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Samson et al.

[11] **3,807,131**

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[54] **LIQUID PACKAGING APPARATUS**

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[52] **U.S. Cl.** **53/281,** 141/25, 417/476

[51] **Int. Cl.** **B65b 3/26**

[58] **Field of Search** 53/281; 141/25; 417/475, 417/476

[56] **References Cited**

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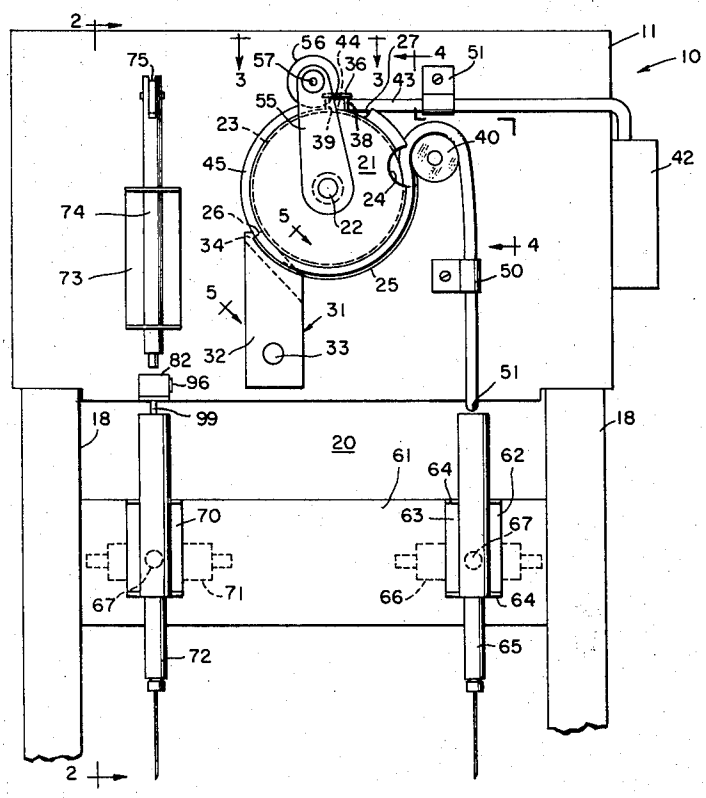
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Primary Examiner—Travis S. McGehee

[57] **ABSTRACT**

A carrier for a selectively variable length of tubing, and rolling means is peristaltic operating relation with the tubing to pump a predetermined quantity of liquid into a container. Closure applying means engage a closure element in closing relation with the container while venting the container to prevent internal pressure build-up.

2 Claims, 8 Drawing Figures



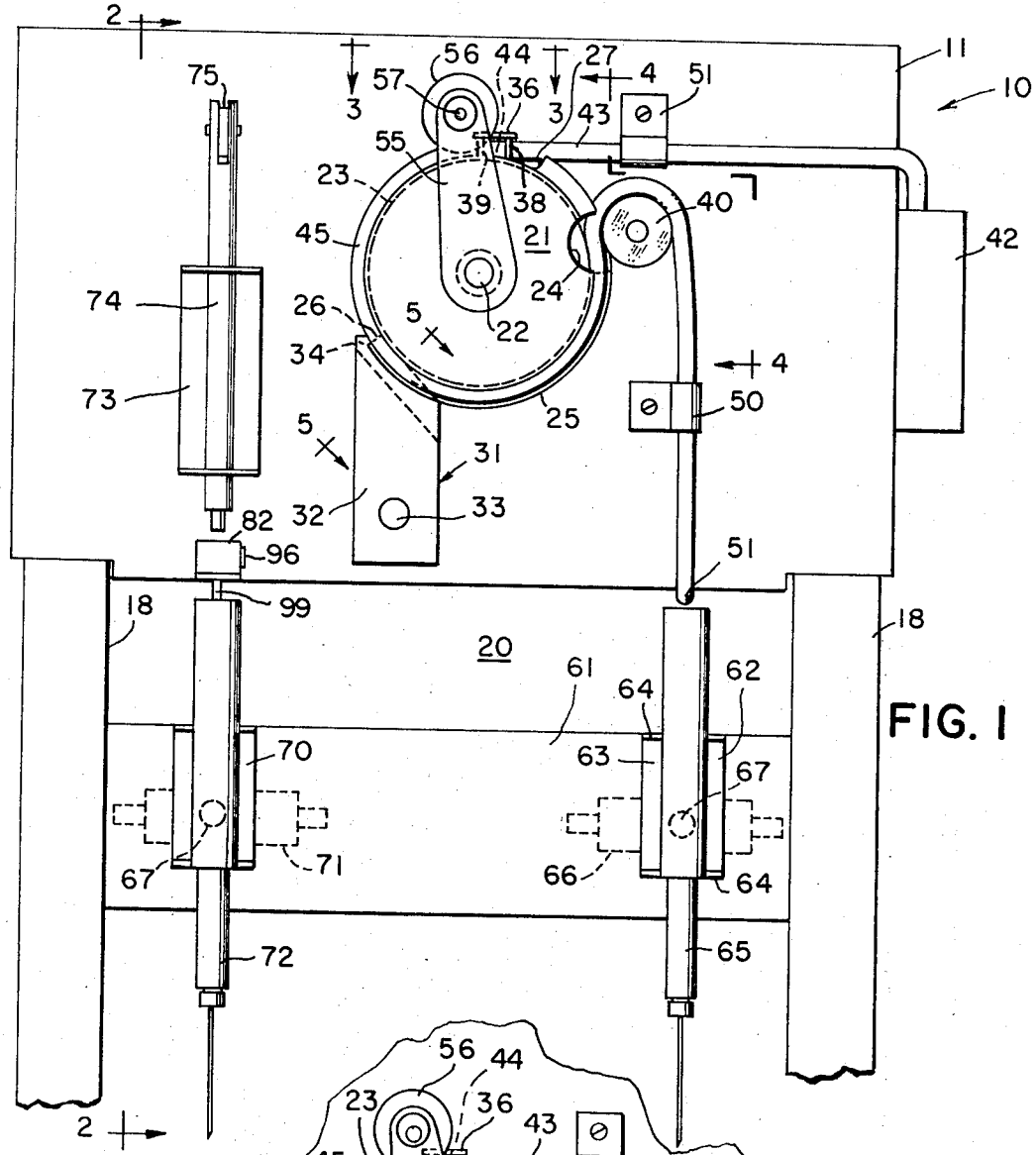

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FIG. 1

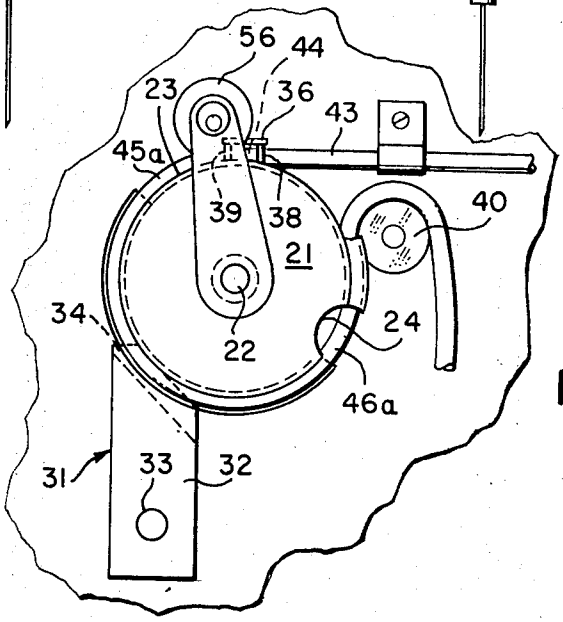

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FIG. 6

FIG. 2

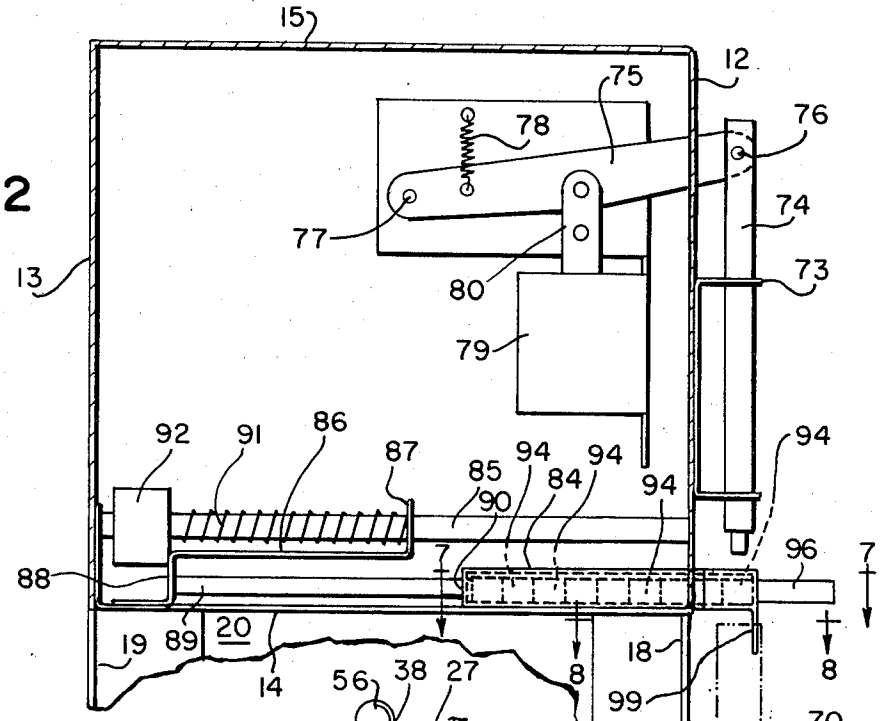
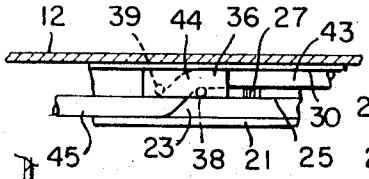


FIG. 3



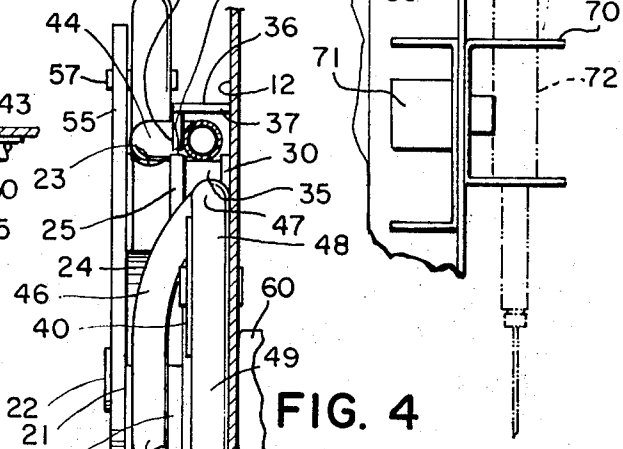


FIG. 4

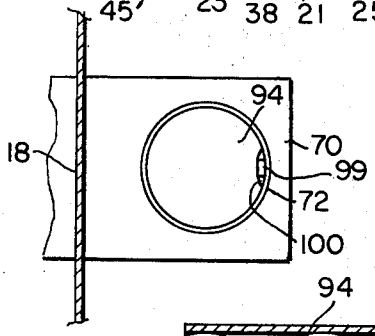


FIG. 8

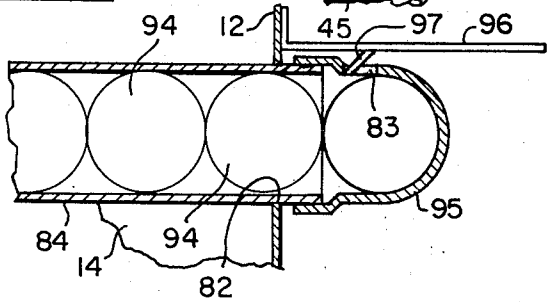


FIG. 7

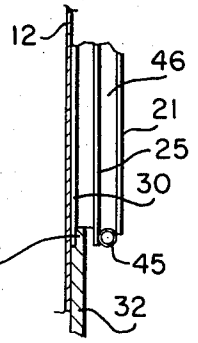


FIG. 5

LIQUID PACKAGING APPARATUS

BACKGROUND OF THE INVENTION

While the apparatus of the present invention has been primarily developed and employed for use in the packaging of hypodermic syringes, and particularly to syringes having the needle end closed before filling and the plunger inserted after filling, and will be illustrated and described hereinafter with particular reference thereto, it is appreciated that the instant apparatus is capable of many varied applications all of which are intended to be comprehended herein.

In the packaging of liquid in containers, such as liquid pharmaceuticals in syringes, accurate measurement of dosage has heretofore been quite expensive, requiring expensive metering pumps which are subject to malfunction and require frequent and careful sterilization and cleaning. Also employed to measure dosage in liquid packaging apparatus are timing devices, which are subject to the same problems of high cost and difficult maintenance.

Considering the package closing operation, the prior art devices generally applied the needle and needle holder to the syringe after filling, as by a spinning operation, which was necessarily slow and expensive.

SUMMARY OF THE INVENTION

It is therefore an important object of the present invention to provide liquid packaging apparatus adapted to package an accurately metered amount of liquid into a container such as a syringe, bottle or the like.

It is another object of the present invention to provide a liquid packaging apparatus which utilizes inexpensive, disposable materials, such that the cost of changing from the dispensing of one material to dispensing another material is reasonable and the procedure for changing is simple and expeditious.

It is a further object of the present invention to provide liquid packaging apparatus which is capable of applying a sealing closure to the fill opening of the package such that the sealing closure is dispensed from a sterilized cartridge and no parts of the apparatus touch the sterile portion of the closure.

More particularly, the present invention contemplates the provision of a liquid packaging device wherein a peristaltic or contractile tubing pump in which a given length of low cost disposable flexible tubing is successively compressed sequentially along its length by a roller, or the like, which in turn forces the fluid along the tubing and from the tubing into the container, to simultaneously draw additional liquid from a supply source into the tubing.

The apparatus of the instant invention permits of maintaining needle sterility by filling through the plunger end of the syringe, and further permits of plunger insertion without contamination thereof, so that presterilized syringes and components may be filled without loss of sterility.

It is still another object of the present invention to provide a liquid packaging apparatus having the advantageous characteristics mentioned in the preceding paragraph which is extremely simple in structure and operation, inexpensive to manufacture, and extremely reliable and dependable throughout a long useful life.

Other objects of the present invention will become apparent upon reading the following specification and

referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view showing packaging apparatus constructed in accordance with the teachings of the present invention.

FIG. 2 is a sectional elevational view taken generally along the line 2—2 of FIG. 1.

FIG. 3 is a partial horizontal view taken generally along the line 3—3 of FIG. 1.

FIG. 4 is a partial sectional elevational view taken generally along the line 4—4 of FIG. 1.

FIG. 5 is a partial sectional view taken generally along the line 5—5 of FIG. 1.

FIG. 6 is a partial front elevational view similar to FIG. 1, but showing a different position of adjustment.

FIG. 7 is a partial horizontal sectional view taken generally along the line 7—7 of FIG. 2.

FIG. 8 is a partial horizontal sectional view taken generally along the line 8—8 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and specifically to FIG. 1 thereof, the packaging apparatus is there generally designated 10 and includes a support structure 11. The support structure 11 may be fabricated as desired, say to include an upstanding front wall 12, an upstanding rear wall 13 spaced rearwardly from the front wall, see FIG. 2, and generally horizontal lower and upper walls 14 and 15 extending between lower and upper regions, respectively, of the front and rear walls. The support structure 11 may thus define a housing and be mounted in spaced relation over a supporting surface as by a pair of laterally spaced depending front legs or standards 18 depending from the front wall 12, and a pair of laterally spaced depending legs or standards 19 depending from the rear wall 13, see FIG. 2. Thus, the support structure or housing 11 is spaced over a workbench or other suitable horizontal supporting surface, as by an open region 20.

A carrier 21 is mounted on the forward side of front support wall 12, and may be disc-like, as of a circular or other suitable outline configuration. The generally disc-like carrier 21 is disposed in facing relation with the support wall 12, being secured thereto by a central or axial securement member or fastener 22. Thus, the carrier 21 is angularly adjustable about its axis coincident with pin, rod or axle 22 for selective location at a desired angular position.

Suitable means are provided for fastening or locking the generally circular carrier at the selected adjustment position, as will appear more fully hereinafter.

Extending along the carrier 21, along the periphery thereof, is a groove or track 23 which faces radially outwardly from the carrier periphery. The carrier track 23 is located in a generally vertical plane spaced forwardly from the front support wall 12, and may extend entirely about the circumference of the carrier except

for the region of a semicircular notch **24** formed in the periphery of the carrier.

As described hereinbefore, the peripheral track **23** may be formed by a radially outwardly facing groove extending circumferentially about the carrier **21** and interrupted by the cutout **24**. Further, a peripheral wall or flange **25** may extend along the inner or rear side of the track **23**, lying in a plane generally parallel to and spaced forwardly from the support wall **12** and extending at least partly about the circumference of the carrier, being interrupted by the carrier cutout or notch **24**. In the illustrated embodiment, the peripheral wall or flange **25** may extend more than 180° about the periphery of the carrier **21**, as between an end **26** (located approximately eight o'clock in FIG. **1**), and progressing thence counterclockwise to an end **27** (located approximately one o'clock). An additional peripheral wall or flange **30** projects radially outwardly from the tubing carrier **21**, extending along and substantially coterminus with the flange or wall **25**, but in inwardly or rearwardly spaced parallelism with the latter wall, lying substantially against the front support wall **12**. It is not essential that the rearward arcuate peripheral wall **30** be cut away at notch or recess **24**. Upon angular or rotative adjustment of the carrier **21**, the latter is selectively secured in position by clamping the flange or wall **30** against the support wall **12**. For this purpose there may be provided carrier securing means **31**, see FIG. **1**, which may include a block **32** selectively secured at one end to the forward support wall **12**, as by a fastener **33**, and having an extension or tongue **34** adapted to overlie an adjacent portion of flange **30** and clamp the latter against wall **12** upon tightening of the fastener **33**.

That is, the carrier **21** may include a generally cylindrical peripheral surface **35** extending circumferentially about the carrier, located in a plane spaced inward or rearward from the plane of groove or track **23**, being interrupted by the notch or recess **24**, and interposed between the partial peripheral walls **25** and **30**. The carrier securing means **31** may extend toward the cylindrical carrier surface **35** into a groove defined by the latter surface and the walls **25** and **30**.

An initial tubing guide **36** is mounted in fixed position on the support wall **12** at one location along the track means **23** on the periphery of tubing carrier **21**, being shown in the illustrated embodiment at the top or twelve o'clock position, and may include a forward projection or bracket **37** extending across and spaced above the cylindrical carrier surface **35**, see FIG. **4**, terminating just short of the peripheral groove or track **23**. Depending from the underside of the projection or bracket **37** of tubing guide **36** may be a pair of legs or pins **38** and **39** which extend toward and terminate short of the carrier, being located just inward or rearward of the track **23**.

Spaced angularly about the carrier **21** from the fixed initial tubing guide means **36**, being located adjacent to the carrier periphery at approximately two o'clock, as seen in FIG. **1**, is a terminal tubing guide member **40**, in the nature of a circular button or disc fixed to the support wall **12** generally coplanar with the cylindrical carrier surface **35**.

A resiliently flexible tubing or length of tube **41** has one end communicating with a fluid source **42**, such as a liquid pharmaceutical to be packaged. The tubing **41** may extend laterally, as through a tubing holder or clamp **51** secured on the support surface **12**, to maintain the tubing closely adjacent to the support surface. From the tubing holder **51** the tubing may extend, as at **43**, in the plane of cylindrical tubing carrier portion **35** toward the tubing guide **36**. At the tubing guide **36**, the tubing passes rearwardly or behind the pin **38**, and thence forwardly between the pins, as at **44**, into the plane of carrier groove or track **23**. Thus, the tubing region **44** offsets or doglegs the tubing into the plane of track **23**, and the tubing extends along and within the track generally counterclockwise, as at **45** to the carrier notch or recess **24**. Within the cutout or recess **24** the tubing traverses, as at **46**, from the plane of track **23** into the plane of cylindrical carrier surface region **35**. The inner cylindrical carrier region **35** may be considered as an inner peripheral carrier track, and the tubing may extend from the region **46** along the inner carrier track, as at **47**, and thence over and about the tubing guide member **40**, as at **48**. Thus, the notch **24**, inner track **35** and disc-like member **40** combine to define a tubing guide structure serving to guide and shift the tubing out of the plane of track **23** and into the plane of track **35**.

After passing over the guide member **40**, the tubing may depend, as at **49**, being held in position on the surface **12** by a tubing clamp or holder **50**. The tubing may terminate in an outlet end **51** located in the opening **20**.

An arm **55** may be located on the forward side of the carrier **21**, extending generally radially thereof, and having its inner end pivotally mounted, as by the central pin or shaft **22** for rotation coaxially of the carrier. On the outer end of the rotary arm **55** there may be provided a rotatable roller or wheel **56** pivotally mounted, as by pivot means **57** for rotation with the arm and rotation relative thereto in squeezing and closing engagement with the tube **41**. The roller or wheel **56** is located in the plane of track **23**, generally tangent thereto, and sized to effect rolling engagement with the tubing region **45** intermediate the initial tubing guide **36** and the terminal tubing guide means **24, 35, 40**. In this rolling engagement, the wheel or roller **56** effects complete collapse of the intermediate tubing region **45** at the location tangent to the track **23** and roller, which collapsed location proceeds along the entire length of tubing in the plane of track **23**. Thus, it will be appreciated that a peristaltic action is effected. The roller **56** is caused to stop in a position squeezing and closing the tube **41** to prevent undesired liquid movement when not filling, as by siphon action. The pivot **57** may be eccentric relative to the roller **56**, if desired, say for adjusting the roller relative to the tube, or for movement of the roller required in tube replacement.

Connected in driven relation with the shaft **22** and its arm **55** is a suitable dirve means **60**, such as a single revolution motor, or motor and single revolution clutch. Thus, the arm **55** is caused to make a single revolution, or a predetermined number of revolutions with the rolling means **56** effecting peristaltic action on the intermediate tubing region **45** to displace fluid through the tubing **41**. Obviously, equal quantities of fluid material will be displaced through the tubing **41** upon each rotation of arm **55**, depending upon the length of intermediate tubing region **45** being squeezed in track **23**.

The length of tubing region **45** lying in track **23** is selectively adjustable and controllable by rotation of the

carrier 21. In particular, the carrier 21 may be released or unclamped, as by loosening the clamp means 31, and the carrier may be rotated in a selected direction, say clockwise to the position shown in FIG. 6. It will there be seen that the tubing region 45*a* intermediate the initial tubing guide 36 and the final tubing guide means of notch 24 and member 40 has been shortened, the tubing region 46*a* extending from the outer track 23 to the inner track 35 having been displaced toward the tubing region 44 passing through the guide means 36. Thus, a shorter intermediate tubing region 45*a* is squeezed or operated upon by the rolling means 56.

Spaced below the housing 11, extending laterally between the upstanding supports or front legs 18, may be an elongate horizontal support member or frame 61. The support member 61 may be a generally rearwardly facing channel, if desired. On the forward side of the support member 61 is a bracket or receiver 62 which may be of generally U-shaped configuration having its bight region 63 suitably fixed to the support member 61, and its pair of legs 64 disposed one above the other and projecting forwardly from the bight region. The receiver or bracket 62 is located directly beneath the outlet or discharge end 51 of tubing 41, and the receiver legs 64 are suitably apertured or configured to removably receive and retain a hypodermic syringe 65 in position to be filled from the outlet nozzle or discharge end 51 of the tubing 41. That is, the syringe 65 is removably disposed in the receiver or bracket 62 with its plunger end uppermost and open for the ingress therethrough of liquid into the syringe. Proximate to the syringe receiver 62, say mounted on the frame member 61, may be an actuating switch 66, as with a switch button 67 located in position to be depressed by the location of a syringe 65 in the holder or bracket 62. The switch 66 may be operatively connected by suitable electrical means to the single cycle drive motor or clutch 60 for energizing the arm 55 and its rolling wheel 56 to effect a single rotation about the tubing carrier 21. That is, automatically upon the engagement of an open-ended syringe in the syringe holder 62, a metered quantity of liquid from the source 42 is pumped through the tubing 41 and discharged from the tubing end 51 into the positioned syringe.

Alongside of the syringe holder or bracket 62 may be an additional syringe holder or bracket 70, leftward as seen in FIG. 1, which may be substantially identical to the first described syringe holder. The syringe holder 70 is also suitably mounted on the frame member 61, and advantageously has associated therewith suitable switch means 71 for energization upon positioning of a syringe 72 in the holder 70.

Over the syringe holder 70, mounted on the forward face of support wall 12, may be a guide member or slideway 73 slidably mounting a vertically disposed longitudinally shiftable pusher member or rod 74. The guide 73 may be defined by a generally U-shaped bracket having its medial or bight region suitably fixed to the support wall 12 and its legs disposed one above the other and projecting forwardly from the support wall. The reciprocatory rod or plunger 74 is located in longitudinal alignment with and spaced over the lower syringe holder 70 for extension into a held syringe 72, as will appear more fully hereinafter.

Suitable means for effecting reciprocation of the pusher rod 74 may be mounted in the housing 11, such as an arm or link 75 having one end pivoted, as at 76 to the upper end of the pusher rod, and extending therefrom interiorly of the housing 11 to have its rearward or inner end pivoted in the housing, as at 77. Suitable means may be employed to resiliently urge the pusher rod 47 upwardly, away from the lower syringe 72, such as a coil tension spring 78; and, suitable operating means may include a solenoid 79 having a plunger 80 connected to the arm 75 to shift the latter downwardly against the force of spring 78. The operating means or solenoids 79 may be energized through the switch 71, as by placement of the syringe 72 in the holder 70, for a purpose appearing presently.

The support wall 12, beneath the plunger 74 and guide 73, may be formed with an opening 82 suitably configured to receive an elongate container, casing or cartridge 84, see FIG. 7. The opening 82 is located just over the bottom wall 14 for receiving the cartridge 84 resting on the bottom wall. A guide member or rod 85 is fixed in the housing 11, extending forwardly and rearwardly over the cartridge 84, and an elongate member 86 extends longitudinally between the rod 85 and the cartridge 84. One end of the elongate member 86 upstands, as at 87 and receives the guide member 85 so as to be slidable therealong. The other end of the member 86 depends, as at 88 into position rearwardly of the cartridge 84 and carries a forwardly projecting pusher member or rod 89. The rod 89 extends slidably through the rear or inner wall 90 of the cartridge 84, and suitable resilient means such as a coil compression spring 91 serves to urge the elongate member 86 and its pusher rod 89 forwardly. That is, the spring 91 may be circumposed about the rod 85 having its rear end engaging a fixed abutment 92 and its forward end engaging the forward rod receiving region 87 of the member 86 to urge the rod 89 forwardly. That is, the spring 91 may be circumposed about the rod 85 having its rear end engaging a fixed abutment 92 and its forward end engaging the forward rod receiving region 87 of the member 86 to urge the rod 89 forwardly in the cartridge 84.

The cartridge 84 contains a row of syringe plungers, pistons or stoppers 94 disposed in generally horizontal, side-by-side relation with respect to each other, see FIG. 7. The rearward region 90 of the cartridge 84 is open to receive the pusher rod 89 urging the stoppers 94 forwardly, while the forward region of the cartridge is open on its upper and lower sides, to respectively pass the plunger or pusher 74 and the forwardmost stopper 94.

Projecting forwardly from the support wall 12, adjacent to the cartridge receiving opening 82, may be a resiliently flexible extension or arm 96, carrying a retainer 97 projecting laterally to snap into opening 83 on one side of the cartridge 84. That is, upon insertion of a cartridge 84 inwardly through the opening 82, the resiliently flexible extension or retainer carrier 96 is deflected out of the path of cartridge movement, as by engagement of the cartridge with the inclined or beveled region of retainer 97, the cartridge being inserted against the force of spring 91 to shift the pusher rod 89 inwardly until the retainer 97 snaps into cartridge retaining position shown in FIG. 7.

Extending from beneath the cartridge end 95 and depending therebelow is an elongate slender vent element 99. The vent element 99 may be a smooth wire, rod, or the like, and is located to enter into the upper end of a syringe 72 positioned in the holder 70.

Thus, when a syringe **72** is positioned in the holder **70**, with the vent element **99** entering downwardly into the upper end of the syringe **72**, the switch **71** is actuated to effect energization of solenoid **79** and downward shifting movement of pusher **74**. The lower end of pusher **74** presses the forwardmost stopper **94** into the open upper end of the syringe **72** to close the latter. During closure the vent element **99** deflects the resiliently compressible stopper **94** so that any gas compressed beneath the stopper may escape through openings **100**, see FIG. **8**. Of course, withdrawal of the syringe **72** from the holder **70** removes the vent **99** from its stopper distorting position and permits the stopper to expand to fully occupy and pneumatically close the syringe. Thus, by the simple procedure of initially placing a syringe in the holder **62** for filling, and subsequently placing the syringe in the holder **70** for closing, effectively accomplishes the packaging operation. Obviously, the filling and closing procedures may be automated, as by suitable syringe handling equipment, as desired for speed, sterility and economy. Even if the syringe is manually handled to effect the filling and closing operations, sterility is insured as it is unnecessary for an operator to touch near the open end. Further, the filling and closing procedures take place in the open region **20** so that full advantage is taken of the laminar air movement occurring in clean rooms.

From the foregoing it is seen that the present invention provides a packaging apparatus which is extremely simple in construction and operation for durability and reliability throughout a long useful life, capable of sterile packing operation either manually or automatically, and which otherwise fully accomplishes its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

We claim:

1. Liquid packaging apparatus comprising support means, a tubing carrier on said support means, track means extending along said carrier, resilient flexible tubing having an intermediate region extending along said track means, control means for varying the length of said intermediate tubing region along said track, one end of said tubing extending to fluid communication with a source of liquid to be packaged and the other end of said tubing extending to fluid communication with a packaging container, rolling means mounted for movement along said track in rolling engagement with said intermediate region of tubing to displace a quantity of liquid to the container, a first bracket on said support means for removably holding a container in position to receive the liquid, a second bracket on said support means for removably supporting an open container, cartridge receiving means mounted on said support means for removably receiving a cartridge of closures in position over an open container supported by said second bracket, and a reciprocable plunger carried by said support means over said cartridge receiving means for displacing successive closures from a cartridge into successive containers.

2. Liquid packaging apparatus according to claim **12**, said support means comprising an open framework, and said first and second brackets being mounted on said open framework in position for exposing the containers to passing air.

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