylene terephthalate, commonly referred to as PET. The ingredient release closure may be of any construction having a sealed compartment for containing the additive and a release mechanism such as a plunger, a frangible seal, or the like. Further, the ingredient release closure may be a sports type closure. The attaching means may be a crimped seal, a threaded seal or the like which provides a sufficient seal to prevent ingress of external gases; thereby, undesirably reducing the vacuum in the container. The vacuum may be formed by applying compression to an outer surface of the vessel, by a vacuum pump, by a vacuum chamber, or the like.

With reference to **Figs. 1A** and **1B**, packaged bottled beverage **10** comprises container **11** and ingredient release closure **12**. Container **11** preferably is made of flexible plastic, such as polyethylene terephthalate or the like. Container **11** has vessel **13** for holding the base component of a beverage and opening **14** for receiving ingredient release closure **12**. Best seen with reference to **Fig. 1B** and **Fig. 8**, ingredient release closure **12**, as shown, is preferably a sports closure having sealed compartment **15**, release mechanism **16** and spout **20**. **Fig. 1A** represents container **11** when filled with the base component and prior to application of ingredient release closure **12**. Vessel **13** has a circular cross-sectional shape in label panel area **17** along line 2-2 of **Fig. 1A**, as shown in **Fig. 2**. **Fig. 1B** represents packaged bottled beverage **10** with ingredient release closure **12** attached to container **11** under vacuum. Under vacuum, in one method of the present disclosure as more fully described below, the cross-section in label panel area **17** is altered by vacuum pressure forces which transform the circular cross-sectional shape into a square cross-sectional shape along line 3-3 of **Fig. 1B**, as shown in **Fig. 3**. Alternatively, the cross-sectional shape may take one of a variety of different forms, such as oval.

In use, the consumer activates ingredient release closure **12** by pulling up spout **20** to engage release mechanism **16** and transfer the additive into the base component of the beverage.

With other ingredient release closures available in the art, consumers may activate the release mechanism by twisting, applying pressure, or the like depending on the mechanical function of the release mechanism.

In one example, a 0.5 liter lightweight container **11**, which is made from 15 to 20 grams of PET, has a pre-vacuum diameter in label panel area **17** along line 2-2 of 6.35 centimeters. Under vacuum, the diameter is reduced to between 5.84 to 4.57 centimeters depending on the viscosity of the additive in ingredient release closure **12**. Using a correlation in percentages, the diameter of vessel **13** in packaged bottled beverage **10** is 95% to 65%, preferably 92% to 72%, of the original size diameter of vessel **13** prior to attaching ingredient release closure **12** to container **11**. For a 0.7 liter container with circular diameter of 6.92 centimeters, the diameter of packaged bottled beverage **10** would be preferably set to between 6.35 to 4.82 centimeters.

When using a 0.5 liter container **11** made from 20-25 grams of PET, the wall thickness of the vessel **13** is greater. As such, the cross-sectional shape of the vessel **13** may be oval rather than square. The resulting cross-sectional shape of vessel **13** depends upon the amount of compression applied during the capping process as further discussed below. For applications wherein container **11** is made of flexible plastic, the vacuum is preferably created by application of compression

to the outer surface of vessel **13**, which effectively reduces the diameter of vessel **13**. Alternatively, the vacuum is created utilizing a vacuum pump or vacuum chamber, which is effective for flexible and rigid containers alike.

In another preferred embodiment, a method for improving delivery of an additive contained within a sealed compartment of an ingredient release closure into a base component of a beverage contained within a vessel of a packaged bottled beverage comprises the steps of providing a container, a closure and a vacuum means. The container comprises (i) an opening for receiving a closure and (ii) a vessel containing a base component of a beverage. The closure comprises (i) a sealed compartment containing an additive, (ii) a release mechanism for dispensing the additive, and (iii) attaching means for attachment to the opening of the container. Preferably, in one simultaneous operation, the closure is attached to the opening of the container and a vacuum is created with the vacuum means to form a packaged bottled beverage with a container under vacuum. Preferably, the container is a flexible container and the vacuum means is provided by applying compression to an outer surface of the vessel of the container. The compression is preferably applied to the outer surface of the vessel by an adjustable rail having a decreasing arc from a point of initial contact with the container to a point of final contact with the

container. Other structures, such as plungers, projectors, opposing plates, rollers or the like, may be used to apply to the outer surface of the vessel. Alternatively, the vacuum means is provided by a vacuum pump or vacuum chamber.

With reference to **FIGS. 4-7**, another preferred embodiment of the invention shows container closing apparatus **40** in a bottled beverage filling plant, which conventionally includes rotatable capper star **41**, rotatable capper mechanism **42** (partially shown), and fixed rear guide **43** spaced radially outwardly from capper star **41** for retaining containers **11** within capper star **41**. Additional star wheel mechanisms are strategically situated to assist movement of containers **11** into and out of the capper star **41**. A transfer star **44** is mated to capper star **41** and feeds filled containers **11** into capper star **41** at inlet **45**. Discharge star **46** is mated to capper star **41** and transfers sealed containers **11a** from outlet **47** of capper star **41**. Both transfer star **44** and discharge star **46** have a rotatable star wheel mechanism having a plurality of pockets adapted to receive containers.

Capper star **41** is a rotatable star wheel mechanism having a plurality of capper pockets **48** adapted to receive containers **11** fed in an assembly line fashion thereto. Overlying capper star **41** is capper mechanism **42**, such as a turret capper head, which rotates in synchronism with wheel **49** of capper star **41**. Capper mechanism **42** has a plurality of

capper heads **50**, designed to apply ingredient release closures **12** to threaded neck **18** of containers **11** as shown in **Fig. 1A**. Best seen with reference to **Fig. 7**, capper heads **50** may employ a clutch mechanism whereby capper head **50** is rotated and driven axially downward at a predetermined force and torque limiting value to tighten ingredient release closures **12** onto threaded neck **18** of container **11**. Fixed rear guide **43** extends between inlet **45** and outlet **47** of capper star **41**. Fixed rear guide **43** is spaced radially outwardly from capper star **41** and functions to retain containers **11** in capper pockets **48** and in axial alignment with capper mechanism **42** as capper star **41** rotates. Capping mechanism **42** is preferably used to apply ingredient release closures **12** of the type having threading onto threaded neck **18** of containers **11**, such as plastic PET containers. Plastic container **11**, shown in **Fig. 1A**, is preferably of the type that has flange **19** extending radially outwardly from threaded neck **18** and positioned a spaced distance below threaded neck **18**.

In the operation of container closing apparatus **40**, filled containers **11** are rotated in a first direction by transfer star **44** to inlet **45** on capper star **41**, which rotates in a direction opposite the direction of rotation of transfer star **44**. Ingredient release closures **12** are supplied to filled containers **11** preferably through supply channel **100**, partially seen in **Fig. 8**, of capper mechanism **42**, but may also

already be placed on threaded necks **18** prior to entering capper mechanism **42**. Capper mechanism **42** has rotation means to attach ingredient release closures **12** to filled containers **11**. Sealed containers **11a** with tightened ingredient release closures **12** thereon are rotated out of capper star **41** at outlet **47** to discharge star **46** rotating in the same direction as transfer star **44** and from thence to a conveyor leading to further processing or handling equipment.

Upon entering container closing apparatus **40**, container **11** is received by capping star **41** in specially contoured capper pocket **48**, which is preferably semi-circular in shape and of a diameter similar to that of the diameter of container **11** which it engages. Best seen with reference to **Fig. 5**, container **11** is preferably held and suspended at threaded neck **18**, in which the underside of flange **19** rests on top on upper ledge **51** of capper pocket **48**. Panel **17** of container **11** is supported by fixed rear guide **43** of capper star **41** to hold container **11** in vertical alignment during the capping operation.

Adjustable rail **60**, as shown in **Fig. 6**, has arcuate member **61** having proximate end **62**, distal end **63**, curved inner wall **64**, and straight outer wall **65**. Fixed fastening means **66** is located at distal end **63** and adjustable fastening means **67** is located at proximate end **62**. With reference to **Fig. 4**, adjustable rail **60** is attached to fixed rear guide **43** with an

arc of decreasing radius relative to fixed rear guide **43**. The radius is decreased by securing fixed fastening means **66** near inlet **45** of capper star **41** and securing adjustable fastening means **67** near outlet **47** of capper star **41**. Fixed fastening means **66** preferably is a nut and bolt that passes through a hole of substantially the same diameter. Adjustable fastening means **67** preferably is a nut and bolt that passes through a slot, which allows for adjustment of arcuate member **61** at a decreasing radius relative to the radius of fixed rear guide **43**. Adjusting the radius of arcuate member **61** is desirable for use with different size containers **11** or the need to vary the compression applied to containers **11**. Any type of fastening means well known in the art may be used for either adjustable fastening means **67** or fixed fastening means **66**.

With reference to **Fig. 4** and **Fig. 7**, as filled container **11** rotates in capper star **41**, adjustable rail **60** comes in contact with filled containers **11** at point **A**. Upon rotation of filled container **11** by capper star **41**, the radius of arcuate member **61** decreases causing adjustable rail **65** to exert compression on outer wall **21** of filled container **11**, as shown in **Fig. 7**. While compression is being applied, filled container **11** is capped with ingredient release closure **12** to form packaged bottled beverage **10** with container **11** under vacuum. Packaged bottled beverage **10** comes off adjustable rail **60** at point **B** and continues its rotation in capper star

41 until exiting at outlet 47 to discharge star 46. Upon exiting outlet 47, container 11 of packaged bottle beverage 10 changes in shape to adjust to the vacuum created therein. A standard packaged bottle beverage without internal vacuum has a circular cross-sectional shape as shown in **Fig. 2**. As the internal vacuum in container 11 of packaged bottled beverage 10 exerts negative pressure, the shape of container 11 adjusts preferably to a square cross-sectional shape as shown in **Fig. 3**.

In one embodiment of the present disclosure, ingredient release closures 12 are sanitized prior to placement on threaded necks 18, preferably while in supply channel 100. As generally depicted in **Figs. 10** and 11, ingredient release closures 12 are delivered to capper mechanism 42 by cap chute 102 of supply channel 100. In this preferred embodiment, and as representatively depicted in **Fig. 9**, supply channel 100 is adapted with metering pump system 104 and storage unit 105, wherein one or more spray nozzles 106 is installed proximate cap chute 102 to spray a metered dose of sanitizer 108 into ingredient release closures 12. According to the preferred embodiment, sanitizer 108 comprises peracetic acid (peroxyacetic acid, PAA); however, other antimicrobial agents with similarly high oxidizing potential, similar effectiveness against microorganisms, and/or other similarly desirable and food safe characteristics may alternately be utilized. The

metered delivery of sanitizer **108** by one or more spray nozzles **106** to ingredient release closures **12** proximately prior to placement on threaded necks **18** prevents the inclusion of any undesirable progenerate in packaged bottle beverage **10**, effectively sanitizing ingredient release closure **12**, yet without affecting taste of packaged bottle beverage **10**. Previously known cap sterilization systems, such as ozonated water baths, have not facilitated such an end result, but have been limitingly successful at dust removal from empty caps; nonetheless, such systems would disadvantageously impact the additive of ingredient release closure **12** if employed subsequent to complete assembly of ingredient release closure **12** and proximate to the time of capping of packaged bottle beverage **10**.

Having thus described exemplary embodiments of the present invention, it should be noted by those skilled in the art that the within disclosures are exemplary only and that various other alternatives, adaptations, and modifications may be made within the scope and spirit of the present disclosure. Accordingly, the present invention is not limited to the specific embodiments as illustrated herein.

WHAT IS CLAIMED IS:

1. A packaged bottled beverage comprising:

   a. a beverage comprising a base component and an additive;

   b. a container comprising an opening for receiving a closure and a vessel containing said base component;

   c. an ingredient release closure comprising a sealed compartment containing said additive, a release mechanism for dispensing the additive, and attaching means for attachment to said opening of said container;

   d. said attaching means of said ingredient release closure attached to said opening of said container to form a packaged bottled beverage,

   wherein said base component is contained under vacuum in said container.

2. The packaged bottled beverage of claim 1, wherein upon releasing said additive from said ingredient release closure using said release mechanism and prior to opening said packaged bottle beverage, suction is created pulling said additive from said

ingredient release closure into said base component in said container.

3. The packaged bottled beverage of claim 1, wherein said vacuum is formed by applying compression to an outer surface of said vessel.

4. A method for improving delivery of an additive contained within a sealed compartment of an ingredient release closure into a base component of a beverage contained within a vessel of a packaged bottled beverage comprising the steps of:

a. providing a container comprising (i) an opening for receiving a closure and (ii) a vessel containing a base component of a beverage;

b. providing a closure comprising (i) a sealed compartment containing an additive, (ii) a release mechanism for dispensing said additive, and (iii) attaching means for attachment to said opening of said container;

c. providing vacuum means; and

d. attaching said closure to said opening of said container and creating a vacuum with said vacuum means to form a packaged bottled beverage having said container under vacuum.

5. The method of claim 4 wherein said container is a flexible container and said vacuum means is provided by applying compression to an outer surface of said vessel.

6. The method of claim 5 wherein said compression is applied to said outer surface of said vessel by an adjustable rail having a decreasing arc from a point of initial contact with said container to a point of final contact with said container.

7. The method of claim 4 wherein said vacuum means is provided by a vacuum pump.

8. The method of claim 4 wherein said vacuum means is provided by a vacuum chamber.

9. A container closing apparatus in a filling plant configured to attach an ingredient release closure onto a container to provide for a sealed container under vacuum comprising:

   a. an inlet being configured and disposed to permit containers to enter a container closing apparatus;

   b. at least one capper mechanism being configured to attach an ingredient release closure onto a container to form a sealed container;

c. a container holding apparatus being configured and disposed to receive and hold said containers to permit ingredient release closures to be attached onto containers by said capper mechanism;

d. a means for creating a vacuum in the space inside said container during attachment of said ingredient release closure onto said container; and

e. an outlet being configured and disposed to permit sealed containers to exit said container closing apparatus.

10. The apparatus of claim 9, wherein said means for creating vacuum is an adjustable rail having an arc of decreasing radius from a point of initial contact with said container at said inlet to a point of final contact with said container at said outlet.

11. The apparatus of claim 9 wherein said means for creating said vacuum is a vacuum pump.

12. The apparatus of claim 9 wherein said means for creating said vacuum is a vacuum chamber.

13. A method of controlling cap cleanliness in a packaged bottle beverage system having an ingredient release

closure with improved additive release, comprising the steps of:

a. obtaining a plurality of sealed ingredient release closures;

b. obtaining a plurality of vessels adapted to receive said sealed ingredient release closures and filled with a beverage base component; and

c. spraying said plurality of sealed ingredient release closures with an antimicrobial solution proximately prior to attaching said ingredient release closures to said plurality of vessels.

14. The method of Claim 13, further comprising the steps of:

d. adapting a supply channel cap chute with a metering pump system and one or more spray nozzles; and

e. delivering a metered dose of said solution to said plurality of sealed ingredient release closures from said one or more spray nozzles.

15. The method of Claim 13, wherein said antimicrobial solution further comprises peracetic acid.

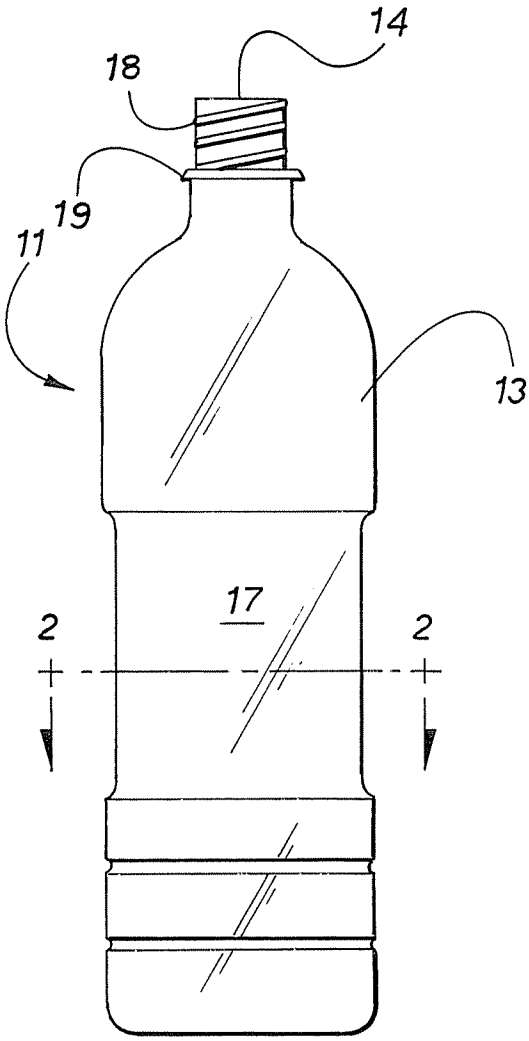


Fig_1A

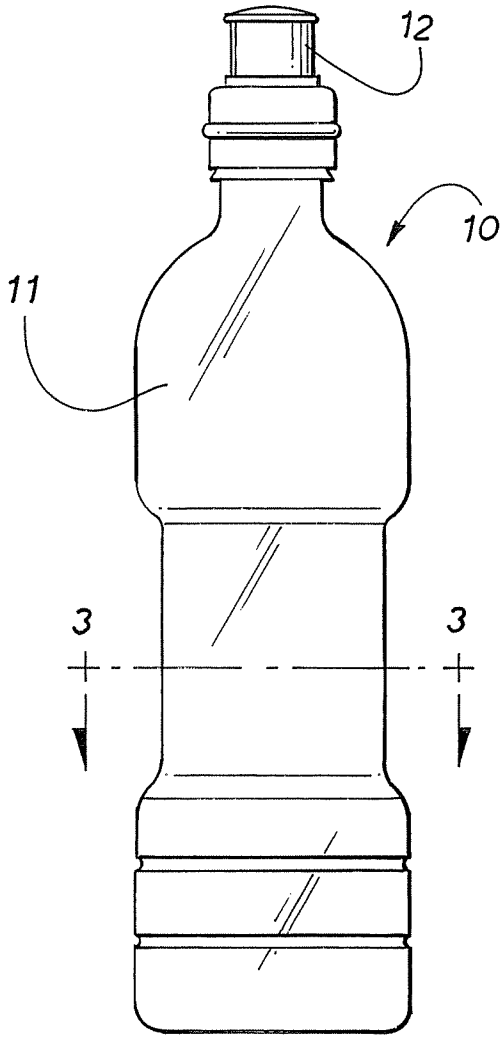


Fig_1B

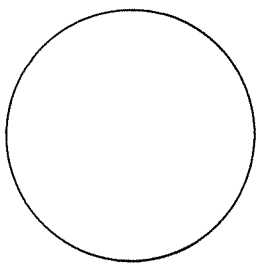


Fig_2

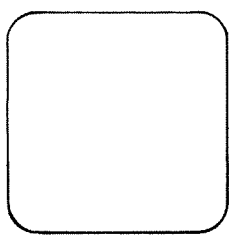


Fig_3

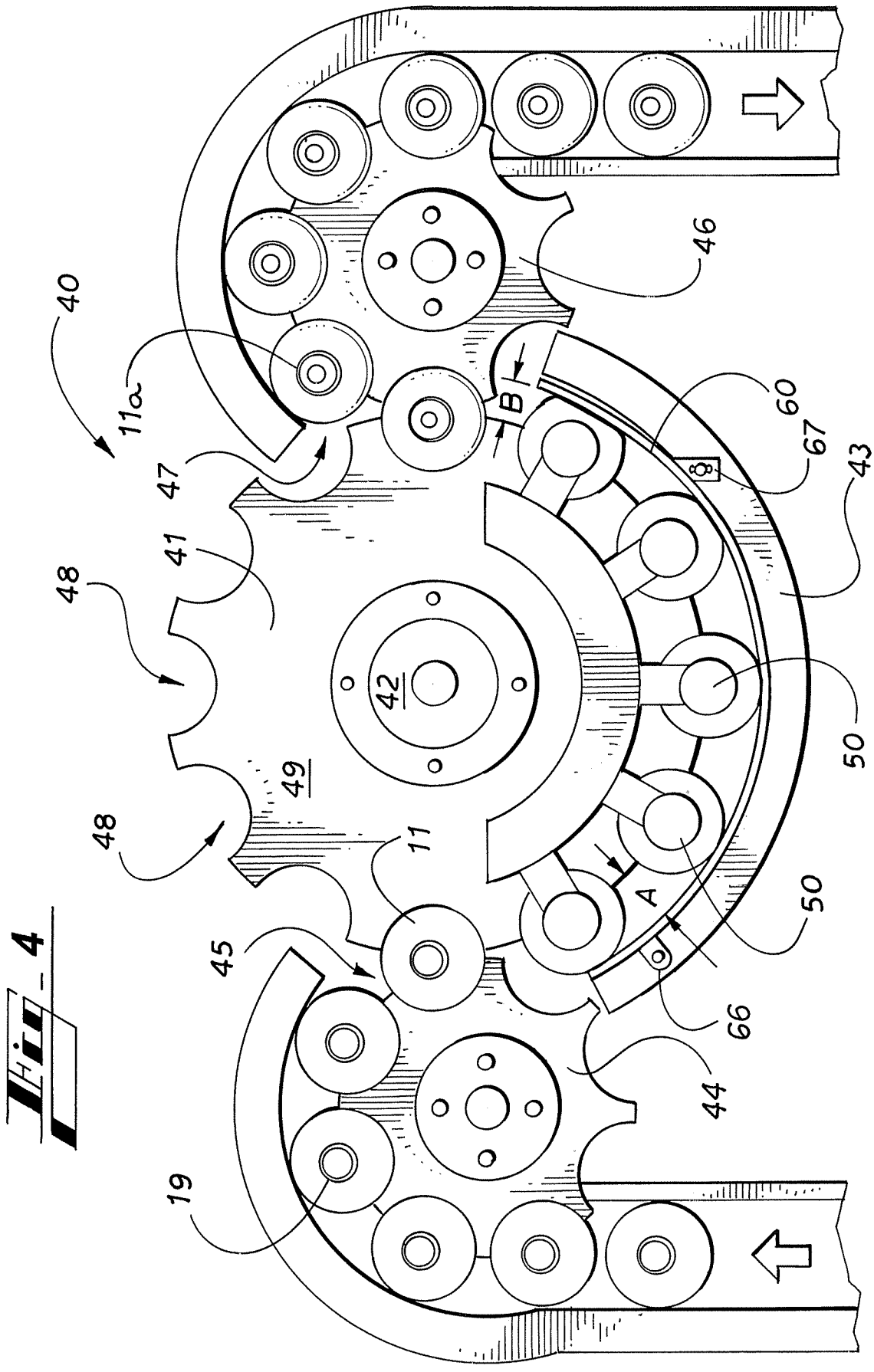


Fig. 4

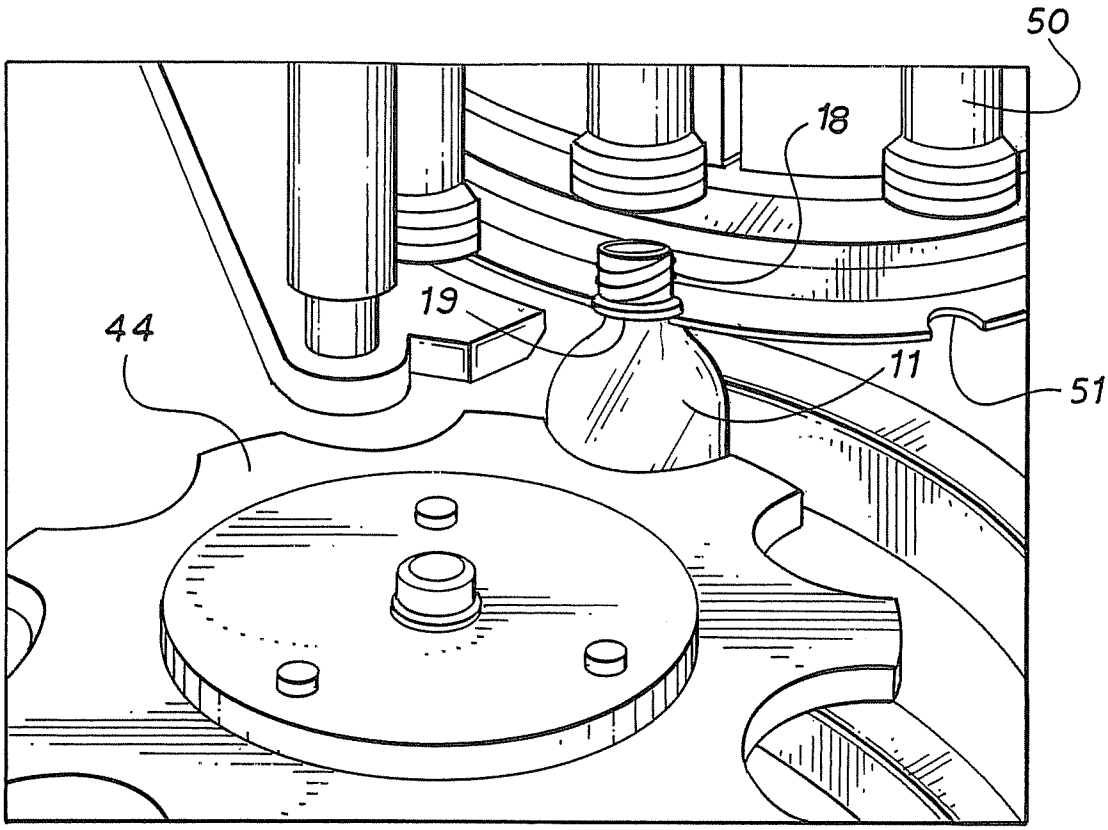


Fig_5

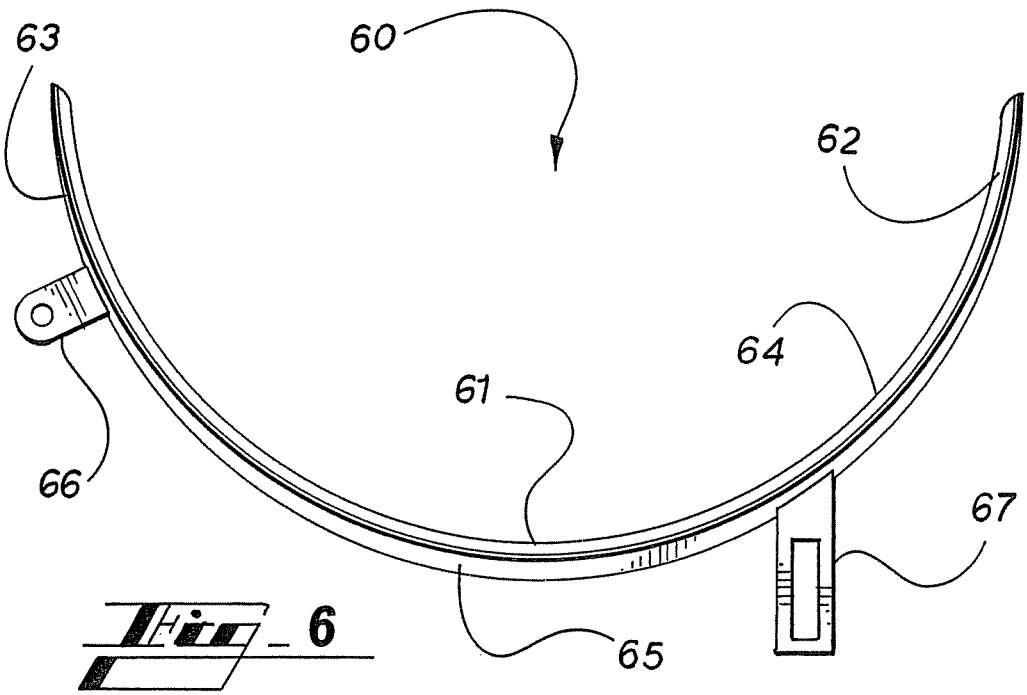


Fig_6

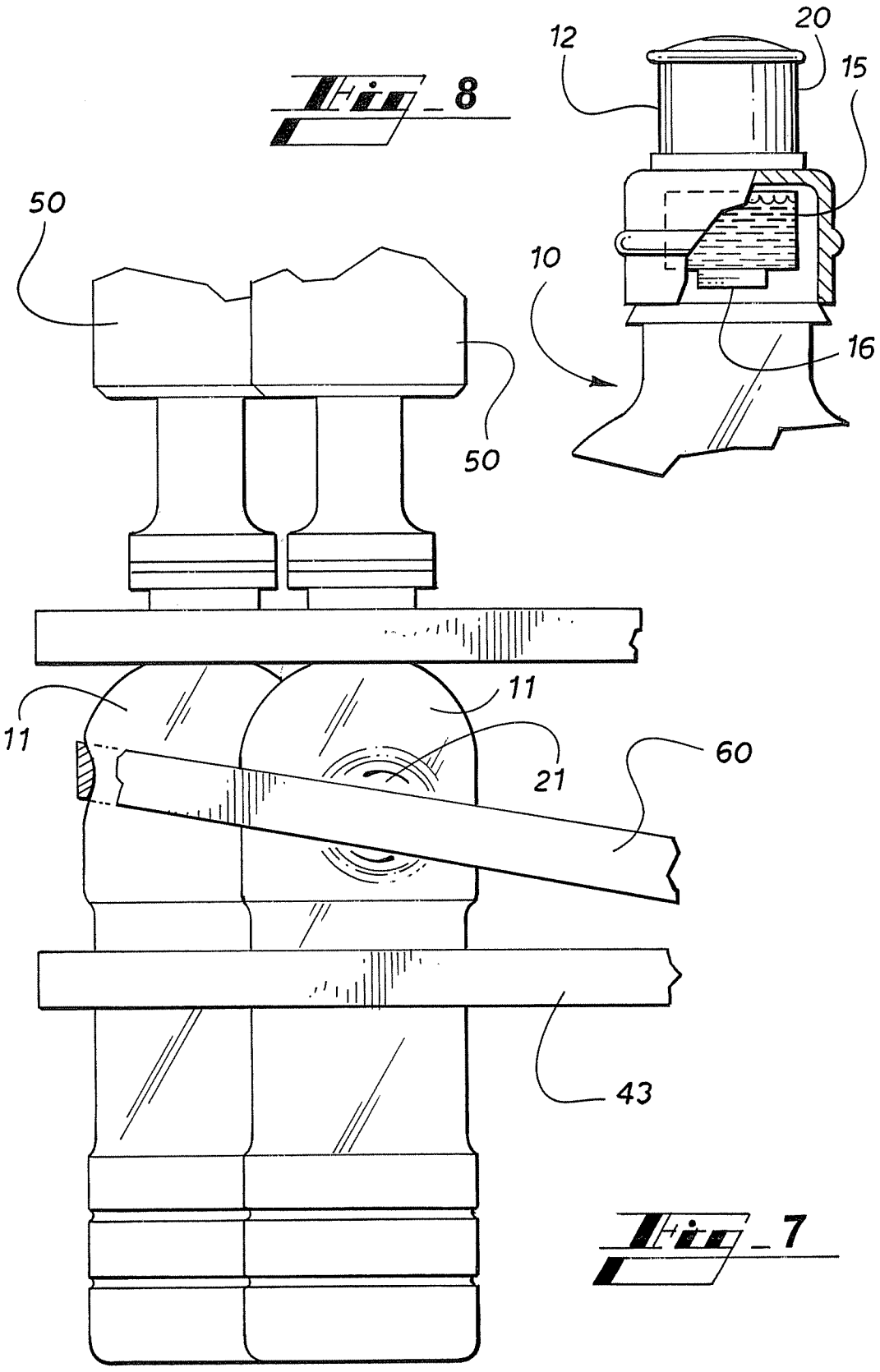


Fig_8

Fig_7

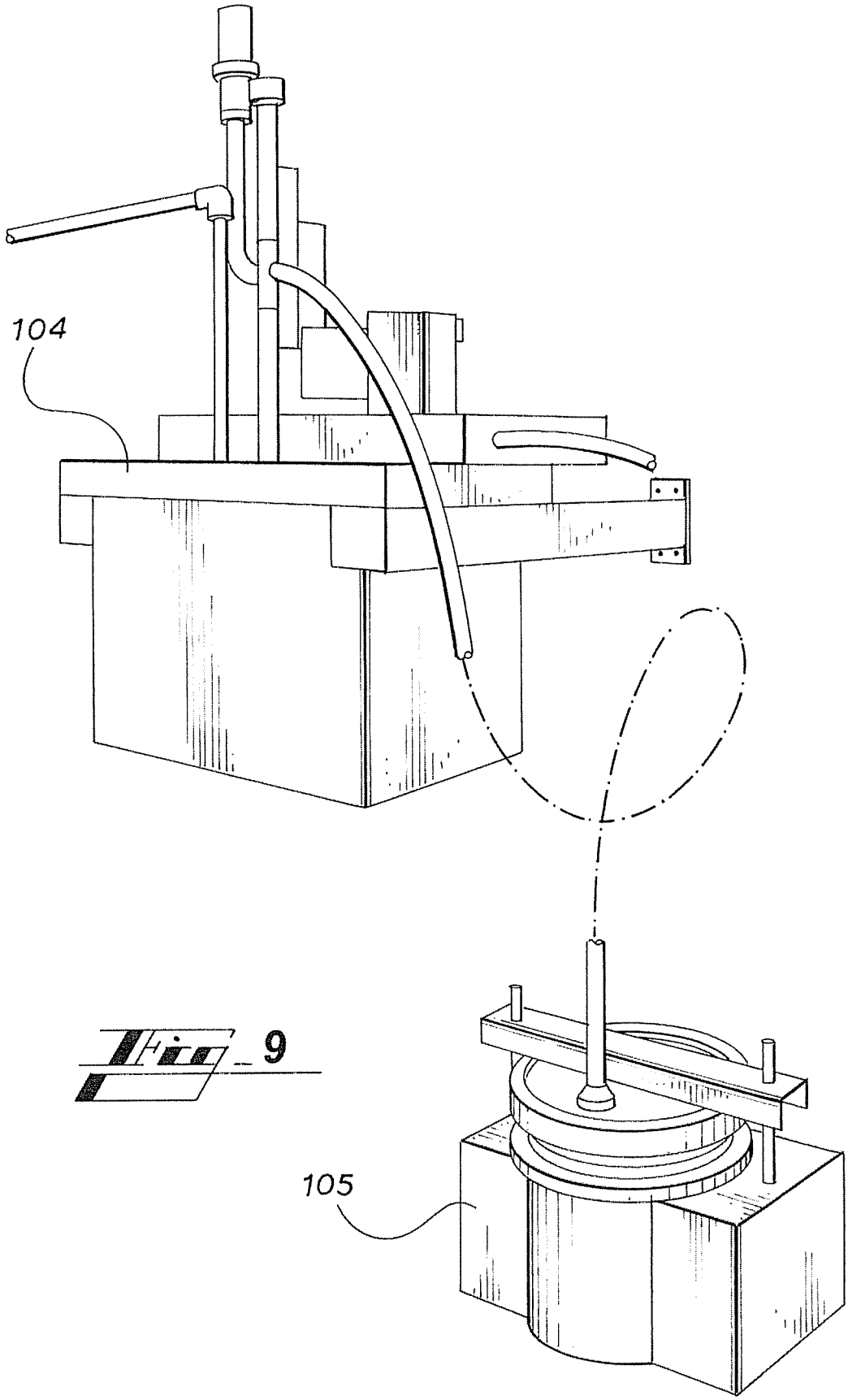


Fig. 9

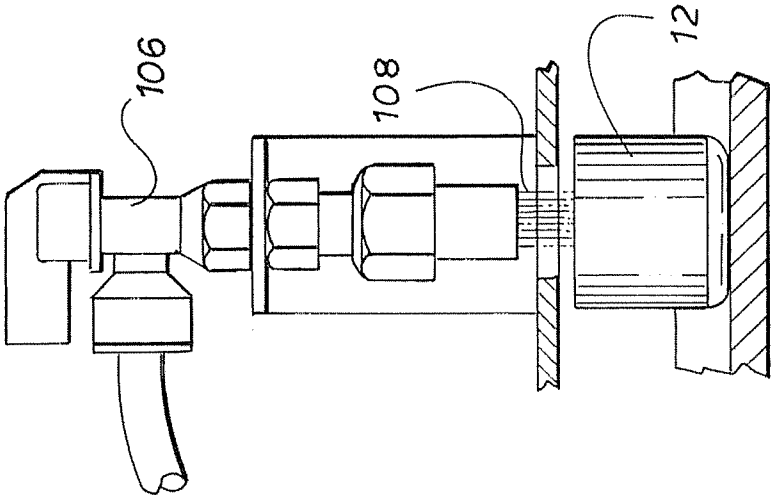


Fig. 11

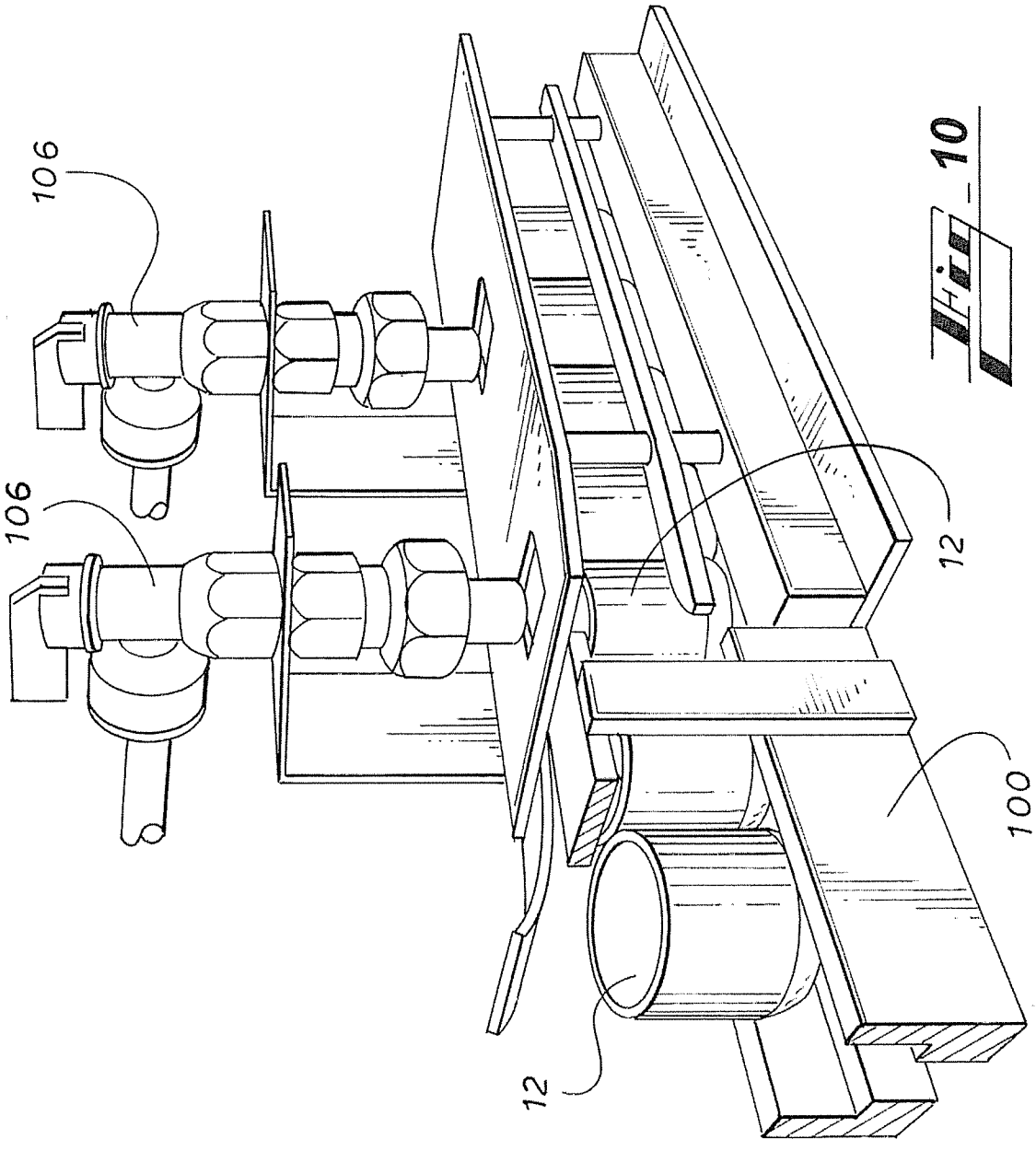


Fig. 10