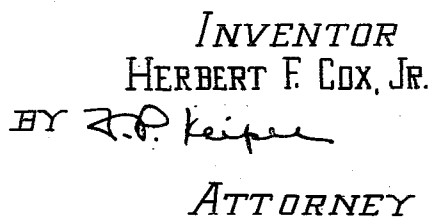


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CONTAINER FILLING APPARATUS

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FIG. 2.

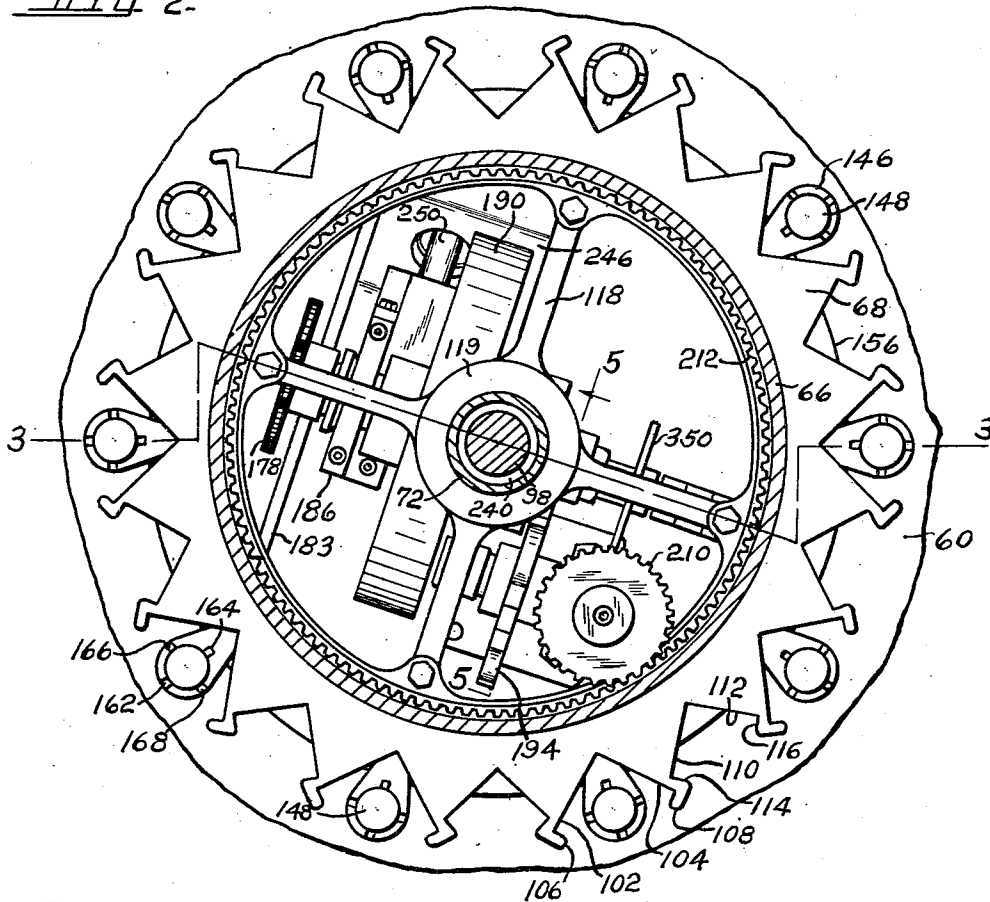


FIG. 4.

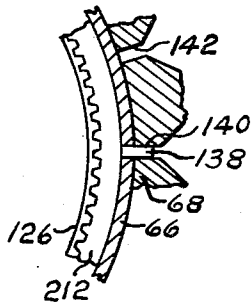
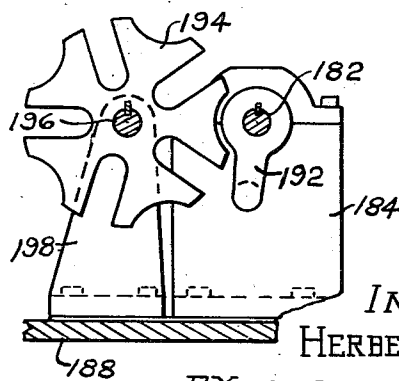


FIG. 5.



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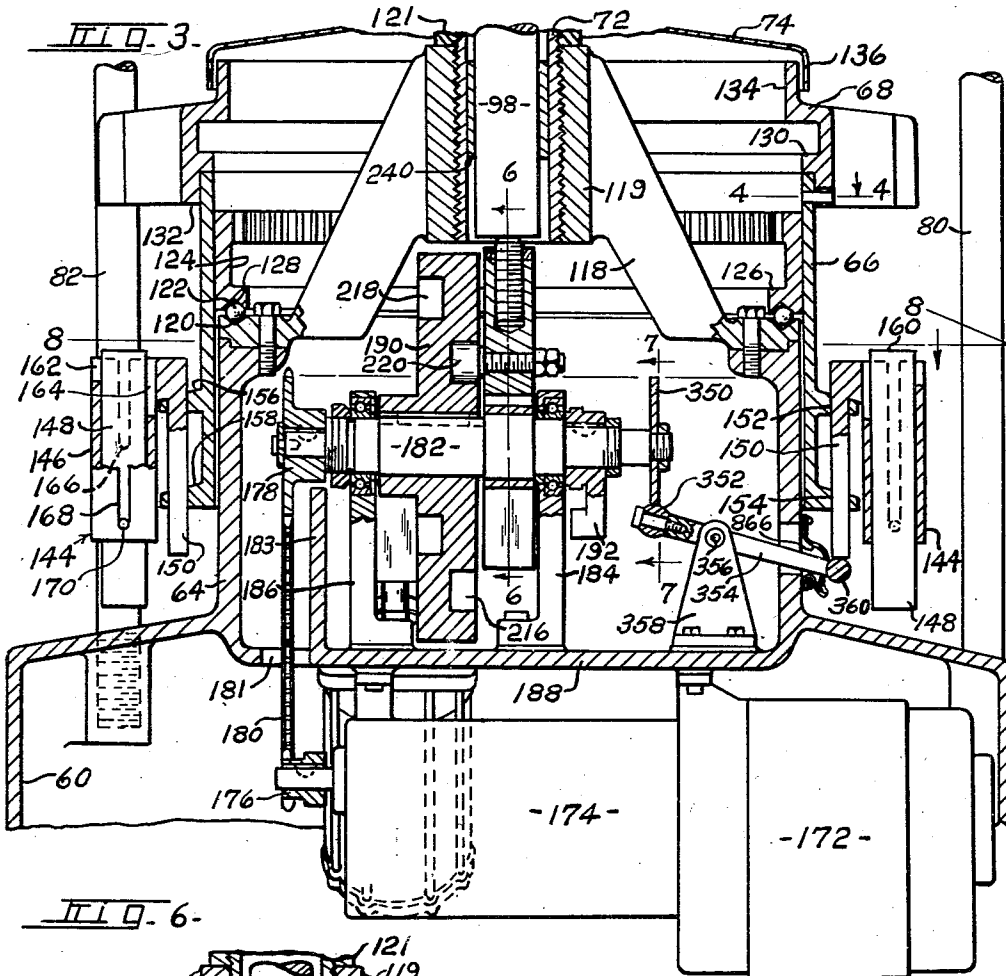


FIG. 6.

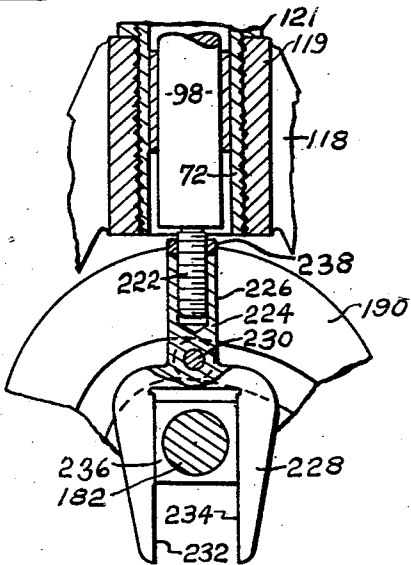
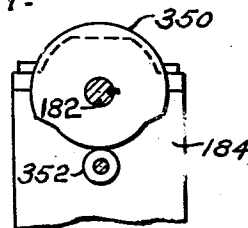


FIG. 7.



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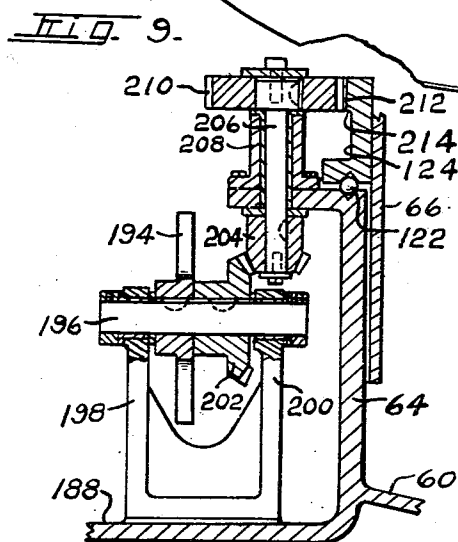
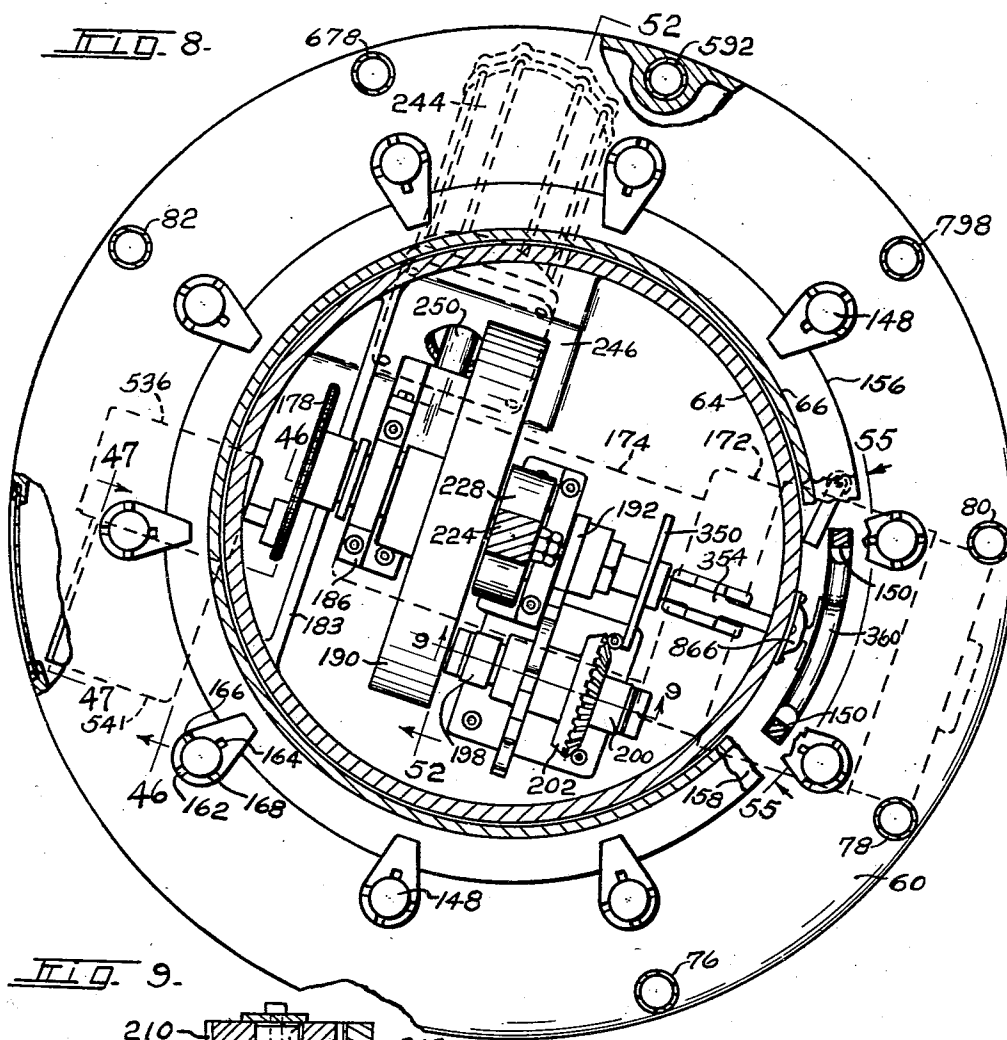
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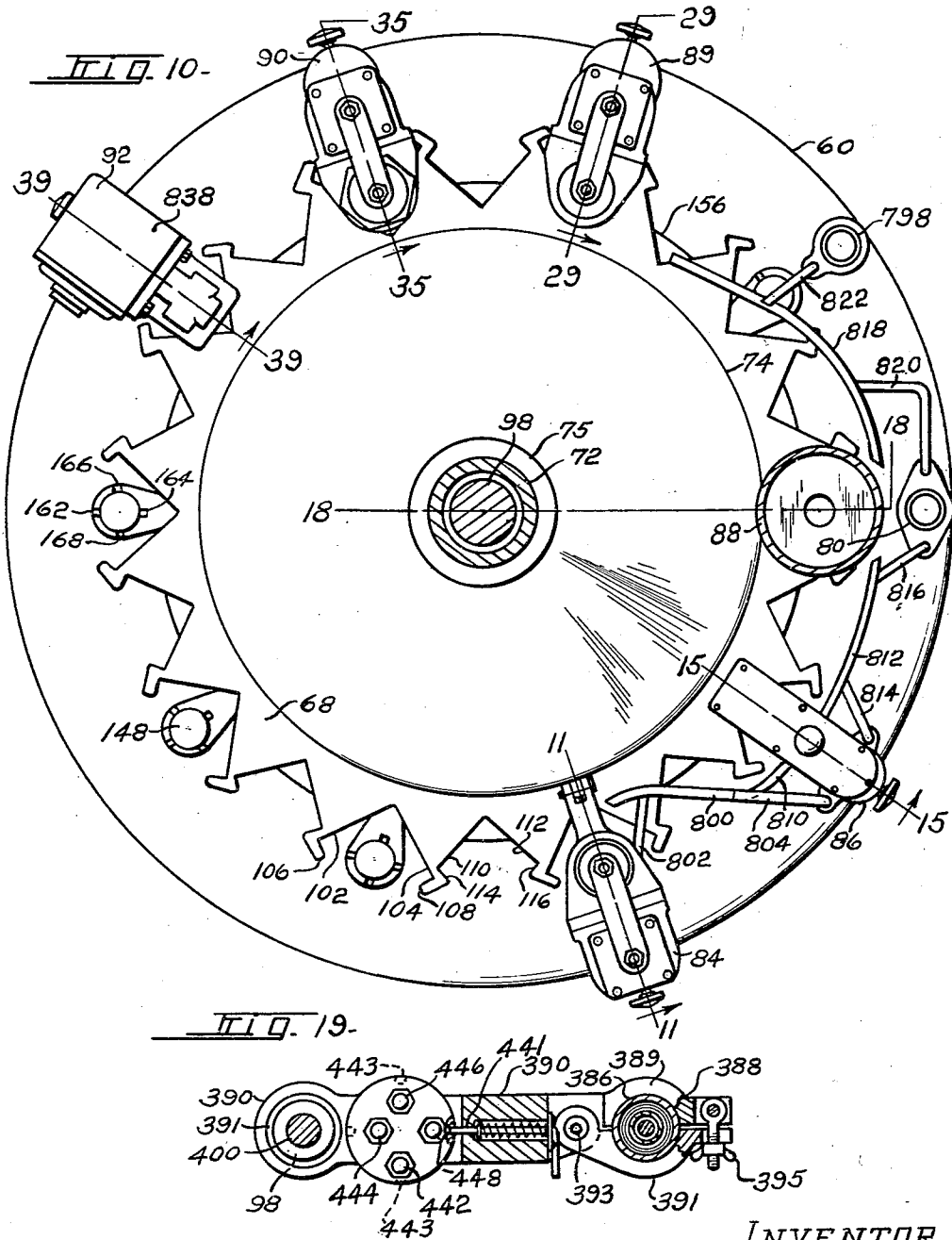
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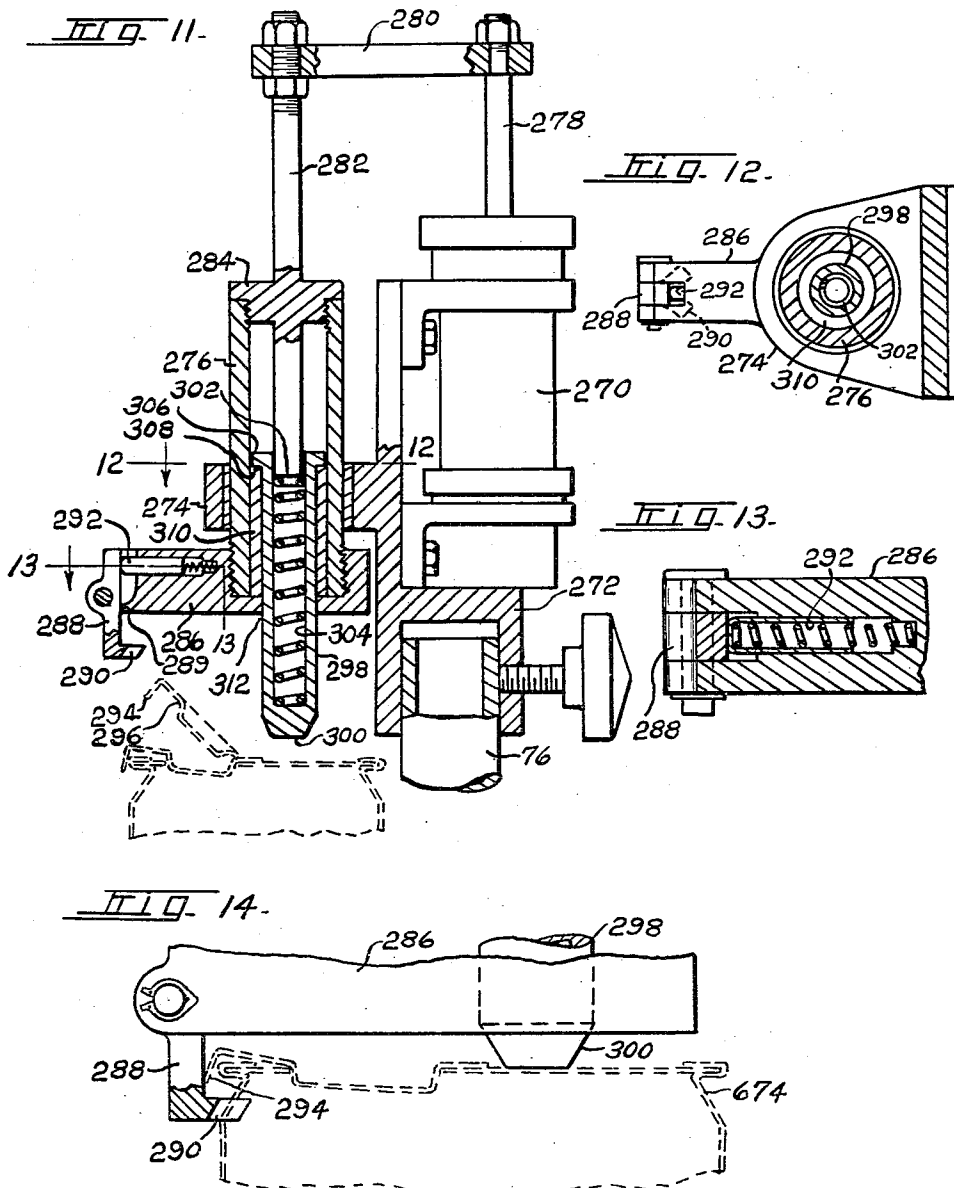
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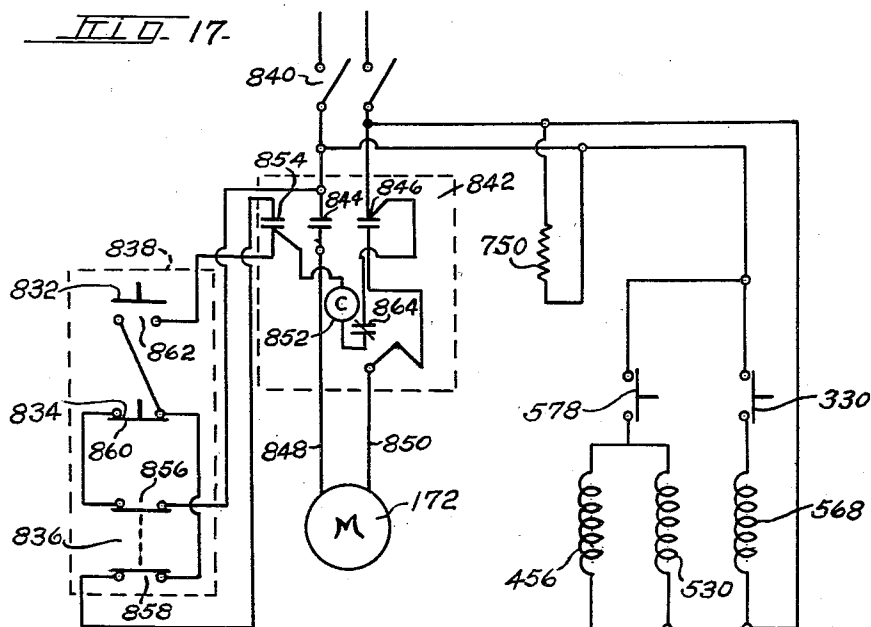
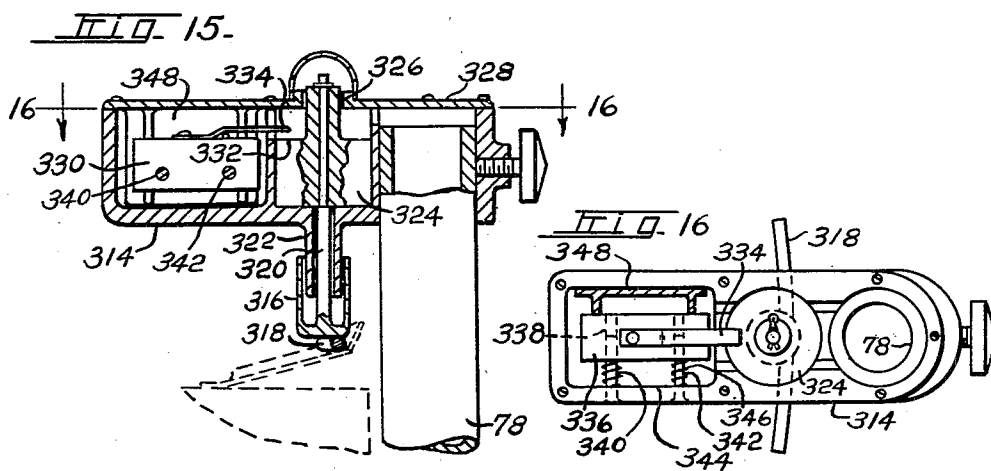
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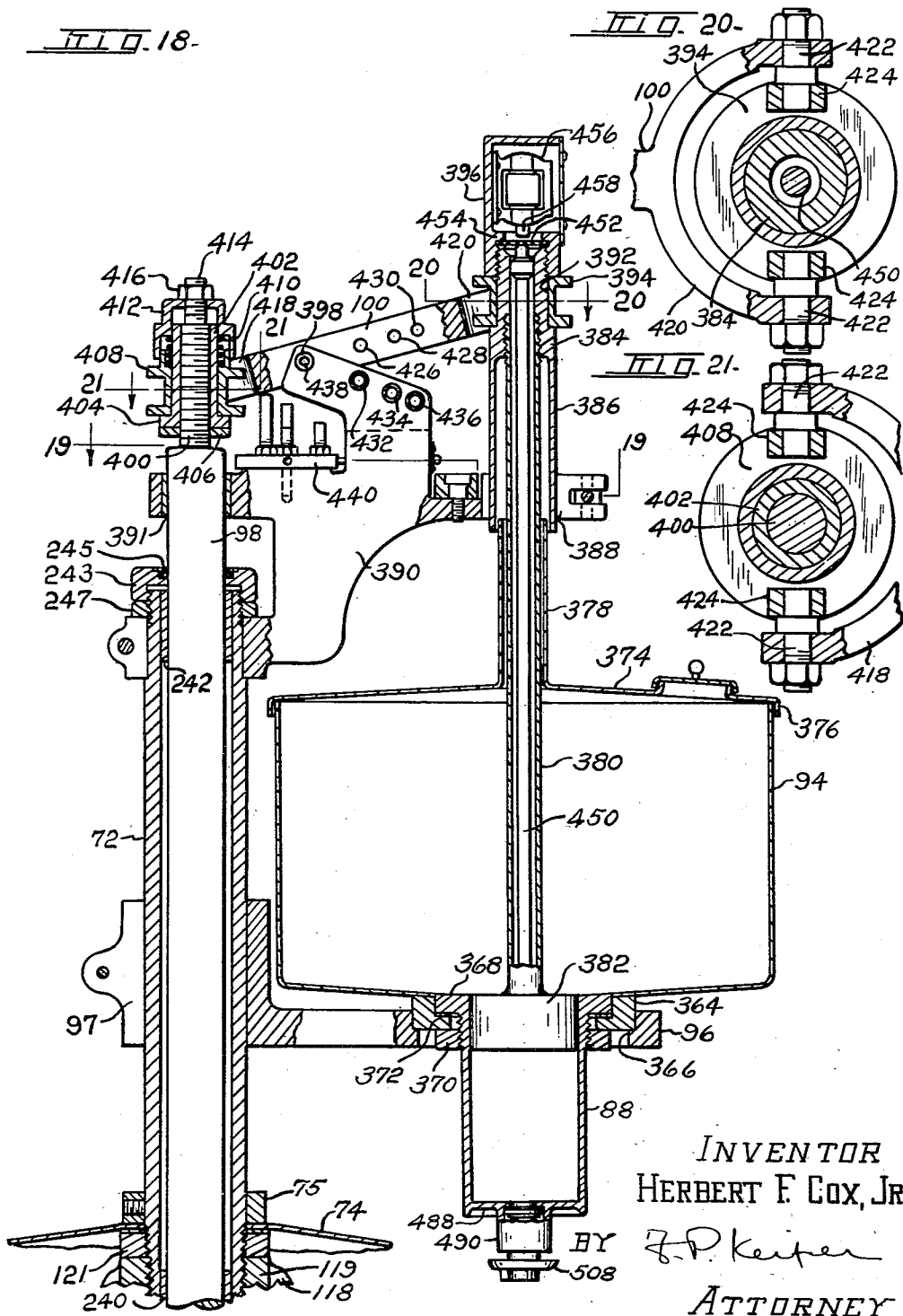
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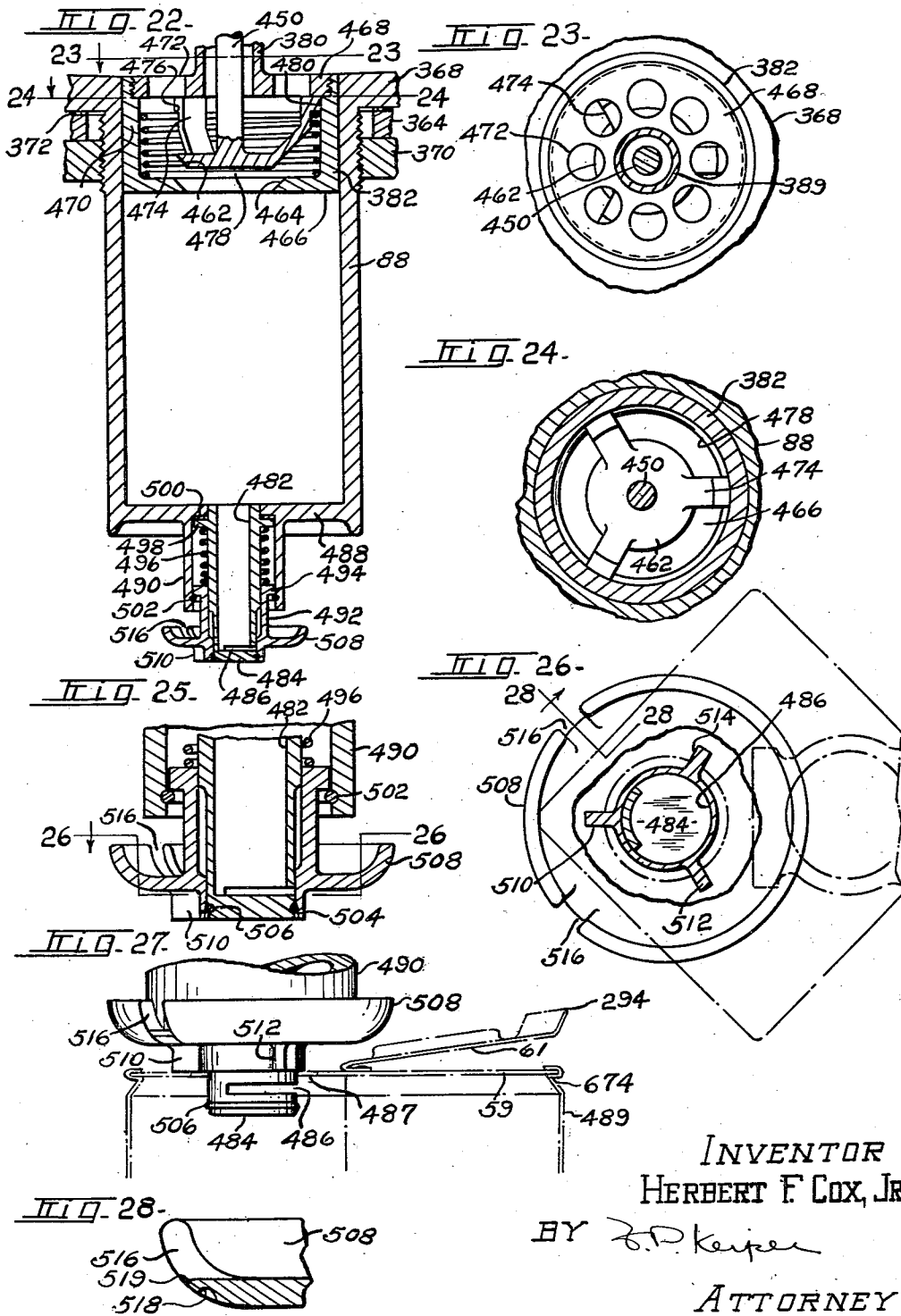
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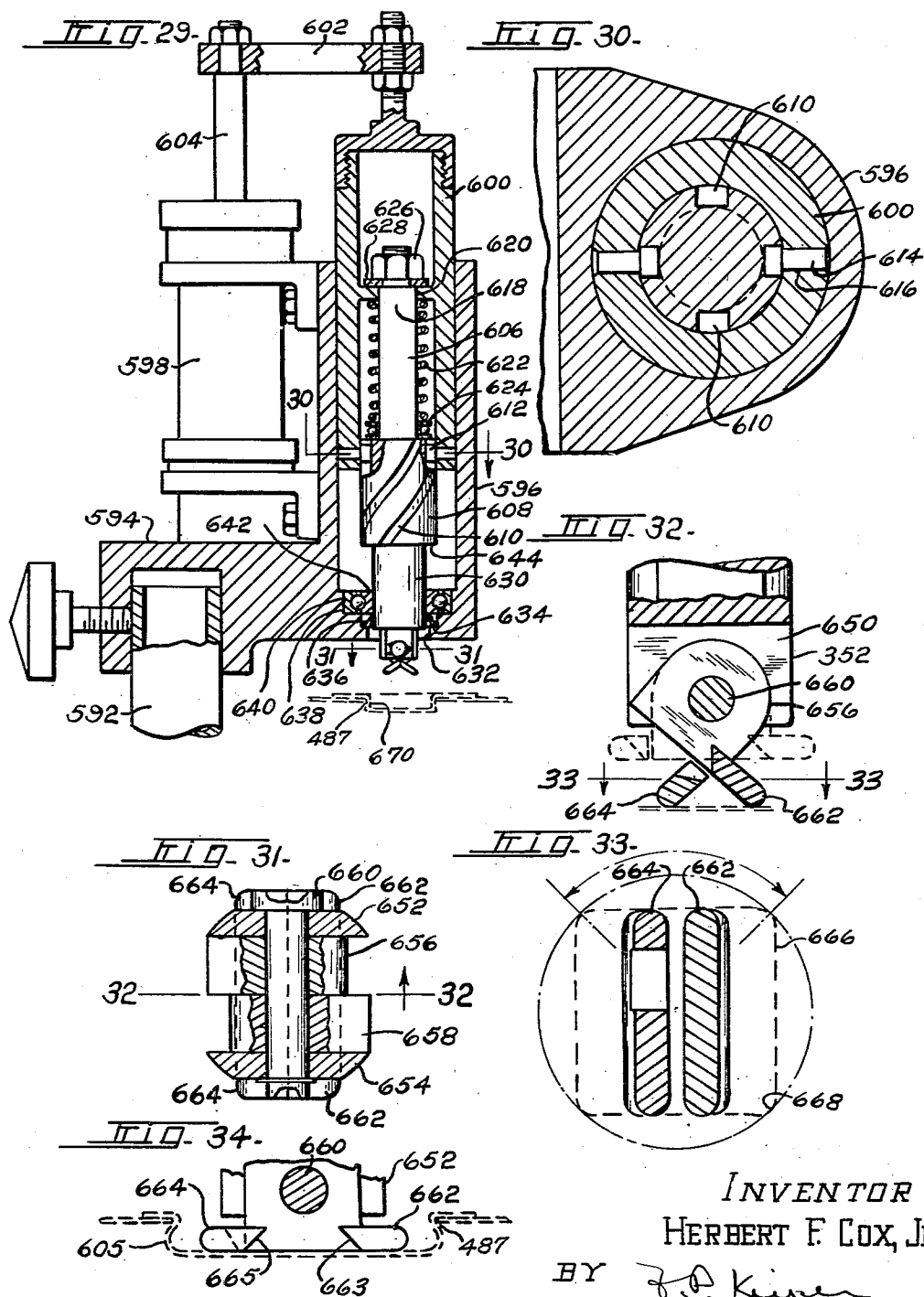
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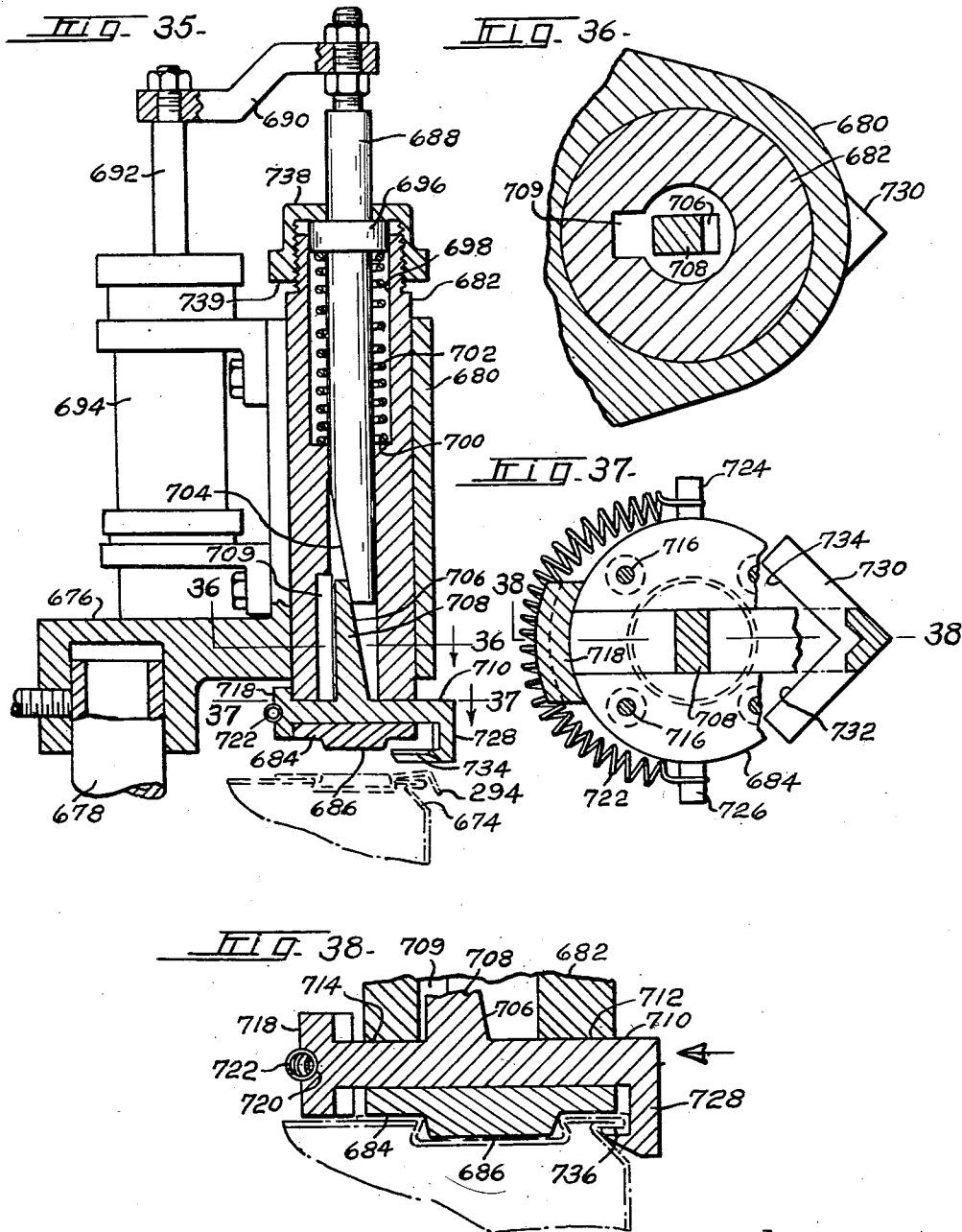
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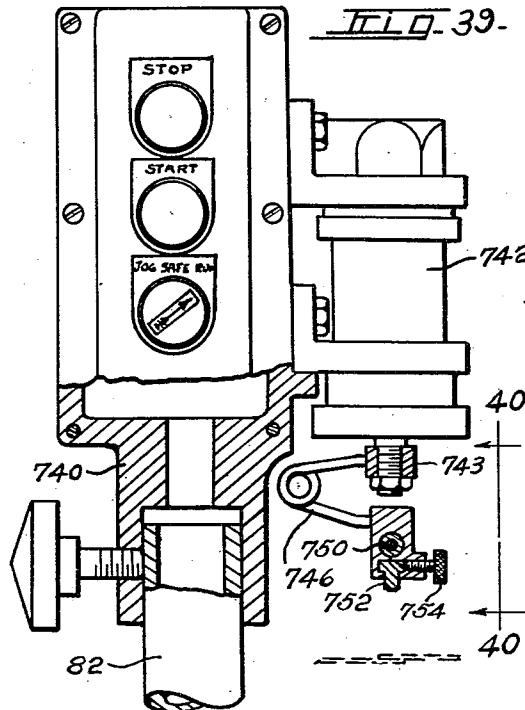


FIG. 40-

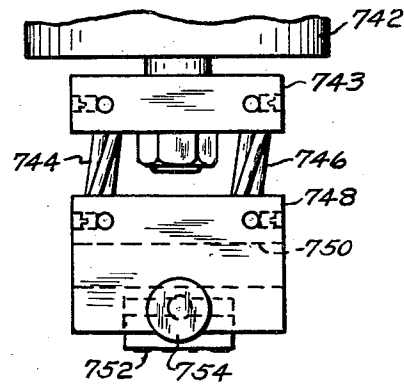
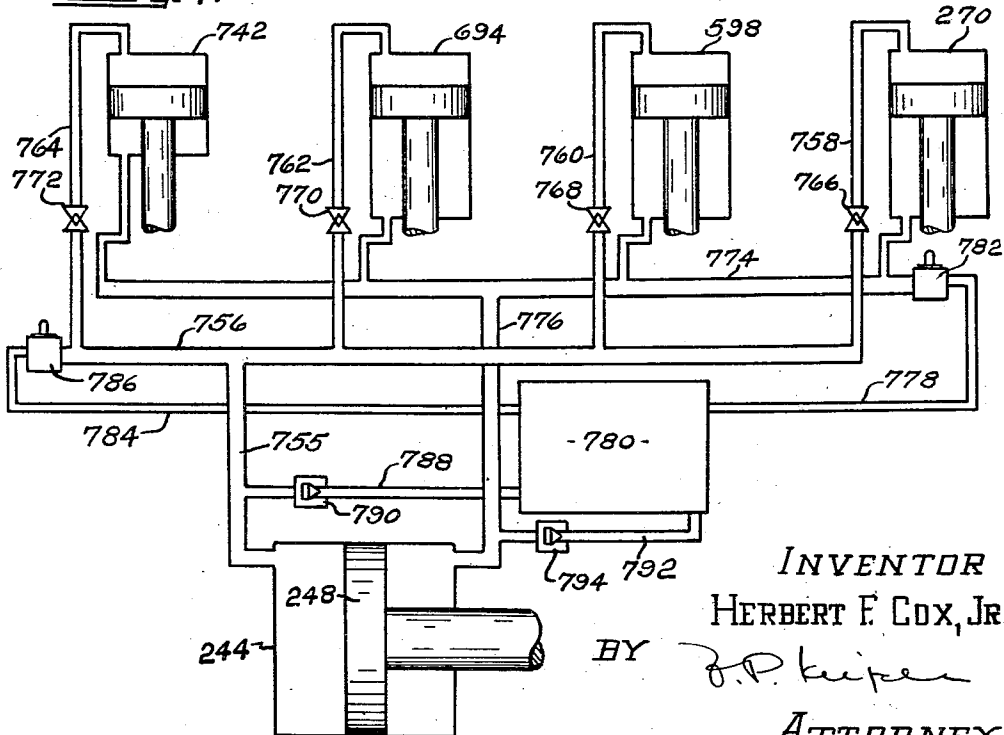


FIG. 41-



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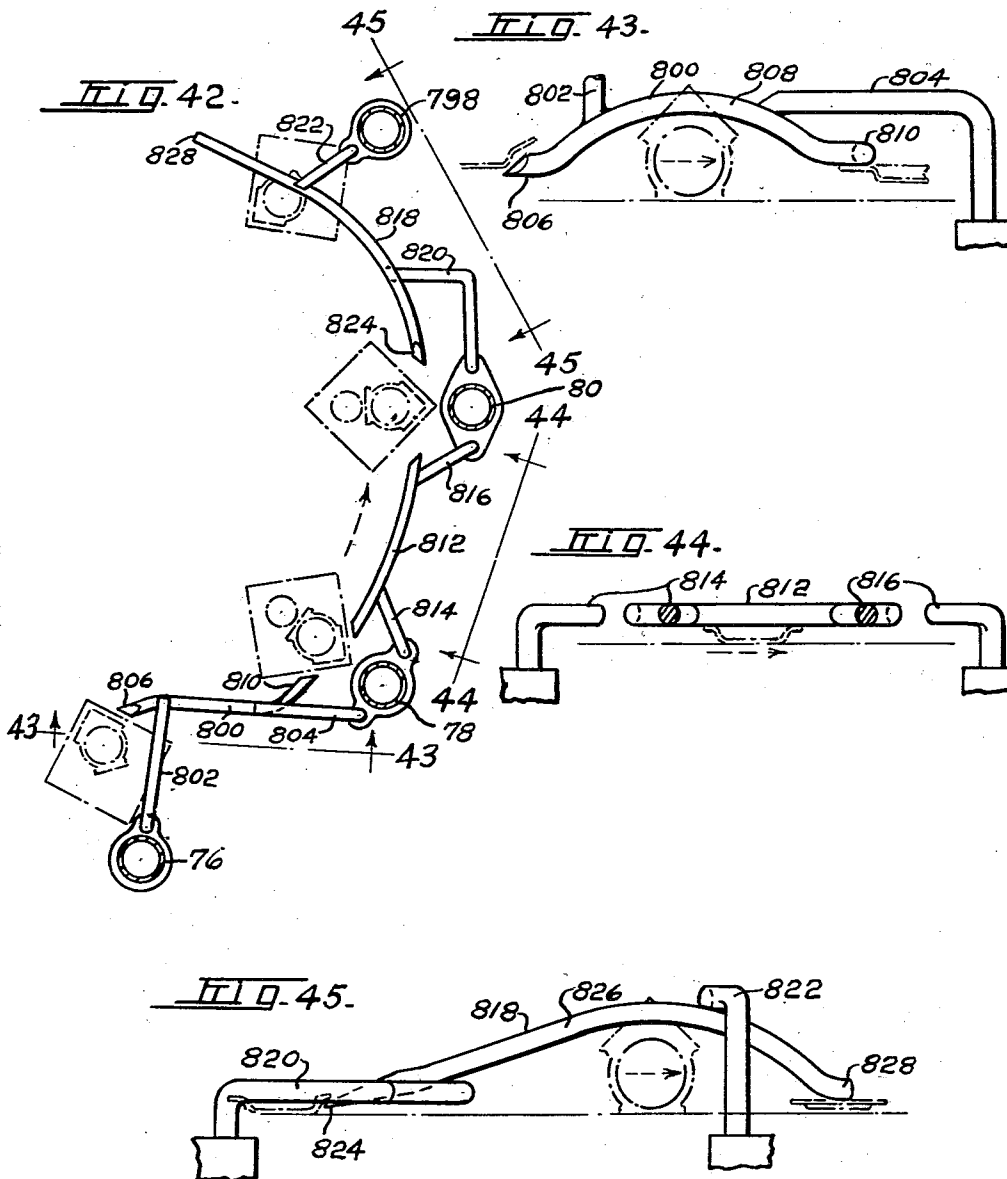
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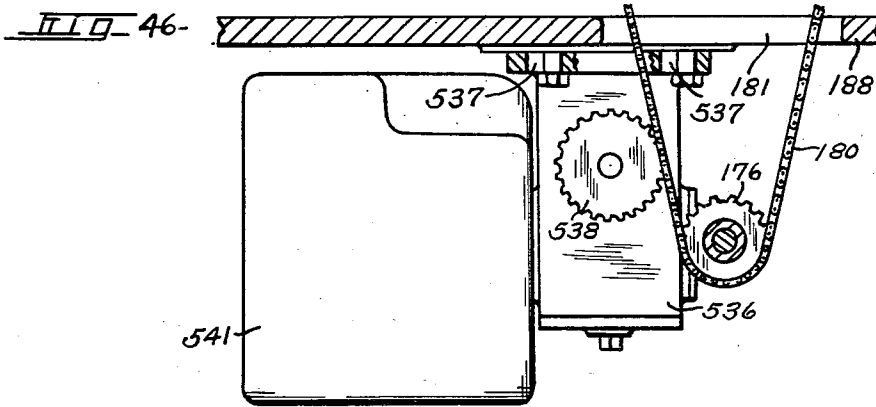


FIG. 47-

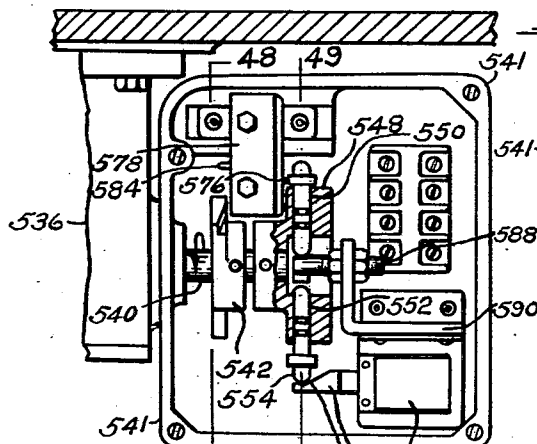


FIG. 48-

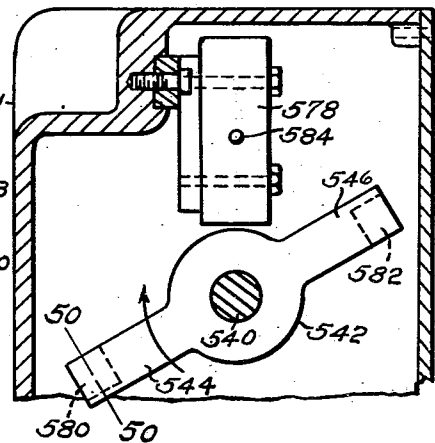


FIG. 49-

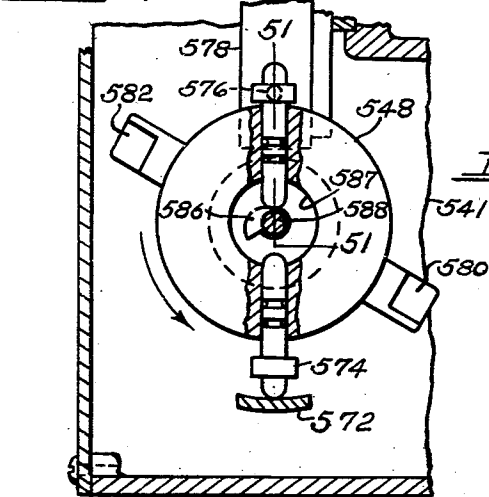
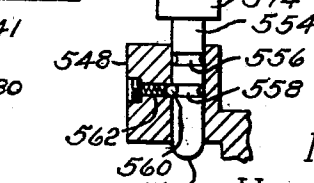


FIG. 50-



FIG. 51-



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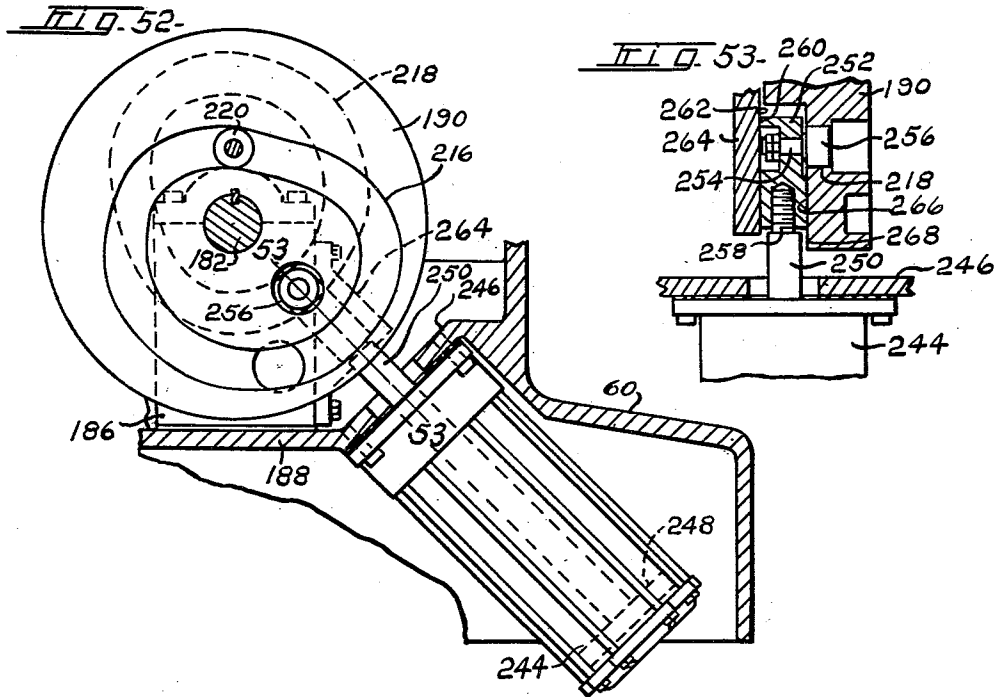
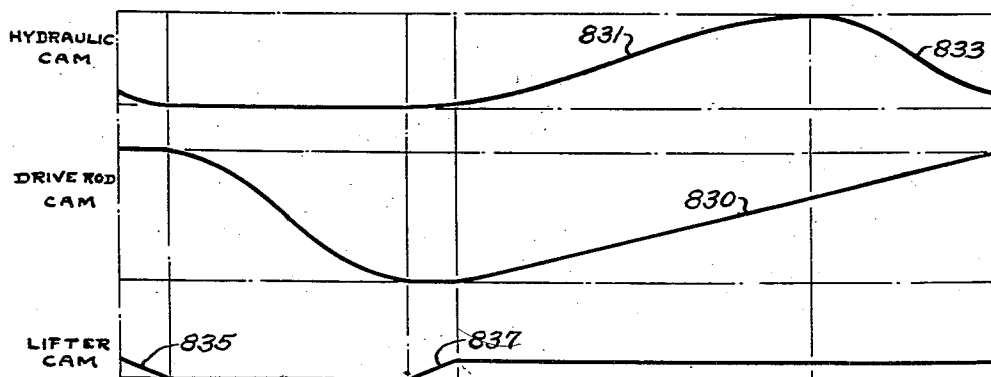


FIG. 54-



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FIG. 55.

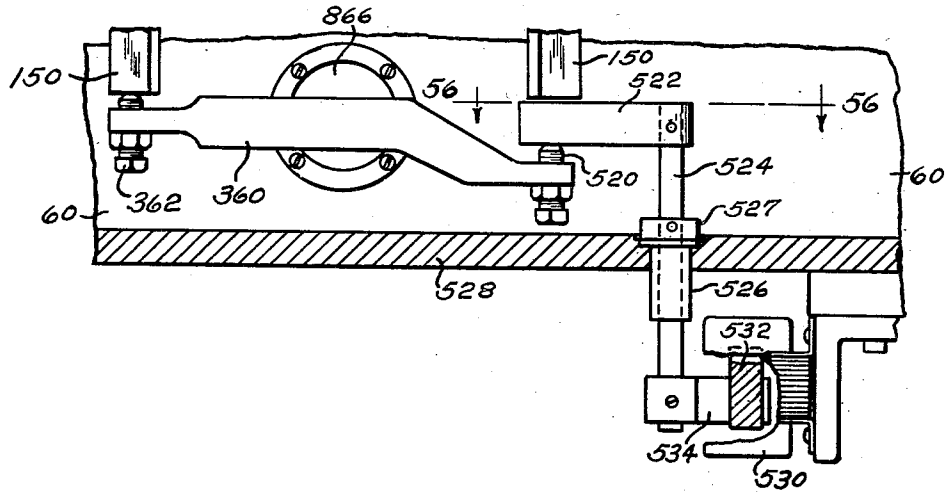
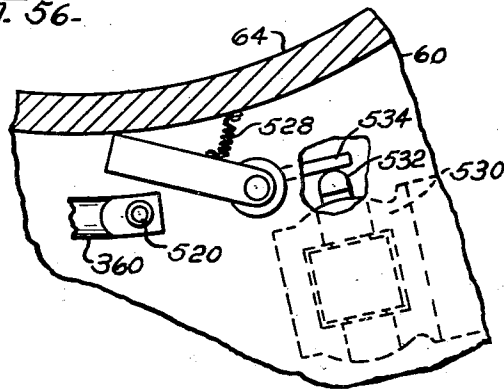


FIG. 56.



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CONTAINER FILLING APPARATUS

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Application December 10, 1951, Serial No. 260,873

46 Claims. (Cl. 141—86)

The present invention relates to apparatus for filling measured charges of liquid into containers and ancillary operations relating thereto, including the preparation of containers for filling and subsequent sealing, and more particularly to a compact automatic filling machine readily adaptable to containers of different capacities.

In apparatus of the type referred to, particularly in the milk industry where square fiber or other shaped containers having restricted openings are employed, the filling time for each container has been relatively long in order to permit filling at a rate not likely to cause excessive foaming or turbulence and consequent foam overflow. In automatic conveyor machines, filling has been effected at a slow rate while the container is in motion through the machine, a number of duplicate filling operations being effected simultaneously upon a sequence of containers passing through the machine. The filling of such containers has frequently been by slow gravity flow from a measuring device, due to the fact that the containers themselves, due to their non-rigid construction, are precluded from acting as a sufficiently accurate measure. Where numerous filling stations are in operation simultaneously, change-over from one size container to another involves laborious adjustments of each of such filling stations to accommodate a change to a different size container as well as substitution of parts. The filling operation in such apparatus occupies a lengthy portion of the conveyor travel path requiring conveyor extensions for performing ancillary and necessary operations prior to filling and subsequent to filling.

It is an object of the present invention to provide container filling apparatus adapted to fill each container by positive power displacement at a uniform fast rate with a minimum of foaming and turbulence.

It is also an object of the present invention to provide a filling nozzle fed by uniform rate of displacement means and adapted to direct a horizontal fan-like stream immediately below the top of the container, the stream being adapted to be deflected downward by the inside container side wall surfaces in such a way that the fan-like stream does not impinge upon the rising liquid surface within the container.

A further object of the invention is to provide a compact filling apparatus having a circular conveyor, and in which all ancillary operations to filling, such as cap opening, and cap closing are performed during passage of a container once around the apparatus.

A further object of the invention is to provide ancillary devices such as cap opening and closing devices adapted to positively perform their respective functions, together with centralized power means for actuating said devices.

Still another object of the invention is the provision of a frame structure for supporting various operative devices at stations angularly disposed in relation to one another, in which a conveyor ring moves containers periodically from station to station, and in which a dwell

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period for the stationary performance of the various operations is provided.

Still another object of the invention is to provide apparatus which may be quickly adjusted to accommodate containers of different volumetric size, and in which accurate control of any desired measured charge can be quickly effected.

A further object of the invention is to provide an apparatus of low cost, capable of handling quantity production in a cleanly manner, and capable of being changed from one production size to another without substantial delay or complicated adjustments or changing of parts.

A still further object of the invention is to provide mechanism for protecting against a false filling operation upon defective or improperly selected or loaded containers, such mechanism operating through a time delay mechanism.

Yet a further object of the invention is to provide an apparatus of the character described having features promoting cleanliness, and in which the casing structure has a minimum of operative openings, well protected, and having adequate wash water shedding characteristics.

A further object of the invention is directed to providing a filling apparatus of simple, effective design, adapted for ready disassembly for inspection and cleaning, and in which replacement of various units may be quickly made.

The invention further has to do with the design of a filling apparatus, in which the various devices are disposed in an accessible manner, independent of one another, and in which modified devices for acting on containers of various shapes may be easily substituted, without substantial variation in the sequence or principle of over-all operation.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

Figure 1 is an elevational view of the apparatus, taken from the loading side;

Figure 2 is a transverse sectional view, taken substantially on the line 2—2 of Figure 1, just above the conveyor ring;

Figure 3 is a broken sectional view through the base, taken substantially on the line 3—3 of Figure 2;

Figure 4 is a fragmentary sectional view taken substantially on the line 4—4 of Figure 3, showing the setting key for the ring conveyor;

Figure 5 is a fragmentary sectional view taken substantially on the line 5—5 of Figure 2, showing the Geneva drive for the conveyor ring;

Figure 6 is a fragmentary sectional view taken substantially on the line 6—6 of Figure 3, showing the central operating bar cam follower and guide;

Figure 7 is a fragmentary sectional view taken substantially on the line 7—7 of Figure 3, of the container lifting cam;

Figure 8 is a transverse sectional view taken substantially on the line 8—8 of Figure 3, showing the main drive shaft;

Figure 9 is a fragmentary sectional view taken substantially on the line 9—9 of Figure 8, showing the conveyor ring drive;

Figure 10 is a transverse sectional view taken sub-

stantially on the line 10—10 of Figure 1, showing the operating stations;

Figure 11 is a fragmentary sectional view taken substantially on the line 11—11 of Figure 10, of the carton filler plug opening station;

Figure 12 is a fragmentary transverse sectional view taken substantially on the line 12—12 of Figure 11;

Figure 13 is an enlarged fragmentary sectional view taken substantially on the line 13—13 of Figure 11;

Figure 14 is a fragmentary elevated view, partly in section, and enlarged to approximately full size, of the opening dog of Figure 11;

Figure 15 is a fragmentary sectional view taken substantially on the line 15—15 of Figure 10, through the detector station;

Figure 16 is a sectional view taken substantially on the line 16—16 of Figure 15;

Figure 17 is an electrical circuit diagram for the apparatus;

Figure 18 is a fragmentary sectional view taken substantially on the line 18—18 of Figure 10, through the filling station;

Figure 19 is a fragmentary sectional view taken substantially on the line 19—19 of Figure 18, showing the filling stroke adjuster;

Figure 20 is an enlarged fragmentary sectional view taken substantially on the line 20—20 of Figure 18, of the filler piston driving collar and yoke;

Figure 21 is an enlarged fragmentary sectional view taken substantially on the line 21—21 of Figure 18, of the central operating bar and lever driven collar and yoke;

Figure 22 is an enlarged sectional view through the liquid pump shown in Figure 18, and taken substantially on the line 18—18 of Figure 10;

Figure 23 is a transverse sectional view taken immediately above the pump cylinder on the line 23—23 of Figure 22;

Figure 24 is a transverse sectional view taken on the line 24—24 of Figure 22, and showing the inlet valve;

Figure 25 is a substantially full size fragmentary axial sectional view through the pump outlet valve and filler nozzle;

Figure 26 is a transverse sectional view taken substantially on the broken line 26—26 of Figure 25;

Figure 27 is a fragmentary side elevational view of the filler nozzle extended to filling position;

Figure 28 is a fragmentary enlarged sectional view through the drip flange taken at the spillway, on line 28—28 of Figure 26;

Figure 29 is a sectional view taken through the filler cap closing and expanding station, substantially on the line 29—29 of Figure 10;

Figure 30 is an enlarged transverse sectional view taken on the line 30—30 of Figure 29, and showing the spiral ways and followers;

Figure 31 is an enlarged sectional view of the cap expanding toggle taken substantially on the line 31—31 of Figure 29;

Figure 32 is a sectional view taken substantially on the line 32—32 of Figure 31;

Figure 33 is a diagrammatic view showing the path of the expander toggle members, taken substantially on the line 33—33 of Figure 32;

Figure 34 is a fragmentary elevational view of the expander members in operative position;

Figure 35 is a sectional view taken through the filler cap sealing and clinching station substantially on the line 35—35 of Figure 10;

Figure 36 is an enlarged sectional view taken substantially on the line 36—36 of Figure 35;

Figure 37 is a sectional view taken substantially on the line 37—37 of Figure 35;

Figure 38 is a sectional view taken substantially on

the line 38—38 of Figure 37, shown in clinching position;

Figure 39 is a view partly in section taken through the marker station substantially on the line 39—39 of Figure 10;

Figure 40 is a fragmentary elevation taken from the line 40—40 of Figure 39;

Figure 41 is a schematic hydraulic control diagram;

Figure 42 is a diagrammatic showing of the guideways adapted to act upon the container cap and progressing from the opening station to the closing station;

Figure 43 is an elevational view, partly in section, taken from the line 43—43 of Figure 42;

Figure 44 is a broken side elevational view, partly in section, taken from the line 44—44 of Figure 42;

Figure 45 is a fragmentary side elevational view taken from the line 45—45 of Figure 42;

Figure 46 is a fragmentary sectional view of the timing mechanism operating in conjunction with the detector taken substantially on the line 46—46 of Figure 8;

Figure 47 is a view of the timing mechanism with parts shown in section and the cover removed, and as viewed from the line 47—47 of Figure 8;

Figure 48 is an enlarged sectional view taken substantially on the line 48—48 of Figure 47;

Figure 49 is an enlarged sectional view taken substantially on the line 49—49 of Figure 47;

Figure 50 is a detailed sectional view taken substantially on the line 50—50 of Figure 48;

Figure 51 is a fragmentary sectional view taken substantially on the line 51—51 of Figure 49, with the pin in reset position;

Figure 52 is a fragmentary sectional view of the hydraulic master cylinder and driving cam taken substantially on the line 52—52 of Figure 8;

Figure 53 is a fragmentary sectional view through the cam and follower taken on the line 53—53 of Figure 52;

Figure 54 is a timing diagram illustrating the relative cyclic operation of the various parts;

Figure 55 is a fragmentary part-elevational and part-sectional view of the container lifting mechanism taken substantially on the line 55—55 of Figure 8;

Figure 56 is a fragmentary sectional view taken substantially on the line 56—56 of Figure 55; and

Figure 57 is a perspective view of the top construction of a container adapted for use in the apparatus.

Referring to the drawings, and particularly to Figure 1, there is shown apparatus from the loading side for holding fiber milk containers, the machine having a ring conveyor for moving the containers around the machine as various operations are performed at various stations in the process of filling such containers. The apparatus as illustrated is particularly adapted for filling containers of the type shown in Figure 57, having a substantially square cross-section, a flat top 59, and a filling opening closed by a hinged member having formed therein a fibrous cap 61 in the form of a shallow cup-like plug, such hinged member being secured to the cover and sufficiently flexible to hinge to an open position substantially along the diagonal line across the top. Such containers are of a well-known type and are essentially like the disclosure in Hothersall Patent 2,085,979, except that the hinged member is also provided with a lip adapted to be formed around the top corner edge bead of the container.

The apparatus comprises a circular base 60 having a plurality of feet 62, and a central circular housing 64 about which is rotatably mounted a circular skirt 66, upon which is mounted a conveyor ring 63 and container support brackets 70. Projecting upwardly above such skirt and on the center axis of the apparatus is a stationary column 72 from which is hung an annular splash guard 74 which overhangs the conveyor ring carried by the rotating circular skirt 66. A ring 75 having a column en-

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gaging set screw is secured to the guard and holds such guard in position, as shown, or in elevated position during inspection.

The base 60 has upwardly projecting from adjacent the edge thereof a plurality of support posts such as 76, 78, 80, and 82, adapted to carry various unitary devices angularly disposed around the apparatus. Such devices include a cap opening mechanism generally indicated as at 84, a detecting apparatus indicated at 86 to determine whether the cap of the container has been properly opened and is in readiness for filling, a filling apparatus 88, a cap closing and clinching apparatus, the clinching portion of which is generally indicated at 90, and a marking apparatus 92 for marking the container, it being understood that where the apparatus is applied to milk containers or other perishable liquids, it is desirable to indicate the date of filling. The opening apparatus 84, the detecting apparatus 86, the filling apparatus 88, the closing and clinching apparatus, the latter shown at 90, and the marking apparatus 92 are disposed around the conveyor ring at angular intervals, for example, as illustrated by Figure 10, such that containers carried by the conveyor ring are moved to proper operative positions with respect to all of such apparatus at any time that the conveyor ring is brought to rest in proper angular relation to any station at which such apparatus is located.

The filling apparatus comprises a reservoir 94 which is adapted to hold a substantial quantity of milk or other liquid. Such reservoir may be continuously filled by float feed apparatus (not shown) or filled from time to time from any available supply. The reservoir 94 is supported from the center column 72 upon a bracket 96 securely clamped thereto as at 97. Power for actuating the filling mechanism is obtained from a reciprocating bar 98 actuated by means within the housing, such bar extending up through the column 72 and acting through lever mechanism generally indicated at 100 above the reservoir 94.

The containers of the type shown in Figure 57 may be of varying capacity, such containers being in half pint, one-third quart, one pint, and one quart sizes. The three smaller sizes of such containers, as commercially produced, are of the same square cross-sectional dimension, but vary in height. The largest size, that is the quart size, is of larger square cross-section, and also of a different height from any of the other three smaller sizes. The present apparatus is adapted to quickly change over from containers of one capacity to containers of a different capacity, so that the apparatus can be run on one size for a period of time until a sufficient production of filled containers of that size is had, and then quickly changed to such other size as there may be a demand for.

Referring to Figure 2, the conveyor ring comprises a plurality of pairs of open pockets, twenty in number, ten of which are adapted to receive the smaller sizes, and ten of which are adapted to receive the largest size. Each of the larger pockets comprises flanks 102 and 104 at right angles to one another and terminating in short broad finger grips 106 and 108. The contour of the flanks 104 and the grips 106 and 108 is such as to closely embrace the large size square container referred to. Such containers are loaded into the pockets by sliding downwardly from above, and then when filled, are lifted out of the pockets. As will be seen from Figure 10, at any one time three adjacent pockets are free from operative devices, affording an unloading station and two loading stations. The large size pockets for receiving the containers are angularly spaced around the ring 36° and between each pair of large size pockets are smaller size pockets for receiving the smaller size containers, such smaller size pockets having flanks 110 and 112 bounded by grips 114 and 116, proportionately similar to the grips 106 and 108 for the large size containers. During operation, the conveyor ring is adapted to be moved 36° at a time, and then remain stationary for a period during which various operations at various stages are performed

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substantially simultaneously, whereupon the ring is advanced 36° and the operations repeated upon the subsequent containers. The large and small pockets are each adapted to hold containers of the type described, with their off-center filler holes inwardly disposed, with the hole centers lying on a common circle.

Referring to Figure 3, it will be seen that the base 60 and upstanding circular housing 64 are provided with an annular bearing member having an annular upwardly facing bearing groove or race 120 and central spider member 118, the spider portion having a hub 119 acting as a supporting member for the center column 72 previously referred to. The column 72 is threaded in the hub, and locked by a nut 121. The race 120 is provided with a plurality of hardened balls 122, upon which is supported an annular member 124 having an inwardly extending circular flange 128 riding on such balls 122. The annular member 124 has secured thereto the circular skirt 66, the lower portion of which overhangs to a considerable extent the housing 64 and the upper end of which forms a support for the conveyor ring 68. The conveyor ring has an internal annular shoulder 130 adapted to seat upon the circular upper edge of the skirt 66, the lower portion 132 of the ring overhanging the skirt 66 a slight distance and telescopically arranged with respect to the skirt so as to accurately center the conveyor ring upon the skirt 66. The conveyor ring has an inwardly offset upstanding flange 134 extending upwardly into the splash guard or cover 74, such cover having a depending narrow skirt 136 overhanging the flange 134.

It will be seen that the pockets previously described which are integrally formed on the ring 68, have considerable depth whereby containers placed in position will be held in accurate vertical alignment. As previously indicated, the conveyor ring is provided with ten large pockets angularly spaced 36° and intermediate smaller pockets located midway between each pair of large pockets. The conveyor ring is so mounted upon the skirt 66 as to be shiftable angularly 18°, so as to move the small pockets to an operative position and move the large pockets to an inoperative position, or vice versa. For this purpose, the skirt 66 (see Figure 4) is provided with radial pins 138 adapted to coast with either one of two keyways 140 or 142 in the conveyor ring 68, so that upon manually lifting the conveyor ring slightly with respect to the supporting skirt 66 and moving the same angularly 18°, the conveyor ring may be readily keyed to the supporting skirt so as to bring either the large size pockets into operative position or the small size pockets into operative position.

Carried by the skirt 66 are ten supporting brackets 144 adapted to act as bottom rests for containers held by the pockets. Such brackets are angularly uniformly spaced 36° around the skirt 66. Each bracket comprises a vertical sleeve 146 in which is adjustably positioned a container support bar 148, such sleeve having an offset supporting arm 150 extending downwardly parallel to the axis of the sleeve, which arm may be square in cross-section and project through square apertures 152 and 154 in the annular flanges 156 and 158 integrally secured to the skirt 66. The support arms 150 are vertically slidable in the apertures 152 and 154 in order to perform certain operations at certain stages which will be hereinafter referred to.

Since the height of the different container sizes varies, it is desirable to vary the height of the supporting surface 160 of the supporting bars 148, so that whatever size container is being operated upon, the top surface of the container will normally always lie in a common horizontal plane. In order to set the height of the supporting surfaces 160, the sleeves 146 are provided with four downwardly longitudinally extending slots of varying length, such as 162, 164, 166, and 168, and the bar 148 is provided with a radial pin 170 adapted to seat in the lower end of any one of such slots. The slot 162, for example,

when engaged by the pin 170, holds the supporting surface 160 of the bar 148 at an elevated height such that the half pint size container would have its top surface lying in the operating plane referred to. When the pin 170 rests in the base of the slot 164, the height is such as to accommodate a one-third quart container with its top in the same operating plane. As shown in Figure 3, the pin is seated in the base of the slot 168 which is the lowermost position, and that which would support a container of the quart size with its top lying in the operating plane. It will thus be seen that by seating all of the pins 148 in the base of slots corresponding to a given size, a particular container size will be accommodated, and that by shifting the conveyor ring 18° by moving the key 138 from one to the other of slots 140 and 142, the proper size pockets will be positioned in alignment with the supporting bars 148 for the particular size container.

Referring to Figure 3, there is shown within the base, a motor 172, which may be of variable speed type, operating through a reduction gear 174 and driving by means of sprockets 176 and 178 and a chain 180 a main drive shaft 182. Such drive shaft is journaled in bearing brackets 184 and 186 mounted upon the housing bottom 188. The drive chain 180 passes through an aperture 181 in the bottom 188. Such opening 181, however, is surrounded by a baffle 183, so that a quantity of oil may be retained in the housing to lubricate the main shaft bearings and mechanism operated thereby. Such drive shaft has keyed thereto a cam wheel 190 and a crank arm 192 of a Geneva movement shown more in detail in Figures 2, 5, 8, and 9. The crank arm 192 operates a star wheel 194 of such Geneva movement, the star wheel being mounted upon a shaft 196 journaled in bearing brackets 198 and 200. The shaft 196 has keyed thereto a bevel gear 202 meshing with a mating gear 204 keyed to a vertical shaft 206 journaled in a bearing bracket and sleeve 208 extending inwardly from the wall of the housing 64. The shaft 206 on its upper end has keyed thereto a driving pinion 210 meshing with internal ring gear teeth 212 which may be formed integrally upon an inwardly extending annular shoulder 214 of the support ring 124 previously referred to, such support ring carrying the skirt 66 and the conveyor ring 68. By means of the Geneva movement and the selection of bevel gears, pinion and ring gear of correct ratios, each rotation of the Geneva arm 192 moves the conveyor ring 36°. The Geneva arm and star wheel 194 are so designed that movement of the ring is effected during approximately 120° of the rotation of the Geneva arm 192 and drive shaft 182, the ring remaining stationary during the remaining 240° of rotation of the Geneva arm 192.

The cam wheel 190 mounted on the main shaft 182 and shown in Figures 2, 3, 6, 8, and 52, is provided with cam grooves 216 and 218 on its opposite faces. The groove 216 is adapted through a roller follower 220 to reciprocate the operating bar 98 extending axially through the center column 72 of the apparatus. The bar 98 at its lower end is provided with a threaded shank 222 received in a cam follower supporting member 224, such member having an upwardly extending threaded sleeve 226, a downwardly extending fork 228, and a laterally extending stub shaft 230 upon which the cam follower roller 220 is rotatably mounted. The fork is provided with spaced facing parallel plane surfaces 232 and 234 adapted to slide upon the opposed faces of a guide block 236 freely rotatably mounted upon the main shaft 182. The shank 222 is adjustable axially within the threaded sleeve 226 to vary the relative position between the bar 98 and the cam follower 220, there being provided a locking nut 238 to secure the selected adjustment. The bar 98 is slidably mounted in sleeve guides 240 and 242 (see Figure 18) within the tubular column 72. As will be referred to hereinafter more in detail, the cam groove 216 is provided with a section adapted to move the central bar 98 downwardly during approximately a third of the

rotation of the cam wheel and to move the bar upwardly during the remainder, and the rise of the portion of the cam effecting upward movement of the bar 98 is substantially uniform so that the velocity of the bar in its upward movement is uniform. The cam is also disposed upon the shaft 182 in such angular relation to the Geneva arm 192 as to effect upward movement of the bar 98 at such time as the Geneva arm is free from the mating star wheel and the conveyor ring stationary.

As previously set forth, the apparatus is provided with mechanism for performing the operation of opening the filler cap of an empty fiber container, subsequently determining that the filler cap has been properly opened, and that a container of proper size has been placed upon the ring conveyor, and thereafter filling such container with a measured quantity of fluid, after which the filler cap 61 is closed, following which the lip 294 of the cap is clinched in position, after which the container is suitably marked. In Figure 10, the various positions at which such operations are performed around the machine are indicated in their angular relation. The opening mechanism 84 is followed by the detecting mechanism 86, which is disposed 36° beyond the opening mechanism. Thereafter, the closing mechanism 89 acts upon the cap to seat the cap in the filler opening, such mechanism being located 72° beyond the filler mechanism. The clinching mechanism 90 for the lip of the cam is located 36° beyond the closing mechanism, and the marking apparatus 92 is angularly disposed 36° from the clinching apparatus 90. The filling mechanism is operated from the reciprocating bar 98 driven by the cam wheel 190. The other operating mechanisms, with the exception of the detector, are actuated by a hydraulic system deriving power from a master cylinder, the piston of which is driven by the cam groove 218 in the cam wheel 190.

In Figures 52 and 53, there is shown the master cylinder 244 mounted upon an inclined portion 246 of the housing bottom 188. The cylinder is disposed at an angle of approximately 45°, and its piston and piston rod are radially disposed with respect to the main shaft 182. The piston 248 in the cylinder 244 is actuated by a piston rod 250 having a guide block 252, such guide block having a stub shaft 254 on which is rotatably mounted a cam follower roller 256 riding in the cam groove 218 of the cam wheel 190. The piston rod has a threaded shank 258 which may be adjustably positioned in the block 252 and the flat face 260 of the block 252 rides upon a guide surface 262 formed upon a bracket member 264 secured to the bearing support 186. The guide block 252 also has a face 266 parallel with the face 260 adapted to engage the plane surface 268 of the cam wheel, such surface being located radially outwardly with respect to the cam groove 218. The cam groove 218 is disposed angularly with respect to the cam groove actuating the bar 98, and the Geneva movement so as to move the piston within the master cylinder 244 through a complete stroke in one direction and return, during the time that the ring conveyor is stationary. The master cylinder is connected to power cylinders at the cap opening station 84, the cap closing station 89, the cap clinching station 90, and the marking station 92, which power cylinders are provided with pistons for actuating the mechanism of the referred-to stations.

Referring to Figures 11-14, wherein the cap opening station is shown in detail, there will be seen a power cylinder 270 mounted upon a bracket 272, the latter supported upon the post 76 extending from the annular step of the base 60. The bracket is provided with a laterally extending guide ring 274 through which reciprocates a sleeve 276, the upper end of which is connected to the piston rod 278 of the cylinder 270 through a tie bar 280 adjustably positioned on the rod 282 having an integral collar 284, the latter having threaded engagement with one end of the sleeve 276. The sleeve at its lower end below the supporting ring 274 is provided with a radially

inwardly extending arm 286 secured to the sleeve 276 by threaded engagement as shown. The end of such arm is provided with a vertically extending lever 288, the lower end of which extends below the arm 286, such lower end being provided with a V-shaped cap-engaging lifting member. The V-member has an inclined inside surface 290 adapted to ride over the marginal edge of a container cap in moving downward therepast, the lever being rocked by the cam action of such inclined surface. The lever is resiliently retained in a vertical position by a spring-pressed pin 292 positioned horizontally in the arm 286, such spring pin bearing against the upper end of such lever 288 and the engagement of the lever with the arm abutment 289. The sleeve 276 slides downwardly through the guide ring 274 carrying the arm 286 with it, and causing the V-member to cam past the marginal edge of the container, and upon return movement of the sleeve, the V-member engages upon the under edge of the marginal lip 294 of the cap, pulling the same to an open position substantially as indicated at 296.

In order to restrain the container from being pulled upwardly in its holding pocket during the upward movement of the V-member 290, and its engagement with the under edge of the lip 294, a spring-pressed plunger 298 reciprocally mounted within the sleeve 276 is provided, the plunger having a broad lower face 300 adapted to engage the top of the container. Such plunger is adapted upon engaging the top of a container, to have its movement arrested, whereupon pressure is continued to be applied to the top of the container by means of a pre-loaded spring 302 located within the central bore 304 of the plunger 298. The upper end of such spring is in engagement with the lower end of the bar 282, and by reason of the pre-loading thereof, the pressure by which the plunger surface 300 bears upon the top of the container is maintained substantially constant, although the spring is compressed by reason of the relative movement between the plunger 298 and the sleeve 276 and its supporting bar 282. The plunger 298 has a radially outwardly extending flange 306 at its upper end which is adapted to bear against the shoulder 308 of the sleeve 310 which is fixed in position within the sleeve 276 by reason of its bearing against the shoulder formed by arm 286 adjacent the aperture 312 in such arm through which such plunger 298 projects and slides.

The cap opening mechanism having raised the cap to the position shown at 296 in Fig. 11, it is necessary to hinge the cap outwardly completely away from the filling aperture and such operation is performed during movement of the ring conveyor from one station to the next, through the medium of a stationary guide bar which engages the end tab or lip of the cap on the under side thereof. Such guide bar (see Figures 42 and 43), which will be referred to in more detail hereinafter, causes the cap to be hinged to an open position such as, for example, illustrated in Figures 26 and 27. Unless the cap has been moved to the out of the way position shown in Figure 27, the container is not properly prepared for the filling operation to follow.

In order to avoid spillage or any attempt to fill an improperly opened container with consequent damage thereto, it is desirable to determine that the container carried by the conveyor ring is of the proper size, and that its cap has been moved to the wide open position. In Figures 15 and 16, there is shown a detecting mechanism for determining the presence of a proper size container, as well as the fact of its cap being in the wide open position. Such detector comprises a housing bracket 314 mounted upon the support post 78 from which depends a feeler thimble 316 having a feeler bar 318. The thimble is mounted upon a central shank 320 extending upwardly through an integral casing sleeve 322 into the casing or housing 314, such shank having mounted on its end within such casing a suitable weight 324, the upper end of which is of reduced diameter and projects through a guide aper-

ture 326 in the upper closure plate 328 of the housing 314.

Within the housing is an electrical microswitch 330 containing electrical contacts adapted to be closed upon the engagement of the shoulder 332 of the weight 324 with the projecting switch contact operating lever 334. The microswitch comprises a body portion 336 having transverse apertures 338 for accurate mounting upon horizontal pins 340 and 342 in the side wall 344 of the housing 314, such pins projecting part way across the housing so as to permit the insertion of the switch by lateral movement upon the pins 340 and 342. The pins 340 and 342 are provided with light coil springs 346 which are compressed upon positioning of the microswitch as shown in Figure 16, and the microswitch is held in proper position by a depending ribbed wedge-like member 348, formed as an integral part of the lid 328 so that the switch member is secured in proper position whenever the cover plate 328 is placed in position.

Actuation of the microswitch is effected by lifting of the container in its supporting pocket of the ring conveyor, the container being slid upwardly in the pocket for the purpose. In order to lift the container a fixed height for detecting purposes, there is provided as shown in Figures 3, 7, and 55, a cam-actuated lever mechanism. As shown in Figures 3, and 7, the main shaft 182 has keyed upon its outer end a disk cam 350 adapted to engage a spherical roller 352 rotatably mounted upon the end of a lever 354 fulcrumed as at 356 in a suitable bracket 358 mounted on the housing bottom 188. The outer end of the lever 354 is provided with an arcuate T-head 360 (See Figure 55), the left hand end of which is provided with an adjustment screw 362, adapted to be aligned with the lower end of the sleeve bracket supporting arm 150 located at the detecting station at such time. The cam 350 is adapted to cause the lever 354 to rock counterclockwise as shown in Figure 3, lifting the sleeve bracket in alignment with the screw 362 so as to lift the container supported by the sleeve-carried bar 148 a predetermined amount. If a container of proper height is in position and the cap is in the wide open position as shown in Figure 27, the detector arm will be lifted sufficiently to close the contacts of the microswitch 330. Such contacts effect operation of a control circuit to be hereinafter described in detail.

Following the opening of the container cap and detection, the container is moved to the filling station, reference being had to Figures 18-28 for a description thereof.

The filling station reservoir 94 has welded, or otherwise secured to its bottom, an inwardly flanged ring 364 adapted to rest in an annular shouldered seat 366 in the support bracket 96. The flanged ring 364 has seated thereupon the external flange 368 of the measuring cylinder 88, and such flange is held in engagement with the shoulder of the ring 364 by a clamp nut 370. A suitable seal 372 is provided between the cylinder flange 368 and the ring shoulder. The reservoir 94 is provided with a lid 374 having a marginal depending flange 376 and an upstanding central sleeve 378 adapted to house the hollow piston rod 380, the lower end of which is secured to the piston 382. The reservoir lid 374 may be provided with an access opening for filling from other vessels or for the insertion of float feed apparatus as may be preferred. The piston rod 380 extends upwardly into a sleeve member 384, which sleeve member has a depending skirt 386 arranged telescopically over the upstanding tubular cover sleeve 378. The sleeve 386 is adapted to reciprocate in a split guide 388, a part 389 of which is an integral extension of the bracket 390 (see Figure 19), the latter being supported on the upper end of the column 72. The other part 391 is hinged as at 393, and held in enclosing relation to the sleeve 386 by the thumb screw 395. The sleeve 384 at its upper end has a reduced diameter portion 392 on which is positioned a channel sectioned collar 394, such collar being clamped in position by a threaded mounting collar of a solenoid housing member 396 pro-

jecting above the upper end of the sleeve 384. The bracket 390 is locked in place by nut 247 and cap 243, the latter having an O-ring seal 245.

Reciprocation of the piston rod 380 is effected by movement of the cam-actuated bar 98 projecting upwardly through the central column 72, acting through a lever 100 fulcrumed on the bracket 390 as at 398. The upper end of the bar 98 slides through a bracket sleeve 391 and is provided with an extended threaded shank 400 on which is adjustably positioned a sleeve 402 having an external shoulder 404 at its lower end. Such sleeve may be locked in any adjusted position upon the shank 400 by a lock nut 406. Slidably mounted upon the sleeve is a channel section collar 408, which collar is slidably mounted upon the sleeve 402 and adapted to be resiliently held against the shoulder 404 by a compression spring 410, such compression spring reacting at its upper end against a cap 412 adjustably positioned upon the tip end of the shank 400 through a reduced diameter threaded end 414 and nut 416. The lever 100 is provided with yokes 418 and 420 at its opposite ends, which yokes are provided with inwardly extending studs 422 having on their inner ends rollers 424 adapted to engage the opposed flanges of the channel section collars 408 and 394. Thus, upward vertical movement of the bar 98 is translated into downward or opposite movement of the piston rod 380 through the operation of the lever 100 fulcrumed as at 398.

In order to measure different quantities of liquid, the stroke of the piston 382 is suitably varied. For conveniently varying the stroke of the piston to produce approximately correct displacement of liquid to be dispensed from the cylinder 88, the lever 100 and the bracket 390 are provided with additional corresponding apertures 426 and 432, 428, and 434, 430 and 436, on the lever and frame, respectively, through which the pivot or fulcrum pin 438 may extend so as to change the ratio of movement of the piston 382 to the movement of the bar 98. Thus, there are provided four different fulcrum points for the lever, any one of which may be quickly selected to adapt the apparatus to measuring the approximate quantity of liquid desired.

Since accuracy with regard to the measuring operation is essential in an apparatus of the type described, the final control of the quantity of liquid displaced in a stroke is not made dependent upon the accurate location of the four fulcrum points, any one of which may be selected, or the exact length of the lever arms on either side of such fulcrum.

In practice, the fulcrum points are so located that the piston is adapted to displace slightly more liquid than is the measured quantity desired. In order to restrict the liquid displacement to the exact quantity desired, a lost motion mechanism is provided together with adjustable stops to restrict the piston travel. Such lost motion mechanism is constituted by the previously described collar 408 in its sliding upon the sleeve 402 against the resilient urge of the compression spring 410. Mounted upon the bracket 390 is a rotatable turret-like plate 440, on which are positioned four adjustable stop posts 442, 444, 446, and 448 (see Figures 18 and 19), any one of which posts which, when placed in the position beneath the lever 100, is adapted to arrest the downward movement of the left hand end of the lever 100, as shown in Figure 18. When the downward movement of the end of such lever is thus arrested, the collar 408 is caused to discontinue its downward movement, compressing the coil spring 410 so as to allow the bar 98 to continue its stroke to the end thereof in response to the main cam 216 from which the bar 98 derives its power and movement. When it is desired to displace a different accurate quantity of fluid for a container of different size, the fulcrum pin 438 is shifted to whatever apertures correspond, and the disk 440 is rotated turretwise to bring the proper corresponding stop pin of the pins 442-448

into position beneath the lever 100, such pins being adjusted as to height so as to accurately arrest the upward movement of the piston. The disk 440 is held in any selected position by a spring detent 441 engaging in depressions 443. Thus, the piston in its upward movement displaces within the cylinder a volume equal to the volume of liquid to be measured at the new setting.

Within the piston rod 380 is a valve operating rod 450, the upper end of which bears against a flexible diaphragm 452, whose marginal edge is clamped between the upper end of the sleeve 384 and an annular shoulder 454 within the mounting collar of the solenoid casing 396. A solenoid 456 within the casing 396 is provided with an armature 458 adapted to bear against the flexible diaphragm 452 when energized, forcing the valve rod 450 downwardly.

Referring to Figures 22, 23, and 24, it will be seen that the valve rod 450 has formed on its lower end a conical valve 462 adapted to engage in a corresponding valve seat 464 arranged in the head 466 of the piston 382. Such piston is connected to the hollow piston rod 380 through an integral flange 468 thereof having threaded engagement within the upper end of the skirt 470 of the piston. Such flange is provided with a plurality of apertures 472 to permit the free flow of liquid therethrough. The valve 462 is provided with radially inclined and upwardly extending spider arms 474, the upper and outer ends of which are shouldered as at 476 to bear against a coil spring 478. Such arms are also provided with cylindrical guide surfaces 480 adapted to slide on the inner wall of the piston skirt 470 so as to guide the valve in its axial movement with respect to the piston. The lower end of the coil spring 478 seats upon the inner wall of the piston head 466 and urges the valve to open position, it being understood that the solenoid 456 is adapted when energized to cause the valve 462 to seat in the piston head whereby, upon downward movement of the piston, a solid piston front is presented.

The cylinder 88 in its lower head end is provided with a centrally disposed outlet nozzle tube 482 closed at its lower end by an integral closure disk 484 and having a radial outlet orifice 486 of an arcuate length of approximately three-quarters of a circle, immediately thereabove. The lower cylinder head 488 has a depending circular skirt 490 surrounding the nozzle tube 482 and spaced therefrom. Between the skirt and the tube is slidably mounted the upper end of a valve sleeve 492, which valve sleeve is provided with an outwardly extending shoulder 494 at its upper end adapted to bear against a light preloaded compression spring 496 seated at its upper end against a flange 498 on the outlet tube 482. Such flange 498 bears against an annular seal 500 seated against the cylinder head 488. Movement of the valve sleeve 492 in a downward direction is arrested by the split ring 502 seated in an internal groove in the skirt 490. As shown in Figure 25, the lower end of such valve sleeve is internally flared as at 504 and adapted to engage an O-ring 506 seated in an annular exterior groove in the disk-like head 484 of the nozzle tube. Thus, when the valve sleeve 492 is resiliently urged to its lower position as shown in Figures 22 and 25, the O-ring engages the internal flared surface of the valve sleeve and acts as a seal to prevent discharge of liquid from the cylinder 88.

The sleeve 482 is provided with an inverted umbrella guard 508 adapted to catch any drip from the cylinder head skirt 490 or the valve sleeve. Beneath the guard and extending radially from the flared end portion 504, are three feet 510, 512, and 514, which are adapted to engage the top of a fiber container adjacent the filling aperture thereof, so that when a fiber container is lifted upwardly against such feet, the valve sleeve will be propelled upwardly to the position shown in Figure 27, thereby exposing the arcuate orifice 486 beneath the top of the carton for discharge in a fan-like horizontal stream within the carton. Such feet are so disposed angularly

as to bear against the top of the container and avoid contact with the cap, and provide space for the escape of air from the container.

It will be observed that the orifice 486 is so oriented with respect to the container opening 487 as to be directed toward the far corner 489 of the container, so as to substantially eliminate foaming and turbulence in the filling of a carton. The stream projects fanwise towards the side walls of the carton more remote from the orifice in a substantially horizontal plane, the liquid upon reaching the carton wall being deflected downward along the side wall of the carton, filling the carton with a minimum of disturbance. Thus, the stream is directed toward substantially 80 percent of the internal wall perimeter of the container for maximum dispersion over the wall of the container, so that but a thin stream falls down the carton wall to the level of liquid within the container.

It will be seen that the inverted umbrella guard 508 is provided with overflow slots 516 which are so oriented as to be beyond the dimensions of the carton positioned immediately below such guard. The overflow channels are provided with drip grooves 518, so as to confine the drip to the region of the lip 519 of the overflow channels and prevent the drip from flowing toward the center. Any suitable keying devices may be employed to preserve the orientation between the reservoir 94, cylinder 88, the nozzle tube 482 and sleeve valve 492, whereby the orifice is directed toward the far corner of the container, and radially outward with respect to the axis of the apparatus as a whole, as well as the proper relation of the overflow channels 516 of the drip guard 508, to cause drip to clear the container.

In order to lift the container into engagement with the feet 510, 512, and 514 of the sleeve valve 492 and lift the latter to the position shown in Figure 27, the container-supporting bracket and support bar 160 beneath the container are lifted by the cam 350 and lever 354, the right hand end of the T-arm 360 being adapted for this purpose (see Figures 55 and 56). As shown, there is provided a screw-threaded adjustable abutment 520 adapted to act through a swinging thrust member 522 to lift the right hand bracket support arm 150 in Figure 55. The swinging abutment 522 is mounted upon a rod 524 freely slidable vertically in a guide thimble 526 mounted in the inclined deck or step 528 of the base 60. A collar 527 on the rod 524 limits its downward movement.

For reasons which will appear hereinafter, should for any reason a container fail to properly operate the detector, it is desirable that the container not be subsequently lifted up into engagement with the filler apparatus. For this purpose, the thrust arm 522, while freely slidable up and down as a result of its mounting upon the slide rod 524, is normally rocked to the position shown in Figure 56 by the tension spring 528, and such arm is caused to swing into a thrust position between the abutment screw 520 and bracket arm 150 only by energization of a solenoid 530 having a broad-faced armature 532 adapted to engage the arm 534 secured to the lower end of the rod 524.

In order to safeguard against the operation of the filling mechanism in the event a container is placed upon the ring conveyor in the wrong position, or is of the wrong size, or if the cap is not properly opened, the previously described detector is coordinated through a timing mechanism shown in Figures 46-51, inclusive, to energize the solenoids 456 and 530 when conditions are correct for filling. The mechanism comprises a reduction gear box 636 having a sprocket 538 meshing with the driving chain 180, and an output shaft 540 extending into the casing 541. The gear box 536 is adjustably mounted to act as a chain tightener by reason of the elongated mounting slots 537. The sprocket 538 and reduction gear are so chosen as to rotate the output shaft 540 once for every two rotations of the main

shaft 182. The shaft 540 has affixed thereto a reset cam member 542 having opposed arms 544 and 546, and a radial pin-carrying block 548 having radial bores 550 and 552, in which are slidably positioned radially extending pins 554. Each of the pins is provided with spaced annular grooves 556 and 558 adapted to be engaged by a detent comprising a ball 560 backed by a light spring 562 in the block 548. The pins are rounded at either end as at 564 and 566. A stationary solenoid 568, having an armature 570 with a camming end 572, is arranged so that the camming end of the armature may be projected into the path of motion of the outer end 564 of either pin 554 as it is rotated by the shaft 540. The solenoid 568 is connected in circuit with the contacts 330 of the detector mechanism disclosed in Figures 15 and 16.

When a properly oriented container of proper size, with its lid in wide open position, is lifted against the detector feeler bar 318, the switch contacts 330 are closed, energizing the solenoid 568, projecting its armature outwardly into engagement with whichever pin 554 happens to be within the range of the arcuately broad cam 572. The armature cam moves the pin from its radially outward position as held by the detent 560 in groove 558 to a radially inward position with the detent lying in groove 556.

It will be understood that the timed relation between the shaft 540 and the operation of the cam 350 which effects closing of the detector contacts through its lifting of the container located at the detector station, is such as to place either one of the pins 554 in a position to be acted upon by the cam 572, upon the lifting of the container into detecting position. Each of the pins is provided with a collar 574 adapted, when moved to the radially inward position by the cam 572, to sweep the path of the actuating pin 576 of a microswitch 578, closing such switch. Such action, however, takes place upon the rotation of the shaft 540 through 180° from the position where the cam 572 moved the pin radially inward. Since the shaft 540 rotates at one-half the speed of the main drive shaft 182, the actual closing of the switch 578 takes place after 360° rotation of the main shaft, or at the time that the container which actuated the detector reaches the filling station position.

Upon the closing of the switch 578, it will be seen from the circuit diagram of Figure 17 that the solenoid 456 is energized, closing the valve in the piston of the measuring cylinder, as well as the solenoid 530, which actuates the thrust arm, bringing it into position so that the T-lever will lift the container into filling position. Should the detector contacts 330 not close by reason of there being an improperly prepared or positioned container, or no container in the pockets of the conveyor ring at the detector station, the solenoid 568 would not be energized and the pin would not be moved radially inward so that the collar 574 would move past the switch pin 576 in a circular path beyond the pin and without engaging such pin.

The switch 578 remains closed until either one of the cams 580 or 582 of the reset member 542 sweeps past the reset pin 584 of the microswitch, which reset pin acts to open the circuit of such switch and prepare the switch for subsequent closing by actuation of the pin 576. It will be observed that the cams 580 and 582 are located approximately 120° behind the pins 554, so that the solenoids 456 and 530 remain energized for substantially the entire period that the conveyor ring is at rest and during which the filling operation is taking place.

In order to restore each pin to its radially outward position after it has performed its function of actuating the microswitch pin 578, there is provided a stationary cam 586 mounted upon a fixed stub shaft 588 carried on a casing mounted bracket 590, such cam 586 being located centrally with respect to the pins 550 and 552 and within the cavity 587, so as to move such pins radial-

ly outward during the time each such pin is moving from the position where it actuates the microswitch pin 576 and the position where it may be again moved radially inward by actuation of the solenoid cam 572.

After the container has been filled and lowered by actuation of the cam 350 and its associated lever, the conveyor ring moves such container to the next station. During such movement, a cam rail hereinafter referred to in detail (See Figures 42 and 45) engages the open cap of the filled container and causes the same to move from a wide open position to a position in readiness for closing. The cam rail operates to so move the cap through two stations of movement, whereupon the container is positioned at the cap closing station.

In Figures 29-34, the cap closure mechanism is shown. Mounted on a post 592 projecting upward from the annular step of the base 60 is a bracket 594 having an upwardly extending cylindrical guide sleeve 596 with a power cylinder 598 secured exteriorly thereof with its axis in parallel relation to the guide sleeve. Within the guide sleeve is a telescopically disposed sleeve 600 connected by a tie bar 602 to the piston rod 604 of the power cylinder 598. Within the telescopic sleeve 600 is slidably arranged an actuating bar 606 having an elongated collar 608 positioned thereon. Such collar is provided with a plurality of helical grooves 610 on its outer cylindrical surface in which ride stationary blocks 612, such blocks being formed as heads on pins 614 positioned in radial apertures 616 in the sleeve 600. The upper shank 618 of the bar 606 is slidably guided in an internal annular shoulder 620. A coil spring 622 bearing against the shoulder 620, and a thrust bearing 624 urges such bar downwardly with respect to the telescopic sleeve 600. The upper end of the bar is provided with a nut 626 and stop washer 628 adapted to engage the annular shoulder 620 to limit the downward relative movement between the bar 606 and the sleeve 600.

The lower end of the bar 630 projects freely through an aperture 632 in the base of the bracket 594, there being provided in a shouldered annular recess 634 a seal 636 between the bar and the bracket. An annular shoulder 638 immediately above the seal and the bracket 594 is provided with a ball bearing 640 adapted to act in thrust as well as radially. The lower end 630 of the bar 606 is adapted to freely slide through the inner ring 642 of such bearing, and upon the shoulder end 644 of the elongated collar 608 engaging the inner bearing ring 642, the downward movement of the bar 606 is arrested. Movement of the bar downwardly is effected by movement of the telescopic sleeve 600, such sleeve transmitting downward movement to the bar through the coil spring 622. When the shoulder 644 engages the bearing ring 642, and the further movement of the bar downward is arrested, further movement of the sleeve 600 results in rotation of the bar 606 by reason of the relative movement therebetween, and engagement of the cam blocks 612 in the helical grooves 610.

The lower end of the bar is cut away as at 650 to provide spaced depending arms 652 and 654 between which are pivotally mounted toggle members 656 and 658. Such toggle members are freely pivoted upon a transverse pin 660. Each of the toggle members is provided with a broad tongue 662 and 664, adapted to normally hang in the position indicated in Figures 29 and 32, when in inoperative position, the beveled edges 663 and 665 engaging each other as stops.

The toggle member tongues, when in the inoperative position shown in Figures 29 and 32, define a rectangular area sufficiently small to be freely received in the circular recess of the cap which is to be projected through the top aperture in the operation of closing and sealing the container. The tongues, however, upon engaging the circular surface of the cap, push the cap into the aperture and are caused to spread to form a substantially square expanding mechanism, the diagonal dimension of which

is sufficiently great so as to expand the shallow cup-like side wall 605 of the cap underneath the marginal edge of the hole 487 in the top of the container. (See Figure 34.) As has been pointed out in connection with the construction of the bar 606 and its associated actuating mechanism, such bar, upon moving downward to the point where the shoulder 644 engages the bearing ring 642, is limited in its further movement, and the toggle-supported tongue members are adapted to be expanded to the outline 666 shown in Figure 33 by such movement, and their engagement with the cap. Further movement of the sleeve 600 acts to rotate the bar 606 by reason of the helical grooves 610, causing the tongue members to rotate within the cap with the rounded corners 668 acting to expand the shallow cup-like wall 670 of the cap beneath the container top at all points, since rotation of the bar takes place through an angle of at least 90°. Upon the reverse movement of the sleeve 600, the bar may, if desired, by reason of the pressure of the spring 622, immediately rotate back to its original position and thereafter be lifted clear of the cap, the tongues returning to the position shown in Figure 32 as soon as the bar commences to lift away from the container.

After the cap has been expanded into position, the container is moved to the next station wherein the lip 294 which overhangs the edge of the carton is caused to be clinched beneath the marginal edge of the top of the container in the perimetral groove 674 present in such containers. (See Figures 35 and 38.)

In Figures 35-38, there is shown apparatus for clinching the marginal lip of the cap beneath the rim of the cover in the perimetral groove 674 referred to. The apparatus comprises a bracket 676 mounted on the post 678 rising from the base 60, the bracket extending inwardly and comprising a cylindrical sleeve 680 in which is slidably mounted a hollow plunger 682, whose lower end is provided with a cap plate 684 suitably shaped to bear upon the cap of a container, there being provided a raised circular portion 686 adapted to project into and anchor the expanded shallow cup portion of the cap against lateral movement. The plunger is provided with a bore in which is slidably mounted a rod 688, which rod is adjustably secured to a tie bar 690 extending to the piston rod 692 of the power cylinder 694, the latter being secured to the bracket 676. The rod 688 is provided with a collar 696 adapted to slide within a cylindrical wall 698 of enlarged diameter located in the upper end of the plunger 682. The annular cavity thus formed between the rod 688 and the cylindrical wall 698 and a shoulder 700 formed by the enlarged cylindrical wall contains a preloaded compression spring 702 so that upon movement of the rod 688, the plunger 682 is urged downwardly in the bracket sleeve 680.

The lower end of the rod 688 is provided with an inclined wedge face 704 engaging a complementary wedge face 706 formed on an upstanding horn 708 carried by a transversely slidable member 710 located in the lower end of the plunger 682. A recess 709 in the internal wall of the plunger 682 provides clearance for lateral movement of the horn 308. The lower end of the plunger is slotted as at 712 and 714 to form guideways to receive the transversely slidable member 710, and to guide its movement in a diametral path across the end of the plunger. The cap plate 684 is secured on the end of the plunger beneath the transversely slidable member 710 by a plurality of threaded fastening means such as 716, thereby completing the guideway formed by the slots 712 and 714, and thus confining the movement of the slidable member 710. One end of the member 710 is provided with an arcuate head 718 having a groove 720 in which rests a garter spring 722, the latter having its ends hooked upon ears 724 and 726 formed upon and projecting radially from the cap 684. The other end of the slidable member is provided with a depending arm 728, the lower end of which is provided with an angular

member 730, the flanks of which are mitered to permit the edges 732 and 734 to project into the perimetral groove 674 immediately beneath the seam of the container and to fold or clinch the marginal lip 294 underneath the marginal edge 736 of the top seam.

It will be seen that as the plunger 682 descends in the sleeve 680, the clinching edges 732 and 734 clear the corner flanks of the container. However, as soon as the lower end of the plunger 686 seats upon the cover of the carton, its downward movement is arrested by the shoulder 739 of the cap 738 engaging the upper end 741 of the sleeve 680, and thereafter by reason of relative movement between the rod 688 and the plunger 682, the horn of the slidable member is caused to move to the left, carrying the slidable member with it and projecting the edges 732 and 734 beneath the marginal edge of the top to a position as indicated in Figure 38. Upon upward movement of the rod 688, the plunger remains in contact with the top of the container, and by reason of the garter spring 722, the slidable member is caused to move to the right so as to clear the edge of the container. As soon as the collar 696 engages the cap 738 on the plunger 682, the plunger is caused to move upward away from the container.

The container is next moved to the marking station, the details of which will appear from Figures 39 and 40. Mounted upon a post 82 extending upward from the base 60 is an inwardly extending bracket member 740 upon which is mounted a relatively short stroke power cylinder 742. The piston of such cylinder carries a block 743 from which is supported through resilient V-springs 744 and 746 a marking block 748, the latter containing a heating element 750 and a marking die 752, the latter being removably held in place by a thumb screw 754. The marking die is maintained at a suitably elevated temperature by the electrical heating element 750 and is brought downwardly into contact with the carton cover and is adapted to brand the container by softening the waxy coating thereof, thereby imprinting into such coating the indicia carried by the die.

The power cylinders 270, 598, 694, and 742 are all adapted to be actuated from the hydraulic master cylinder 244, and the hydraulic connections for such actuation are diagrammatically illustrated in Figure 41. One end of the master cylinder 244 is connected by a manifold conduit 756 from which conduits 758, 760, 762, and 764 lead to the upper ends of the cylinders 270, 598, 694, and 742, respectively. Each of the conduits 758, 760, 762, and 764 are provided with check valves having a metering bypass as diagrammatically indicated at 766, 768, 770, and 772. The check valve prevents free flow of operating liquid to the upper ends of the power cylinders referred to, the fluid being required to flow through the restricted bypasses around such check valve. By such means, the movement of the various pistons is to a degree coordinated and all pistons tend to move simultaneously in response to the movement of the piston 248 in the master cylinder. The lower ends of the cylinders 270, 598, 694, and 742 are connected through the manifold to a manifold 774 having a connection 776 to the piston rod end of the power cylinder 244, as well as a pressure relief connection 778 to a reservoir 780, flow being permitted to the reservoir through the relief valve 782 whenever the pressure exceeds a preset value. The manifold 756 is likewise provided with a connection 784 to the reservoir 780 through a relief valve 786 adapted to permit flow of liquid to the reservoir when a preset pressure is exceeded.

The connections 755 from the master cylinder to the manifold 756 are provided with a conduit 788 leading to the reservoir 780, the same, however, having a check valve 790 permitting flow from the reservoir to the power cylinder. The conduit 776 is also provided with a connection 792 to the reservoir 780, such connection having a check valve 794, permitting flow of liquid from the

reservoir to the power cylinder. By the system thus described, full stroke of all of the pistons in the cylinders 270, 598, 694, and 742 is assured, and the stroke of the piston 248 in the master cylinder is permitted to over-travel to assure such full stroke, the excess hydraulic liquid being returned to the reservoir through the relief valve 786. Likewise, the pistons in the power cylinders are caused to effect a full return stroke, since upon movement of the piston 248 in the master cylinder, over-travel is provided and any excess hydraulic liquid is permitted to escape through the pressure relief valve 782 to the reservoir. The pressure relief valves 782 and 786 are set sufficiently high to assure that the power cylinders will carry their loads and the pistons within the power cylinders will carry their loads and perform their operations at pressures safely below the relief pressure setting of the valves 782 and 786.

In moving the containers from the cap opening station to the detector station, a guide rail was referred to as engaging the lip end of the cap so as to hinge the cap to a wide open position prior to the container reaching the detector station. Likewise, reference was made to a guide adapted to move the cap from the wide open position following the filling operation to a substantially closed position prior to the container reaching the cap closure station. In Figure 42, the guides for performing these operations are diagrammatically illustrated. Such guides are supported from the posts 76, 78, 80, and 798. The guide 800, for moving the cap from a slightly open position to the wide open position, is supported from the posts 76 and 78 by rods 802 and 804. Such guide 800 is provided with a nose portion 806 adapted to engage beneath the lip of the partially opened cover and a raised arcuate portion 808 extending diagonally outwardly of the apparatus which is adapted to continuously engage the lip of the cap in swinging the cap over to the wide open position as the cap approaches the detector station. The guide 800 terminates as at 810, and the feeler bar 318 of the detector is sufficiently close to the cap so as to prevent the cap from swinging to any degree from the wide open position.

Upon the container moving from the detector position to the filling position, the lip of the cap is engaged by a guide 812 supported from the posts 78 and 80 on rods 814 and 816. Following the filling operation, a guide 818 is adapted to engage the lip of the cover and lift the same and hinge the cover to a closed position. Such guide is supported on posts 80 and 798 through rods 820 and 822. The guide has a nose 824 adapted to extend beneath the lip of the cap, and an arched portion 826 is adapted to follow the path of the cap lip while being moved from the filling station to the closure station, while at the same time being moved from the wide open position to a position adapted to be acted upon by the closure mechanism. The guide 818 terminates as at 828, leaving the cap substantially flat against the top of the container. The guides, and in fact all the apparatus described, is so adapted as to contact only the lip or tab portion of the cap, so as to avoid contact with any surface ultimately exposed to milk, to avoid contamination.

In Figure 54, there is shown a diagram indicating the relative movements of the hydraulic cam follower, the drive rod cam follower, and lifter cam follower, and their relative time coordination. It will be observed that the drive rod cam moves the drive rod 98 from an upper position to its lowermost position in approximately one-third of a cycle of operation, or single rotation of the main drive shaft 182. Thereafter, in the space of slightly less than approximately two-thirds of a cycle of operation, the drive rod cam moves the drive rod upwardly at a uniform rate as is indicated by the straight line portion 830 of the diagram. By moving the drive rod at a uniform rate during the part of its stroke when it is actuating the piston in the measuring cylinder, a uniform rate of flow of fluid from the nozzle within the container is afforded through

the entire stroke. Thus, the stream projecting from the nozzle will be of substantially horizontal fan shape from the time fluid commences to flow into the container until the time the complete measured quantity of fluid has flowed, so that such fan-shaped stream will be directed toward and deflected by the inside wall of the container with a uniform velocity throughout the filling operation. By maintaining the flow uniform in this manner, a minimum of turbulence and foaming results in the filling of the container, and the stream does not strike the rising liquid level in the container. It is essential that the foaming be maintained at a minimum, lest the quantity of foam be such as to exude through the opening in the cover with the result of spilling milk over the outside of the container in an unsanitary and untidy manner, and by maintaining uniform flow, the stream is prevented from striking the rising liquid level, the major cause of foaming.

The hydraulic master cylinder cam will be seen as performing its power stroke commencing substantially at the time the drive rod upward stroke commences, as is indicated at 831. The master cylinder stroke, however, is completed when about two-thirds of the drive rod stroke has taken place, and thereafter the master cylinder return stroke commences, as indicated at 833. The return stroke is concluded in about half the time of the power stroke. The lifter cam which lifts containers two at a time, one into the detector position and the other into the container filling position, raises such containers immediately prior to the commencement of the upward stroke of the drive rod, as at 837. The containers are maintained elevated by the lifter cam until the filling stroke of the drive rod is completed, when they are lowered as at 835.

Any suitable control circuit for the main drive motor may be provided as, for example, in Figure 17. Control buttons 832, 834, and 836 for starting, stopping and jogging, respectively, may be conveniently mounted in a casing 838 formed as a part of the bracket 740 supporting the marking apparatus at the marking station. Power is supplied to the motor and to the control solenoids and marking heater element through a main switch 840, from which connections extend to a starting switch 842 in circuit with the motor 172. The starting switch comprises contacts 844 and 846 in the motor leads 848 and 850. The switch is held closed by a holding coil 852 connected in circuit with the line side of the contact 846 and a hold-in contact 854. The hold-in contacts 854 are connected to the line side of contacts 844 through the jog switch contacts 856 and 858, which are normally closed, and the stop switch contacts 860. It will be observed that the starting switch contacts 862 are adapted to bridge the contacts 854 momentarily to energize the coil 852 and close the contacts 844, 846, and 854. In circuit with the hold-in coil 852 are thermostatically actuated contacts 864 adapted to be opened upon heat developed as a result of overload in the motor circuit 850. It will be observed that by opening the contacts 860, the hold-in coil 852 circuit is broken, so that the contacts 846, 844 and 854 are opened. The jog switch is provided with three positions, the run position in which contacts 856 and 858 are closed, a jog position in which contacts 858 only are closed, whereupon operation of the start button will effect energization of the motor for so long as the start button is closed, and a safe position in which contacts 858 are opened with the result that the hold-down and switch operating coil cannot be energized by the operation of the start switch.

It will be observed that the apparatus described has been particularly designed so as to completely house the various mechanism and to provide shielding and water sheds, so that the apparatus may be hosed for cleanliness without danger of water entering the mechanism. The base, for example, is provided with an integral circular housing 64, projecting upwardly well within the skirt 66, and the conveyor ring is provided with a flange 134 projecting well into the cover 74. The lever 354 where it emerges through an aperture in the side wall of the housing 154 is pro-

vided with a flexible boot 866, and the various component parts such as the cover opening mechanism, the detector mechanism, the closure mechanism, the clinching mechanism, and the marking mechanism are supported on posts so as to be readily removable for repair and replacement by spares which may be kept on hand. The construction of the filling station, as will be observed from Figure 18; is so arranged as to permit the quick removal of the tank 94, the tank and the piston operating mechanism being secured in place by resting upon the support bracket 96 and positioned within the split clamp guide shown in Figure 19.

Lubrication of the operating parts within the housing is efficiently effected by a small quantity of oil lying on the housing bottom, the oil being maintained at a level merely sufficient for the cam wheel 190 to act as a distributing agent. Such housing is completely protected against entrance of washing water required to be frequently applied to the exterior of the machine, there being but two exposed openings from the housing, the cap 343 over the column 72 having the O-ring seal 245, through which the bar 98 extends, and the actuating lever opening, sealed by the flexible boot 866. The frame structure affords a substantially complete housing for the main mechanism, and provides a central stationary column from which filling mechanism is supported in overhanging relation to the path of conveyor travel, as well as numerous stationary supports outside the path of conveyor travel, from which devices are supported conveniently disposed with respect to the conveyor. The tubular supports provide protected conduits for electrical and hydraulic connections to the devices supported thereby.

The operation of the apparatus will appear from the foregoing description. Briefly, however, the conveyor ring is angularly set by placing its key 138 in the proper slot 140 or 142 of the skirt 66, so as to align the proper size pockets with the supports 148. The support pins 148 are all set in their sockets to the desired height, and the stroke of the measuring piston set by proper placement of the fulcrum pin 398, and selection of the proper abutment stop pin 442-448. When these settings are correctly coordinated and the motor speed suitably selected, all of which requires a minimum of time and no removal or addition of parts, the apparatus is ready for operation.

Containers of the size for which the apparatus is set are placed in position, with their filling openings inwardly disposed, in the empty conveyor pockets immediately preceding the plug or cap opening device 84. The conveyor ring is advanced periodically carrying such containers to the successive stations, where the operations described are performed. Upon the filled containers being moved from the marking station 92, such filled containers are promptly removed from the conveyor to provide empty pockets for the reception of empty containers to be filled. The speed of operation of the apparatus may be varied by changing the motor speed, to suit requirements, and the particular container size being filled. In practice, the speed may vary upwardly from as many as fifteen a minute, affording ample loading and unloading opportunity. Thus a cycle is completed in about four seconds or less. Since the advancing movement of the conveyor takes place in approximately $\frac{1}{3}$ of the cycle period, the conveyor being stationary for $\frac{2}{3}$ of such period, the filling time may be in the order of $2\frac{2}{3}$ seconds or less, such rapid filling being rendered possible by the uniform pressure and flat substantially horizontal fan-like stream directed against the inside container walls. It will be understood, however, that the machine will be required to operate at a speed sufficient to assure the ejection of a flat horizontal fan-like stream from the filler orifice throughout the measuring stroke of the piston, the high rate of filling being dependent thereupon. For example, in filling a small container, the stroke of the piston will approximate a fourth or less of the length of the cylinder. In order that the movement of the piston

through this short stroke will take place at a rate to discharge fluid at the orifice with sufficient velocity, the speed of the apparatus as a whole will be increased, if necessary, to provide such velocity. Such speed increase is usually desirable and permissible when operating on smaller containers. While reference has been made to varying the motor speed, actual variation of the speed of the motor output may be effected through variable speed mechanism incorporated in the reduction gear 174. The control for varying the speed may be located conveniently as desired.

If for any reason a filled container is not removed from the conveyor, and is permitted to pass the various stations a second time, it will be seen that the opening device will be unable to grip the lip of the cap when clinched beneath the marginal edge of the container top. Thus when such filled container progresses to the detecting station, the cap will remain in sealed closed position, and thus the container will not actuate the detector to close the contacts. When such container reaches the filling station, the lifting lever 354 will be ineffective to lift the container into filling position, and the valve 462 of the measuring cylinder piston will remain open. Thus the quantity of liquid within the cylinder, upon movement of the piston, will flow freely past the piston on its measuring stroke. While the cap closing and clinching devices will proceed to operate upon the container cap, since it is already in a closed position, no change will be effected thereby.

While the sequence of operation upon a filled container allowed to repeat its passage has been described to illustrate the automatic safety features of the apparatus, it will be seen that any container which does not cause the detector to respond correctly will automatically pass through the machine without spillage or other harm to the mechanism.

Due to the simplicity of the few changes required to adapt the apparatus to a different size container, the apparatus is suitable for small milk station operations, it being practical to fill a substantial quantity of containers of different capacity from a single machine without any appreciable delay in changing over from one size to another size. While the apparatus illustrated has been designed with due consideration to the specialized requirements relating to the filling of containers with milk, it will be appreciated that the apparatus will be equally effective to perform the operations described with other liquids.

The apparatus is so arranged as to afford a central stationary support as well as peripheral supports from which the various operative devices at angularly spaced stations are detachably supported. The apparatus and the various devices have been described in relation to containers of the general type shown in Figure 57, the devices being specially constructed to perform the filling and operations ancillary thereto, respecting prior opening, detection and subsequent closing and marking. It will be appreciated that the filling station with its uniform flow and fan-like horizontal filling stream is adapted to fill containers of varying shape other than the square flat top container set forth, with a minimum of foaming, and it will also appear that the apparatus may be provided with devices having different operating characteristics to perform the necessary operations prior to filling or subsequent thereto, which may be required of containers of special shape. Where such different operating characteristics are required, the various devices for performing such characteristics may be supported in the same manner at the various stations and actuated by the same hydraulic power source, the containers being progressed in the same manner from station to station. Thus the adaptability of the general scheme of the apparatus to variations in requirements will be apparent, the main apparatus being utilizable for such purposes through minor changes in the devices at the respective stations, and the substitution of a conveyor ring having suitable pockets.

Although a single embodiment of the invention has been illustrated and described, it is to be understood that the

invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

The cap closing feature of the invention has been made the subject matter of a divisional application No. 411,818 filed February 23, 1954.

What is claimed is:

1. A container filling apparatus, comprising a base having an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, a reciprocating actuating bar slidably mounted in said column and projecting beyond the upper end thereof, drive means within said housing for periodically angularly advancing said skirt, and actuating said bar, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, and means mounted on said column and overhanging said skirt and having mechanism actuated by said bar for filling containers carried by said skirt one at a time between periodical advancing of said skirt.

2. A container filling apparatus, comprising an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, means mounted on said column and overhanging said skirt and having mechanism for filling containers carried by said skirt, means for actuating said filling mechanism enclosed within said housing and extending through the length thereof, and means for periodically rotating said skirt within said housing and independent of said column.

3. A container filling apparatus, comprising an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, an annular splash guard mounted on said column having a peripheral flange overhanging said skirt, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, means mounted on said column and overhanging said skirt and having mechanism for filling containers carried by said skirt, means for actuating said filling mechanism enclosed within said housing and extending through the length thereof, and means for periodically rotating said skirt within said housing and independent of said column.

4. A container filling apparatus, comprising an annular one-piece base having a lower annular step portion and an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, a reciprocating actuating bar slidably mounted in said column and projecting beyond the upper end thereof, drive means within said housing for periodically angularly advancing said skirt and actuating said bar, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column and means mounted on said

column and overhanging said skirt and having mechanism actuated by said bar for filling containers carried by said skirt one at a time between periodical advancing of said skirt, supports projecting upwardly from said base step portion and spaced angularly therearound, devices mounted on said supports for preparing containers for filling and filled containers while supported by said skirt, and means deriving power periodically from said drive means for actuating said devices.

5. A container filling apparatus, an upstanding cylindrical housing, a cylindrical skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, a conveyor ring mounted on said skirt, an annular splash guard mounted on said column having a peripheral flange overhanging said ring and skirt, power transmission means extending through said column, drive means within said housing for periodically angularly advancing said conveyor and skirt and actuating said power transmission means, means on said conveyor ring for supporting a plurality of containers in uniformly angular spaced relation to move said containers in a circular path about said column, means mounted on said column and overhanging said conveyor, and having mechanism actuated by said transmission means for filling containers supported on said ring one at a time between periodical advancing of said ring.

6. A container filling apparatus, comprising an annular one-piece base having a lower annular step portion, and an upstanding cylindrical housing, a cylindrical skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, a central hollow column mounted on said housing and projecting upwardly beyond the housing and skirt, a conveyor ring mounted on said skirt, an annular splash guard mounted on said column having a peripheral flange overhanging said ring and skirt, power transmission means extending through said column, drive means within said housing for periodically angularly advancing said conveyor and skirt and actuating said power transmission means, means on said conveyor ring for supporting a plurality of containers in uniformly angularly spaced relation to move said containers in a circular path about said column, means mounted on said column and overhanging said conveyor, and having mechanism actuated by said transmission means for filling containers supported on said ring, one at a time between periodical advancing of said ring, supports projecting upwardly from said base step portion and spaced angularly therearound, devices mounted on said supports for preparing containers for filling and filled containers carried by said ring, and means deriving power periodically from said drive means for actuating said devices.

7. In a container filling apparatus, a base comprising an annular step and central circular housing upstanding therefrom, a spider having an annular ring mounted on the upper end of said housing, a hollow column extending above said housing and affixed to said spider, a thrust bearing associated with said ring, circular conveyor means surrounding said housing and rotatably hung from said thrust bearing, an actuating bar slidably mounted in said column, a plurality of supports mounted on said step and projecting upward to points adjacent said conveyor, a hydraulic master cylinder in said base, means in said housing for moving said conveyor stepwise, and for actuating said bar and master cylinder in periodic relationship to said conveyor, and operative devices mounted on said column and said supports disposed in operative position with respect to said conveyor ring, and

means for actuating certain of said devices mounted on said supports from said master cylinder and for actuating the remainder of said devices from said bar.

8. In a container filling apparatus, a base comprising an annular step and central circular housing upstanding therefrom, a spider having an annular ring mounted on the upper end of said housing, a hollow column extending above said housing and affixed to said spider, an actuating bar slidably mounted in said column, a thrust bearing associated with said ring, circular conveyor means surrounding said housing and rotatably hung from said thrust bearing, a plurality of supports mounted on said step and projecting upward to points adjacent said conveyor, transmission means extending through said column, a hydraulic master cylinder in said base, means in said housing for moving said conveyor stepwise, and for actuating said bar and master cylinder in periodic relationship to said conveyor, and operative devices mounted on said column and said supports disposed in operative position with respect to said annular ring, and means for actuating some of the devices mounted on said supports from said master cylinder and for actuating the remainder of said devices from said transmission means.

9. In a container liquid filling apparatus, means for detecting containers correctly prepared for filling, one at a time, means for filling correctly prepared containers, conveyor means for progressively moving in timed sequence a series of containers one at a time at fixed time intervals to said detecting means and thereafter to said filling means while moving a subsequent container to said detecting means, repetitive means coordinated for movement with said conveyor means having means settable by said detecting means as each container is conveyed to said detecting means, means adapted to be subsequently actuated by the setting of said settable means upon elapse of said time interval, and means associated with said filling means for controlling the operation thereof in response to actuation of said actuated means.

10. In a container liquid filling apparatus, means for detecting containers correctly prepared for filling, one at a time, means for filling correctly prepared containers, conveyor means for progressively moving in timed sequence a series of containers one at a time at fixed time intervals to said detecting means and thereafter to said filling means while moving a subsequent container to said detecting means, repetitive means coordinated for movement with said conveyor means having means settable by said detecting means as each container is conveyed to said detecting means, means adapted to be subsequently actuated by the setting of said settable means upon elapse of said time interval, means associated with said filling means for controlling the operation thereof in response to actuation of said actuated means, and means for resetting said settable means after the elapse of said time interval for repeated setting by said detecting means.

11. In a container liquid filling apparatus, means for preparing containers for filling one at a time, means for detecting containers correctly prepared for filling, one at a time, means for filling correctly prepared containers, conveyor means for progressively moving in timed sequence a series of containers one at a time at fixed intervals to said preparing means, thereafter to said detecting means and thereafter to said filling means while moving subsequent containers to said preparing and detecting means, repetitive means coordinated for movement with said conveyor means having means settable by said detecting means as each container is conveyed to said detecting means, means adapted to be subsequently actuated by the setting of said settable means upon elapse of said time interval, and means associated with said filling means for controlling the operation thereof in response to actuation of said actuated means.

12. In a container liquid filling apparatus, means for preparing containers for filling one at a time, means for

detecting containers correctly prepared for filling, one at a time, means for filling correctly prepared containers, conveyor means for progressively moving in timed sequence a series of containers one at a time at fixed intervals to said preparing means, thereafter to said detecting means and thereafter to said filling means, while moving subsequent containers to said preparing and detecting means, repetitive means coordinated for movement with said conveyor means having means settable by said detecting means as each container is conveyed to said detecting means, means adapted to be subsequently actuated by the setting of said settable means upon elapse of said time interval, means associated with said filling means for controlling the operation thereof in response to actuation of said actuated means, and means for resetting said settable means after the elapse of said time interval for repeated setting by said detecting means.

13. In a liquid filling apparatus for containers, a detecting station, including means for sensing correctly prepared containers for filling when placed in detecting position, a filling station including means for filling correctly prepared containers placed in filling position, a conveyor for moving at regular intervals a series of containers one by one into detecting position with respect to said detecting station, and advancing said containers therefrom at regular intervals into filling position with respect to said filling station, means for rendering said filling means inoperative or operative to fill each container when advanced to said filling position, and means actuated by said sensing means for rendering at an interval later said filling means inoperative or operative in accordance with whether said detecting station means sensed an incorrectly or correctly prepared container.

14. In a container liquid filling apparatus, a ring conveyor having means for holding a series of containers at uniformly angularly spaced intervals, means for periodically rotating said conveyor through an angle equal to the angular spacing of said containers held by said conveyor, detector station means disposed adjacent said conveyor and adapted to detect a container correctly prepared for filling held by said conveyor, filling station means disposed adjacent said conveyor and adapted to fill containers correctly prepared therefor, said detector station and said filling station being arranged to operate on each container in sequence and being so disposed with respect to said conveyor as to act on containers carried by said conveyor in the interval between periodical rotation thereof, controlling means for said filling station means to prevent filling operation thereof, and means actuated by said detector means in response to correctly prepared containers and effective an interval later to cause actuation of said controlling means whereby to cause the filling of each container previously detected as correctly prepared.

15. In a liquid filling device for containers having a top opening, a liquid dispensing device, said device having an outlet conduit having a downwardly directed end portion, a substantially horizontal slit orifice extending around a substantial portion of said conduit adjacent the end thereof, and lying in a substantially horizontal plane, means for supporting a container to be filled with its upper edge above said slit orifice, and means for dispensing liquid from said device through said slit orifice at a uniform rate sufficient to maintain a substantially horizontal discharge.

16. In a liquid filling device for containers having a top opening, a liquid dispensing device, said device having an outlet conduit having a downwardly directed end portion, a slit orifice extending lengthwise in a plane transverse of the conduit end portion and around a substantial portion of said conduit adjacent the end thereof, and lying in a substantially horizontal plane, means for supporting a container to be filled with its upper edge above said slit orifice, said support being adapted to hold said container in off-center relation to said end portion and with said slit orifice facing the far inside walls of said

container, and means for dispensing liquid from said device through said slit orifice at a uniform rate sufficient to maintain a substantially horizontal discharge stream.

17. In a liquid filling device for containers having a top opening, a liquid dispensing device, said device having an outlet conduit having a downwardly directed end portion, a substantially horizontal slit orifice extending around a substantial portion of said conduit adjacent the end thereof, and lying in a substantially horizontal plane, means for supporting a container to be filled with its upper edge above said slit orifice, said support being adapted to hold said container in off-center relation to said end portion and with said slit orifice facing the far inside walls of said container, and means for dispensing liquid from said device through said slit orifice at a uniform rate and in a measured quantity, said slit orifice and such uniform rate dispensing means being coordinated to maintain a substantially horizontal discharge stream.

18. In a liquid filling device for containers having a top surface, and a filling hole therein offset from the center, a liquid dispensing device, said device having an outlet conduit having a downwardly directed closed end portion, a substantially horizontal slit orifice extending around a substantial portion of said conduit, means for supporting for filling a container having a top surface with an off-center hole therein, with the hole in alignment with said end portion and with the slit orifice facing toward the center of the container, means for moving the container relative to the end portion to project said end portion through the container hole with the slit orifice immediately below the top thereof, and means for dispensing liquid from said device through said slit orifice in a substantially horizontal stream at a uniform rate.

19. In a liquid filling device for containers having a top surface, and a filling hole therein offset from the center, a liquid dispensing device, said device having an outlet conduit having a downwardly directed closed end portion, a substantially horizontal slit orifice extending around a substantial portion of said conduit, means for supporting for filling a container having a top surface with an off-center hole therein, with the hole in alignment with said end portion and with the slit orifice facing toward the center of the container, a valve for said orifice having actuating means adapted to engage the top of a container, means for moving the container relative to the end portion to engage said actuating means and open said valve and to project said end portion through the container hole with the slit orifice immediately below the top thereof, and means for dispensing liquid from said device through said slit orifice in a substantially horizontal stream at a uniform rate.

20. In a liquid filling device for containers having a top filling hole therein, a liquid dispensing device, said device having an outlet conduit having a downwardly directed closed end portion, a substantially horizontal slit orifice extending around a substantial portion of said conduit, means for supporting for filling a container having a top surface with a hole therein, with the hole in alignment with said end portion, a sleeve valve for said orifice slidable on said end portion and having actuating means adapted to engage the rim of the container hole, means for moving the container relative to the end portion to engage said valve actuating means to open the valve and to project said end portion through the container hole with the slit orifice immediately below the top thereof, and means for dispensing liquid from said device through said slit orifice in a substantially horizontal stream at a uniform rate.

21. In a liquid filling and measuring apparatus, a cylinder, a discharge outlet at one end, a piston adapted to displace liquid within the cylinder through said outlet when moved in a discharge direction, means for positively driving said piston in said discharge direction, preloaded yieldingly biased lost motion means for moving said piston in the opposite direction to fill said cylinder, and means for positively arresting the cylinder filling move-

ment of said piston and causing said lost motion means to yield whereby to fill said cylinder with a measured quantity of liquid.

22. In a liquid filling and measuring apparatus, a cylinder, a discharge outlet at one end, a piston adapted to displace liquid from said cylinder through said outlet, power means for moving said piston through a return stroke to fill the cylinder and for moving said piston through a discharge stroke to displace the contents thereof through said outlet, a preloaded yielding connection between said means and piston preloaded to be unresponsive to liquid pressures against said piston, and positive stop means for limiting the stroke of said piston to a partial stroke and causing said connection to yield to effect discharge of a measured quantity of liquid.

23. In a container conveyor feed, a base, a cylindrical member rotatably mounted on said base, a conveyor ring mounted on said cylindrical member, a plurality of pockets adapted to receive containers of one size mounted on said conveyor ring, said pockets being uniformly disposed around said ring, a plurality of pockets mounted on said conveyor ring adapted to receive containers of a different size disposed between adjacent first-named pockets and uniformly angularly displaced therefrom, a plurality of container supports on said member located below said ring and angularly spaced to cooperate with all of the pockets of one size on said conveyor ring, means for varying the height of all of said supports to accommodate containers of different heights, and means for angularly shifting and keying said ring in two different positions on said member for rotation with said member with the pockets of one size or the other in cooperative relation to said supports said two positions being angularly disposed from one another by the angular spacing between a pocket of one size, and a pocket of said different size.

24. In a container conveyor feed, a base, a cylindrical member rotatably mounted on said base, a conveyor ring mounted on said cylindrical member, a plurality of pockets adapted to receive containers of one size mounted on said conveyor ring, said pockets being uniformly disposed around said ring, a plurality of pockets mounted on said conveyor ring adapted to receive containers of a different size disposed between adjacent first-named pockets and uniformly angularly displaced therefrom, a plurality of container supports on said member angularly spaced to cooperate with all of the pockets of one size on said conveyor ring, and means for angularly shifting and keying said ring in two different positions on said member for rotation with said member with the pockets of one size or the other in cooperative relation to said supports said two positions being angularly disposed from one another by the angular spacing between a pocket of one size, and a pocket of said different size.

25. In a container conveyor feed, conveyor means having a first series of pockets of uniform size disposed at uniform spacing along the length thereof, said pockets being adapted to receive containers of one size, a second series of pockets of a different size disposed on said conveyor means intermediate adjacent pockets of said first-named size, said second series of pockets being uniformly spaced along the length of said conveyor means, means for driving said conveyor means, means for imparting intermittent movement to said driving means to move said driving means and said conveyor means in increments equal to the spacing between pockets of said first series, and means for shifting the relationship between said conveyor means and said driving means an amount equal to the space between a pocket of the first series and an adjacent pocket of the second series.

26. In a container filling and measuring apparatus, a cylinder, a piston having a rod adapted to displace measured quantities of liquid from said cylinder, a drive rod for actuating said piston, means for driving said last-named rod at uniform velocity through the entire length

of a fixed stroke, a lever connecting said drive rod with said piston rod, and means for varying the fulcrum point on said lever to vary the displacement stroke of said piston.

27. In a container filling and measuring apparatus, a cylinder, a piston having a rod adapted to displace measured quantities of liquid from said cylinder, a drive rod for actuating said piston, said drive rod being adapted to move through a fixed stroke, means for periodically driving said rod in the same direction at uniform velocity through the entire stroke, a lever connecting said drive rod with said piston rod, a resiliently biased lost motion connection between said drive rod and lever, and selectable stop means adapted to restrict the movement of said lever in one direction through said lost motion connection to less than a full stroke to calibrate the displacement movement of said piston.

28. In a container filling and measuring apparatus, a cylinder, a piston having a rod adapted to displace measured quantities of liquid from said cylinder, a drive rod for actuating said piston, said drive rod being adapted to move through a fixed stroke, a lever connecting said drive rod with said piston rod, means for fixing the fulcrum point on said lever at a plurality of positions along the length to vary the displacement stroke of said piston, a resiliently biased lost motion connection between said drive rod and lever, and selectable adjustable stop members corresponding in number to said fulcrum positions adapted to restrict the movement of said lever in one direction to calibrate the displacement movement of said piston, each of said stop members being adapted to calibrate the piston displacement for one of said fulcrum positions.

29. In a container filling and measuring apparatus, a cylinder, a piston having a rod adapted to displace measured quantities of liquid from said cylinder, a drive rod for actuating said piston, said drive rod being adapted to move through a fixed stroke, means for driving said rod at uniform velocity, a lever connecting said drive rod with said piston rod, means for fixing the fulcrum point on said lever at a plurality of positions along the length to vary the displacement stroke of said piston, a resiliently biased lost motion connection between said drive rod and lever, and selectable adjustable stop members corresponding in number to said fulcrum positions adapted to restrict the movement of said lever in one direction to calibrate the displacement movement of said piston, each of said stop members being adapted to calibrate the piston displacement for one of said fulcrum positions.

30. In a liquid filling apparatus for containers, a housing, a hollow column projecting upward from said housing, a conveyor movably supported on said housing, pocket means for holding a plurality of containers mounted on said conveyor, lateral support means on said column overhanging said conveyor, container filling mechanism on said support means, means mounted on said support means and including a bar reciprocable in said column for actuating said filling mechanism, means for intermittently advancing said conveyor to bring successive containers into filling position with respect to said filling mechanism, container lifting means mounted on said housing adjacent said conveyor and adapted to lift each container toward said filling mechanism when in said filling position, and common drive means within said housing for driving said intermittent means, reciprocating said bar in said column, and operating said container lifting means in operative sequence.

31. In a liquid filling apparatus for containers, a housing, a hollow column projecting upward from said housing, a conveyor movably supported on said housing, pocket means for holding a plurality of containers mounted on said conveyor, lateral support means on said column overhanging said conveyor, container filling mechanism on said support comprising a cylinder and cylinder discharge orifice, a displacement piston in said cylinder, means including a bar reciprocable within said column and a lever

fulcrumed on said support for moving said piston in said cylinder, means for intermittently advancing said conveyor to bring successive containers into filling position with respect to said filling mechanism, container lifting means mounted on said housing adjacent said conveyor and adapted to lift each container toward said filling mechanism when in said filling position, and common drive means within said housing for operating said intermittent means, reciprocating said bar and operating said lifting means, in operative sequence, said drive means comprising a shaft disposed transversely of and below said column, a cam keyed to said shaft, and a cam follower on said bar, said cam having a uniform rise effective to move said bar upward at a uniform rate between consecutive intermittent movements of said conveyor.

32. In a filling apparatus for containers having a hinged cap, a housing having an annular step, a circular conveyor rotatably mounted upon said housing above said step, means for advancing said conveyor intermittently through a fixed angle, container supports on said conveyor spaced uniformly therearound and from one another by a like angle, support posts rising from said annular step spaced from one another therearound by a like angle, said supports being located adjacent conveyor container supports when the conveyor is at rest, a support column rising centrally from said housing, a device mounted on one of said support posts for partially opening the hinged cap of containers carried on said conveyor, a device for detecting containers having a cap in wide open position mounted on an adjacent support post, a guide rail supported upon said last-named posts adapted to engage a partially open cap and guide said cap to the wide open position upon movement of each container from the opening device to the detecting device.

33. In a container liquid filling apparatus, a frame, a conveyor mounted for movement upon the frame, said conveyor having means for supporting containers in uniformly spaced relation therealong during a filling operation, means for periodically advancing said conveyor an amount equal to the spacing between said container supporting means, a detector device mounted on said frame and adjacent said conveyor, sensitive to containers correctly prepared for filling, a filling device mounted on said frame adjacent said conveyor, said detector device and filling device being spaced for substantially simultaneous operation upon adjacent spaced containers, supported on said conveyor supporting means between periodic advances of said conveyor, a timing wheel, means coordinated with said conveyor advancing mechanism for rotating said wheel once for each two advances of said conveyor, diametrically oppositely disposed pins slidably mounted in said wheel and slidable between two positions, stationary means adjacent said wheel having means actuated by said detector device in response to detection of correctly prepared containers for moving each of said pins from one position to the other in passing said detector actuated means, stationary means acting in response to pins moved to the other position after rotation through a half revolution, and adapted to control said filling device, and cam means for moving each of said pins to the one position before each of said pins re-approach said detector actuated means.

34. A container filling apparatus, comprising a base having an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing for supporting the skirt for rotation around the housing on a vertical axis, said bearing comprising a ring mounted on the upper end of said housing, and a ring mounted internally of said skirt and superimposed over said housing ring, a central hollow column mounted on said housing ring and projecting upwardly beyond the housing and skirt, a reciprocating actuating bar slidably mounted in said column and projecting beyond the upper end thereof, drive means within said housing for periodi-

cally angularly advancing said skirt, comprising an internal gear on said skirt ring, and a driving pinion therefor journaled within said housing, and actuating said bar, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, and means mounted on said column and overhanging said skirt and having mechanism actuated by said bar for filling containers carried by said skirt one at a time between periodical advancing of said skirt.

35. A container filling apparatus, comprising an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, said bearing comprising a ring mounted on the upper end of said housing, and a ring mounted internally of said skirt and superimposed over said housing ring, a central hollow column mounted on said housing ring and projecting upwardly beyond the housing and skirt, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, means mounted on said column and overhanging said skirt and having mechanism for filling containers carried by said skirt, enclosed within said housing and extending through the length thereof, means for actuating said filling mechanism, and means for periodically rotating said skirt within said housing and independent of said column, comprising an internal gear on said skirt and a driving pinion therefor journaled within said housing.

36. A container filling apparatus, comprising an upstanding circular housing, a circular skirt arranged around the upper portion of said housing, an annular thrust bearing coacting between said skirt and housing, for supporting the skirt for rotation around the housing on a vertical axis, said bearing comprising a ring mounted on the upper end of said housing, and a ring mounted internally of said skirt and superimposed over said housing ring, a central hollow column mounted on said housing ring and projecting upwardly beyond the housing and skirt, an annular splash guard mounted on said column having a peripheral flange overhanging said skirt, means carried by said skirt for supporting a plurality of containers to move said containers in a circular path about said column, means mounted on said column and overhanging said skirt and having mechanism for filling containers carried by said skirt, means for actuating said filling mechanism enclosed within said housing and extending through the length thereof, and means for periodically rotating said skirt within said housing and independent of said column, comprising an internal gear on said skirt and a driving pinion therefor journaled within said housing.

37. A conveyor ring comprising an annular one-piece member, said member having a plurality of like substantially square pockets of one size for receiving and centering containers of one size, each of said pockets having a diagonal thereof extending radially, and having their outer sides partially removed to produce open pockets, said pockets being disposed around said member and being uniformly angularly spaced from one another, and a plurality of substantially square pockets of a smaller size for receiving and centering containers of a smaller size disposed around said member in spaces intermediate adjacent pockets of said first-named size, said smaller pockets being uniformly spaced angularly about said member and having one of their diagonals extending radially and the outer sides being partially removed to provide open pockets, the outer remaining side portions lying substantially within the adjacent outer sides of the adjacent pockets of said first-named size.

38. In a container filling apparatus, a source of liquid supply, a liquid dispensing device adapted to receive liquid from said source, said device having an outlet conduit having a downwardly directed end portion, a slit orifice extending around a substantial portion of said con-

duit adjacent the lower end thereof, and lying in a substantially horizontal plane, means for supporting a container to be filled with its upper edge above said slit orifice, means for periodically displacing a quantity of liquid from said device for filling a sequence of containers one at a time while each is supported on said supporting means, and power means for actuating said displacing means at a uniform rate for dispensing liquid from said device through said slit orifice during the entire displacement of each quantity of liquid.

39. In a liquid filling and measuring device for containers having a top filling hole therein, a cylinder having an outlet conduit having a downwardly directed closed end position, a slit orifice extending around a substantial portion of said conduit, means for supporting for filling a container having a top surface with a hole therein, with the hole in alignment with said end portion, a sleeve valve for said orifice slidable on said end portion and having actuating means adapted to engage the rim of the container hole, means for moving the container relative to the end portion to engage said valve actuating means to open said valve, and to project said end portion through the container hole with the slit orifice immediately below the top thereof, a piston having a rod adapted to displace measured quantities of liquid from said cylinder, a drive rod for actuating said piston, said drive rod being adapted to move through a fixed stroke, means for driving said rod at a uniform velocity, a lever connecting said drive rod with said piston rod, means for fixing the fulcrum point on said lever at any one of a plurality of positions along the length to vary the displacement stroke of said piston, a preloaded resiliently biased lost motion connection between said drive rod and lever, and selectively adjustable stop members corresponding in number to said fulcrum positions adapted to restrict the movement of said lever in one direction to calibrate the displacement movement of said piston, each of said stop members being adapted to calibrate the piston displacement for one of said fulcrum positions, whereby to dispense liquid from said device through said slit orifice in a substantially horizontal stream at a uniform rate.

40. In a liquid filling and measuring apparatus, a source of liquid, a cylinder adapted to receive liquid from said source in its upper end, a discharge conduit extending from its lower end, having a normally closed valve therein, a piston in said cylinder having a valve in the head thereof, means for moving said piston downwardly in said cylinder at a uniform rate through substantially its entire stroke with said valve closed, to discharge liquid through said conduit when said conduit valve is open, and means for moving said piston upwardly in said cylinder with said valve open to draw liquid from said source into said cylinder below said piston.

41. In a liquid filling and measuring apparatus, a cylinder, a discharge outlet at one end having a normally closed valve, a piston adapted to displace liquid within the cylinder through said outlet upon opening said valve when moved in a discharge direction, a valve in said piston adapted to be opened when moved in the opposite direction to fill said cylinder below said piston, means for positively driving said piston in said discharge direction, preloaded yieldingly biased lost motion means for moving said piston in the opposite direction to fill said cylinder, and means for positively arresting the cylinder filling movement of said piston and causing said lost motion means to yield whereby to fill said cylinder with a measured quantity of liquid.

42. In a liquid filling and measuring apparatus, a measuring cylinder having a discharge outlet at one end, a piston reciprocable in said cylinder and having fluid tight engagement with the cylinder, means for admitting liquid into the cylinder from the other end, a valve carried by said piston in the head thereof and out of contact with the cylinder providing free passage through the piston when open, and means moving with the piston

for closing said valve during a discharge stroke of said piston.

43. In a liquid filling and measuring apparatus, a measuring cylinder having a discharge outlet at one end, a piston reciprocable in said cylinder, a tubular piston rod connected to said piston and extending out of said cylinder away from the discharge end, means for admitting liquid into the cylinder from the other end, a valve carried by said piston in the head thereof, providing free passage through the piston when open, said valve having a stem extending through said tubular rod, and means carried by said rod and acting on said stem and moving with the piston for closing said valve during a discharge stroke of said piston.

44. In a liquid filling and measuring apparatus, a measuring cylinder having a discharge outlet at one end, a piston reciprocable in said cylinder, a tubular piston rod connected to said piston and extending out of said cylinder away from the discharge end, means for admitting liquid into the cylinder from the other end, a valve carried by said piston in the head thereof providing free passage through the piston when open, said valve having a stem extending through said tubular rod, and electro-magnetic means carried by said rod and acting on said stem and moving with the piston for closing said valve during a discharge stroke of said piston.

45. In a liquid filling apparatus for containers, a detecting station, including means for sensing correctly prepared containers for filling when placed in detecting position, a filling station including means for filling correctly prepared containers placed in filling position, a measuring cylinder having a discharge outlet for filling containers and a piston in said cylinder having a valve adapted to be opened for filling said cylinder and closed for discharging liquid from said cylinder, a conveyor for moving at regular intervals a series of containers one by one into a detecting position with respect to said detecting station, and advancing said containers at regular intervals into filling position with respect to said filling station, means for rendering said filling means inoperative or operative to fill each container when advanced into place in said filling position, and means actuated by said sensing means for rendering at an interval later said filling means inoperative or operative through control of said valve in accordance with whether said detecting station means sensed an incorrectly or correctly prepared container.

46. In a container conveyor feed, a base, a cylindrical member rotatably mounted on said base, a conveyor ring mounted on said cylindrical member, a plurality of pockets adapted to receive containers of one size mounted on said conveyor ring, said pockets being uniformly disposed around said ring, a plurality of pockets mounted on said conveyor ring adapted to receive containers of a different size disposed between adjacent first named pockets and uniformly angularly displaced therefrom, and means for angularly shifting and keying said ring in two different positions.

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