United States Patent

Sullivan

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[54] CONTAINER CLOSING APPARATUS AND METHOD

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[52] **U.S. Cl.** **53/42,** 53/201, 53/338, 53/282

[51] **Int. Cl.** **B65b 7/28,** B65b 59/04

[58] **Field of Search** 53/201, 267, 277, 42, 310, 53/331, 338, 339, 340, 282, 183, 3, 343, 353

[56] **References Cited**

UNITED STATES PATENTS

3,537,231	11/1970	Dimond	53/201
3,470,667	10/1969	David et al.	53/201 X
3,524,294	8/1970	Koll	53/3
2,359,932	10/1944	Newey	53/201
3,308,604	3/1967	Nekola	53/343
3,332,211	7/1967	Koll et al.	53/353
2,550,156	4/1951	Lyon	53/183

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Assistant Examiner—Horace M. Culver
Attorney—Woodcock, Washburn, Kurtz & Mackiewicz

[57] **ABSTRACT**

Separable infeed, filling, drive, and closing modules are provided for filling and closing bottles and cans. When bottles are filled and closed, the closing module includes a turret having interchangeable roll-on cap applying heads or crown applying heads. When cans are filled and closed, the closing module includes a seamer.

13 Claims, 12 Drawing Figures

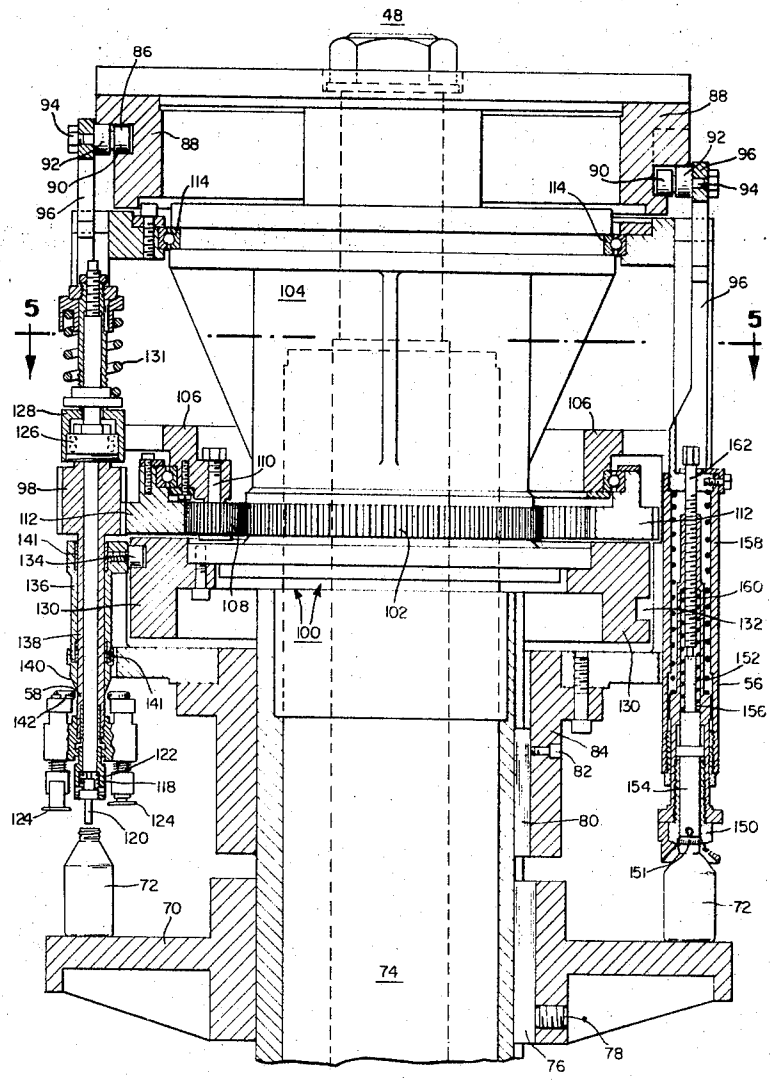
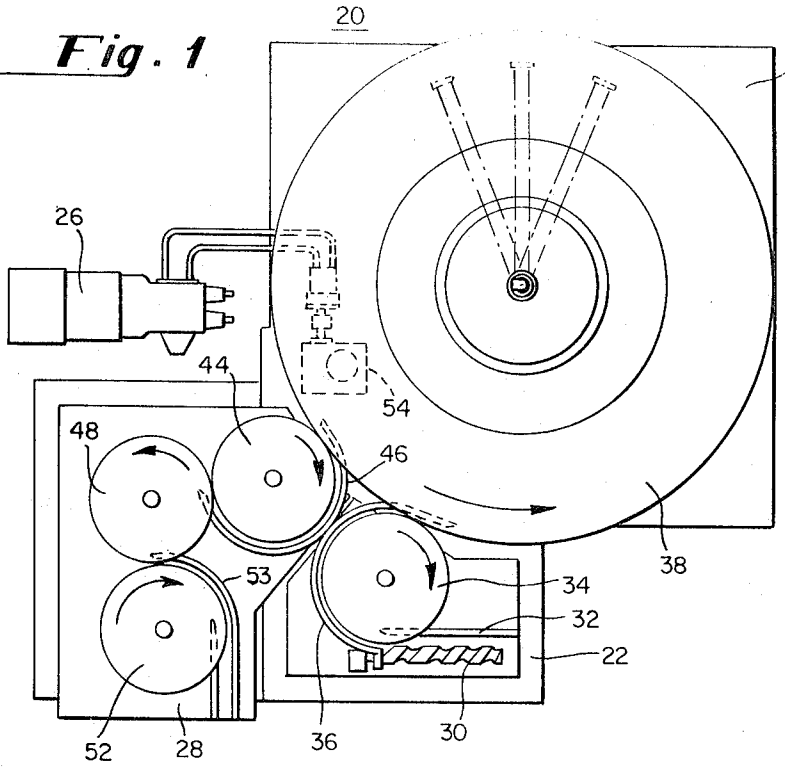


Fig. 1



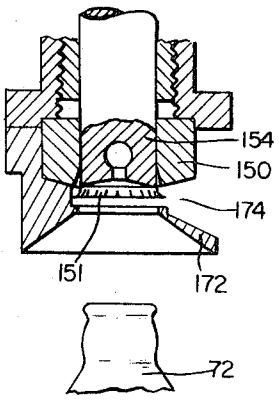


Fig. 6

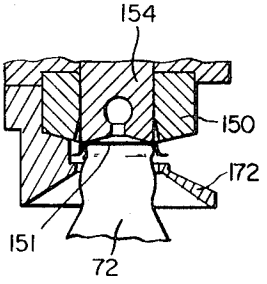
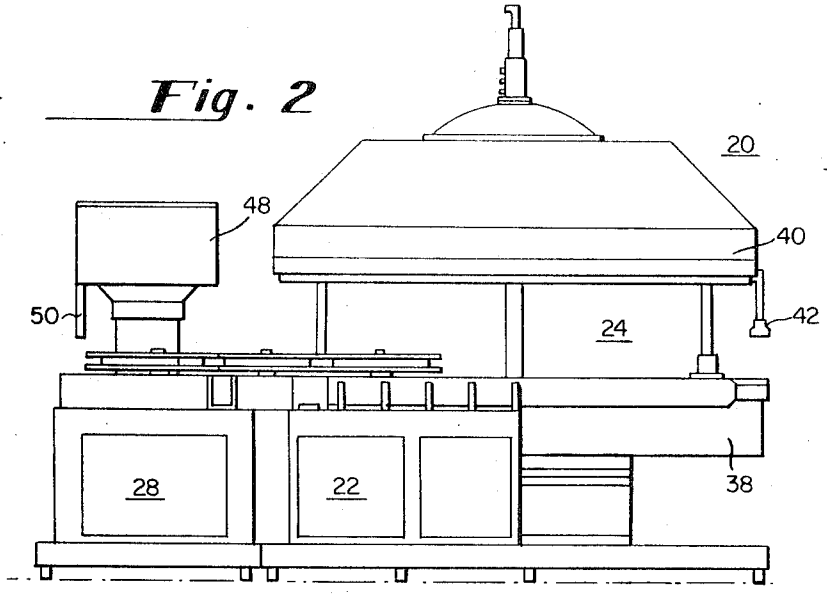


Fig. 7

Fig. 2



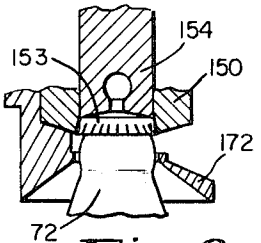
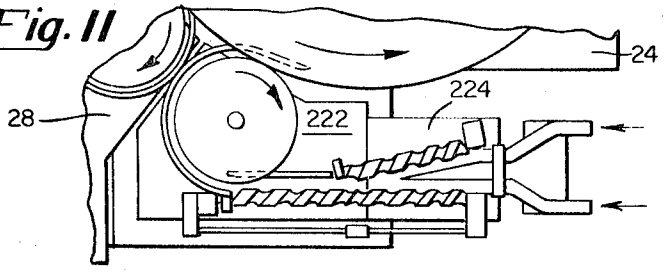


Fig. 8

Fig. 11



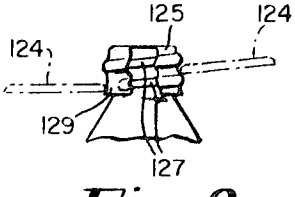


Fig. 9

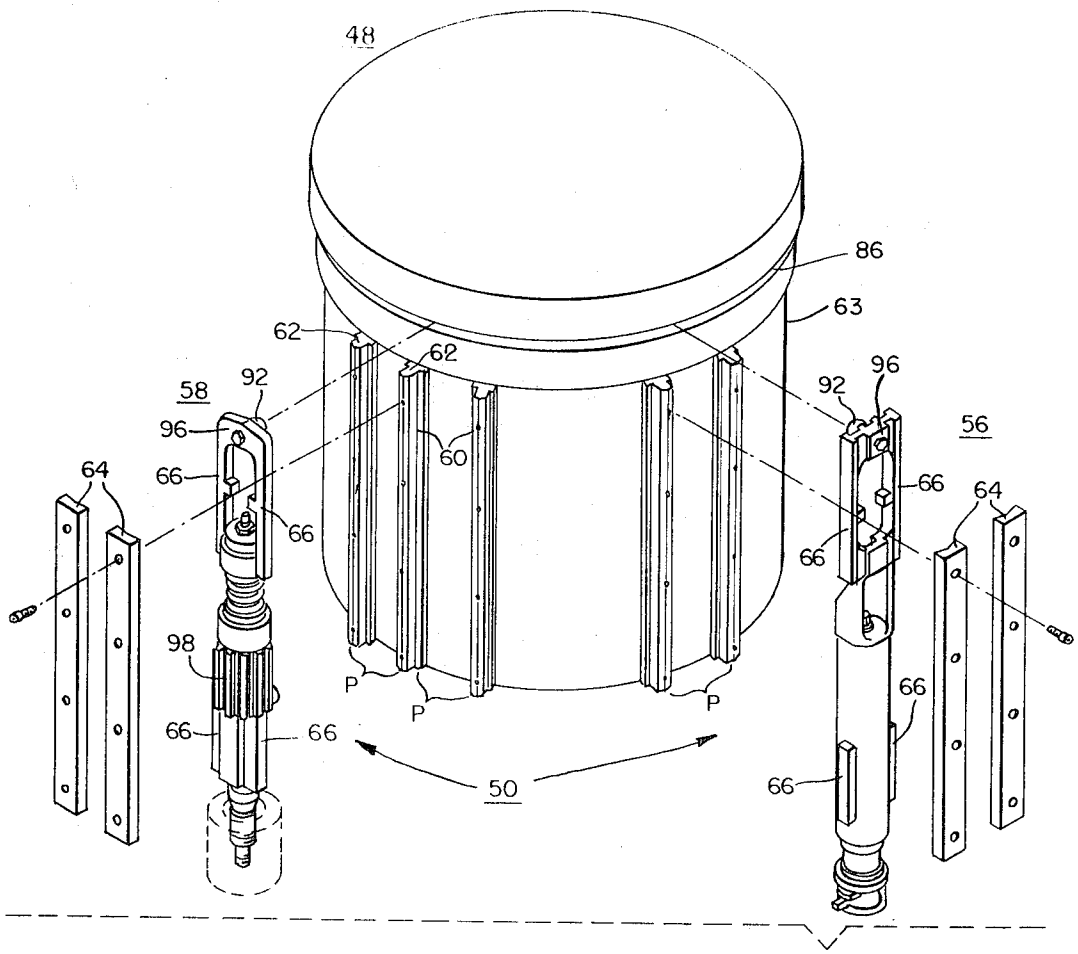

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Fig. 3

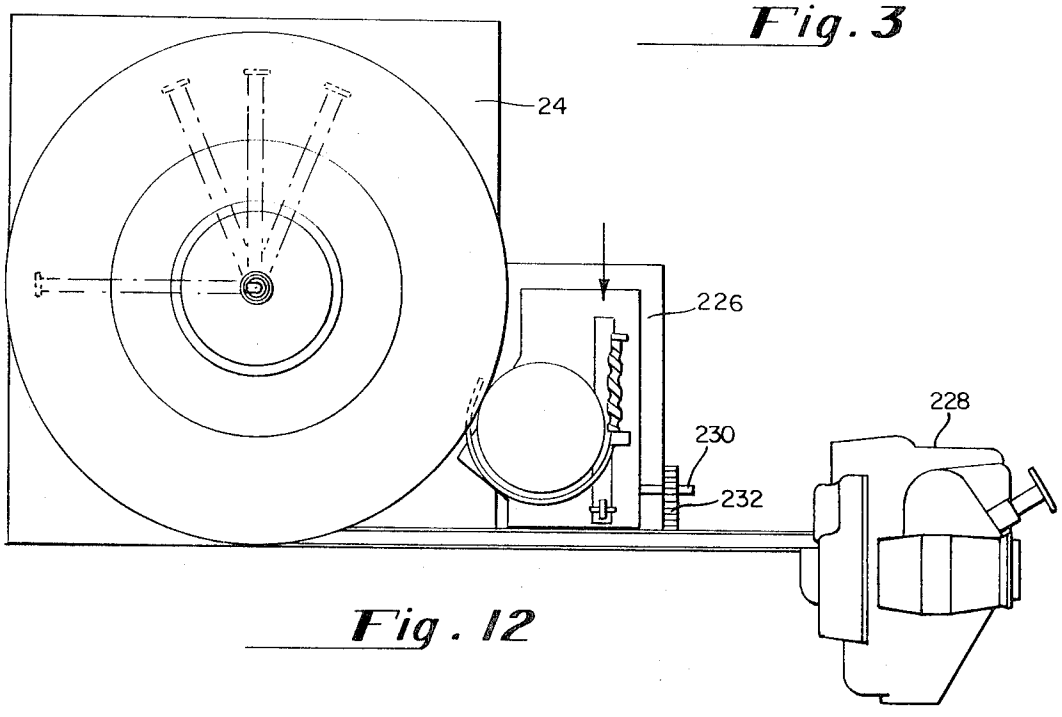
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Fig. 12

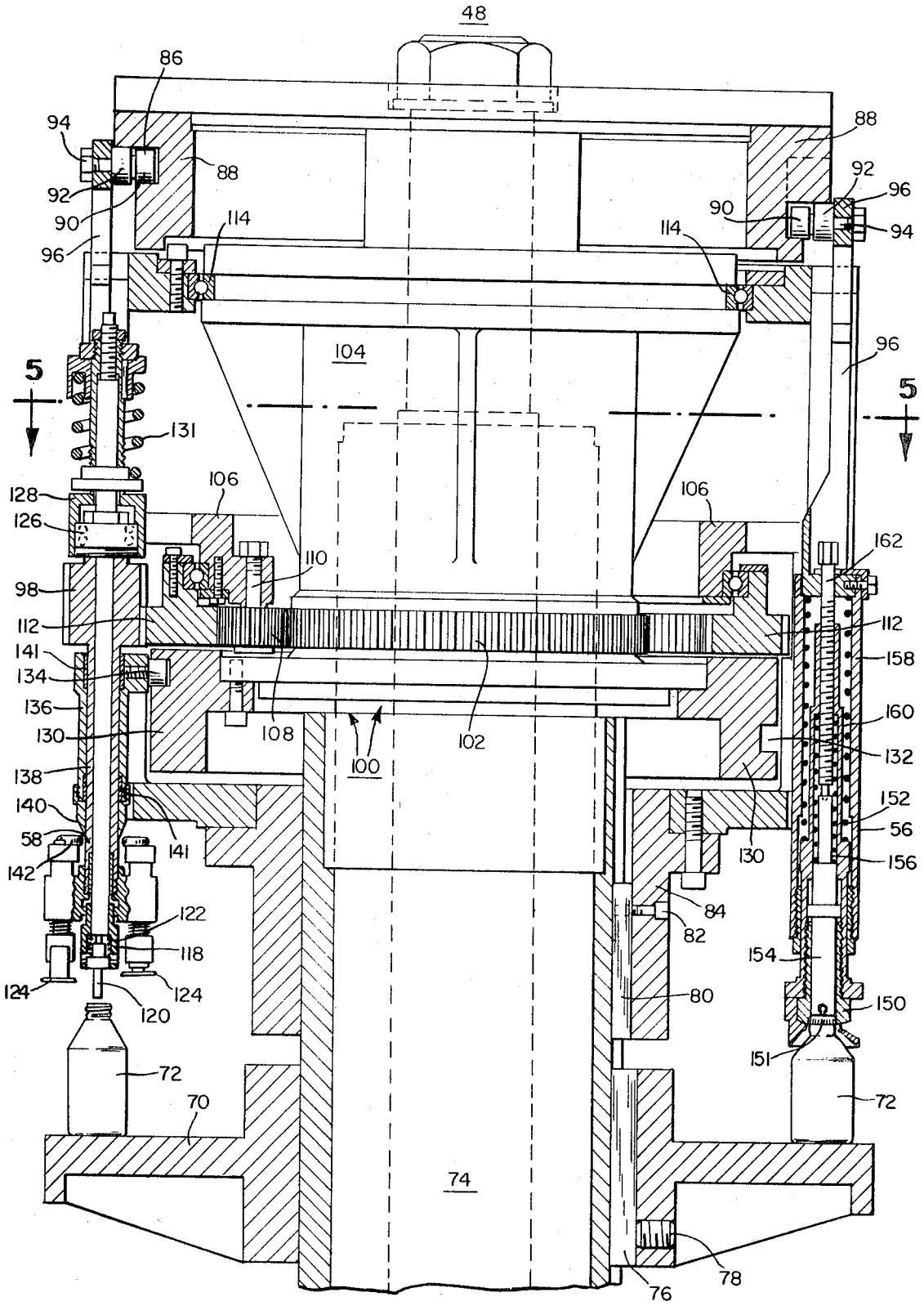
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Fig. 4

Fig. 5

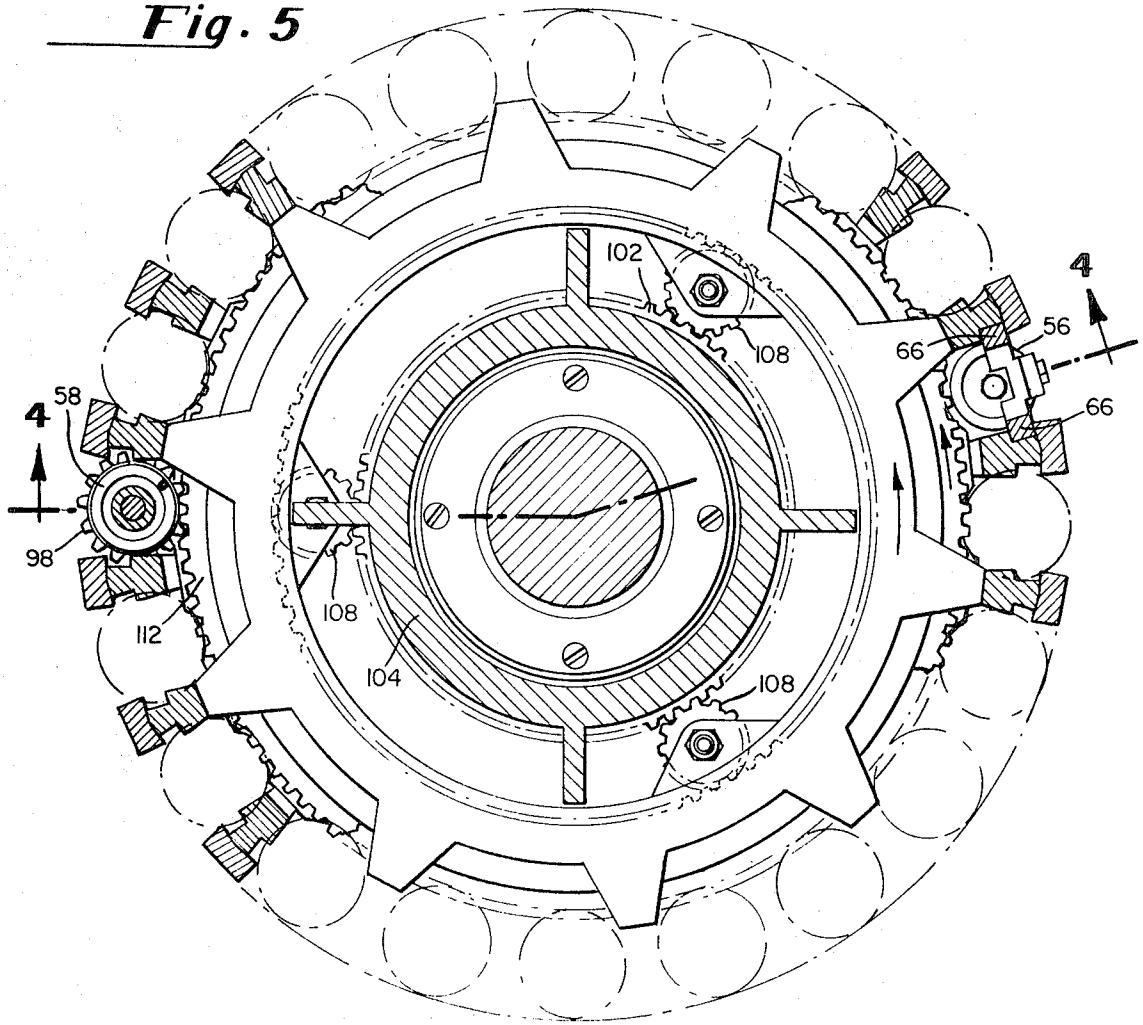
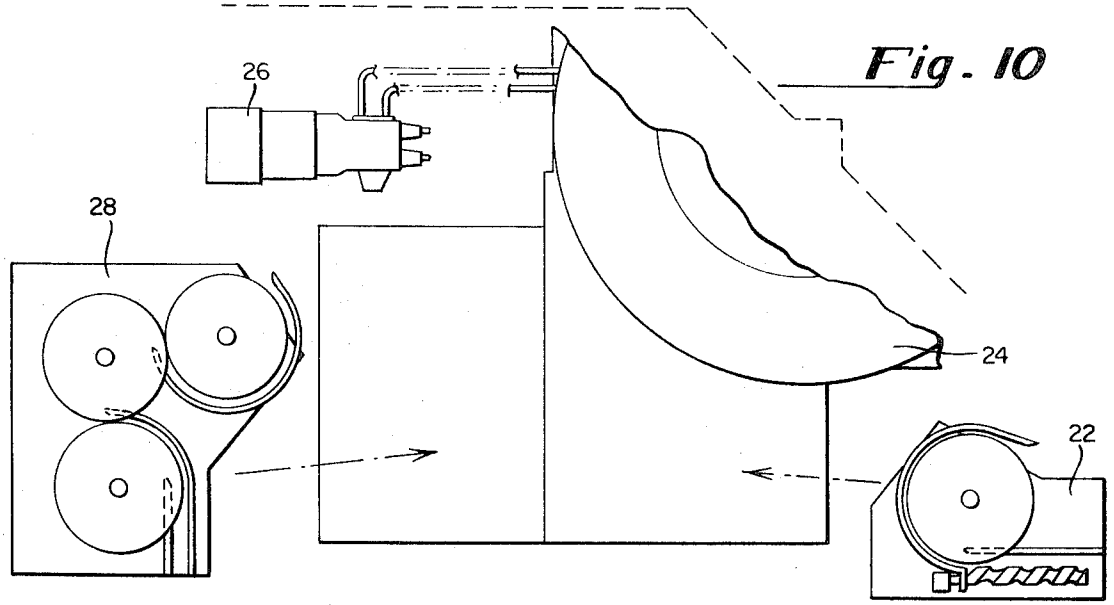


Fig. 10



CONTAINER CLOSING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

This invention relates to the closing of containers.

Containers such as cans or bottles are filled and closed during a plurality of successive operations which are performed by large, complex, and expensive machinery. The apparatus must comprise means for infeeding the containers to a multi-station filler. The apparatus must also comprise means for transferring the containers from the filler, means for applying closures such as roll-on caps, crowns or can ends, and outfeed means.

For example, when a crown is to be applied to a bottle, the closure applying means must include heads for applying crowns. The entire unit is then manufactured with crown applying heads which cannot be used to apply roll-on caps to bottles let alone apply can ends to can bodies even though a substantial portion of the unit is for the most part suited to handle roll-on cap type bottles or cans. In some instances, roll-on cap type bottles have been filled and closed with machines which have been designed for and include means for filling as well as closing crown type bottles. These machines were used in combination with additional means for applying caps. In these instances, the expensive crown applying means has been a useless appendage of a rather inflexible piece of equipment. In other instances, entire turrets including heads have been substituted to permit crowns or roll-on caps to be applied. The substitution of turrets is undesirable because of the excessive down time and the necessity for outside rigging help.

SUMMARY OF THE INVENTION

It is the overall object of this invention to provide a flexible apparatus for use in closing various types of containers.

In accordance with one important aspect of the invention apparatus is provided comprising a turret assembly and interchangeable crown applying and roll-on cap applying heads. The turret includes a plurality of revolving head mounts including guideways, means for reciprocating the interchangeable heads through the guideways, and means for rotating the roll-on cap applying heads.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a filling and closing apparatus embodying the invention;

FIG. 2 is an elevational view of the apparatus of FIG. 1;

FIG. 3 is an exploded perspective view of a closure turret assembly including closure applying heads;

FIG. 4 is a sectional view including the turret assembly of FIG. 3 taken along section line 4—4 of FIG. 5;

FIG. 5 is a sectional view including the turret assembly of FIG. 3 taken along section line 5—5 of FIG. 4;

FIGS. 6–8 represent various positions for the crown applying head of FIG. 3;

FIG. 9 represents the cap applying head of FIG. 3 on the bottle;

FIG. 10 is a schematic representation of the apparatus of FIG. 1 with the various modules separated;

FIG. 11 is a partial plan view corresponding to FIG. 1 with a different infeed module; and

FIG. 12 is a plan view of a filling and closing apparatus for cans embodying the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 disclose a filling and closing system 20 comprising an infeed module 22, a filler module 24, a drive module 26, and a closing module 28 including transfer, closure applying, and outfeed means. The apparatus 20 with the particular modular combination shown is designed to fill and close bottles.

The bottles first enter the system at the infeed module 22 through the use of an infeed worm 30 adjacent a back guide 32. The bottles are then carried on an infeed multi-pocket spider 34 which is rotating in a clockwise direction along a guide 36.

When the bottles enter the filler module 24, they are carried along a counter clockwise path by a cylinder support assembly 38. A valve carrier assembly 40 rotates with the cylinder support assembly 38 to fill the bottles as they move along the counter clockwise path. Only one filling valve tube and bell assembly 42 has been shown, but it will be appreciated that the valve carrier assembly 40 includes a number of these assemblies 42 circumferentially spaced with respect to one another.

When the bottles have been filled, they move to the closing module 28. The bottles are removed from the cylinder support assembly 38 by a multi-pocket transfer spider 44 which is rotating in a clockwise direction to carry the bottles along a guide 46. The bottles then move to the closure applying area of the module 28.

As shown in FIGS. 1 and 2, the bottles move in a counter-clockwise direction beneath a rotating turret assembly 48 including a plurality of closure applying heads. Only one of the closure applying heads 50 has been shown on the turret 48. A suitable closure feeding mechanism not shown is utilized to supply the closures to the head 50. After the closures have been applied to the bottles, the bottles leave the closing module 28 via an outfeed spider 52 which rotates in a clockwise direction. The spider carries the bottles at the plurality of circumferentially spaced pockets along a guide 53.

In order to drive the apparatus 20, the drive module 26 is provided. As shown, the module 26 comprises a split drive hydraulic power unit which is coupled to an hydraulic motor 54 in the filler module 24. The other modules 22 and 28 are then driven off the motor 54.

The turret assembly 48 will now be discussed in somewhat more detail with reference to FIG. 3. In accordance with one very important aspect of the invention, the turret assembly 48 including heads 50 may be adapted to apply steel crowns or aluminum roll-on caps. In order to provide this capability of applying either crowns or roll-on caps, the heads 50 are of two different types, crown applying heads 56 or cap applying heads 58. As shown, both heads 56 and heads 58 may be interchangeably mounted at any revolving station or mount on the turret assembly 48 with a very simple change-over procedure. Each head receiving mount is provided with a pair of machined rectangular bearing ways 60 in vertically cast ribs 62 which are circumferentially spaced about a substantially conventional turret 63 to provide mounts of a predetermined and constant pitch P. The heads 56 and 58 are then mounted in the bearing ways 60 through the use of a pair of easily removable cover plates 64 which are bolted to the ribs 62. Two sets of radially extending machine lugs 66 on each of the heads 56 and 58 are held in guideways formed by the bearings ways 60 and the removable cover plates 64 which are bolted to the ribs 62. These guideways permit the reciprocating motion or vertical stroke which is necessary for applying the crowns and the roll-on caps to the bottles. It will be understood that the crown applying head 56 and the cap applying head 58 have the same vertical stroke through the guideways. However, the cap applying head also rotates at the lower end while the crown applying head does not. Nevertheless, the cap applying heads and the crown applying heads are fully interchangeable in the turret 63 as will be clear from FIGS. 4 and 5.

For purposes of illustration, FIGS. 4 and 5 show the closure applying apparatus including the turret assembly 48 with one crown applying head 56 and one cap applying head 58 in place. It will of course be appreciated that the turret assembly 48 will either carry crowning heads 56 at all of the mounts or capping heads 58 at all of the mounts depending upon the nature of the bottle to be closed.

The closure applying apparatus includes a revolving table 70 which is located beneath the turret assembly 48 for carrying bottles 72 along with the heads 56 or 58 as the turret assembly 48 rotates in a counter clockwise direction. The table

70 is keyed to a drive column 74 at a key 76 and a set screw 78 while the rotating turret 63 is keyed to the drive column 74 at a key 80 and a set screw 82 which extends through a turret hub 84. As the column 74 which is coupled to the motor 54 of FIG. 1 rotates thereby rotating the turret 63, the heads 56 and 58 are revolved about the turret axis.

In order to impart a reciprocating motion for a vertical stroke of the heads 56 and 58 as the turret 63 rotates, reciprocation drive means in the form of a fixed upper slide cam 88 and a reciprocation driven means in the form of cam followers 90 and 92 on each of the heads 56 and 58 are provided. The planetary gear system 100 includes a fixed center gear 102 which is mounted on a center bearing and gear support member 104 along with a bearing assembly 114. A rotating planetary gear support member 106 which is part of the rotating turret 63 carries a plurality of planetary gears 108 which rotate around shafts 110 and revolve around the gear 102. The planetary gear system 100 further comprises an annular external driving gear 112 which is driven off the planetary gears 108 along the internal surface of the gear 112. The external surface of the gear 112 engages and rotates the capper head spindle driven gear 98.

It may be noted that the single cam track 86 is utilized to provide the same vertical stroke for both the crowner head 56 and the capper head 58. As mentioned previously, the substantially identical lugs 66, bearing ways 60, and plates 64 are utilized to guide the both types of heads.

The operation and configuration of the capper head 58 is substantially conventional. As the cam followers 90 and 92 of the capper head 58 move from the up dwell position at the left, through the fall, and to the down dwell position at the right, the lugs 66 will descend between bearings ways 60 and the cover plates 64 to carry a pressure pad 118 of the head set to the mouth of a bottle 72 having a screw thread glass finish. The cap is held in this position on the mouth of the bottle by a cap control plunger 120 which is biased to an extended position by a spring 122 as shown. On contact with the cap, the plunger 120 retracts within the pressure pad 118. The rotational motion of the head which is achieved by the planetary gear system 100 in combination with the capper head spindle gear 98 then revolves rollers 124 to both roll the skirt of the cap 125 at bottle threads 127 and roll the lowermost portion of the cap skirt 129 inwardly as shown in FIG. 9.

In order to apply the necessary sealing pressure to the cap 125 and cap liner as well as accommodate any slight variations in bottle height, a spring 131, is provided. The spring is of sufficient strength to transmit the stroking force provided by the camming track 86 while at the same time providing a stroke take-up function where the length of the stroke exceeds that necessary for the particular bottle which is being capped.

Since only the lower portion of the capper head 58 rotates, bearing means must be provided between the rotating and nonrotating portions. Accordingly, bearing raceways are provided at the upper end of the capper head spindle gear 98 for bearings 126 which are enclosed within a bearing housing 128.

The turret assembly 48 also includes a lower slide cam 130 including a cam track 132 receiving a cam follower 134. The cam follower 134 is part of a lower cam slide 136 of the capper head 58. Only the interior of the capper head 58 and more particularly the pinion spindle 138 is rotating. The lower slide 136 does not rotate with the pinion spindle 138 but is separated therefrom by bushing 141. As the cam follower 134 moves from the upper dwell position at the left, through the fall, and to the lower dwell at the right, the conical camming surface 140 at the lower end of the lower slide 136 engages rollers 142, pivoting the rollers 142 outwardly and the rollers 124 inwardly to engage the cap skirt as shown in FIG. 9. This mechanism is substantially conventional and the details are accordingly well known in the art.

In contrast with the capper head 58 which has a substantially conventional configuration, the crowner head 56 represents a departure from the conventional crowner head configuration in accordance with one very important aspect of the invention. In this connection and as mention previously the crowner head 56 includes the lugs 66 which move between bearings ways 60 and the cover plates 62 of the turret 63 to provide a vertical stroke derived from a camming track 86 and cam followers 90 and 92. When the head 56 is at the bottom of the vertical stroke, the crowner head 56 is in contact with a threadless bottle 72 after having applied a crown 151. In the position shown, the crown head throat 150 has wiped and crimped the crown skirt 153 down along the side of the bottle as best seen in FIG. 8. Referring again to FIG. 4, the throat 150 is held in the position shown by a compensating spring 152 which accommodates slight variations in bottle heights. A presser foot 154 engages the top of the crown with a pressure determined by a presser foot spring 156. The presser foot spring 156 must be sufficiently strong to establish a seal between the bottle mouth and the crown liner.

The compensating spring 152 is located within an annular chamber defined by an outer crowing cylinder 158 at the exterior of the crowner head 56, a compensating slide 160, and the lower end of the slide 96 of head 56. The presser foot spring 156 is enclosed within a chamber defined by the compensating slide 160 and a crimp adjusting rod 162. If the crimp adjusting rod 162 is backed off or raised with respect to the lower end of the upper slide 96, the crimp on the skirt of the crown is tighter since the skirt will be allowed to reach a deeper point in the throat 150.

It will be noted that the camming track 132 and the internal and external gears 112 do not in any way affect or interfere with the crowning operation. The crowner heads are spaced from the gear 112 and therefore are not engaged by or coupled to the gear 112. As mentioned previously, the crowning is achieved by a strictly reciprocating motion without rotational motion and there are no rollers associated with the application of a crown to a bottle as in the case of the roll-on cap. For a further understanding of the crowning operation, reference will now be made to FIGS. 6–8.

In FIG. 6, the crown 151 is shown at the opening of the throat 150 after entering a crown platform 172 through an opening 174. The crown 151 is held in place by magnetic means in the presser foot 154.

As shown in FIG. 7, the throat 150 and presser foot 154 have descended toward the mouth of the bottle with the presser foot 154 resting on the top of the crown 151. At this point in time, the preload compression on the presser foot spring 156 is increased due to the continuing downward movement of the compensating slide 158 as shown in FIG. 4. The compensating spring 152 remains under preload compression only.

In FIG. 8, the throat 150 has wiped and crimped the crown skirt 153 on the threadless bottle 72. The compensating spring is now additionally compressed and in a position corresponding to the position shown in FIG. 4 where the cam followers 90 and 92 of the crowner head 56 are in the lower dwell of the cam track 86. As the cam followers 90 and 92 ride up the cam track 86 toward the upper dwell, the compensating spring 152 will first be released to a state of preload compression followed by the release of the presser foot spring 156 back to preload compression which serves to eject the crown from the throat 150.

In the foregoing discussion, a great deal of emphasis has been placed upon the flexibility of a module which is capable of applying crowns as well as roll-on caps. By utilizing such a module, the same apparatus may be utilized for closing various types of bottles. It will now be shown that the entire filling and closing system becomes more flexible when a closure applying apparatus and the other apparatus of the system are divided into the modules shown in FIG. 1. In FIG. 10, the apparatus of FIG. 1 which includes such a closure applying module is shown separated into its module components. The figure is intended to illustrate and emphasize the importance of the modular approach to container filling and closure apparatus to provide the ultimate in flexibility. In particular, it should be appreciated that various modules may be replaced

by other modules to provide the same or similar functions for different containers or the same functions on the same containers at other filling and closing rates.

In order to further illustrate the flexibility of a modular approach to container filling and closing systems, reference is now made to FIG. **11** wherein an infeed module **222** is shown having a twin worm feeding mechanism **224**. This infeed module **222** can be utilized in conjunction with the module as shown in FIG. **1** where it is desireable to utilize two conveyors thereby reducing the bottle speed along the infeed conveyor means. When a filler module is utilized having as many as 100 valves, such an infeed module can provide a sufficient number of bottles without requiring excessive speeds of the bottles along each of two conveyors.

FIG. **12** further illustrates the flexibility of a modular approach to container filling and closing systems. By merely adapting the valves of a bottle filler module **24** and utilizing that module in combination with a suitable infeed module **226** and a can end seamer **228**, the bottle filler module **24** may be utilized as part of a can filling and closing apparatus. The seamer **228** may also be utilized to provide the drive for the filler module **24** as well as the infeed module **226** by suitable drive transmission means including a shaft **230** in combination with a chain **232**. In this connection, it should be noted that the filler has a counter clockwise direction of rotation which is conventional in the can fillers. This direction could be clockwise in FIG. **12** as well as in FIGS. **1** and **11**.

Although the roll-on caps and the crowns have been specified as the conventional aluminum and steel respectively, the caps and crowns may comprise other materials.

While particular embodiments of the invention have been described, it will be understood that various modifications may be made which fall within the true spirit and scope of the invention as claimed.

We claim:

1. Apparatus for applying crowns to containers comprising a turret including a plurality of revolving head mounts having guideways permitting reciprocating head motion, reciprocation driving means associated with each of said head mounts, and rotation driving means associated with each of said head mounts, said head mounts adapted to receive roll-on cap applying heads in said guideways, said roll-on cap applying heads being reciprocated by said reciprocation driving means and having rotating head sets driven by said rotation driving means, the improvement residing in crown applying heads mounted interchangeably with said roll-on cap applying heads in each of said head mounts, each of said crown applying heads having a presser foot and a throat member, said presser foot and said throat member of said crown applying heads being coupled to said reciprocation driving means without being coupled to said rotation driving means for reciprocating motion without rotational motion of said presser foot member and said throat member, said presser foot member applying pressure to the crown to form a seal between a crown liner and the container, and said throat wiping and crimping the crown skirt down over the container.

2. The apparatus of claim **1** wherein said crown applying heads comprise a plurality of radially extending lugs received by said guideways at each of said head mounts.

3. The apparatus of claim **2** wherein said crown applying heads comprise cam follower means cooperating with said reciprocation driving means comprising a stationary cam having a cam track establishing the reciprocating motion of said crown applying heads.

4. The apparatus of claim **3** wherein said crown applying heads further comprise a presser foot spring means engaging said presser foot for applying pressure to the presser foot as said head descends and a compensating spring for accommodating any overstroke on the container.

5. The apparatus of claim **4** wherein said crown applying heads further comprise an outer crowning cylinder and a compensating slide enclosed within said outer crowning cylinder, said compensating spring being enclosed within a chamber formed between said outer crowning cylinder and said compensating slide and bearing upon said compensating slide, and said presser foot spring being enclosed within said compensating slide and bearing upon said presser foot.

6. A turret assembly for applying closures comprising:

a rotating turret having a plurality of closure applying head mounts including vertically extending ribs having bearing ways therein and removable cover plate means attachable to said ribs to provide guideways permitting reciprocating head motion;

a slide cam means associated with each of said head mounts for reciprocating heads;

a drive hear means associated with each of said head mounts for rotating heads;

roll-on cap applying heads mountable at said head mounts, each of said roll-on cap applying heads comprising cap applying rollers for engaging and threading the cap, cam slide means cooperating with said slide cam means for imparting a reciprocating motion to said roll-on cap applying heads, a driven gear means cooperating with said drive gear means for imparting a revolving motion to said cap applying rollers, and radially extending lugs retained within said guideways for guiding said heads through a reciprocating motion; and

crown applying heads having a presser foot and a throat member for crimping a crown, said crown applying heads being interchangeably mountable at said revolving head mounts in place of said roll-on cap applying heads, said crown applying heads comprising cam slide means cooperating with said slide cam means for imparting a reciprocating head motion to said crown applying heads, and radially extending lugs retained within said guideways for guiding said crown applying heads through a reciprocating motion, said crown applying heads being spaced from said drive gear means so as to preclude a rotational motion of said crown applying heads.

7. A turret assembly for applying crowns to bottles comprising:

a rotating turret member having a plurality of revolving head mounts adapted to receive roll-on cap applying heads;

a slide means associated with each of said head mounts adapted to drive roll-on cap applying heads through a vertical stroke;

a drive gear means associated with each of said head mounts to drive said roll-on cap applying heads in a rotational motion;

a guide means at each of said head mounts adapted to guide roll-on cap applying heads through a vertical stroke; and

a plurality of crown applying heads fully interchangeable with roll-on cap applying heads mounted at said head mounts, said slide means driving said crown applying heads through said guide means in a vertical stroke without engaging said drive gear means so as to preclude rotational motion of said crown applying heads.

8. The turret assembly of claim **7** wherein said guide means comprises vertically extending ribs having bearing ways therein and removable cover plates attached to said ribs and said crown applying heads comprise radially extending lugs retained between said bearing ways and said cover plates.

9. The turret assembly of claim **8** wherein said slide means comprises a fixed slide cam and said crown applying means comprises cam slide means, said fixed slide cam cooperating with cam slides of said crown applying heads.

10. The new use for a turret assembly including:

a rotating turret member having a plurality of revolving head mounts adapted to carry roll-on cap applying heads;

a rotation driving means adapted to rotate cap applying heads;

a slide means associated with each of said head mounts adapted to drive roll-on cap applying heads through a vertical stroke; and

a guide means at each of said head mounts adapted to guide roll-on cap applying heads through a vertical stroke;

the new use comprising the steps of:

mounting a plurality of crown applying heads at said plurality of revolving head mounts so as not to be coupled to said rotation driving means;

driving said crown applying heads through a vertical stroke with said slide means without rotating said crown applying heads; and

guiding said crown applying heads through said vertical stroke with said guide means.

11. A turret assembly for applying closures comprising:

a turret having a plurality of closure applying head mounts including vertically extending ribs having bearing ways therein and removable cover plate means attachable to said ribs to provide guideways permitting reciprocating head motion;

an upper slide cam means and a lower slide cam means associated with each of said head mounts;

a drive gear means associated with each of said head mounts for rotating heads;

roll-on cap applying heads mountable at said head mounts, each of said roll-on cap applying heads comprising cap applying rollers for engaging the cap, an upper cam slide means cooperating with said upper slide cam means for imparting a reciprocating motion to said roll-on cap applying heads, a lower cam slide means cooperating with said lower slide means for moving said rollers into and out of engagement with the cap, a driven gear means cooperating with said drive gear means for imparting a revolving motion to said cap applying rollers, and radially extending lugs retained within said guideways for guiding said heads through a reciprocating motion;

crown applying heads interchangeably mountable at said revolving head mounts in place of said roll-on cap applying heads, said crown applying heads comprising upper cam slide means cooperating with said upper slide cam means for imparting a reciprocating head motion to said crown applying heads, and radially extending lugs retained within said guideways for guiding said crown applying heads through a reciprocating motion, said crown applying heads not being coupled to said drive gear means and said lower slide means.

12. Apparatus for applying crowns to containers comprising a turret including a plurality of revolving head mounts having guideways permitting reciprocating head motion, reciprocation driving means associated with each of said head mounts, and rotation driving means associated with each of said head mounts, said head mounts adapted to receive roll-on cap applying heads of the type having rotating head sets or crown applying heads of the type having a presser foot and a throat member in said guideways, said roll-on cap applying heads including driven means being driven by said reciprocation driving means and said rotation driving means to both reciprocate and rotate said head sets, the improvement residing in said crown applying heads including guide means received by said guideways for reciprocating motion therethrough, said crown applying heads including driven means being driven by said reciprocation driving means without being driven by said rotation driving means so as to drive said presser foot and said throat member through a vertical stroke without rotational motion, said presser foot applying pressure to the crown to form a seal between a crown liner and the container and said throat wiping and crimping the crown skirt down over the container.

13. The apparatus of claim 1 wherein said guide means of said crown applying heads comprise a plurality of radially extending lugs received by said guideways at each of said head mounts.

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