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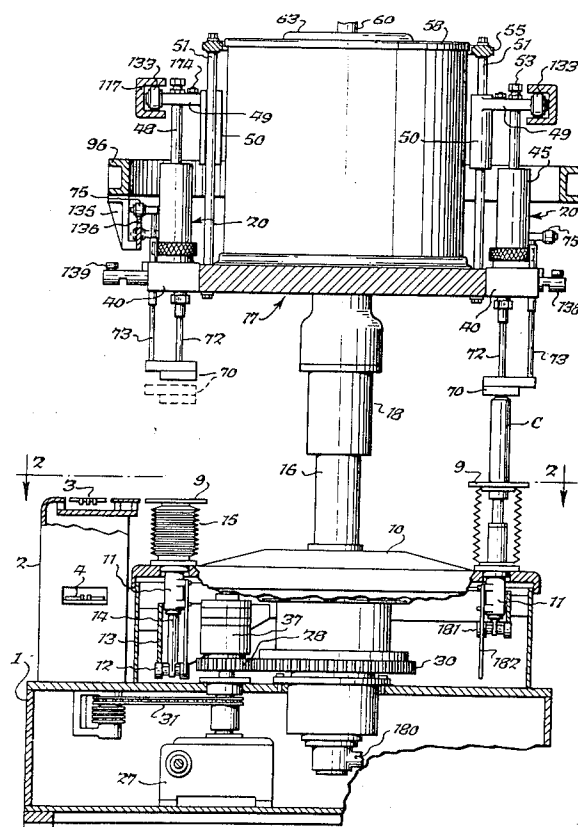
[54] **CONTAINER FILLING MACHINE**
14 Claims, 16 Drawing Figs.

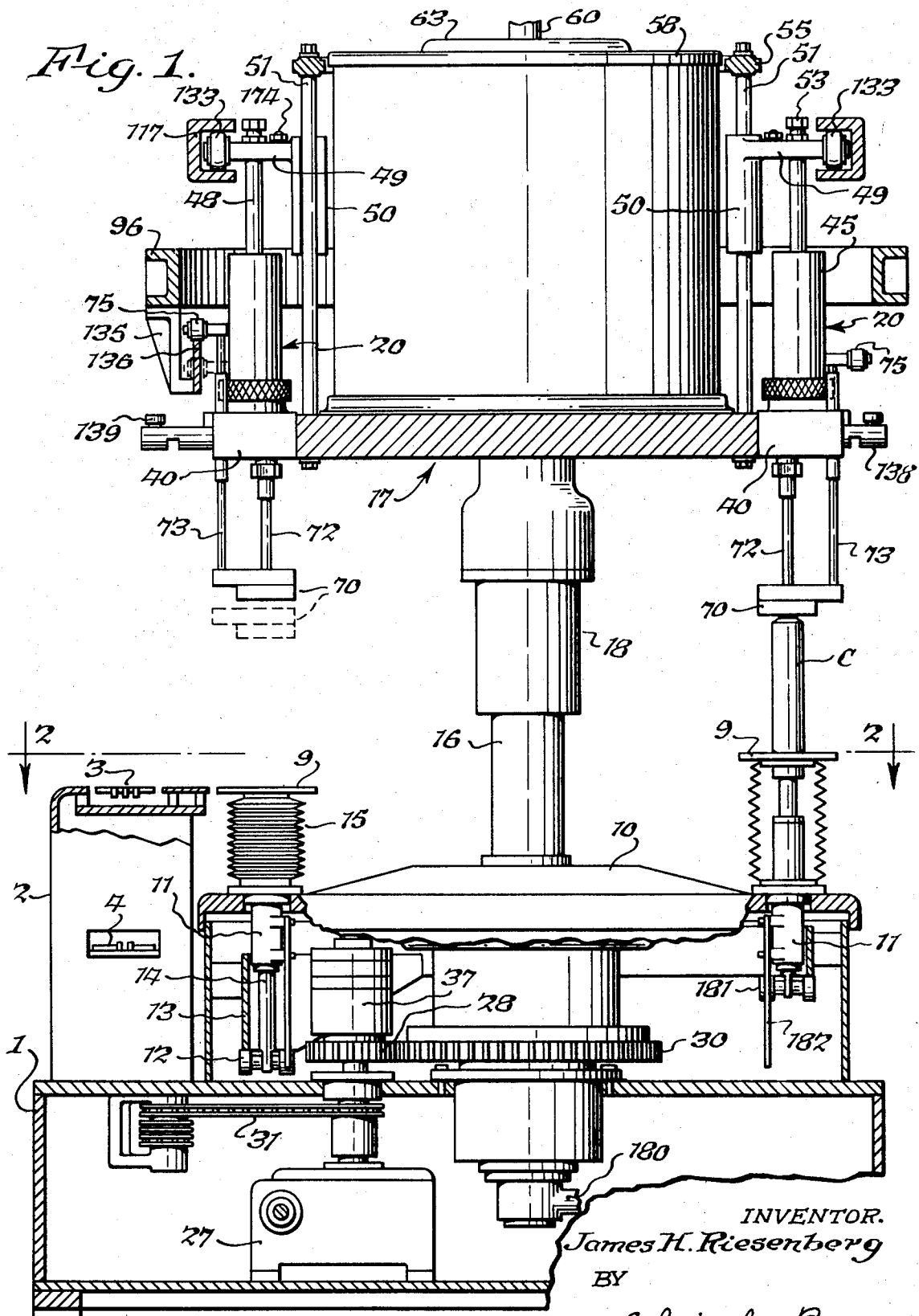
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[51] Int. Cl. **B65b 57/06**
[50] Field of Search 141/115,
146, 147, 158, 286, 141, 152; 222/168.5, 189,
305, 306, 309, 387, 366, 444, 571; 137/625.68;
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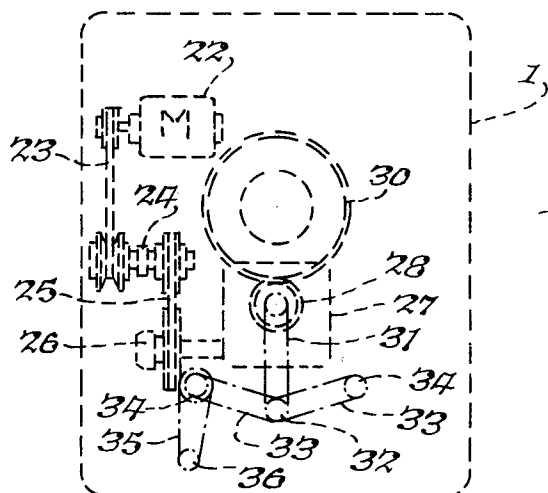
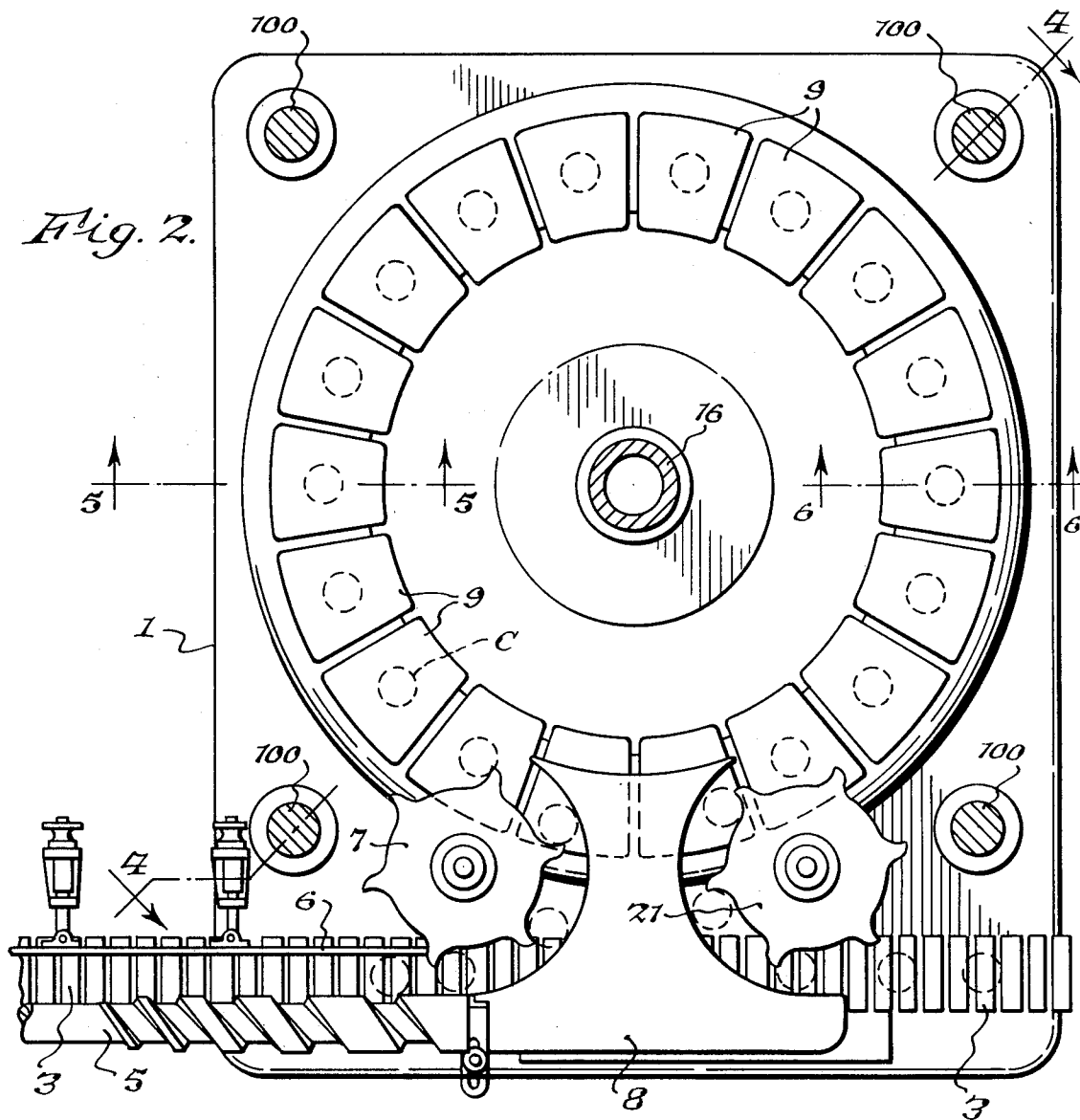
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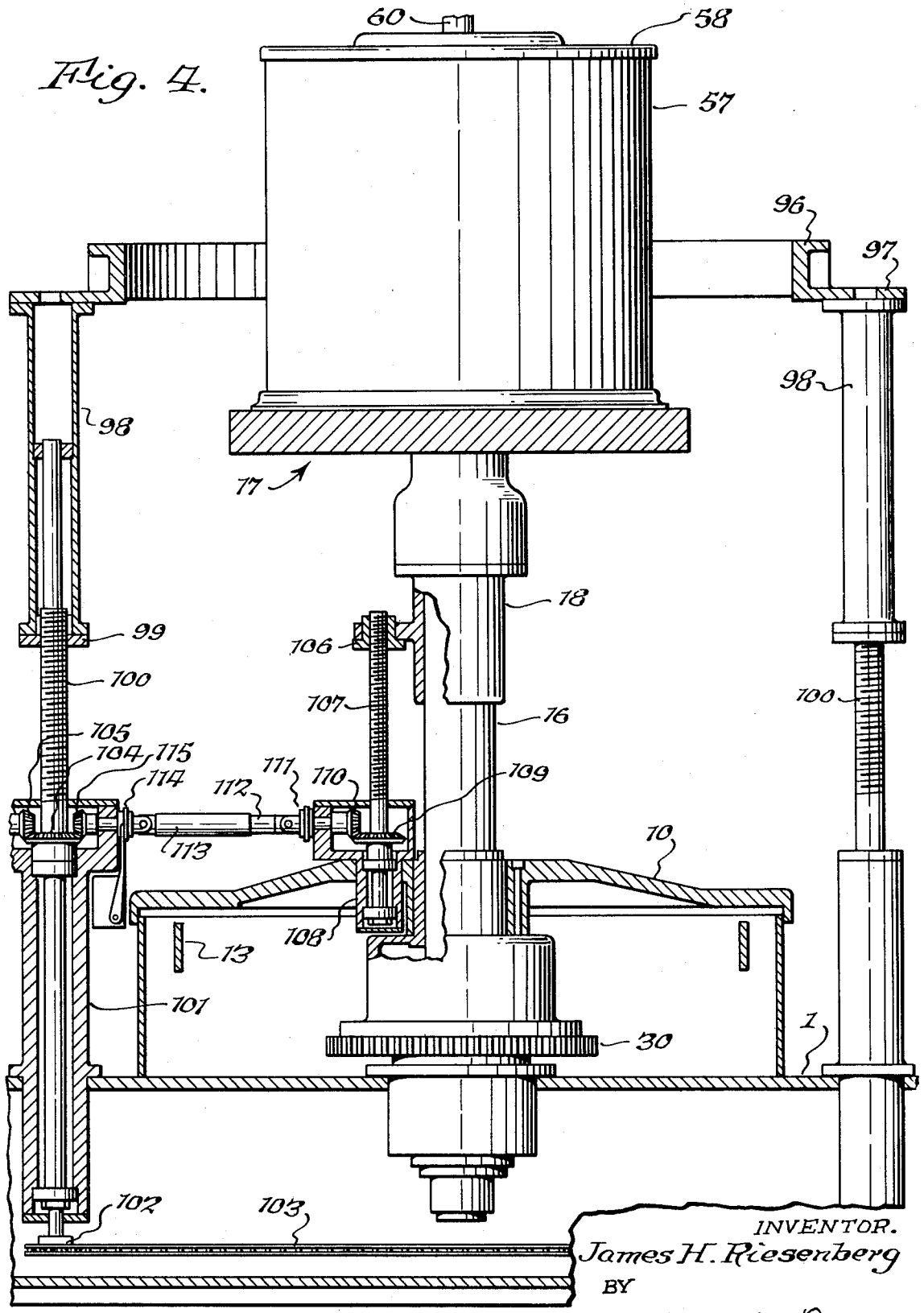
ABSTRACT: A container filling machine having a container supporting tray and a filling head including a charging cylinder and a filling stem, the tray and head being mounted for movement through a predetermined path. A piston is movable in the cylinder and a follower connected to the piston successively engages a first cam section extending along the path for moving the piston in a first direction to draw product from a source into the cylinder and a second cam section extending along the path for moving the piston in the opposite direction to discharge product from the cylinder. A spool-type valve is slidable between a first position placing the charging cylinder in communication with the source and a second position placing the cylinder in communication with the stem, the valve shifting arrangement being disabled prior to the discharge stroke in the absence of a container to be filled whereby the product is returned from the cylinder to the source. The cam sections are pivotally supported for movement in opposite directions to selectively vary the rise of the first cam section and thereby vary the piston stroke and consequently the volume of product dispensed. A spring-loaded check valve in the filling stem opens under discharging pressure applied by the piston, closing when the pressure is released, and a surface tension increasing element at the filling stem outlet avoids dripping. A return cam is positioned adjacent the exit end of the second cam section and is operable to engage the piston follower against the first cam section just prior to the conclusion of the discharge stroke, whereby the piston stroke is determined by the first cam section as a reference and the follower is eliminated as a variable.



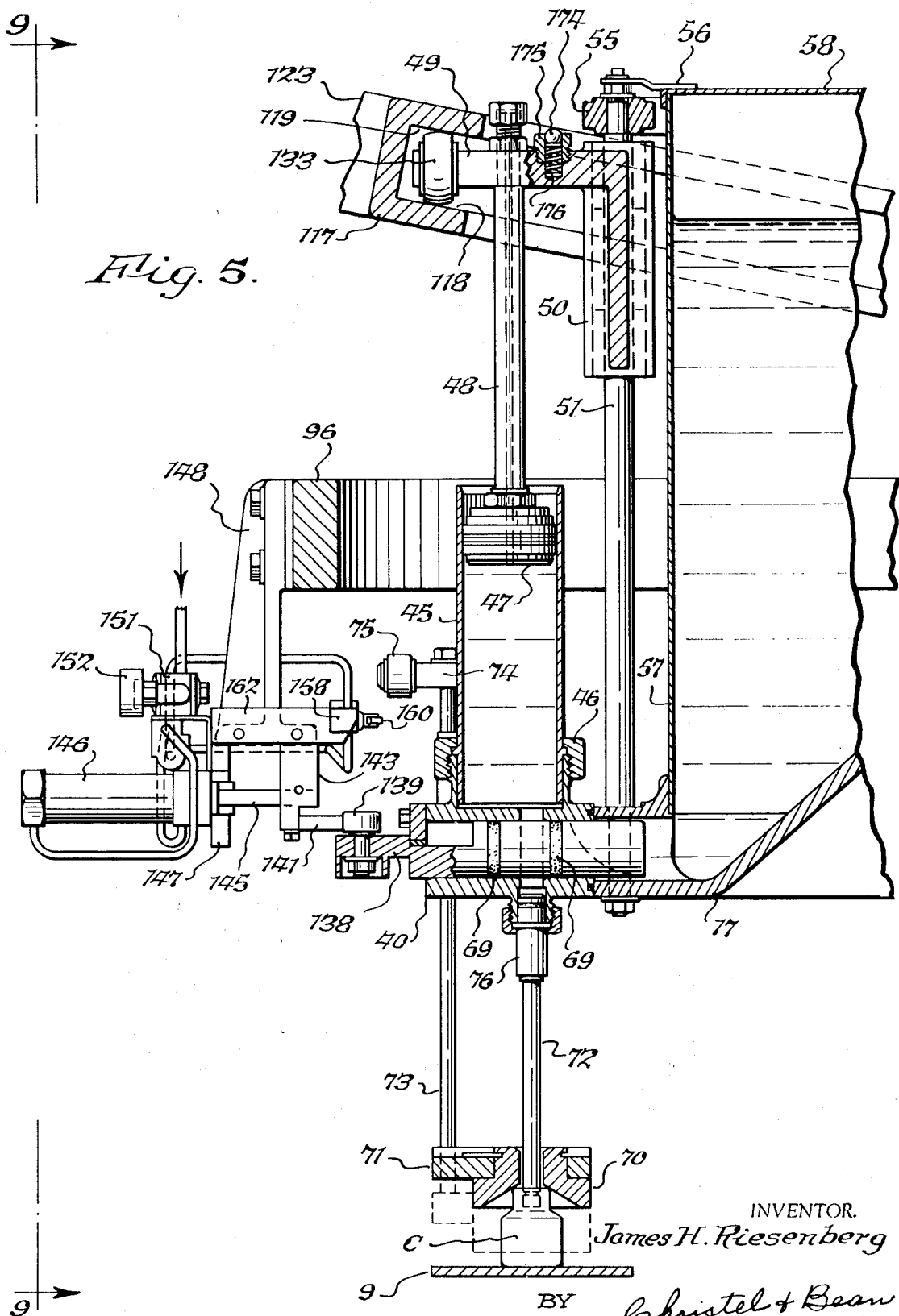




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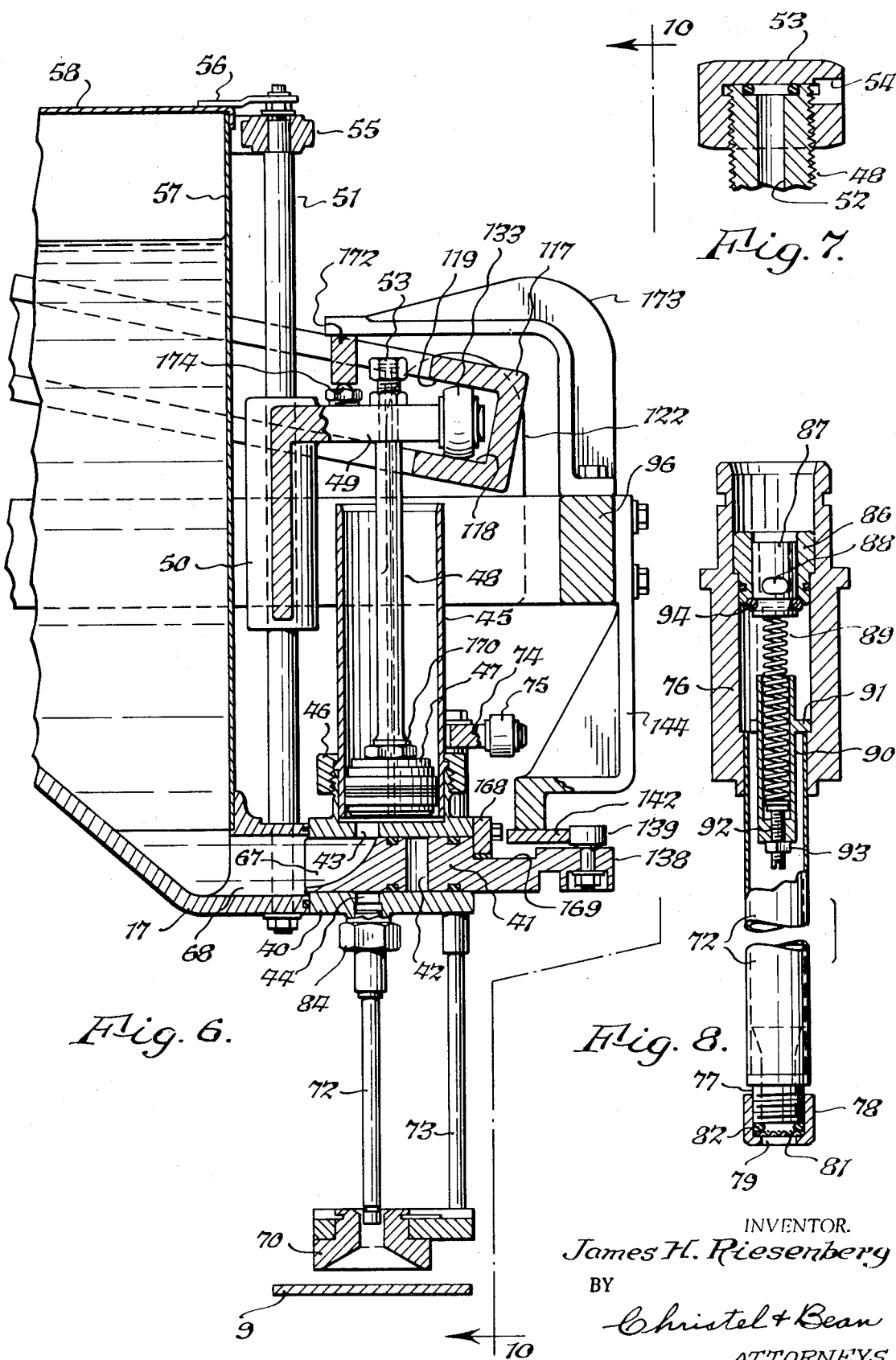


Fig. 9.

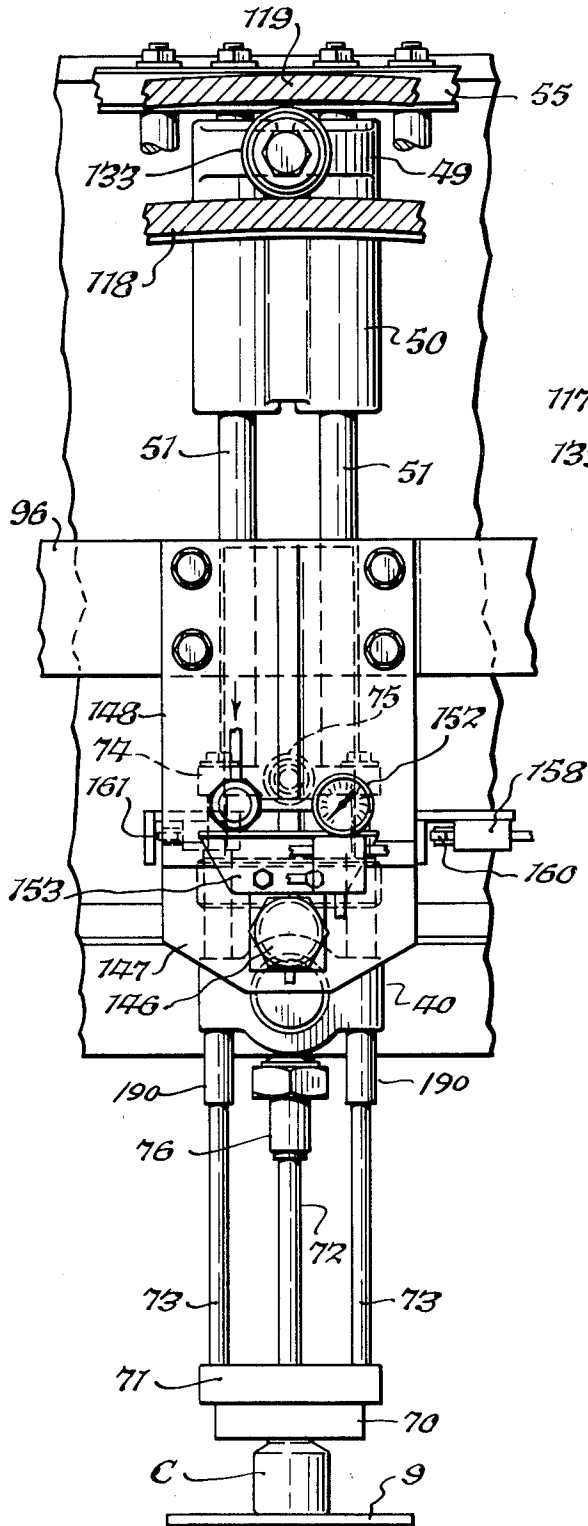
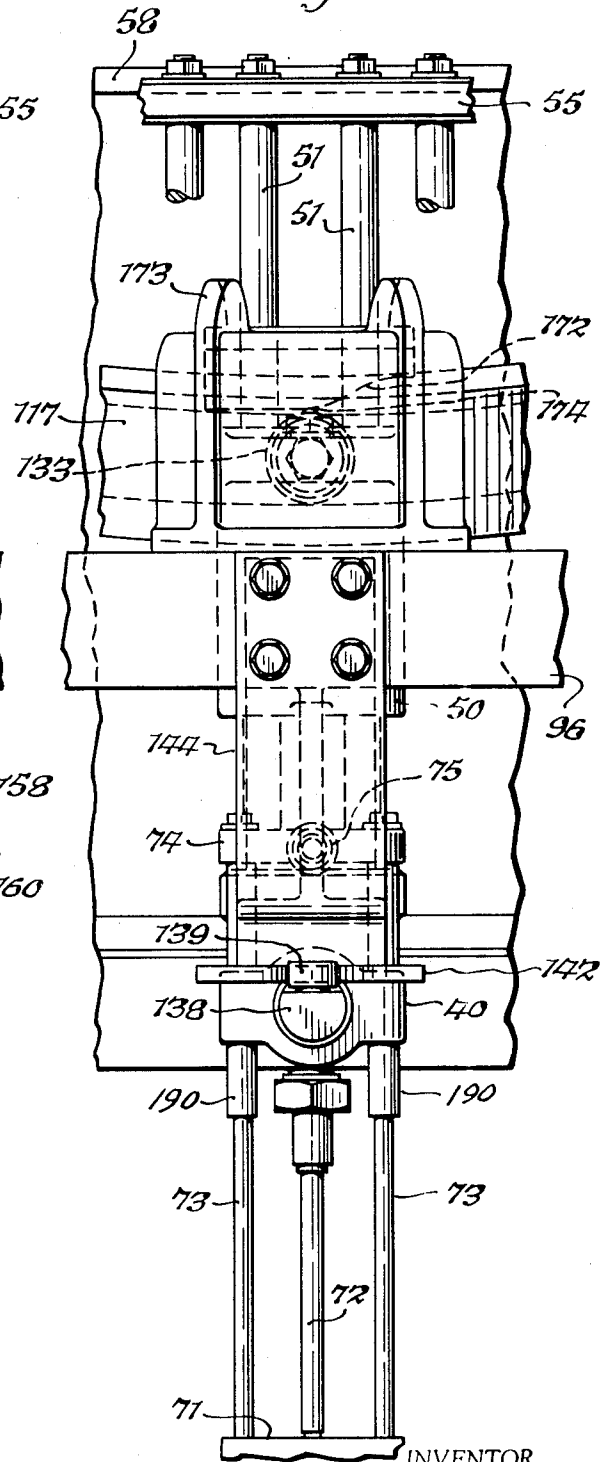
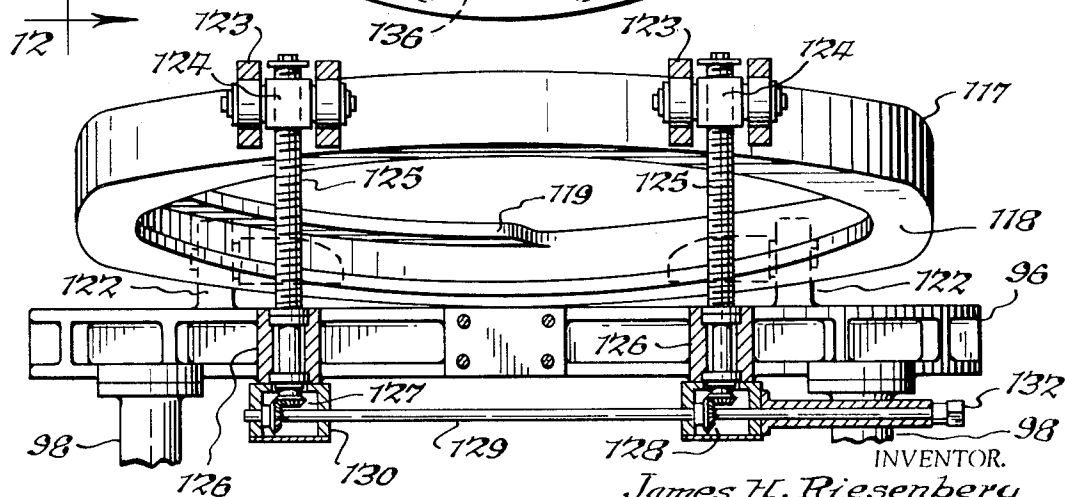
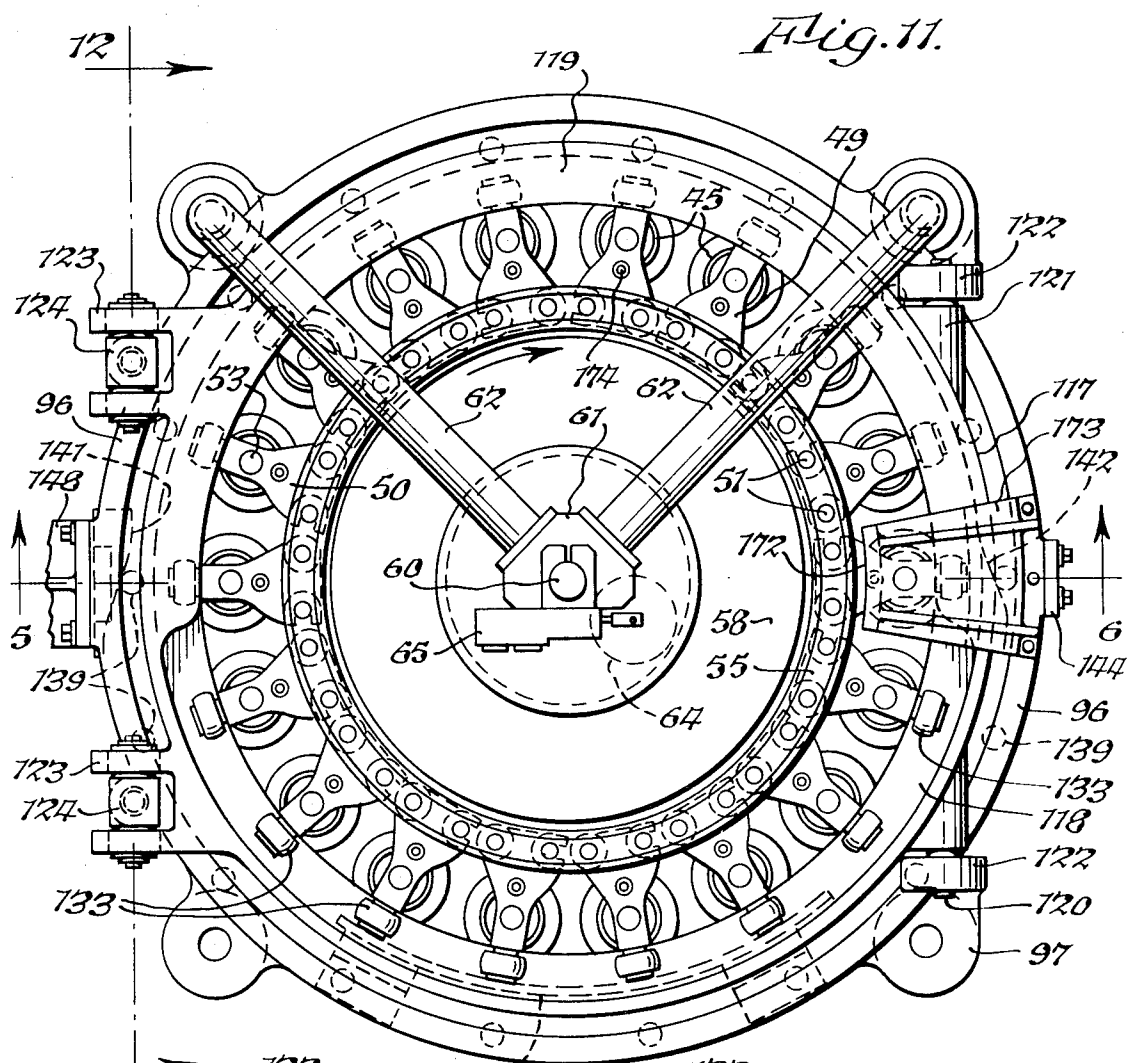


Fig. 10.



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Fig. 14.

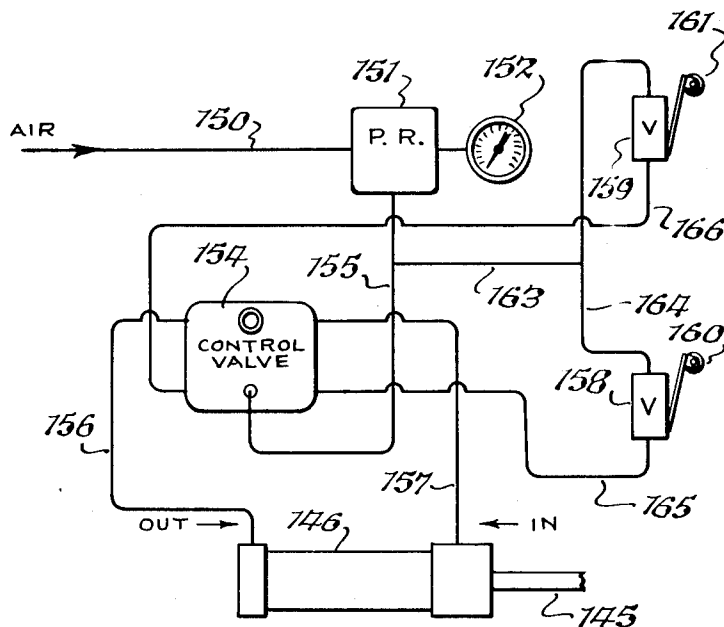


Fig. 13.

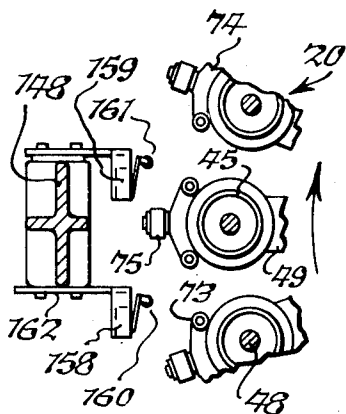


Fig. 15.

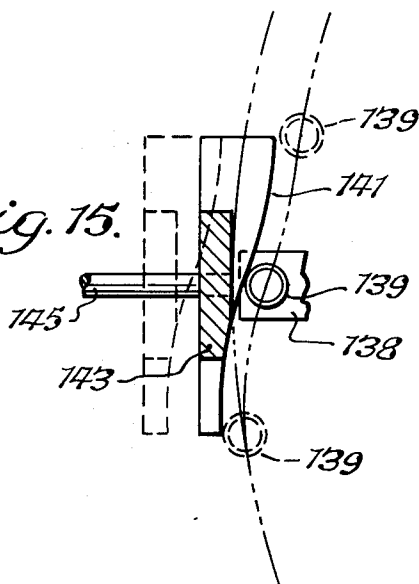
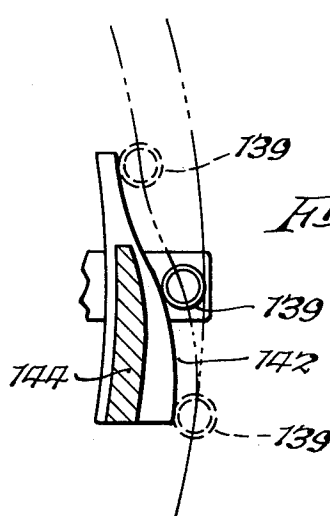


Fig. 16.



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CONTAINER FILLING MACHINE

BACKGROUND OF THE INVENTION

This invention relates generally to the container filling art, and more specifically to a new and useful machine for filling containers to a specific volume.

Various approaches have been employed in the filling of containers to a specific volume, the most versatile being the utilization of a metering piston which permits a wide range in viscosity of products that can be handled.

However, most piston fillers utilize a type of valve which allows bypassing and this condition worsens as the valves wear. Variations in machine speed resulting in variations in pressure applied to the product also will affect the amount of bypassing.

This is disadvantageous because the amount of bypassing is not constant from one valve to another, requiring individual adjustment of each piston stroke in an effort to provide the same volume from each piston. In addition to inaccuracy in the volume of product dispensed, such bypassing also tends to cause dripping from the filling stem, particularly with low-viscosity products.

Further adjustment is required as the cam engaging followers begin to wear. Such followers are not identical in size, because of manufacturing tolerance, and do not necessarily wear uniformly, thereby posing a problem.

SUMMARY OF THE INVENTION

A primary object of this invention is to provide a piston-type volumetric filler having a valve arrangement avoiding bypassing and the problems associated therewith.

Another object of this invention is to provide a piston-type filler incorporating a simple mechanical arrangement avoiding dripping of product.

Still another object of this invention is to provide a piston-type filler utilizing cams and cam followers wherein the size of the cam follower is eliminated as a factor in the piston stroke and thereby does not effect the volume dispensed.

It is also an object of this invention to provide a piston-type volumetric filler incorporating means for infinite adjustment through a finite range of the stroke of all the metering pistons, simultaneously and while the machine is running.

DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a view partially in vertical section and partly in elevation showing a filling machine of my invention, parts being broken away to show details and for convenience in illustration;

FIG. 2 is a view thereof partly in plan and partly in horizontal section, taken about on line 2-2 of FIG. 1;

FIG. 3 is a generally diagrammatic view of the drive mechanism thereof;

FIG. 4 is a view thereof partly in vertical section and partly in elevation, taken about on line 4-4 of FIG. 2, certain parts being omitted for clarity in illustration;

FIG. 5 is a fragmentary, vertical sectional view thereof, on an enlarged scale, taken about on line 5-5 of FIG. 2;

FIG. 6 is a view similar to that of FIG. 5, but taken about on line 6-6 of FIG. 2;

FIGS. 5 and 6, placed side by side, also represent a fragmentary vertical sectional view thereof taken about on line 5-6 of FIG. 11;

FIG. 7 is a fragmentary, vertical sectional view on a further enlarged scale showing the upper end of the charging plunger;

FIG. 8 is a view, partly in elevation and partly in vertical section, showing a filling stem of my invention;

FIG. 9 is a fragmentary view in elevation, taken about on 9-9 of FIG. 5;

FIG. 10 is a fragmentary view in elevation taken about on line 10-10 of FIG. 6;

FIG. 11 is a plane view of the machine shown in FIG. 1;

FIG. 12 is a view of the plunger controlling cam taken about on line 12-12 of FIG. 11, parts being omitted for greater clarity;

FIG. 13 is a fragmentary, detail view of the valve shifting control switch arrangement;

FIG. 14 is a diagrammatic view of the valve shifting cam control mechanism and circuit; and

FIGS. 15 and 16 are generally diagrammatic views of the valve shifting cams at opposite ends of the filling cycle.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring now in detail to the illustrative embodiment depicted in the accompanying drawings, there is shown a filling machine of my invention having a base 1 and a conveyor section 2 which includes a conveying mechanism having a conveying flight 3 and a return flight 4. Empty containers are fed to the machine on flight 3 under control of an infeed worm 5, being held in position thereagainst by a laterally adjustable guide 6. Worm 5 delivers containers in properly spaced sequence to an infeed star wheel 7 which carries them around a guide cam 8 and onto the container supporting trays or platforms 9.

In the illustrated machine there are a total of eighteen trays 9, although either a larger or a smaller number could be provided. Trays 9 are mounted on a rotatable cover plate 10 of housing 1 and are vertically reciprocable relative thereto under control of any suitable means such as, for example, pneumatic cylinders 11 urging rollers 12 against a guide cam 13 which regulates the raising and lowering of trays 9 in a manner understood in the art. The cylinder pistons are guided in their vertical movement to maintain rollers 12 properly positioned relative to cam 13, by guide rollers 181 tracking in guide yokes 182 depending from motors 11. Trays 9 can be mounted on the upper ends of piston rods 14 which are enclosed by flexible boots 15 from trays 9 to cover plate 10.

Trays 9 are annularly arranged about a rotating central column 16 to which plate 10 is secured for rotation therewith. A machine head assembly 17 is mounted on column 16 for rotation therewith, having a sleeve 18 arranged in vertical telescoping relation to column 16 for raising and lowering the head assembly 17 relative to cover plate 10, in a manner to be described.

Air for cylinders 11 can be brought in through the lower end of column 16, via conduit 180.

Individual filling head assemblies 20 are provided, equal in number to the container supporting trays 9 and being generally vertically aligned therewith. The containers fed onto trays 9 are filled by the filling head assemblies 20 as they are carried around the axis of central column 16, and the filled containers are discharged by an outfeed star wheel 21 in conjunction with guide cam 8 onto the conveying flight 3.

Central column 16 is rotated by a drive mechanism including a motor 22 having a drive belt connection 23 to a shaft 24 which in turn has a drive belt connection 25 to the input shaft 26 of a speed reducer 27. A gear 28 on the output shaft of speed reducer 27 engages a gear 30 connected to column 16, and a drive chain 31 provides a drive connection to a sprocket 32 which has chain and sprocket connections 33 to the drive shafts 34 of the infeed and outfeed star wheels 7 and 21. A chain and sprocket drive connection 35 is provided from infeed star wheel shaft 34 to a power shaft 36 for worm 5. In this way column 16, star wheels 7 and 21 and worm 5 are driven by motor 22 in properly synchronized relation. A clutch 37 is interposed in the drive connection between speed reducer 27 and column 16. Each filling assembly 20 includes a valve body unit 40 comprising a housing bolted or otherwise secured to the head assembly 17 and containing a horizontally reciprocable cylinder valve 41 having a diametral passage 42 adapted to be shifted into and out of communication with passages 43 and 44 arranged in diametrically opposed relation through the wall of body 40. Passage 43 communicates with the lower end of a charging cylinder 45 secured within a lateral sleeve on body 40 by a clamping nut 46. Cylinder 45 includes a vertically reciprocable piston 47 carried at the lower end of a rod 48 which is detachably secured, at its upper end, to the

horizontal arm 49 of a bracket which includes paired bushings 50 journaled on guide rods 51. The latter are secured at their lower ends to head assembly 17. At their upper ends, guide rods 51 are secured to a spacing ring 55.

A bleed passage 52 extends through rod 48 (FIG. 7), communicating with a similar bleed passage through the attached piston 47.

At their upper ends, stems 48 are closed by caps 53 threaded thereon and each having a vent passage 54 arranged for communication with the associated bleed passage 52 when cap 53 is partially unthreaded from stem 48, all for a purpose to be described. Hold down members 56 are connected to selected rods 51 at spaced points around a tank 57 which is mounted on the base of head assembly 17, the members 56 releasably holding a tank cover 58 in place. The product to be dispensed is introduced into tank 57 through the upper end thereof via a filling stem 60 supported by a guide member 61 (FIG. 11) carried by a pair of support arms 62 which extend across the top of tank 57 from vertical legs secured to the machine frame. Cover 58 has a relatively large, central opening therethrough, closed by a cap 63 conveniently secured to stem 60 and providing a communicating passage between the interior of tank 57 and the ambient atmosphere. A level controlling float 64 suspended from a bracket 65 can be provided for regulating the supply of product to the interior of tank 57.

Each valve 41 includes, in addition to the diametral passage 42, a generally diagonal passage 67 adapted, in the position of valve 41 shown in FIG. 6, to place passageway 43 in communication with the interior of tank 57 by the adjacent lateral passage 68 through head 17. In the position of FIG. 6 valve 41 places charging cylinder 45 in communication with supply tank 57, whereas in the position of FIG. 5, passage 42 of valve 41 places charging cylinder 45 in communication with the filling stem passage 44. This simplified valve arrangement is an important feature of my invention, the valve body 41 carrying a pair of O-rings or other suitable seals 69 isolating passage 42 from passage 67 and supply tank 57.

Each filling assembly 20 also includes a centering bell 70 carried by a yoke 71 for engaging containers C adjacent the neck thereof to center the same relative to filling stem 72. Yokes 71 are carried by paired rods 73 which are journaled in housings 190 carried by valve body 40 for vertical reciprocation therein. At their upper ends, the paired guide rods 73 carry a crossbar 74 on which a roller 75 is journaled, for reasons to become apparent.

Each filling stem 72 is an elongated tube welded or otherwise secured at its upper end to a mounting head 76 (FIG. 8). An insert 77 welded or otherwise secured to the lower end of tube 72 receives a retainer cap 78 threaded thereon and having a central aperture 79 through which the product is dispensed. A surface tension producing member in the form of a screen 81 is held in place across opening 79, against an O-ring 82 sealing retainers 78 and insert 77. Mounting head 76 is inserted in an externally threaded sleeve on body 40, being clamped thereagainst by a nut 84 whereby filling stem 72 can be readily detached for cleaning, adjustment or other purposes.

A tubular valve seat 86 is positioned against a shoulder within mounting head 76, and slidably receives a tubular plunger 87 having two or more sidewall openings 88 therethrough. Plunger 87 is spring-urged into closed position, as shown in FIG. 8, by a coil spring 89 carried in a retainer sleeve 90 having centering fingers 91, the opposite end of spring 89 bearing against a headed adjustment screw 92 having a locknut 93. The lower end of screw 92 is formed to receive a screwdriver or like implement, for varying the compressive force on spring 89 and thereby varying the force required to unseat plunger 87 and open passages 88 for the dispensing of product through mounting head 76 and between fingers 91 into the filling stem. An O-ring 94 seals plunger 87 against seat 86 when plunger 87 is in closed position.

It is a feature of my invention that the filling stems are dripless. When dispensing pressure ends, plungers 87 close,

leaving a column of product in the filling stem. Normally this would tend to drip, requiring a vacuum connection or other means for removing the product. However, screen 81 provides increased surface tension at the discharge end of the filling stem whereby the product, which usually will be somewhat viscous in nature, will be self-adhering to the filling stem and dripping is avoided. Obviously, other means for increasing the surface tension across the discharge outlet 79 can be used.

An annular support ring 96 has pads 97 adapted for connection to tubular support housings 98 having threaded engagement at 99 with supporting posts 100. Posts 100 are journaled at their lower ends in tubular housings 101 carried by housing 1, and at their lower ends each post 100 carries a pinion 102, there being four posts 100 linked by a chain 103 engaging the pinions thereof. One of the posts 100 carries a bevel gear 104 engaging a bevel gear 105 carried by a shaft adapted to be rotated by a wrench, handwheel or the like, thereby rotating all of the posts 100 in unison to raise and lower support ring 96 for purposes to become apparent.

A nut 106 carried by a lateral extension of sleeve 18 engages a threaded post 107 journaled in a housing 108 carried by cover plate 10. A bevel gear 109 on post 107 engages a level gear 110 on a shaft adapted to receive a socket wrench head 111 or other form of detachable coupling, the latter being pivotally connected to one part 112 telescoping within another drive coupling part 113 pivotally connected to a socket wrench head 114 or other detachable coupling connected to the shaft of another bevel gear 115. The telescoping parts 112, 113 are spring-urged in opposite directions, and when attached will cause the mounting head assembly 17 to be raised or lowered simultaneously with the support ring 96. Coupling 112, 113 normally is detached, end ring 96 and head 17 can be raised and lowered independently.

An annular, plunger guide cam 117, of generally U-shape providing parallel lower and upper cam surfaces 118 and 119 has a trunnion support on ring 96. To this end, a pair of oppositely directed pivot pins 120 extend from bosses 121 on cam member 117 and are journaled in upstanding brackets 122 carried by ring 96. On the opposite side thereof, cam 117 is provided with paired brackets 123 between which are journaled nuts 124 threaded on upstanding jack posts 125 journaled in brackets 126 carried by support ring 96. At their lower ends, posts 125 carry bevel gears 127 engaging bevel gears 128 on a shaft 129 journaled in gear housings 130 carried by brackets 126. A socket head 132 at one end of shaft 129 is adapted to receive a wrench or other tool, for rotating the shaft. Rotation of shaft 129 will rotate posts 125, thereby selectively increasing and decreasing the angle of inclination of cam 117. Each piston rod bracket 49 journals a cam follower roller 133 which engages cam 117 between the cam surfaces 118, 119 thereof.

Support ring 96 carries a pair of brackets 135 which support a cam 136. Centering bell rollers 75 engage cam 136 for lifting centering bell 70 to an elevated position above the containers C, from a point just prior to the discharge of the filled containers to a point subsequent to the container infeed.

Each valve 41 has an arm 138 extending therefrom beyond the valve body 40. A roller 139 is vertically journaled in each horizontal arm 138, and is positioned to engage cams 141 and 142 at opposite sides of the machine for shifting the position of valve 41. Cams 141 and 142 are carried by brackets 143 and 144, respectively, the latter being fixed to the support ring 96 as shown in FIG. 6. Bracket 143 is a carrier connected to a gib member 145 comprising an extension of the piston rod of a motor in the form of a pneumatic cylinder 146 carried by an extension 147 of a bracket 148 bolted to support ring 96.

Referring now to the schematic circuit diagram of FIG. 14, air for cylinder 146 is furnished under appropriate pressure from a suitable source, not shown, via line 150 and pressure regulator 151 to which a pressure gauge 152 may be connected. Regulator 151 and gauge 152 are mounted on a bracket 153 (FIGS. 5 and 9) for convenient visual observation, the bracket 153 being mounted on the extension 147 of

bracket 148. Air is supplied to cylinder 146 under control of a valve 154 which receives air from regulator 151 via conduit 155 and supplies air alternately via conduits 156 and 157 to the cylinder 146. Valve 154 is controlled pneumatically by switching valves 158 and 159 having actuators 160 and 161, respectively, positioned to be engaged by centering bell rollers 75 when there is no container on the associated supporting tray, the bells 70 then being in their lowermost position shown in FIG. 6 and in broken lines in FIG. 5. Switches 158 and 159 are supported on brackets 162 secured to opposite sides of bracket 148, and control valve 154 via conduits 163, 164, 165 and 166. The valves 154, 158 and 159 are conventional and per se form no part of my invention.

In operation, valve 154 is biased in a direction causing piston rod 145 and cam 141 to be extended, for engaging rollers 139 as indicated in FIG. 15 and shifting valves 41 from the intake position of FIG. 6 to the discharge position of FIG. 5. This occurs only after centering bell 70 has engaged the neck of a supported container, and the latter has begun moving through the filling portion of the cycle.

At this point, plunger roller 133 transfers its bearing engagement from the lower cam surface 118 to the upper cam surface 119 which latter is substantially only semicircular (FIG. 11). Since cam 117 retreats, from this point, to the follower shown in FIG. 6, cam surface 119 causes follower 133 to lower piston 47, which in turn forces the product in cylinder 45 through discharge openings 43, 42 and 44, into and through filling stem 72. As long as piston 47 is moving downwardly, the pressure exerted on the product is sufficient to hold valve 87 open for the discharge of product and the associated container is filled. At the end of the discharge stroke, the product pressure holding valve 87 open is released and valve 87 closes, trapping a column of liquid in the stem. During the discharge stroke, follower 133 is held against surface 119 by the product being dispensed and the check valve spring.

However, if there is no container to be filled, no product is discharged, this being accomplished as follows. In the absence of a container centering bell 70 lowers to the broken line position shown in FIG. 5, placing its roller arm in position to engage valve actuators 160 and 161, as indicated in FIG. 13. As the roller stem engages actuator 161, valve 154 is reversed, causing piston rod 145 and cam 143 to be retracted to the position shown in broken lines in FIG. 15. This removes cam 141 from the path of follower 139, causing valve 41 to remain in the position shown in FIG. 6. In this position discharge port 42 is sealed out of communication with tank 57 and cylinder 45, preventing the discharge of product from the latter to stem 72. As soon as that filling head has passed cam 141, its follower stem engages actuator 161 which reverses cylinder 146, causing piston 145 and cam 141 to be extended for shifting the position of the valve 41 in the immediately following filling head, assuming that its centering bell has engaged a container supported in position to be filled.

When valve 141 remains in its extended position of FIG. 6, because of the absence of a container to be filled, piston 47 is lowered as before to discharge product from cylinder 45. However, the product is simply returned to tank 57 via passages 43, 67 and 68.

FIG. 6 shows the position of the parts when the dispensing of product has been completed and the supported container completely filled. The supporting tray 9 then drops away and the filled container is transferred by outfeed star wheel 21 to conveyor 3.

As the filling head assemblies move from the position shown in FIG. 6 to the position shown in FIG. 5, follower 133 is raised by the upwardly inclining bottom cam surface 118. This raises piston 47, drawing product from tank 57 via passages 68, 67 and 43 into cylinder 45. Valve 41 has been shifted to its intake position by engagement with cam 142, as indicated in FIG. 16. Where there was no container to be filled, valve 41 will have remained in its intake position. Note that a stop-plate 168 (FIG. 6) is secured to body 40, to engage spaced shoulders

on a reduced neck 169 of valve arm 138 and thereby define the limits of its movement in opposite directions.

Piston 47 has an O-ring seal with cylinder 45. To eliminate excess air from below piston 47 when the machine is first placed in operation head 53 is partially unthreaded, opening stem passage 52 to atmosphere via passageway 54. As the plunger lowers, air trapped beneath it will be vented to atmosphere. When product appears at opening 54 the operator will know that the filling head has been sufficiently vented, and can thereafter close nut 53 to the position shown in FIG. 7.

Individual adjustment of pistons 47 in cylinders 45 is accomplished by the threading and unthreading of individual pistons 47 on their stems 48, locknuts 170 being provided to hold them in adjusted position. Also, the dispensing valve spring tension can be adjusted by varying the setting of screw 92, whereby each filling head assembly can be individually adjusted for proper operation.

It is a feature of my invention that the amount of product dispensed by the various filling heads can be readily adjusted, simply by turning shaft 129 and thereby raising and lowering the high end of cam 117. This provides a quick and easy means for varying the height to which pistons 47 are raised, thereby providing an infinitesimal number of adjustments between the upper and lower limits of posts 125. It is another feature of my invention that the selected volume of product to be dispensed is consistently dispensed from each filling head, consistently. This poses a problem because of roller wear, and because of variations in roller diameter due to manufacturing tolerances.

The piston stroke theoretically is determined by the height of surface 118 at its uppermost level (FIG. 5) less its height at its lowermost level (FIG. 6). In other words, the vertical travel of plunger 47 produced by the rise in surface 118 determines the intended volume of product to be dispensed. However, the dispensing movement of plunger 47 is caused by roller 133 bearing against the overhead cam surface 119. While theoretically cam surfaces 118 and 119 are spaced apart a distance sufficient only to provide the necessary working clearance, the fact is that they must be spaced apart sufficiently to permit the insertion of rollers 133 into position therebetween and also to permit free rolling of rollers 133 on either surface without interference from the other. As a result, when rollers 133 move from the high point of surface 119 (FIG. 5) to the low point thereof (FIG. 6) they will be slightly spaced from the low point of surface 118. This, in itself, could be compensated for. However, variations would occur as the rollers wear, because they will wear at different rates. Variations in roller diameter resulting from manufacturing tolerances also could cause variations in the volume of product dispensed.

However, that is avoided with my invention by the provision of a return cam 172 carried by a bracket 173 mounted on guide 96. Cam 172 is positioned above the path of follower arms 49, behind follower rollers 133, at the low point of cam 117. Each filling head includes a ball 174 confined within a retainer sleeve 175 screwed into the upper surface of arm 149. A spring 176, confined within sleeve 175 and an arm socket, urges ball 174 outwardly into engagement with the undersurface of cam 172 which occurs just prior to engagement of valve roller 139 with return cam 142. Cam 172 is designed and arranged so that as each ball detent 74 engages the undersurface thereof (FIG. 10) its arm 49 and roller 133 are moved downwardly away from overhead cam surface 119 and its roller 133 is yieldably urged against lower cam surface 118. Spring 176 provides the necessary clearance for continued movement of detent 174 past cam 172 once follower 133 has bottomed on surface 118.

With this construction, the travel of piston 47 is in fact determined by the rise in surface 118, because plunger 47 is raised by engagement of roller 133 with surface 118 to the high point of the latter, and just prior to the end of the discharge stroke of piston 47 roller 133 is returned against surface 118, whereby surface 118 is used as the reference at both

ends of the piston stroke. Even as the rollers wear, the piston stroke remains the same because the roller size has been eliminated as a factor and the rise in cam surface 118 remains the reference.

Should it become necessary to replace the ball detent structure, that is accomplished easily and inexpensively.

Accordingly, it is seen that my invention fully accomplishes its intended objects.

I claim:

1. In a container filling machine, a container supporting tray, a filling head having a charging cylinder including a piston and a filling stem, a source of product to be dispensed, a sliding valve spool movable between a first position placing said charging cylinder in communication with said source and a second position placing said cylinder in communication with said stem, said sliding valve spool having a first passage therein placing said cylinder in communication with said source in said first valve position and a second passage therein placing said cylinder in communication with said stem in said second valve position, sealing means on opposite sides of said second passage for sealing said first passage out of communication with said cylinder in said second valve position and sealing said second passage from said source in both valve positions, means mounting said tray and said head for movement through a predetermined path, cam means for moving said piston in a direction charging said cylinder with product from said source and a direction discharging product from said cylinder through said stem, valve shifting means for moving said valve into said first position for said charging stroke and into said second position for said discharge stroke, said filling stem having a dispensing passage therethrough and an outlet therefrom, and a spring-backed check valve controlling product flow through said passage, said check valve opening under product pressure during said discharge stroke and closing upon release of such pressure.

2. A container filling machine as set forth in claim 1 wherein said cam means include a first cam section extending along said path for moving said piston in a direction charging said cylinder with product from said source and a second cam section extending along said path for moving said piston in a direction discharging product from said cylinder through said stem.

3. A container filling machine as set forth in claim 2 together with means for selectively varying the rise of said first cam section thereby to vary the volume of product dispensed.

4. A container filling machine as set forth in claim 3, wherein said first cam section is pivotally supported adjacent its entrance end, and wherein said last-named means include means for moving said first cam section about its pivot.

5. A container filling machine as set forth in claim 3, wherein said path is circular, said first and second cam sections comprising a cam ring pivotally supported adjacent the entrance end of said first cam section, said last-named means including means for raising and lowering said cam ring about its pivot support.

6. A container filling machine as set forth in claim 2, including a cam follower connected to said piston and successively

engaging said cam sections as said filling head moves through said path, together with means transferring engagement of said follower from said second cam section to said first cam section just prior to the end of said discharge stroke, whereby the stroke of said piston and the volume of product dispensed is determined by said first section as a reference.

7. A container filling machine as set forth in claim 2, wherein said path is circular and said first and second cam sections comprise an overhead cam ring, together with a cam follower connected to said piston and successively engaging said cam sections, and means transferring engagement of said cam follower from said second cam section to said first cam section just prior to the end of said discharge stroke, whereby the stroke of said piston is determined by said first cam section as a reference.

8. A container filling machine as set forth in claim 1, wherein said valve shifting means includes first means for moving said valve into said first position and second means for moving said valve into said second position, together with means for disabling said second means in the absence of a container on said tray.

9. A container filling machine as set forth in claim 1 wherein said valve shifting means include first and second cams engaging a follower connected to said valve spool, together with means for shifting said second valve shifting cam out of spool follower engaging position.

10. A container filling machine as set forth in claim 1, together with a piston rod connected to said piston and a cam follower connected to said rod, a cylinder vent passage through said piston and said rod, and means on said rod selectively operable to open and close said passage.

11. A container filling machine as set forth in claim 1 including a cam follower connected to said piston, said cam means including a first cam section extending along said path and engaging said follower for moving said piston in a first direction to draw product from said source into said cylinder and a second cam section extending along said path and engaging said follower for moving said piston in the opposite direction to discharge product from said cylinder, said valve shifting means including a first means for moving said valve into said first position during the charging stroke of said piston and a second means for moving said valve into said second position during the discharge stroke of said piston, and means urging said follower against said first cam section just prior to the end of said discharge stroke.

12. A container filling machine as set forth in claim 11, wherein said follower is connected to said piston by means including an arm, and wherein said means urging said follower against said first cam section include a spring-backed ball detent carried by said arm and a detent engaging return cam positioned adjacent the exit end of said second cam section.

13. A container filling machine as set forth in claim 1, together with means for selectively adjusting the closing force exerted on said check valve by its backing spring.

14. A container filling machine as set forth in claim 1, together with a tension increasing screen across said outlet.

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