Aug. 22, 1967 A. N. MONACO 3,336,728

APPARATUS FOR APPLYING TO CONTAINERS CLOSURE BLANKS HAVING LOCKING BANDS

Filed Oct. 31, 1963

2 Sheets-Sheet 1

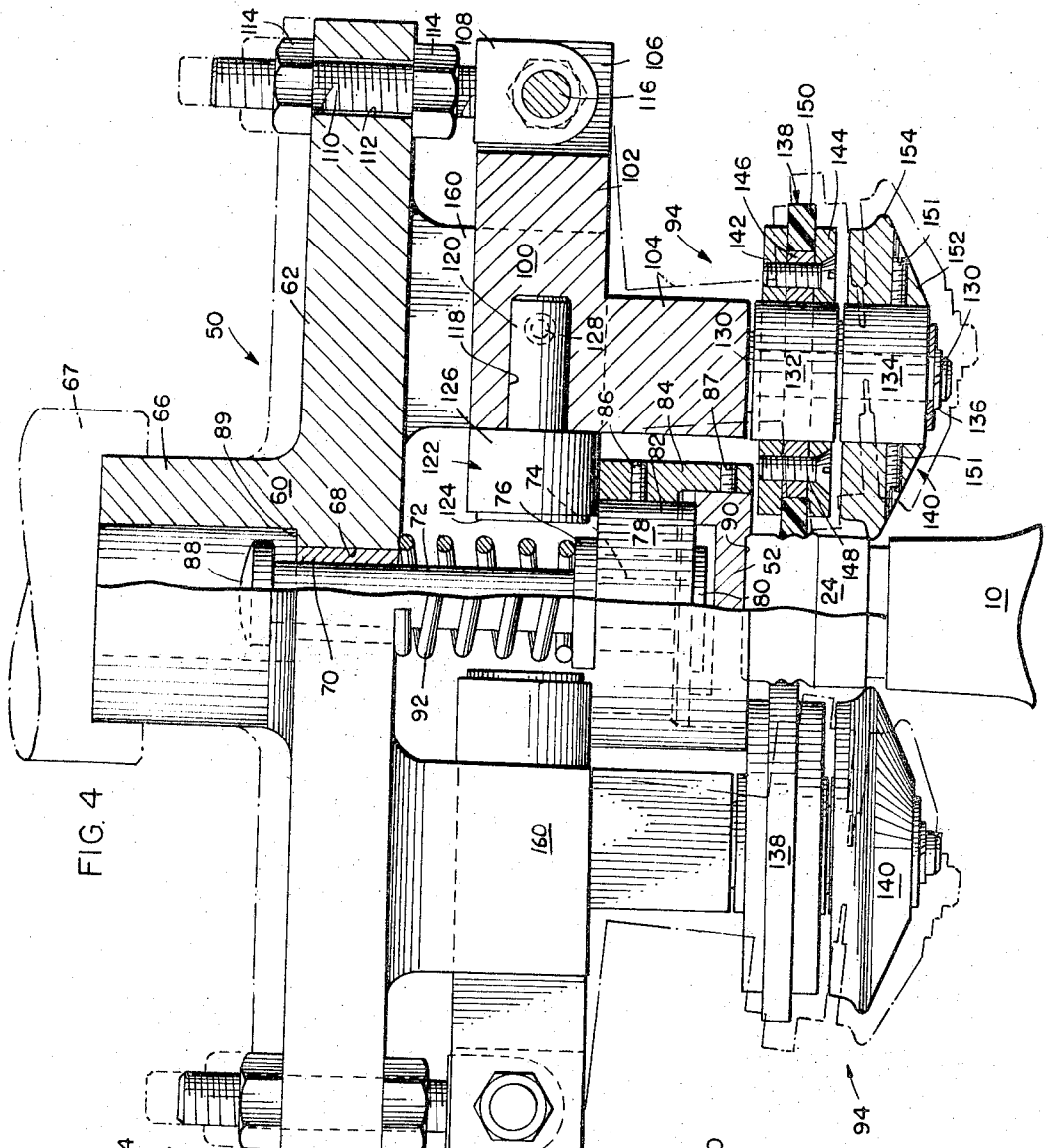

FIG. 4

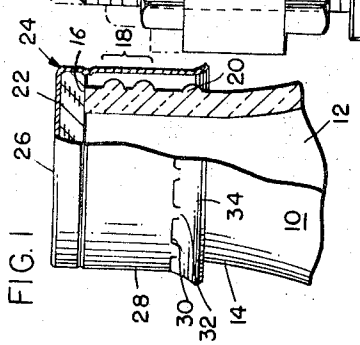

FIG. 1

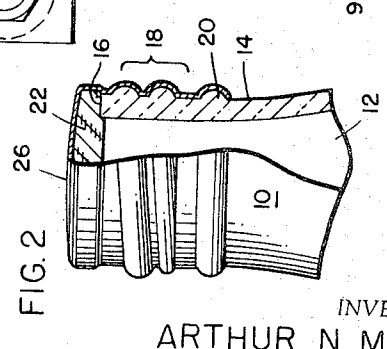

FIG. 2

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Filed Oct. 31, 1963 2 Sheets-Sheet 2

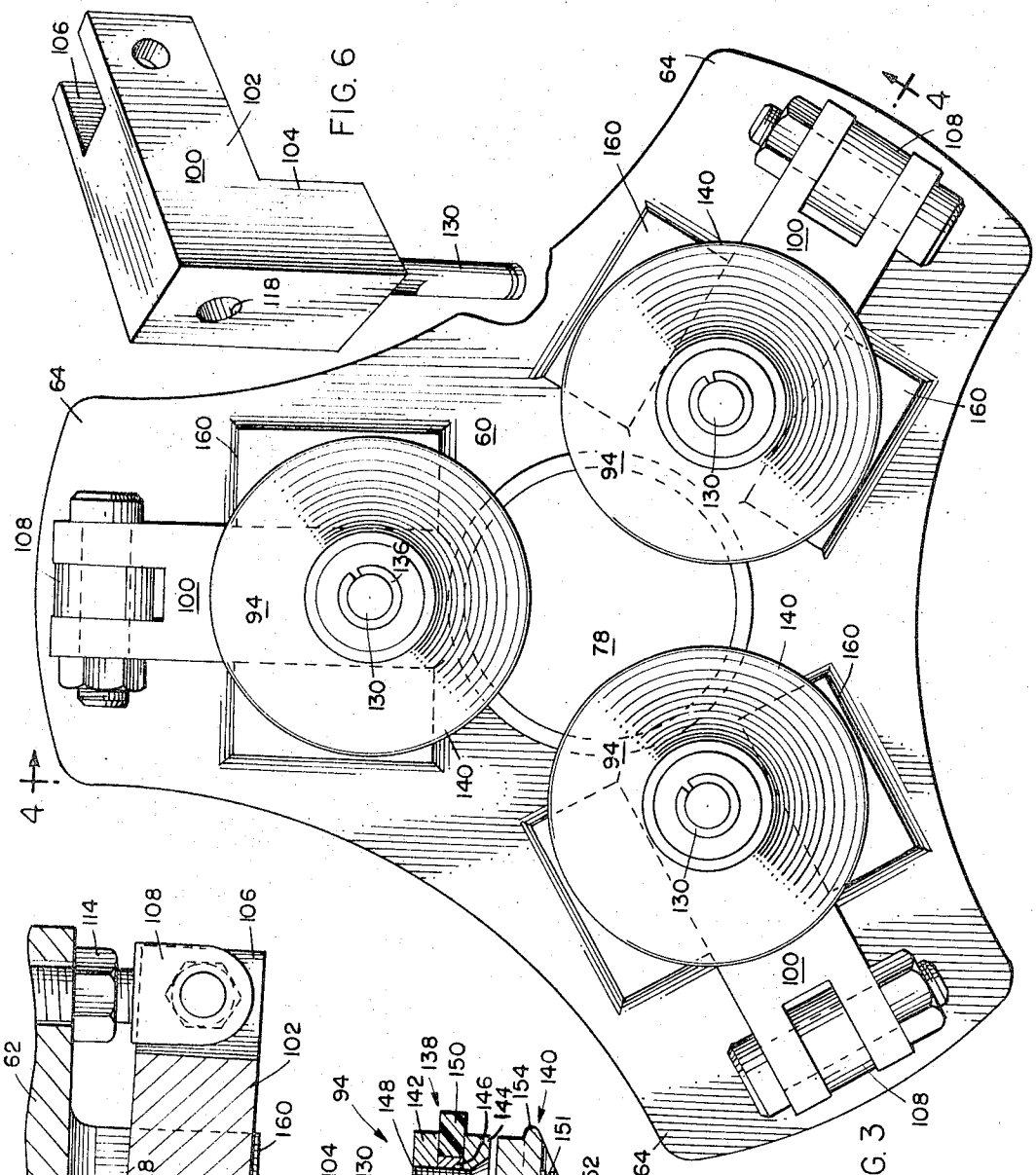

FIG. 6

FIG. 3

FIG. 5

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APPARATUS FOR APPLYING TO CONTAINERS CLOSURE BLANKS HAVING LOCKING BANDS

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5 Claims. (Cl. 53—334)

The present invention relates to an apparatus for applying to the threaded neck portions of containers, especially glass bottles, cup-like closure blanks having locking bands associated therewith. A closure blank in the form of an inverted cup-like body having a depending skirt portion with a detachable or severable locking band at the lower rim of the skirt portion is well known in the art. Such a closure blank is affixed to the threaded neck of the associated container and the locking band thereof serves, until broken from the superjacent part of the skirt portion of the closure blank, to protect the sealed container from undetectable tampering with the contents thereof. In order completely to affix to a container a closure blank of the aforementioned type, it is necessary to conform the depending skirt portion of the closure blank to the external screw thread on the neck of the container and also to press a portion of the locking band, namely, the lower marginal portion, so that it will engage tightly under an annular locking bead on and near the base of the neck of the container.

Heretofore, the affixation of a closure blank of the type or character under consideration, in commercial practice at least, has involved a two-station sealing operation utilizing rotatable spinning rollers, the skirt portion of the blank being spun into position about the threaded container neck at one station and the locking band being spun into position beneath the annular bead at another station. Although single station operations for simultaneously rolling the skirt portion of the blank onto the threaded container neck and rolling the locking band into position beneath the annular bead have also been proposed, it has been found that design consideration which involve the crowding of the rotary spinning rollers or other elements into a small vertical space which encompasses the container neck have made such single station operations impractical. Furthermore, when simultaneous spinning operations are performed at a single station upon both the threaded portion of the neck of the container and the annular locking bead, a serious problem of metal distribution in the closure blank presents itself, the larger area spinning operation which is effected on the threaded neck of the container depriving the smaller area spinning operation of metal so that frequently the locking band, after spinning, is short of metal to accomplish its particular purpose.

The present invention is designed to overcome the above-noted limitations that are attendant upon the construction and use of a conventional closure blank applying apparatus and, toward this end, it contemplates the provision of a novel apparatus for applying to the threaded necks of containers, principally glass containers, such as, bottles and the like, closure blanks having locking bands on the lower parts of their skirt portions, the improved apparatus involving a single spinning station and a novel disposition of structure and operating parts in and around such station. More specifically, the invention contemplates the provision of a single, continuously rotatable, spinning head having associated therewith radially disposed and equidistantly spaced apart pairs of spinning elements, each pair including a rotary thread-spinning wheel and a rotary locking band-spinning wheel. The two wheels of each pair of spinning elements are mounted on a common shaft for free rotation thereon. The spinning head further includes an axially extending, free floating compression die which, as the spinning head descends upon a container neck with a closure blank loosely and telescopically positioned thereon, initially seats upon the crown portion of the closure blank, becomes immobile, and presses the blank downwardly to compress the usual sealing gasket against the rim of the container neck in the usual manner of gasket compression. Thereafter, continued descent of the spinning head sets into operation a certain novel leverage mechanism which, utilizing the immobile compression die as its reaction member, engages the compression die tractionally and causes the pairs of spinning elements to swing inwardly toward the skirt portion of the closure blank to effect their spinning action thereon. During such inward motion of the pairs of spinning elements, the rotary thread-spinning wheel of each pair first engages the skirt portion of the closure blank and, thereafter, the rotary locking band-spinning wheel engages said skirt portion. In this manner, neither wheel of each pair of spinning elements deprives the other wheel of metal and there is no drawing of the metal of the skirt portion in between the two spinning areas.

The novel supporting means for the pairs of spinning elements and the tractionally operable lever arrangement for effecting successive thread-spinning and locking band-spinning operations constitute the principal feature of the present invention. Other and important features of the invention reside in the manner in which adjustability of the pairs of spinning elements for different thread widths, adjustability of the level fulcrum points for varying closure blank skirt or container neck widths, and adjustability of effective level lengths for regulation of spinning pressure, are effected.

Other objects and advantageous features of the invention will readily suggest themselves as the nature of the invention is better understood by reference to the following detailed description.

In the accompanying two sheets of drawings forming a part of this specification, one illustrative embodiment of the invention has been shown.

In these drawings:

FIG. 1 is a fragmentary side elevational view of the threaded neck of a bottle showing a closure blank loosely positioned thereon preparatory to closure blank-applying operations by way of an apparatus embodying the invention;

FIG. 2 is a fragmentary side elevational view similar to FIG. 1 but showing the closure blank after it has been applied to the threaded bottle neck;

FIG. 3 is a bottom plan view of a closure blank-applying apparatus constructed according to the principles of the present invention;

FIG. 4 is a vertical sectional view taken substantially along the line 4—4 of FIG. 3 and in the direction indicated by the arrows;

FIG. 5 is a fragmentary sectional view of a portion of the structure shown in FIG. 3 but with the rotary wheels of one pair of spinning elements shown in their actual spinning positions; and

FIG. 6 is a perspective view of one of the lever arms that are employed in connection with the invention and forms parts of the improved closure blank-applying apparatus.

Referring now to the drawings in detail and in particular to FIG. 1, there is disclosed in this view a conventional glass bottle **10** having a body portion **12** and a reduced neck **14** on the upper part of the body portion. The upper end of the neck **14** presents an open annular rim **16**. Immediately below the rim **16** is a threaded area **18** and below the threaded area is the usual annular lock-

ing bead 20. According to the present invention, a seal is formed between a disk-like sealing gasket 22 and the annular rim 16 of the neck 14 by placing a plain inverted cup-shaped metallic closure blank 24 with the gasket 22 installed therein over the neck 14 and then reforming the closure blank to conform the same to the neck by simultaneously applying downward pressure to the crown portion 26 of the blank while rolling the skirt portion 28 of the blank against the generally cylindrical threaded area 18 and the locking bead 20, pressure being first applied to conform the skirt portion 28 to the threaded area 18 of the neck 14 and, immediately thereafter, pressure being applied to the skirt portion to conform it to the locking bead 20. As shown in FIG. 2, after application and reformation of the closure blank 24 has taken place, the crown portion 26 of the blank, which originally was flat, assumes a frusto-spheroidal shape wherein the gasket 22 is sealingly pressed against the rim 16; an intermediate area or part of the blank skirt portion 28 is rolled into substantially coextensive sealing engagement with the threaded area 18; and the extreme lower region of the skirt is rolled inwardly beneath the annular locking bead 20. The bottle 10 and the closure blank 24 are of conventional design, the illustrated form of closure blank, when applied to the bottle, being commonly referred to as a tamperproof cap or closure wherein the skirt portion 28 is provided with an annular series of slits 30 and intervening ties 32 which divide the upper part of the skirt portion 28 which is to be pressed against the threaded area 18 from the lower part of the skirt portion which is to be pressed beneath the bead, this lower part constituting what is generally referred to a tamperproof locking band and being identified by the reference numeral 34. Any attempt to unscrew the applied and reformed closure from the neck of the bottle will result in rupture of the ties 32 and retention of the locking band 34 on the neck of the bottle, thus giving a visible indication that the applied closure has been tampered with.

Referring now to FIG. 4, the closure blank-applying apparatus of the present invention is in the form of a continuously rotating head 50 which is capable of vertical movements bodily between raised and lowered positions, the raised position thereof being an inoperative one wherein the head is poised above and is clear of a container such as the bottle 10 and its loosely applied closure blank 24. This raised position of the head is shown in dotted lines in FIG. 4. The full-line position of the parts represents a position wherein the rotating head has descended to a point where a crown-forming die 52 has engaged the crown portion 26 of the blank 24 preparatory to deforming the same and preparatory to causing the bottle and its applied closure blank to exert a reaction force on the rotary operating parts of the apparatus to initiate the various rolling and spinning operations of which the apparatus is capable. It will be understood, of course, that a suitable reaction support (not shown) for the bottle 10 is provided below the closure blank-applying apparatus.

Immediately prior to descent of the rotating head 50, the sealing gasket 22 and the closure blank 24 are applied to the bottle neck 14 in telescopic relationship in the manner previously set forth so that the crown portion 26 of the closure blank rests upon the gasket 22 and the latter rests upon the rim 16 of the bottle neck. It is to be noted at this point that the crown portion 26 of the closure blank is of substantially flat circular configuration and that the skirt portion 24 of the blank embraces the threaded area 18 as well as the annular locking bead 20.

Referring further now to FIG. 4, the head 50 involves in its general organization a spider-like star-shaped casting 60. The latter includes a relatively thick flat suspension plate 62 having three radial arms 64, each arm establishing a revolving spinning station. A centrally disposed tubular shank 66 projects upwardly from the suspension plate 62 and constitutes means whereby the head 50 may be connected to and supported from a rotary power-driven chuck forming a part of a conventional press (not shown), a part of the chuck being shown at 67. The plate 62 has formed therein a central opening 68 within which there is pressed a bushing 70. Slidable within this bushing is a free floating plunger 72 having a reduced stem 74 (see FIG. 5) which is surrounded by a spacer washer 76. Beneath this spacer washer there is disposed a free floating roller bearing assembly 78 including an inner race 80 and an outer race 82. A die retainer 84 surrounds the outer race 82, is anchored thereto by a set screw 86 and, in turn, serves to support the crown-forming die 52 by means of a set screw 87. Downward movement of the plunger 72 is limited by means of an enlarged head 88 which is formed on the upper end of the plunger and is engageable with a shoulder 89 at the rim of the opening 68.

The crown-forming die 52 is in the form of a disk having a generally concave underneath surface depression 90 which is adapted to seat upon the crown portion 26 of the closure blank 24 during descent of the plunger 72. A spiral compression spring 92 surrounds the plunger 72 and yieldingly urges the same downwardly to apply deforming pressure to the crown portion 26 through the free floating crown-forming die 52. The lowermost position of the plunger 72 is limited by a series of three spinning units 94 which are associated with the three previously mentioned spinning stations.

The three spinning units 94 are identical and, therefore, a description of one of them will suffice for them all. Each unit comprises an L-shaped level arm 100 (see also FIG. 6) having a substantially horizontal arm 102 and a substantially vertical arm 104. The distal end of the horizontal arm 102 is bifurcated as at 106, the bifurcation straddling a pivot block 108 on the lower end of a vertical adjusting screw 110 which passes loosely through a vertical hole 112 at the outer end of the associated arm 64 and is capable of being anchored in selected adjusted positions of elevation by upper and lower clamping nuts 114. A horizontal pivot pin 116 projects through the bifurcated portion of the arm 102 and also through the pivot block 108 and establishes a pivotal axis for the L-shaped lever 100 as a whole. The inner end of the horizontal arm 102 is provided with a relatively deep, substantially horizontal socket 118 which adjustably receives the shank 120 of a roller bearing 122, the shank 120 being integrally formed with the inner race 124 of the bearing, and the outer race 126 of said bearing overlying the peripheral regions of both the die retainer 84 and the roller bearing assembly 78 and being designed for rolling contact therewith. A set screw 128 receives the shank 120 in the socket 118 in any selected position. The two arms 102 and 104 of the lever 100 are substantially square in transverse cross section and the lower end of the vertical arm 104 has projecting downwardly therefrom a spindle 130 which carries an upper roller bearing 132 and a lower roller bearing 134, the two roller bearings being arranged in contiguity on the spindle and the lower bearing being held in position on the spindle by a split ring 136 in an annular groove in the lower end of the spindle. The upper bearing 132 serves rotatably to support thereon a composite spinning wheel 138, while the lower bearing serves similarly to support a spinning wheel 140. The spinning wheel 138 registers horizontally with the threaded area 18 of the bottle neck 14, while the spinning wheel 140 registers horizontally with the locking bead 20 during actual spinning operations. The composite spinning wheel 138 includes an upper retaining ring 142, a lower retaining ring 144 and an intermediate spacer ring 146, the three rings being pressed upon the outer race of the upper roller bearing 132 and secured together by screws 148. An elastomeric spinning ring 150 is interposed between the upper and lower re-

taining rings **42** and **144** and surrounds the spacer ring **146**. The spinning ring **150** projects radially outwardly beyond the peripheries of the retaining rings **142** and **144** and is designed for spinning engagement with the skirt portion **28** of the closure blank **24**. The lower spinning wheel **140** is solid. It is secured to the outer race of the lower roller bearing **134** by set screws **151** and is provided with a frusto-conical underneath face **152** and a peripheral spinning edge **154** at the large base of the cone.

In order to maintain the spinning wheels **138** and **140** of the three spinning units **94** in their 120° circumferentially spaced relationship about the central vertical axis of the closure blank **24**, the horizontal arm **102** of each lever arm **100** is guided in its swinging movements between two guide posts **160** (see FIG. 3) which projects downwardly from the underneath face of the plate **62** in spaced apart relationship and straddle the arm **102** in such a manner that the flat inside faces thereof make sliding contact with the flat side faces of the arm. Fairly close tolerances are maintained so that there is no side sway of the arms **102** under the influence of the rolling contact which is made between the roller bearings **122** and the die retainer **84**, or between the spinning wheels **138** and **140** and the skirt portion of the closure blank **24**.

In the operation of the present closure blank-applying apparatus, assuming the parts to be in the position in which they are shown in dotted lines in FIG. 4, the continuously rotating head **50** is maintained in an elevated position by the chuck **67**. The gravitational force of the free floating plunger **72**, together with the downward thrust of the spring **92**, serves to maintain the plunger and its associated parts in a lowered position with respect to the casting **60**, this position being limited by engagement of the head **88** of the plunger **72** with the shoulder **89** at the rim of the opening **68** in the plate **62**. In this lowered position of the plunger **72**, the three roller bearings **122** rest upon the upper annular edge of the die retainer **84**, thus supporting the lever arms **100** of the units **94** in a lowered position wherein the vertical arms **104** thereof are inclined downwardly and outwardly at a slight angle so that the spinning wheels **138** and **140** are maintained spaced from one another a sufficient distance that there is room for entry of the bottle neck **14** with its loosely applied closure blank **24** between these wheels when the aforementioned press causes the head **50** to descend upon the bottle neck for closure blank-applying operations. At this time, the entire head **50** rotates about the vertical axis of the press but there is no relative rotation or other relative movement between he various pars. Gravitational and centrifugal forces cause the outer races **126** of the roller bearings **122** to seat upon the die retainer **84** and the three spinning units revolve about a central axis but there is no rotation of said outer races of the bearings **122** since these races simply rest upon die retainer **84** and move in their paths of revolution while the die retainer rotates under the influence of frictional forces developed in connection with the transmission of torque thereto by the compression spring **92** through the inner race of the bearing assembly **78**. Stated otherwise, all parts of the head **50** are free-floating and in equilibrium and there are no frictional forces available to initiate relative motion between any of the parts.

Upon initial descent of the head **50**, the crown-forming die **52** first seats and comes to rest upon the crown portion **26** of the closure blank **24**. Although the head **50** continues to rotate, rotary motion of the die **52**, the die retainer **84** and the outer race **82** is abruptly terminated by the anti-torque reaction force exerted by the stationary bottle neck and its loosely applied closure blank. The inner race **80** of the roller bearing assembly **78** and the plunger **72** may continue to rotate since these elements remain free-floating and motion is transmitted thereto through the spring **92**. However, such rotation of these parts is without function.

As soon as the die **52** and the die retainer **84** thus come to rest, the outer races **126** of the roller bearings **122** become tractionally engaged with the die retainer **84** so that these bearings roll in a circular path upon the annular upper rim of the retainer. Descent of the head **50** thus lowers the pivotal axes of swinging movement of the lever arms **100**, as represented by the pivot pins **116** and the three lever arms commence inward swinging movements which first carries the upper composite spinning wheels **138** into spinning engagement with the skirt portion of the closure blank **24**, and thereafter carries the lower spinning wheels **140** into engagement with this skirt portion. During this time, the plunger **72**, in effect, moves upwardly through the bushing **70**.

It is pointed out at this time that the elevations of the three spinning wheels **138** differ slightly from one another, which is to say that these three wheels are offset in a vertical direction a slight distance from one another. The desired degree of offset is determined by the width of the threaded area **18** on the bottle neck **14** and the necessary adjustment for such offset may be made by means of the clamping nuts **114** which may be caused to raise or lower the pivot pins **116** as desired. Adjustment may alternately be made by the use of spacer washers on the spindle **130** if desired.

The vertical offset relationship of the three spinning wheels **138** is preferably such that the vertical spans of the elastomeric spinning rings **150** overlap one another as they traverse the skirt portion **28** of the closure blank **24**. The resilient material of these spinning rings **138** serves to compress the skirt portion of the blank tightly against the threaded area **18**. As the vertical arms **104** of the levers **100** continue to move inwardly toward the bottle neck **14**, increased pressure is applied to the skirt portion of the blank while at the same time the lower spining wheels **140** converge upon the skirt portion and, by a spinning action, compress the lower region of the locking band **34** beneath the lock bead **20**. The elevation of the various spinning wheels **140** may be adjusted to accommodate locking beads of varying height by selective placement of the wheels on the outer races of the bearings **134**, utilizing the set screws **151** to fasten the wheels when the desired adjustment has been made.

Upon restoring the spinning head **50** to its elevated position, the bushing **70** slides upwardly on the plunger **72** until such time as it engages the head **88** on the plunger. At this time, the spring **92** maintains the plunger fully extended from the plate **62** so that the levers **100** are swung outwardly, thus clearing the spinning wheel units **94** from the applied closure blank **24** and leaving the bottle **10** seated upon its aforementioned reaction support. The bottle may then be removed and another bottle substituted therefor preparatory to the next closure blank-applying operation.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. Therefore, only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. An apparatus for sealing a bottle-like container with an external finish about its neck by pressing a skirted and crowned closure blank over the container neck, said apparatus comprising, in combination, a continuously rotatable, vertically shiftable spinning head adapted to be positioned above and in concentric relationship with the closure blank when the latter is loosely and telescopically applied over the container neck, said head including a suspension plate establishing therebeneath a plurality of circumferentially spaced revolving spinning stations, identical spinning instrumentalities at each spinning station and each including a substantially horizontally disposed

and radially extending spindle-supporting lever arm, means pivotally connecting the outer end of said lever arm to said plate for limited swinging movement of the arm about a horizontal axis, a spindle fixedly secured to and depending from the inner end of said lever arm, a spinning wheel freely and rotatably mounted on said spindle, said lever arm being independently movable between a lowered position wherein the spinning wheel is removed from engagement with the skirt portion of the closure blank and a raised position wherein the spinning wheel engages said skirt portion and spins the same into sealing engagement with said external finish, a roller mounted for axial shifting movement on the inner end of said lever arm and effectively engageable with the crown portion of the closure blank upon descent of the head whereby said crown portion offers reaction force to the roller against downward movement and thus effects shifting of the lever arm from its lowered position and means for securing said roller in any selected position of axial adjustment on said lever arm to its raised position.

2. An apparatus for sealing a bottle-like container having a reduced neck provided with a threaded area immediately below its rim and a locking bead beneath the threaded area, by pressing a skirted and crowned closure blank over the container neck and against said threaded area and locking bead, said apparatus comprising, in combination, a continuously rotatable vertically shiftable spinning head adapted to be positioned above and in concentric relationship with the closure blank when the latter is loosely and telescopically applied over the container neck, said head including a suspension plate establishing therebeneath a plurality of circumferentially spaced revolving spinning stations, a vertically disposed plunger coaxial with said spinning head and slidably carried by said suspension plate, a freely rotatable crown-shaping die rotatably carried at the lower end of said plunger and engageable with the crown portion of the closure blank upon descent of the head, identical spinning instrumentalities at each spinning station and each including a substantially horizontally and radially extending spindle-supporting lever arm, means pivotally connecting the outer end of said lever arm to said plate for limited swinging movement of the arm about a horizontal axis, a spindle fixedly secured to and depending from the inner end of said lever arm, a thread-spinning wheel freely rotatable on said spindle, a bead-spinning wheel freely rotatable on the spindle below the thread-spinning wheel,

said lever arm being movable during descent of the spinning head from a lowered position wherein the spinning wheels are both removed from engagement with the skirt portion of the closure blank, through an intermediate position wherein the thread-spinning wheel engages said skirt portion and spins the same into sealing engagement with said threaded area while the bead-spinning wheel remains removed from engagement with the skirt portion, to a raised position wherein the thread-spinning wheel remains in spinning contact with said skirt portion while the bead-spinning wheel engages the skirt portion and spins the same into sealing engagement with said locking bead, a roller mounted for axial shifting movement on the inner end of said lever arm and engageable with said crown-shaping die when the latter is in engagement with said crown portion of the closure blank whereby said crown portion offers a reaction force to the roller through the crown-shaping die, thus shifting the lever arm from its lowered position, through its intermediate position and means for securing each roller in any selected position of axial adjustment on its associated lever arm to its raised position.

3. A sealing apparatus as set forth in claim 2 and including, additionally, means for varying the effective position of the pivotal axis of each lever arm in a vertical direction with respect to the suspension plate.

4. A sealing apparatus as set forth in claim 2 and including, additionally, a pair of spaced guide posts depending from said suspension plate at each spinning station, said guide posts closely straddling the associated lever arm and serving to maintain the same against angular shifting movement in a direction other than the direction of swinging movement of the lever arm.

5. A sealing apparatus as set forth in claim 2 and wherein the various thread-spinning wheels are disposed at slightly different elevations.

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