

April 29, 1969

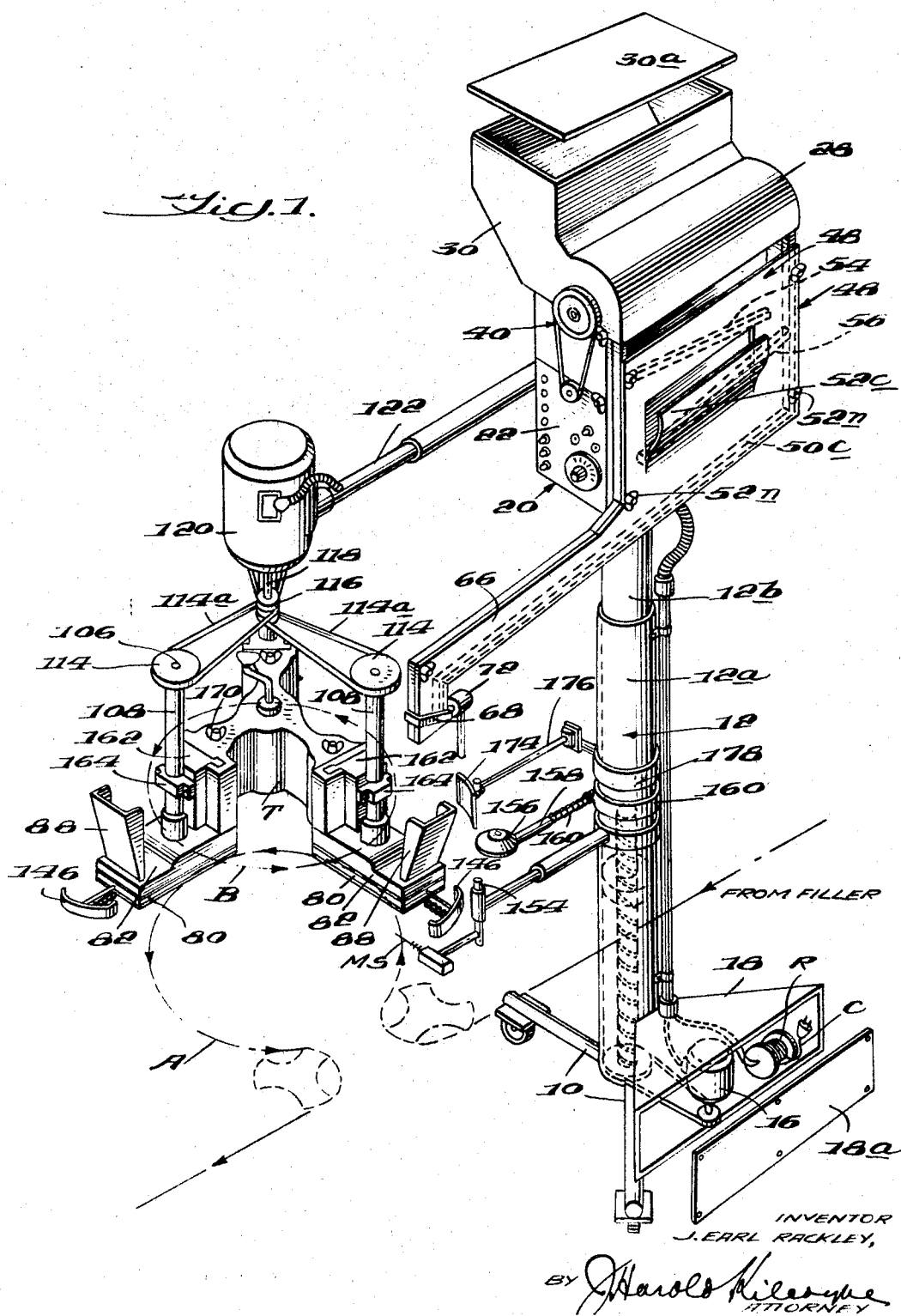
J. E. RACKLEY

3,440,798

CONTAINER CAPPING MEANS

Filed June 24, 1966

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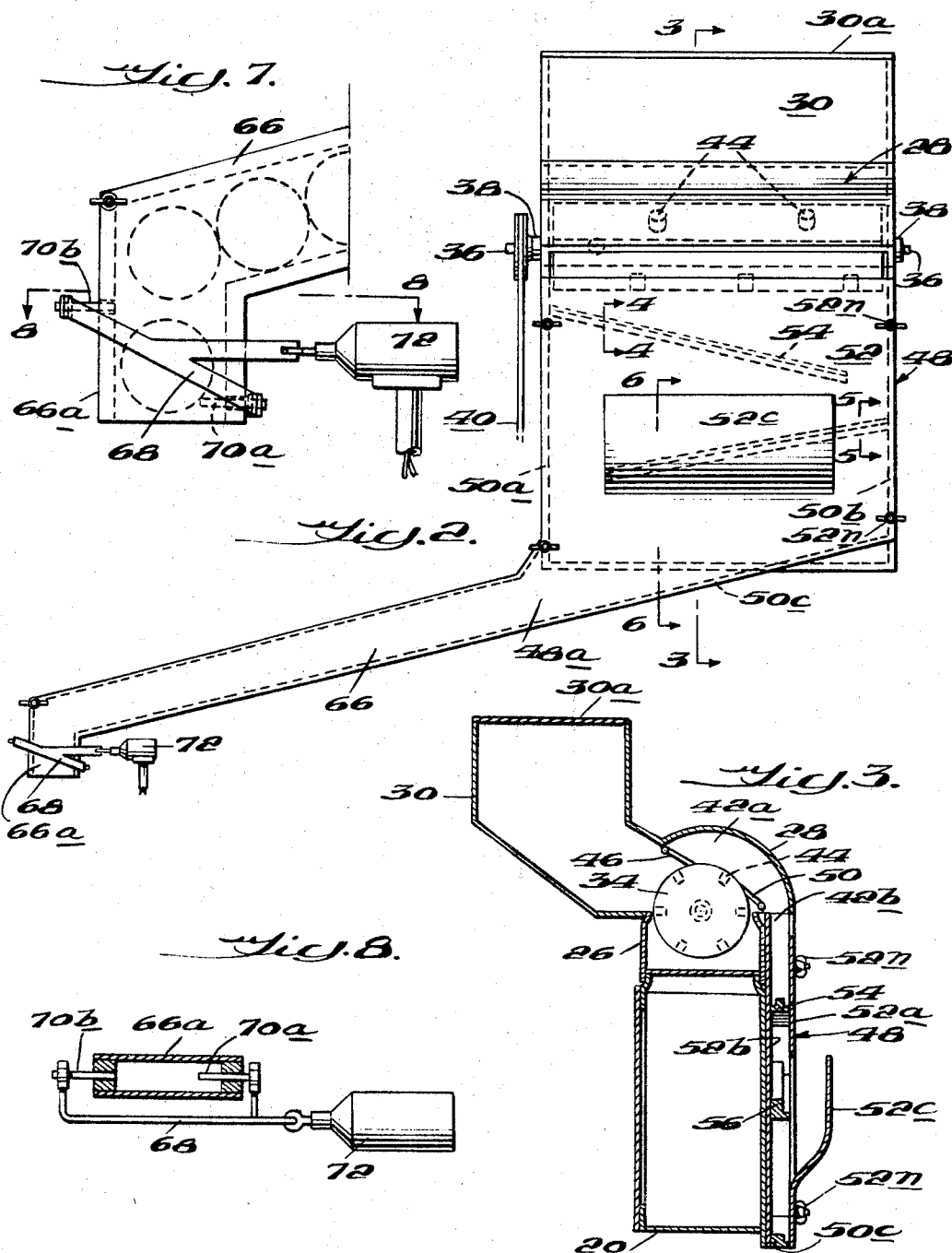
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Fig. 4.

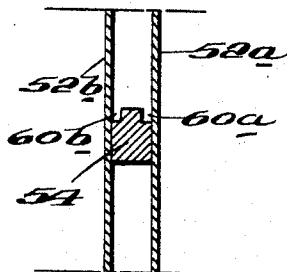


Fig. 5.

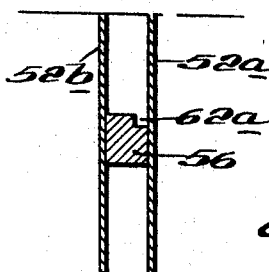


Fig. 6.

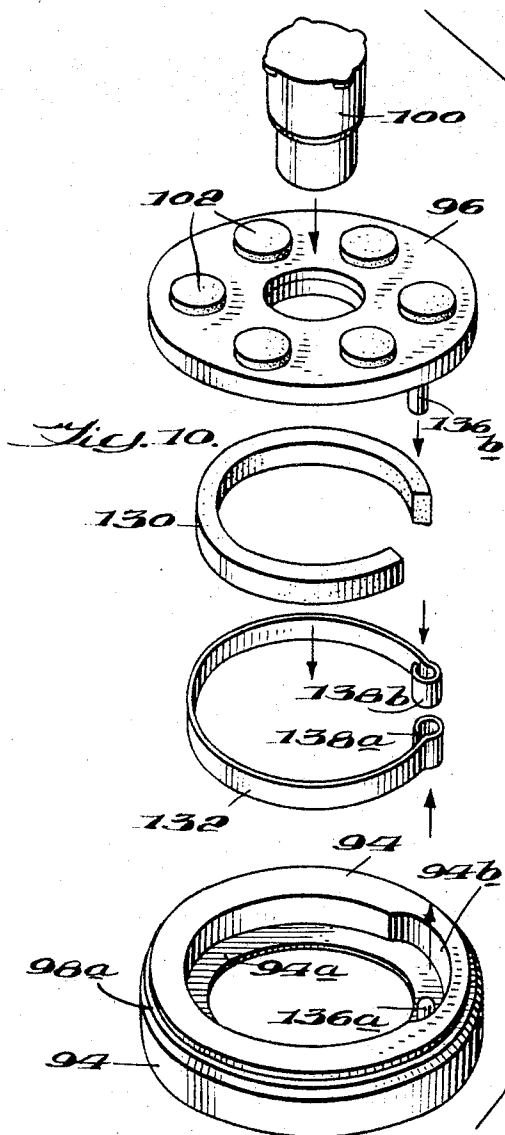
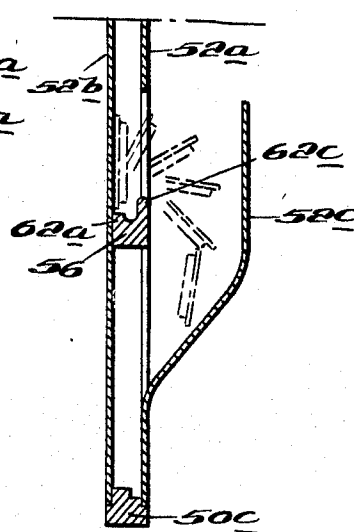
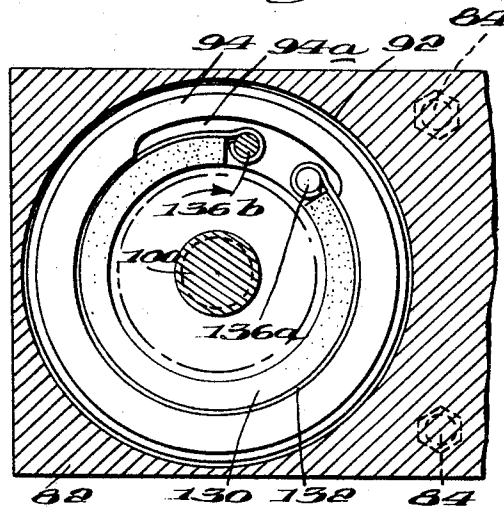


Fig. 11.



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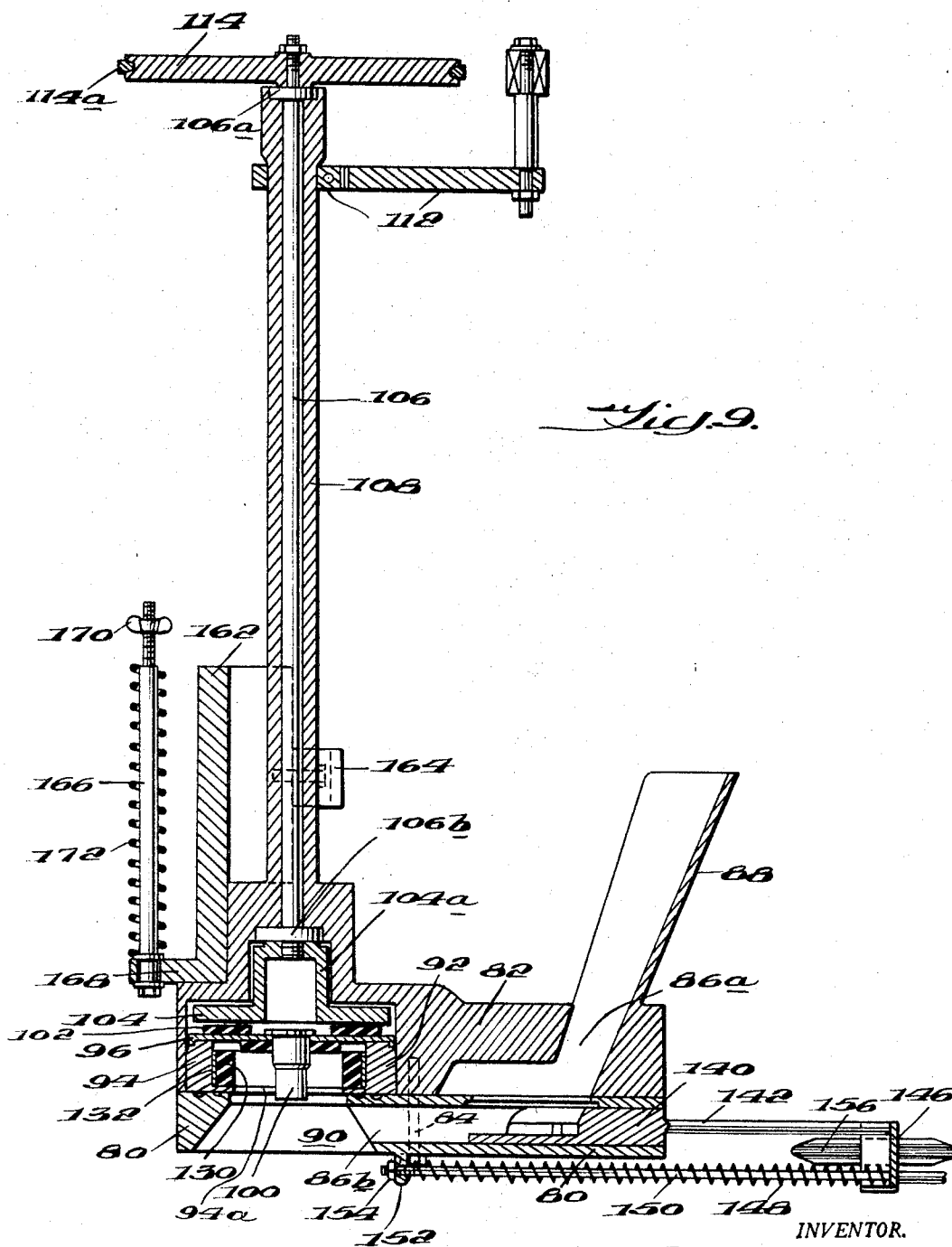
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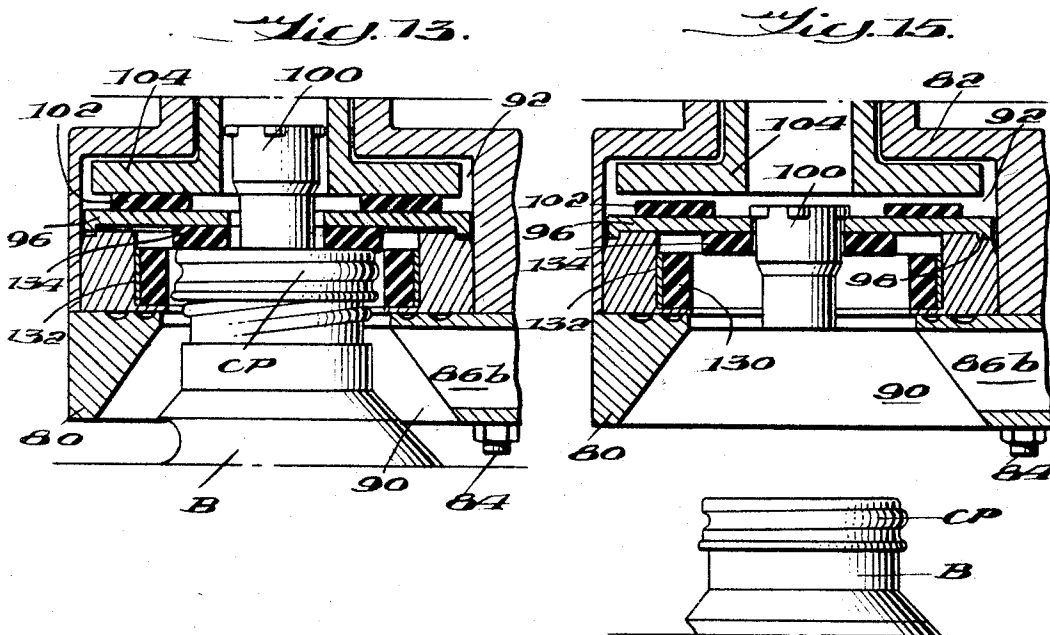


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CONTAINER CAPPING MEANS

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13 Claims

ABSTRACT OF THE DISCLOSURE

A capping machine for applying screw-on caps to bottle-type containers, i.e. plastic bottles, incorporating means for rectifying randomly faced caps feeding from a supply hopper to each of a plurality of capping head assemblies which operate in turn to apply said caps moving thereto in line formation. Each of said capping head assemblies includes chuck means for screwing a cap onto the neck of a container, the operation of which is responsive to the thrust of said bottle neck moving upwardly against a cap then in a position in said capping head assembly to receive said bottle neck.

This invention relates to improvements in container capping means and more particularly to an improved capping machine for applying screw-on metal caps to plastic bottles.

As related in an article entitled, "Tempest in a Milk Carton," appearing in Dun's Review and Modern Industry, issue of December 1965, plastic gallon and half-gallon bottles usually shaped as a squarish jug with a handle, and which were previously used to a limited degree only as containers for fluid household products such as detergents, are now actively competing with glass and paper containers for the fluid milk container market, this despite the fact that the plastic bottle costs more to produce than the prior glass and paper containers.

This growing popularity can be attributed to the increasing awareness of the many advantages that the plastic bottle has over the paper and glass-bottle type fluid containers, principally that the plastic bottle is leak-proof and is easier to handle than the paper container, lighter than and not so easily broken as the glass bottle, and is re-usable by the housewife.

However, while many of the earlier technical difficulties in developing plastic bottles for the market, notably those having to do with the filling and capping of such bottles, have been largely overcome, the capping operation and/or the machines employed to cap the filled plastic bottle still leave much to be desired. More particularly, the caps conventionally employed to cap plastic bottles are of the press-on or crimp-on type, the application of which subjects the filled bottle or the neck portion thereof, which being of plastic is non-rigid, to deforming if not collapsing forces. Furthermore, it is possible for press-on and/or crimp-on caps, even though properly applied to the filled plastic bottles, to pop off the necks thereof when, for example, a bottle is squeezed and/or held too tightly in its body portion.

Stated broadly, an object of the present invention is to provide a capping machine for use in applying caps to plastic bottles which not only overcomes the difficulties previously encountered in capping containers of this type but also does so in simple, practical and thoroughly dependable manner.

A further object of the invention is the provision of a plastic-bottle capping machine whose construction and design suits it for use with standard plastic-bottle filling equipment.

A more particular object of the invention is the provision of an improved capping machine specifically de-

signed for applying screw-on metal closure caps to plastic bottles.

A still further object of the invention is the provision of a self-contained portable capping machine capable of applying screw-on closure caps to plastic bottles.

A still further object of the invention is the provision of a self-contained portable capping machine capable of applying screw-on closure caps to plastic bottles, characterized by a construction enabling it to be substituted in a plastic-bottle filling and capping line for the capping press previously incorporated in said line.

Still another object of the invention is the provision of a plastic-bottle capping machine for applying preformed screw-on closure caps to filled plastic bottles, which incorporates improved and simplified means for rectifying the caps feeding from a supply hopper to the one or more capping head assemblies of a capping machine as herein contemplated.

Still another object of the invention is the provision of a capping machine for applying preformed screw-on type closure caps to plastic bottles, which incorporates highly effective yet simple, practical and thoroughly dependable means for imparting turning or twisting motion to caps positioned on the threaded neck of said bottles, as effects tightening of the caps on the bottle necks.

Yet another object of the invention is the provision, in a screw-cap applying machine of the type known in the art as a capper, of improved chuck means for tightening a screw cap on the threaded neck of a plastic bottle or like container, without damage to or marring of the cap and/or deformation of the plastic bottle as could interfere with proper capping thereof.

The above and other objects and features of advantage of the plastic-bottle capping machine of the present invention will be apparent from the following detailed description thereof, in which reference is had to the accompanying illustrative drawings, in which:

FIG. 1 is a perspective view of a capping machine according to the invention shown as mounted to the rotating turret of an existing capping machine, in substitution of the capping instrumentalities, i.e. cap forming, feeding, applying, etc. means, supplied with said machine;

FIG. 2 is a front elevation of the cap supply, rectifying and downflow means incorporated into the capping machine of the invention;

FIG. 3 is a vertical section taken on line 3—3 of FIG. 2;

FIGS. 4, 5 and 6 are enlarged sectional detail views, on an enlarged scale, taken on lines 4—4, 5—5 and 6—6, respectively, of FIG. 3;

FIG. 7 is a detail view on an enlarged scale, looking onto the vertical terminus of the cap downflow spout and associated cap release means;

FIG. 8 is a section taken on line 8—8 of FIG. 7;

FIG. 9 is a section taken through one of the capping head assemblies on the vertical center plane thereof;

FIGS. 10 is an exploded view illustrating the individual parts making up the cap turning and tightening means built into each of the capping head assemblies;

FIG. 11 is a section taken horizontally through a capping head generally on line 11—11 of FIG. 12; and

FIGS. 12—15 inclusive are broken-away detail views, which illustrate the sequence of operation taking place upon a loaded capping head assembly and a bottle to be capped arriving at and thence moving through their respective angular positions at which capping takes place.

To aid in an understanding of the present invention, it will be first generally described and thereafter described in greater detail, as follows:

GENERAL DESCRIPTION

Although not limited to any particular type or make of

bottle filling machine with which it may be associated in use, the capping means of the present invention was designed to be fitted to a plastic-bottle filling and capping machine presently on the market, known as the Cemac machine, in substitution of the capper used therewith. This machine, which is manufactured by Crown Cork & Seal Company, Inc., Baltimore, Md., bears, among others, the Patent No. 2,029,823, but as this patent is directed to apparatus for filling and capping glass bottles, it would appear that the manufacturer of the Cemac machine, as did other manufacturers of this type of equipment when plastic bottles began to compete with glass bottles for the fluid milk container market, modified glass-bottle filling and capping machines of its manufacture for use in filling and capping plastic bottles. Thus, it may be said that since the capping means conventionally employed in the combined Cemac filling and capping machine is of a type adapted to apply only press-on or crimp-on caps, use of the capping means of the invention which is specifically designed to apply preformed screw-on metal caps in substitution of the capper supplied therewith, has the potential of extending the use of the Cemac-type filler to plastic bottles having externally screw-threaded cylindrical necks or spouts and which are adapted to be capped by the screw-on type cap.

Having been designed to be substituted for the capping means with which the Cemac or a similar type filling and capping machine is provided, the bottle capping means of the invention preferably utilizes such existing means or mechanisms as are incorporated in said machine for advancing the filled bottles coming from the filling machine to and through said capping means, and also for imparting such other motion to the bottles to be capped as were previously employed to achieve effective capping thereof. More particularly, capping means as herein contemplated utilizes the rotary cam-track operated raisable platform means arranged in circular series about a vertical axis, the rotary turret mounted to turn on said axis and which in turn mounts a cluster of capping head assemblies above said platform means, each said assembly being vertically related to an individual platform of said platform means, the means for rotating said platform means and said turret in unison, and the means for raising each said platform the amount as brings the neck or spout of a bottle supported thereon into coaxing capping relationship with the capping head assembly disposed immediately above same, all of which means and/or mechanism are to be found in the filling and capping machine disclosed in said Patent No. 2,029,823 and in the commercial Cemac machine.

Illustratively, the capping means (or more simply the "capper") of the invention comprises preferably portable supporting means which directly mounts combined cap-supply, rectifying and downflow means and has operatively associated therewith a plurality of capping head assemblies, each including cap feed-in turning and tightening means, which are adapted to be affixed to the aforesaid rotary turret in place of the capping heads supplied therewith. Preferably, said supporting means also mounts the driving means, i.e. motors, necessary to the actuation of the cap rectifying and the cap turning and tightening means, as well as a motor for adjusting the operating level of the capping head assemblies in accordance with the height of the particular run of bottles then being capped.

The aforesaid combined cap supply, rectifying and downflow means functions to deliver a succession of preformed, preferably metal, screw-on type caps, one at a time and each properly faced or turned, from a supply of randomly positioned caps contained in a supply hopper through the downflow means (chute) which is common to all said capping head assemblies to the cap feed-in means of the one capping head assembly then positioned during the course of its continuous rotation to receive a cap dropping from said chute. Thereupon, assuming that

a bottle to be capped is properly positioned on its rotary platform means below said assembly, said feed-in means advances a so-received cap to a position within the assembly in which its opening or recess (which is always downwardly faced by virtue of the action of the rectifying means) is disposed immediately above the open neck or spout of said bottle.

Initial upward motion imparted to said bottle by the platform raising means effects movement of its neck or spout a limited distance into the downwardly facing opening of said cap, thereby placing the cap on the bottle, and continuing upward motion of the bottle effects corresponding upward movement of the now placed cap to a position within the capping head assembly in which it is adapted to be engaged by normally inactive cap-encircling chuck means mounted in said assembly and in which it also effects energization of normally deenergized clutch means similarly incorporated into said assembly. When said clutch is energized, drive is transmitted from a motor common to all the capping head assemblies to said chuck means, causing it to close on and impart bodily turning movement to the cap in direction and amount as effects not only initial threading of the caps, on the external neck threads of the bottle but also final tightening of the cap on said bottle neck.

Thereupon, the platform which has previously moved upwardly to its raised position is lowered by action of the cam track thereon, and such is reflected in lowering of the now fully capped bottle from said one capping head assembly which has just performed the capping operation thereon. Responsive to this lowering movement, the clutch means incorporated into said capping head assembly is deenergized and the chuck means is deactivated, thus to condition both chuck and clutch means of said assembly for the next capping operation which it will be called upon to perform with continuous rotation of the rotary turret and rotary platform means. Thus, the action of the capper of the invention is to apply screw caps to a sequence of filled plastic bottles moving to same from a filling machine in thoroughly dependable manner.

SPECIFIC DESCRIPTION

Now considering the "capper" of the invention in its more specific aspects, the aforementioned portable supporting means which directly mounts the cap-supply, rectifying and downflow means and with which the capping head assemblies are associated illustratively comprises a wheeled base generally designated 10 and mounted thereon a vertical post or column 12 preferably consisting of tubular sections 12a, 12b which are telescopically related so that the height thereof may be increased and decreased in accordance with the height of the bottles being capped. Preferably, the means for adjusting the height of the column 12 comprises screw-jack means designated 14 contained within said column and which is powered by a motor 16 housed within a motor housing 18 on the base, the open front of which is adapted to be closed by a removable panel 18a.

As best seen in FIG. 1, the column 12 carries at its upper end an open-top rectangular power box 20, so called because it encloses a motor (not shown) which drives a rotary cap-transfer cylinder to be described, and has affixed to one end thereof a control panel 22 which mounts the various switch buttons and signal lights for controlling and indicating capper operation.

Secured on said power box 10 is a combined supply hopper and cylinder-housing unit 24. By reference to FIGS. 2 and 3, said unit illustratively comprises a rectangular open-top foundation housing 26 fitted to the open top of the power box so as to provide a closure therefor, a generally semi-cylindrical housing cover 28 and a hopper 30 which is offset laterally of said housing cover. The hopper is also shown to be of open-top construction and its open top may be closed by means of a cover 30a fitted thereto.

The aforesaid cap-transfer cylinder designated 34 operates within the enclosure provided by the foundation housing 26 and its cover 28 and it is supported on co-axial stub shafts 36 extending from the ends thereof and which are journaled in bearings 38 set in facing notches in the meeting edges of the end walls of the housing and cover, respectively. The cylinder is power-driven by a belt and pulley drive connection generally designated 40 from the motor (not shown) enclosed within the power box 20, said drive connection preferably including speed reducing means also enclosed within the power box.

As seen in FIG. 2, the length of said cylinder 34 corresponds generally to the length dimension of the foundation housing 26 and its cover 28, and its diameter corresponds generally to the width dimensions of said housing. However, as seen in FIG. 3, the housing cover 28, although having length corresponding substantially to that of the cylinder, has greater diameter, thus to provide a semi-annular cap-transfer passageway 42a between the upper-half surface of the cylinder and the inner wall surface of said housing cover and, by virtue of the forward edge of the housing cover overhanging the corresponding top edge of the foundation box, a downwardly facing slot-like cap discharge passage 42b.

As best seen in FIG. 3, the cap-transfer cylinder 34 has embedded in its outer cylindrical surface a plurality of spaced-apart permanent magnets designated 44 which function to pick up individual metal bottle caps from the multiplicity of such caps randomly positioned within the hopper and thereupon transfer same through the cap-transfer passage 42a to positions just inwardly of the aforesaid downwardly-facing cap discharge passage 42b.

As also seen in FIG. 3, a pivoted correction blade 46 extending between the end walls of the housing cover adjacent the entrance side of the cap passageway 42a is mounted so that its free edge depends downwardly towards the upper peripheral surface of the cylinder 34. This correction blade serves both to prevent more than one cap being held to the cylinder by a magnet end to insure that the individual caps are initially correctly positioned on the peripheral surface of the cylinder, i.e. either with their closed ends or their rims held flat against the cylinder, rather than being held on edge, for example.

Means to remove the caps magnetically held to the surface of the cylinder 34 by the magnets 44 are also provided, such preferably comprising a transversely extending blade 50 pivotally mounted to the ends of the housing cover 28 adjacent the cap discharge passage 42b in position such that its free edge engages the peripheral surface of said cylinder. By design, the inclination of said blade 50 is such that it not only scrapes caps from the cylinder but also directs them to said cap discharge passage.

The cap rectifying and downflow means is preferably fabricated as an integrated unit capable of being bodily affixed to the coplanar front walls of the power box 20 and foundation housing 26 in position to receive caps dropping through the cap discharge passage 42b, and it functions to insure that all the caps discharging therefrom to the individual capping head assemblies are properly faced, i.e. turned so that their openings or recesses are directed forwardly or to the right as viewed in FIG. 6 and ultimately downwardly when acted upon by the cap feed-in means associated with the capping head assemblies. More particularly, said unit comprises an open-top casing 48 of generally square configuration as viewed in front elevation and having width and height so as to extend substantially coextensive with said power box and foundation-housing front walls. It is a feature of said casing also that its front-to-rear dimension, i.e. thickness, is not substantially greater than the axial dimension of the caps feeding therethrough, except throughout a particular area thereof to be described, and also that its bottom slopes downwardly and away from one side, thus to define with the latter a sidewardly directed cap outlet opening 48a.

Illustratively, said casing is comprised by parallel, spaced-apart upright members 50a, 50b, preferably of square section, which constitute the ends of the casing; a bottom member 50c which has "cap-track" section as will be described and which is sloped downwardly away from the lower end of the upright member 50a so as to define therewith said cap outlet opening 48a; and front and rear walls comprising metal sheets 52a, 52b secured to the front and rear faces of said upright and bottom members, of which the front wall 52a is removably secured as by wing nuts 52n as permits ready opening up of the casing for cleaning thereof.

Disposed within the casing and extending fully across the space between its front and rear walls are upper and lower cap tracks 54, 56, so called because caps disposed on edge will roll thereon. The upper track 54 slopes downwardly from its higher left end which is affixed to the left-side upright member 50a of the casing to its right end which is spaced from the right-side upright member 50b of the casing by an amount slightly greater than the diameter of said caps. On the other hand, the lower track 56 slopes downwardly from its right end, which is affixed to the right-side upright member 50b of the casing at a location thereof which spaces said right end below the corresponding right end of the upper-track member 54 a distance only slightly greater than the diameter of the caps, to its left end which is spaced from the left-side upright 50a of the casing a distance which is also only slightly greater than the diameter of said caps.

Before detailing the section of said tracks 54, 56, which according to the invention aids in rectification of those caps which are improperly face, it is explained that said caps, being of the screw-on type, conventionally have a cylindrical body closed at one end by a plane end wall and terminating at the other end in a rim in the form of a radially outwardly extending flange. Thus, the tracks 54, 56 (or at least their upper surfaces) must be configured to accommodate the cap rims if said caps are to roll freely down same. Since according to the invention all caps dropping thereto from the aforesaid cap passage 42b are to roll down the upper track member 54, regardless of the direction in which the cap openings face, the configuration of the upper surface of said track must be such as to accommodate the cap rims, whether inwardly or outwardly disposed. Thus, as seen in FIG. 4, the upper side or face of the upper track 54 is formed with rim-accommodating grooves 60a, 60b extending along both upper corners. As distinguished therefrom, the upper side or face of the lower track 56 is formed with but one rim-accommodating groove designated 62a and such is provided along only the relatively outer upper corner thereof. Thus, when a cap positioned with its opening facing in proper direction, i.e. outwardly, drops from the upper track 54 on to the upper end of the lower track 56, it will roll freely down same consequent to its rim flange being accommodated in the corner groove 62a. However, should said cap be improperly faced, i.e. disposed with its opening and rim flange turned towards the casing inner wall 52b (as in FIG. 6), its tendency is to fall away from said inner wall due to the fact that its center of gravity is disposed well outwardly of its rim flange.

To utilize this tendency of improperly faced caps to fall sidewardly away from said inner wall and tip or turn over to a properly faced position, a width area of the outside casing wall 52a disposed along said lower track 56 is cut away from the wall proper and bent outwardly from the plane thereof so as to provide increased width of the casing along the major length portion of said lower track. More particularly and as best seen in FIG. 6, this cut-away area of the casing front wall designated 52c includes an upper portion which extends parallel to and is spaced from the outer casing wall proper 52a a distance greater than the diameter of the caps, and a lower portion which inclines downwardly-inwardly towards and eventually merges into said outer casing wall. Thus, as im-

properly faced caps rolling down the lower track 56 reach the widened portion of the casing, as provided by said cut-out area 52c of its front wall, they will fall sidewardly-downwardly from said track on to the lower downwardly-inwardly sloped portion of said cut-out wall area 52c. In so doing, the caps will turn 180° to a position in which their openings face properly, i.e. outwardly, and will then be directed relatively inwardly on to the bottom 50c of the casing, which latter has top surface configuration accommodating the cap rim corresponding to that shown in FIG. 5.

If desired or considered advisable, the lower track 56 may be and preferably is formed throughout its length portion extending transversely across the opening in the casing wall 52a defined by the cut-out 52c with an upwardly extending lip 62c disposed outwardly of its cap-rim groove 62a. This lip provides firm insurance that properly faced caps rolling down the track 56 will not fall over as they travel past the opening in the casing outer wall caused by said cut-out area.

The cap downflow means which as stated above is combined with the casing 48 of the rectifying means comprises a downwardly inclined spout 66 defining a cap passage extending in continuation of and being in full communication with the cap discharge opening 48a of said casing. Preferably, the lower end of the spout terminates in an open-ended vertical portion 66a, through which caps rolling down the incline portion may drop by gravity. To insure free rolling movement of the caps through the downflow spout 66, its bottom wall preferably has the same upper face configuration as provides for accommodation of the rim flange of the caps traveling therealong, i.e. being again that shown in FIG. 5.

Preferably, means are provided both to prevent uncontrolled cap flow from and to insure single cap delivery through the vertical terminus 66a of the downflow spout. As best seen in FIGS. 7 and 8, such means comprises a reciprocatory bracket 68 disposed externally of said spout terminus but carrying two opposing fingers 70a, 70b which are adapted to be alternately projected into its vertical passage to positions therein in which they block said passage. By virtue of the inclination of the bracket mounting same, said fingers are arranged at different elevations, the difference in elevations being substantially equal to the diameter of a cap. By design, the elevation of the lower finger 70a is such that when it is projected into the terminus passage it completely blocks movement of all caps therethrough, whereas the elevation of the upper finger 70b is such that when it is projected into said passage, it blocks movement of all but the lowermost cap from said passage.

Illustratively, the bracket 68 is reciprocated by oppositely acting spring and solenoid means generally designated 72, for which the solenoid is normally deenergized and the spring (not shown) normally maintains the bracket in its leftmost position in which it is shown and in which the lower pin 70a blocks passage of any and all caps through the spout terminus 66a. However, energization of the solenoid imparts movement of the bracket against the bias of said spring to a position in which the lower pin 70a is retracted and the upper pin 70b is projected into cap-blocking position. The solenoid is of course connected in an electrical control circuit which times its energization to take place as each of the capping head assemblies moves into a cap-receiving position beneath the vertical downflow terminus 66a.

Next considering the capping head assemblies of the invention to which the downflow means releases caps one at a time as aforesaid, such are of identical construction and hence a description of one will suffice for all said assemblies, three of which are illustrated. As best seen in FIG. 9, such an assembly includes a generally rectangular foundation block 80 and a coextensive rectangular top block 82 mounted on and affixed thereto as by bolts 84. The top block 82 is provided towards its relatively outer

end with a downwardly-inwardly inclined through passage 86a whose upper end is in full open communication with that of an upwardly-outwardly inclined loading chute 88 whose lower end is secured by welding to the upper face of said top block. Preferably, the body of said chute has channel section and its upper end is full open so as to be capable of receiving a cap falling thereto from the aforesaid spout 66.

The lower end of the top-block passage 86a, which is shown to be enlarged laterally, opens into an intermediate-length portion of a horizontal passage 86b extending from the relatively outer end of the foundation block 80 to a circular, vertically disposed, through opening 90 therein near its relatively inner end. Preferably, said opening 90 has diameter which progressively decreases from its lower end, whose diameter is substantially greater than that of the caps as well as of the neck of the bottles to which said caps are to be applied, to its upper end whose diameter is only slightly larger than cap and bottle-neck diameter. Thus, said opening 90 not only provides for the reception of the neck of an upwardly moving bottle to be capped and a cap placed thereon, but also it serves to center the bottle as it moves upwardly within said opening, should any centering thereof be required.

It will be understood that each of the loading chute and block passages aforesaid has width and height slightly greater than the outer diameter and axial length of the caps to be applied so that the latter may move freely through same to the circular through-opening 90. Thus, said passages and opening, together with a reciprocatory plunger operating in the outer end of the foundation-block passage 86b for advancing the caps moving thereto to said opening and the means for reciprocating said plunger, both of which latter will be described hereinafter, constitute effective cap feed-in means built into each capping head assembly according to the present invention.

The aforesaid vertical opening 90 communicates at its upper end with a coaxially related chamber 92 provided in the relatively inner end of the top block 90, in which is disposed an annular chuck housing 94. Normally resting on the upper edge of said housing is a driven clutch plate 96 which is centered with respect to said housing as by a rim flange 98 which depends therefrom into a complementary rim groove 98a in said housing top edge, which arrangement provides for centered rotation of said clutch plate with respect to the clutch housing 94. Said clutch plate loosely mounts a vertically disposed permanent magnet 100 whose smaller-diameter shank end normally depends to and terminates at the approximate level of the caps advancing to the opening 90 through the cap passage 86b in the foundation block 80, the magnet thus functioning to temporarily hold each said cap in place. However, by virtue of its loose mounting in the clutch plate 96, the magnet and a cap held thereby may move upwardly in unison, for example, when raising movement is imparted to the cap by upward movement of a bottle to be capped whose neck has moved into said opening 90 of the foundation block and thence into the cap opening.

The driven clutch plate 96 has bonded to its upper radial surface a plurality of spaced-apart friction elements 102 of rubber or similar material, illustratively of disc shape, which together serve as a friction driving connection between said plate and the complementary clutch plate 104 preferably formed with a central cup portion 104a for the accommodation of the upper or head end of the magnet 100 in the raised position of the latter. The driving clutch plate 104 is affixed to the lower end of a powered upright spindle 106 mounted for turning movement in suitable bearings 106a, 106b within a tubular spindle housing 108; whose lower end is affixed as by welding to a boss-like formation 110 on the top block 82 serving to close the upper end of the aforesaid chamber 92 thereof and whose upper end is supported in a higher-level clamp and its supporting means 112 generally as shown in FIG. 9.

At its upper end, the shaft 106 mounts a pulley 114 which, as best seen in FIG. 1, is driven by a belt 114a from a driving pulley 116 affixed on the shaft 118 of a driving motor 120. Illustratively, said motor 120 is mounted to the outer end of a mast arm 122 whose other or inner end is rigidly affixed to the aforesaid power box 20. Preferably, said mast arm is made of extensible tubular sections, thus enabling adjustment of motor position laterally of the supporting column 12 and, being tubular, it provides a means for enclosing the supply conductors running from a control switch on the aforesaid control panel 22 to said motor 120. At this point of the description, it is explained that said motor 120 is common to the driving elements, i.e. clutch plates 104, of the clutches incorporated into all three of the capping head assemblies shown in FIG. 1, and that when the capper is placed in operation, said motor drives the spindles of all three capping head assemblies continuously.

Referring to FIG. 10, the aforementioned chuck means contained within the housing 94 comprises a split ring or annulus 30 of resilient material such as neoprene, a radially-outwardly biased band spring 132 encircling same for the major arc of its outer periphery, and normally inactive means for contracting said band spring, and thereby the split neoprene ring, which is rendered active responsive to initial energization of the aforesaid clutch means constituted by the clutch plates 96, 104 and remains active so long as the clutch means is energized. The split neoprene ring 130 preferably has appreciable radial thickness, a normal unstressed diameter slightly greater than the external diameter of the screw-on caps being applied, and axial length which is substantially equal to that of the cylindrical body portion of said caps. If desired or considered necessary, an annular buffer ring 134 made of soft rubber or the like is secured flush against the under face of the driven clutch plate 96. Being interposed between said clutch plate and any cap held by the chuck means, said buffer ring 134 serves to prevent marring of the outer face of the closed end of the so held cap by direct engagement of the clutch plate 96 therewith.

As best seen in FIG. 10, the aforesaid means for effecting contraction of the band spring 132 and thereby of the split neoprene ring 130 illustratively comprises a pin 136a affixed to and disposed to extend vertically upwardly from a radial bottom flange 94a with said chuck housing 94 is formed, and which projects into the vertically disposed aperture of an ear 138a provided on one end of said band spring, and a downwardly directed pin 136b affixed to the under side of the driven clutch plate 96 and projecting downwardly therefrom into the vertically disposed aperture of an ear 138b provided on the opposite end of said band spring. As seen in FIGS. 10 and 11, the inner side wall of the chuck housing 94 is cut away as at 94b so as to accommodate said pins and ears. Such arrangement provides that, upon initial rotation being imparted to the driven clutch plate 96, the previously expanded band spring 132 is contracted by an amount effecting forceful contraction of the split neoprene ring as causes said ring to close on the firmly grip to the outer surface of a cap body then disposed within the ring.

By virtue of the weight of the chuck housing 94 in relation to the capability of and the time required for the band spring 132 and split neoprene ring 130 to contract as aforesaid, said housing 94 initially remains stationary. However, upon the torque force being applied to said housing by the rotating spindle 106 via the engaged clutch and the pin and ear connection between same and the housing becoming large enough to overcome the inertia of the latter to turning, the chuck means and housing turn in unison and, in so doing, said chuck means tightens a cap frictionally held within the split neoprene ring 130 on the neck of the bottle on which said cap has been earlier placed responsive to the bottle neck having moved upwardly into the down-

wardly facing opening of said cap with upward movement imparted to the bottle by the platform of the rotating platform means on which it is supported.

Upon the now fully capped bottle partaking of its lowering movement consequent to the platform on which it is supported being lowered, the reverse operations take place. That is to say, first the clutch means is deenergized, whereupon the assembly of driven clutch plate 96, split neoprene ring 130, spring metal band 132, and chuck housing 94, under the combined weight thereof, falls away from the driving clutch plate 104, and the band spring 132 expands, thereby releasing the split neoprene band 130 from the tightened cap. Upon the ring and band returning to their normal inactive state and the clutch housing lowering to its normal lowered position within the top block 82 of the capper head, the capper head assembly is conditioned for the next capping assembly which it will be called upon to perform with continued operation of the capper.

The cap feed-in means which is associated with each capping head assembly includes a plunger as aforesaid (designated 140 in FIG. 9) which is mounted for reciprocating travel in the cap passage 86b of the foundation block 80 of said assembly from an outermost or retracted position, in which its forward end is adapted to receive a cap entering said passage from the passage 86a in the top block 82, to an advanced position in which it moves said cap into the vertical opening 90 in which said passage 86b terminates and finally positions same directly below the shank end of the permanent magnet 100, which latter proceeds to attract the cap and hold it temporarily, that is, during the time required for the cap to be placed on a bottle neck by bodily upward movement of a bottle disposed below and coaxially with respect to the so-held cap.

The plunger 140 is adapted to be actuated forwardly responsively to its capping head assembly as a whole moving through a predetermined point or station located on its circular path of motion. More particularly, the plunger has rigidly affixed to its outer or rearward end via a connecting rod 142 a shoe 146 adapted to engage a cam wheel 156 mounted in a normally fixed position with respect to the aforesaid post or column 12, as will be described. When engagement of the shoe on cam wheel occurs, the shoe and thereby the plunger 140 are actuated inwardly to advance any cap then in the block passage 86b to a position beneath the magnet 100.

In moving inwardly as aforesaid, the shoe 146 effects compression of a coil spring 148 disposed in encircling relation on a spring-mounting rod 150 extending beneath the capper head assembly. The relatively outer end of said rod is affixed to said shoe and its inner end passes through a guide eye 152 affixed to and projecting downwardly from the under face of the block 80. An enlarged head or nut 154 on the inner end of said spring-mounting rod acts through its engagement with a side face of the guide eye both to prevent uncontrolled separating movement of plunger and shoe from the block 80 and to determine the outermost or normal position of plunger and shoe. Compression of the spring 148 as aforesaid stores up energy sufficient to effect retraction of the plunger 140 and shoe 146 when said shoe rides off the wheel 156.

Said shoe-engaging wheel 156 is mounted to turn on a vertical axis extending through the outer end of a fixed-position arm 158 whose inner end is rigidly secured to the aforesaid post or column 12 via a clamp ring 160 affixed to the latter. Preferably, the arm 158 is comprised of telescoping sections and its outer wheel-mounting section, which is held against turning with respect to its inner section as by a key connection between sections, may yield with respect to said inner section when the outward bias of a spring 160 reactive between said arm sections is exceeded. Such arrangement permits the shoes 146 of the capping head assemblies and the wheel 156 to be so related in space that as each capping head assembly dur-

ing the course of its orbital or rotary travel moves past said wheel, the latter engages the shoe thereof to in turn actuate the plunger 140 inwardly throughout its cap-feeding stroke. Upon the shoe riding off the wheel with continued movement of a capping head assembly, the spring 148 effects retraction of said plunger and shoe to their respective normal positions in which they are shown.

To insure positive inward motion of the plungers 140 responsive to engagement of the shoes 146 with the wheel 156, the shoes are each disposed at an angle of say 45° to the longitudinal center line of its capper head assemblies thereby to approach the wheel at the most favorable angle as effects the desired positive inward motion of its plungers. This same result may of course be achieved by suitably angling the capper head assemblies with respect to the arms of the turret to which they are affixed, or by so angling both the capper head assemblies and their wheel-engaging shoes as to effect the desired result of ready yet positive plunger motion being achieved upon the shoes engaging said wheel.

While the operation of a bottle capper as described and illustrated herein will, it is believed, be clear to persons skilled in the particular art, such as briefly summarized as follows:

As a corollary to the fact that the present capper was designed to be substituted for the existing capping mechanism used on a filling and capping machine of the Cemac type and, when so substituted, to utilize in its operation the capping head rotating means (turret), the rotating platform and lift means and the bottle transfer means for feeding filled bottles to and from said platform means of said existing capping machine, it is necessary in the first instance that the existing capping heads with which the Cemac machine was supplied, as well as such cap-feed means as was employed therewith, be removed. However, this can be simply achieved, since the existing capping heads are designed so as to be readily removable from the outer ends of the turret arms as facilitates cleaning of said heads at frequent intervals, and the Cemac and similar machines are conventionally designed to handle various types of cap feeds, so that the removal of the cap feed means supplied therewith presents no problem.

Thereupon, a capper according to the invention is simply wheeled into operative position adjacent the retained means or parts of the existing capping mechanism, as is made possible by the wheels on the base 10 which supports the entire assembly of cap supply, rectifying and downflow means, together with the driving means therefor and the common motor and driving connections which power the driving plates of the clutches incorporated into the plurality (three being shown) of capping head assemblies which are to be substituted for the now removed, existing capping heads, and which further has said capping head assemblies associated therewith in readiness to be mounted on the outer ends of the arms of the retained turret of said existing capping mechanism. Such mounting may now be readily effected by securing to each said capping head assembly in the first instance an adapter bracket fitted to it, such as that designated 162 (FIG. 9), by means of a clamp 164 and thereupon fastening each said bracket with capper head secured thereto to the end of a turret arm, preferably by the same fastener means as was employed to fasten the removed capper head to said turret arm end, i.e. an upright elongated stud 166 affixed at its lower end to an offset lug 168 extending from the lower end of the bracket 162 and which after its upward projection through a vertically disposed hole in the turret arm end is secured in place to said arm end by a wing nut 170 threaded onto the upper threaded end of said stud. Preferably, each said stud mounts the usual stabilizing spring 172 which is compressed against the under face of the turret arm consequent to upward projection of the stud through its hole as aforesaid. It is to be understood that the configuration and section of the adapter brackets 162 will depend on that of the ends of

the turret arms, since the latter may and usually does vary somewhat in accordance with the make and/or model of the filling machine to which the present capper is applied.

Thereupon, the main supply conductor C for all the electrical appurtenances, i.e. motor 16, the power-box motor for driving the cylinder 34 and the clutch-plates driving motor 120, which conductor is shown in FIG. 1 to be in the nature of an extensible cord wound on a reel R mounted within the motor housing 18 on the portable base 10, is plugged into a suitable source of electrical energy. Upon said cylinder driving motor and the clutch-plates driving motor being placed in operation by throwing appropriate control switches on the control panel 22 to their "on" position, the capper of the invention is ready for operation on filled bottles coming from the filler.

On the assumption that the filler and bottle-feed conveying and transfer means associated therewith, and similarly that the platform means and the bottle conveying and transfer means of the existing capper, have been placed in operation, the filled bottles coming from the filler will move to and through the capper in a path indicated on the heavy lower-level dash-dot line A shown in FIG. 1. Since the turret T of the existing capper mechanism mounts the substituted capping head assemblies for rotation in the same direction as but at a higher level such that they will coast with the necks of bottles to be filled supported on said platform means, said assemblies will move in a circular or orbital path about the axis of the turret which is indicated by the higher-level dash-dot circle B. It will also be understood that the motion of the rotating capping head assemblies is synchronized and phased with that of the rotating platform means to the end that a capping head assembly will always be disposed above a bottle-supporting platform of said platform means. Also to be understood is that as the filled bottles move along the arcuate, substantially full-circular portion of their path of motion as established by said platform means, each is first raised by the cam track means associated with said platform means to a position enabling the capping head assembly moving therewith to coast therewith and perform its intended capping operation thereon, and then is lowered from said assembly, with such lowering taking place only after completion of the capping operation.

With these preliminary observations in mind, caps from the supply hopper 30 and which have been rectified by the rectifying means 50-62c (FIGS. 2-6), i.e. positioned so that upon their arrival at the capping head assemblies their openings are properly faced to receive the necks of bottles to be capped moving upwardly thereto, are released one-at-a-time through the vertical terminus 66a of the downflow spout 66 to which the rectifying means discharges. As seen in FIG. 1, the path of motion of the funnel-shaped ends of the loading chutes 88 of the capping head assemblies is such that said chute ends will pass directly under said downflow spout terminus 66a and thus, if the cap is released at the proper instant, it will fall by gravity into a loading chute. Preferably, properly timed release of the caps is under the control of a micro-switch MS disposed in the path of motion of the bottles to be filled then on the platform means and which is further positioned so as to be engaged by the moving bottle disposed immediately behind the one being capped. When the microswitch MS is momentarily closed, it energizes the aforesaid normally deenergized solenoid of the spring-solenoid means 72 associated with the downflow spout terminus 66a, thereby releasing the lowermost cap therein which drops to the leading chute of the one capping head assembly which immediately follows the capping head assembly then performing a capping operation and then slides down same to a position within the cap passage 86b of the foundation block 80 of said one assembly generally corresponding to that of the cap shown in broken lines in FIG. 9.

Upon said one or following capping head assembly being loaded with a cap as aforesaid, its continued motion brings it to an angular position in which the shoe 146 of its cap-feed-in means engages the fixed-position rotary wheel 156. Consequent to such engagement, the plunger 140 of said one capping head assembly is actuated throughout its cap feed-in stroke and, in partaking of this movement, advances said cap to a position within its vertical block opening 90 in which it is attracted to and thereafter held in place by the magnet 100 of said assembly. The net effect of such timing is that when said one (or following) capping head assembly in the course of its continued movement reaches the angular position in which it will coax with the neck of a raised bottle to effect capping thereof, it will not only be cap-loaded but also it will mount a cap in "capping ready" position therein.

The sequence of operations which takes place upon a loaded capping head assembly and a bottle to be capped arriving at and then moving through their respective angular positions at which capping takes place is intended to be illustrated in FIGS. 12-15. Referring to this series of views, FIG. 12 shows a screw cap CP held within the opening 90 of the particular capping head assembly moving to the capping position by the magnet 100, the neck of the bottle B which is to receive the cap although moving with said assembly being still spaced below the cap, the chuck means which turns and tightens the cap being still inactive and the clutch means which activates the chuck means being also still deenergized.

FIG. 13 shows the action taking place upon the bottle being raised by the cam track associated with the bottle-supporting platform means to a position in which its neck enters the cap opening, such initially placing the cap on said neck and thereafter, by upward push of the neck against the driven clutch plate 96, effecting energization of the clutch means comprising said clutch plate 96 and the continuously rotating driving clutch plate 104, essential to the activation of the chuck means comprising the split neoprene ring 130 and the band spring 132 which encircles said ring.

FIG. 14 is intended to illustrate the condition of chuck means activation, as effects contraction of the split neoprene ring 130 about the cylindrical body of the cap. Since the clutch means is shown to be energized, the chuck means 130, 132 and the housing 94 are rotating or at least said chuck means is imparting torque force on the cap gripped thereby of a magnitude as effects secure tightening of the cap on the bottle neck, such assuming the bottle to be held stationary.

Finally, FIG. 15 illustrates that the capped bottle has fallen away from the capping head assembly which has performed the just described capping operation, consequent to the platform means which had previously raised the bottle to a position enabling it to be capped as aforesaid being lowered by the cam track associated with said means. When the capped bottle lowers or falls away from a capping head assembly, the clutch means incorporated therein is first deenergized and then the chuck means is deactivated. Thus, upon completion of a capping operation performed thereby, all moving parts of the capping head assemblies according to the invention return to their initial state or position, in which they are conditioned for the next capping operation which they may be called upon to perform.

In connection with the above assumption as to the bottle being held stationary while a cap is being tightened thereon, FIG. 1 illustrates a means for so holding a bottle against turning movement during the short period of time that a torque force is being applied thereto through the cap. More particularly, there is provided adjacent the path of the bottles and at a predetermined angular position therealong as to be engaged by the bottle being capped a spring-backed abutment shoe 176 mounted on the outer end of a knuckled supporting arm 176 affixed

at its other end to the main column 12 as by means of a clamp ring 178. The abutment shoe when engaged by the side wall of the bottle functions to brake rotation of said bottle about its axis. However, the biasing or back-up spring contained in the connection of the abutment shoe to the arm 176 (or which is otherwise suitably associated with said parts) will yield in the event the bottle presses against said shoe with a force determined in advance to be greater than that required for the shoe to exercise its braking function, thus to permit unimpeded motion of the bottle past said shoe when such is necessary to protect against the line of bottles becoming jammed.

While in the foregoing the capper of the invention has been described as one depending for its operation on the rotating turret and the bottle-supporting and elevating platform means of an existing capping machine of the type incorporated in the combined filling and capping machine of the Cemac make, it is to be understood that the invention is not limited in this respect. That is to say, a capper of the invention may include or incorporate its own rotating turret and platform means and such may be either power-driven or hand-powered. In either case, the rotating turret and platform means would constitute, together with the means associated therewith constructed according to the present invention, an integrated capping machine structurally and functionally complete in all respects.

And of course it is equally the fact that the capping means according to the invention as described may be substituted for the capping mechanism of combined filling and capping machines of other types than that represented by the Cemac machine.

Without further analysis it will be apparent that a capper or capping means of the invention achieves the objectives of the invention as stated in the foregoing in simple, practical and thoroughly dependable manner. More particularly and most notable is the fact that the capping means of the invention effects fast, speedy capping of plastic bottles with screw-on caps in regular sequence without any deformation of the bottle and without any marring or scuffing of the caps being applied.

However, as many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A screw-cap applying machine comprising, in combination: means for advancing bottle-type containers each having an externally threaded neck along a predetermined path of motion and for successively raising and then lowering said bottles as they move through fixed, spaced-apart locations along said path; at least one capping head assembly and means for mounting said assembly in vertical registry with a bottle moving along said path and for moving it along a predetermined, fixed-level path of motion which is disposed above the container path; means for feeding screw caps with their openings faced downwardly into said capping head assembly in one-at-a-time sequence; said capping head assembly including means for holding a cap fed thereto in position to receive the neck of a bottle moving upwardly to same, normally deenergized clutch means including a continuously-rotating driving element disposed above a so-held cap and being adapted to be energized responsive to upward movement of said cap, and normally inactive chuck means disposed in encircling relation about said cap and being adapted to be rendered active responsive to initial energization of said clutch means and when active to tightly engage about and turn said cap; and means for so interrelating said bottle-advancing, raising and lowering means, said capping-head assembly moving means and said cap feed means that as a bottle moves along its path of motion and is raised its threaded neck will enter the opening and

a cap previously fed to and then held in said capping head assembly in position to receive same and raise said cap to a position in which it effects energization of said clutch means and thereby activation of said chuck means as in turn effects threading and tightening of the cap on the bottle neck, and further that as the capped bottle moves farther along its path of motion it will lower and thereby effect de-energization of said clutch means and deactivation of said chuck means.

2. A screw-cap applying machine according to claim 1, wherein said chuck means comprises a contractible split ring of resilient material having inner diameter normally greater than that of said cap, a radially-outwardly biased band spring encircling said split ring, and means responding to the initial energization of said clutch means for contracting said band spring and thereby said split ring to a diameter such that it will firmly grip to the cylindrical body of said cap.

3. A screw-cap applying machine according to claim 1, wherein said clutch means includes a driven clutch element cooperatively related to said continuously rotating driving element but being normally spaced below same, and said chuck means comprises a normally stationary chuck housing positioned below said clutch means, a contractible split ring of resilient material and a radially-outwardly biased band spring encircling said split ring, both contained within said housing, said split ring in its normal unstressed state having inner diameter greater than that of said cap, and means for contracting said band spring and thereby said split ring comprising pin means connecting the ends of the band spring to the driven clutch member and to the chuck housing, respectively, said last means being responsive to driving engagement between the driving and driven clutch elements being established by upward movement of the cap as aforesaid.

4. A screw-cap applying machine according to claim 1, wherein said cap feeding means includes mechanism for facing all caps feeding to said capping head assembly with their openings faced downwardly regardless of the initial facing of said caps.

5. A screw-on cap applying machine comprising, in combination: means for advancing bottle-type containers each having a threaded neck along a predetermined path including an arcuate portion constituting the major arc of a circle and for successively raising and then lowering the bottles as they move through predetermined, spaced-apart positions disposed along said arcuate portion; continuously rotating turret means mounted to turn on a vertical axis extending through the center of said circle; a plurality of circumferentially spaced capping head assemblies mounted on said turret means above and in vertical registry with bottles moving along the arcuate portion of said path of motion; said assemblies each having a downwardly facing opening for the reception both of a screw cap to be applied and the neck of a bottle moving upwardly thereinto; means common to said plurality of assemblies for feeding a cap turned so that its opening faces downwardly to the opening of each assembly responsive to said assembly arriving at a predetermined position in its circular path of motion which is ahead of said spaced-apart, positions at which raising and lowering of the bottles occur; each said capping head assembly further including normally deenergized clutch means disposed above said opening thereof and including a continuously rotating driving member; and normally inactive chuck means for turning said cap on the bottle neck and which is rendered active responsive to the energization of said clutch means; the construction and arrangement being such that as each said bottle is raised its neck moves upwardly into the cap disposed in the opening of the capping head assembly disposed above said and, acting through said cap, effects energization of the clutch means and thereby activation of the chuck means included in said assembly as in turn effects screw-

ing of said cap onto the bottle neck, and being further such that lowering of the capped bottle from said opening effects deenergization of said clutch means and deactivation of said chuck means.

6. A screw-on cap applying machine according to claim 5, wherein each said clutch means includes a driven member disposed intermediate the rotating driving member thereof and a cap received in said opening and being normally spaced from said driving member, and wherein the raising movement of the bottle is such as to effect upward movement of said driven member into clutching engagement with said clutch driving element.

7. A screw-on cap applying machine according to claim 5, and further including a means common to all said capping head assemblies for continuously rotating the driving elements of the clutch means thereof.

8. A screw-on cap applying machine according to claim 5, wherein said cap feeding means includes mechanism common to all said capping head assemblies for facing all caps feeding to the cap receiving openings thereof so that their openings face downwardly regardless of the initial facing of said caps.

9. Means for applying screw-caps to the threaded necks of bottles comprising: a capping head assembly including a head member having a downwardly facing vertical opening therein for the reception of a screw cap to be applied and a coaxial, upwardly disposed chamber in communication with said opening, normally inactive chuck means in said chamber including a split ring of rubber-like material adapted when said chuck means is activated to close about the cylindrical body of a cap moving into said ring, and normally deenergized clutch means disposed in said chamber upwardly of said chuck means and including an upper, continuously rotating driving element and normally spaced below same a lower driven element, means for activating and thereupon rotating the chuck means responsive to energization of the clutch means, and means for energizing the clutch means responsive to upward thrust of the neck of a bottle moving upwardly against a cap received in said opening.

10. Screw-cap applying means according to claim 9, wherein said chuck means further includes a normally radially-outwardly biased band spring extending about said split ring, a normally stationary but rotatable clutch housing enclosing said split ring and band spring, and connections between the outer ends of the band spring and the driven element of the clutch and said chuck housing, respectively, whereby initial energization of the clutch means effects contraction of the band spring and closing of said split ring on a cap encircled thereby and continued energization of said clutch means effects bodily rotation of both the band spring and split ring and screwing of the caps on to the bottle neck.

11. Screw-cap applying means according to claim 9, wherein said head is provided with a cap-feed passage leading to said vertical opening and further mounts means for advancing a cap entering said passage to said opening.

12. Screw-cap applying means according to claim 10, wherein said head includes a magnetic cap holding means for holding a cap received in said opening in position to receive the neck of a bottle moving upwardly thereto.

13. Means for applying caps having cylindrical bodies closed at one end and radially outwardly extending, circumferential rim flanges at their open ends to bottle-type containers including: a capping head assembly; mechanism for supplying a succession of caps thereto positioned so that their open ends face in proper direction to be acted upon by said assembly, said mechanism comprising a casing having front and rear walls which are spaced apart a distance not substantially greater than the axial dimension of said caps, an inclined trackway in said casing disposed to receive caps randomly faced and which are supplied to the upper end thereof, said trackway including upper, lower and bottom downwardly inclined tracks extending between said front and rear walls and being so

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related that caps rolling down the upper track will fall to the upper end of the lower track and after negotiating same will fall to the bottom track, the upper track having rim-accommodating grooves extending along both upper-outer corners thereof as permits all caps falling thereto to freely roll down the length thereof regardless of their facing, the lower track having a rim-accommodating groove extending along only one of its upper corners, whereby caps so faced that their rims ride in said groove may roll freely along said lower track and thence fall to said bottom track but caps so faced that their rims roll on the non-grooved upper corner of said track are unbalanced and tend to tip over and fall sidewardly from said track, the one wall of the casing towards which the caps tend to tip having a cut-out area whose upper portion is extended laterally from said one wall a distance as permits the unbalanced caps to tip over and turn throughout a full 180° arc and whose lower portion is inclined downwardly-inwardly towards said bottom track thereby to direct the so turned caps to said bottom track,

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and said bottom track having a rim-accommodating groove disposed similarly to the groove of the lower track; and means for releasing the caps leaving said bottom track in one-at-a-time sequence to said capper head assembly.

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