July 6, 1937. E. N. TRUMP 2,085,879

BOTTLE CAPPING MACHINE

Filed April 15, 1935 2 Sheets-Sheet 1

FIG. 1.

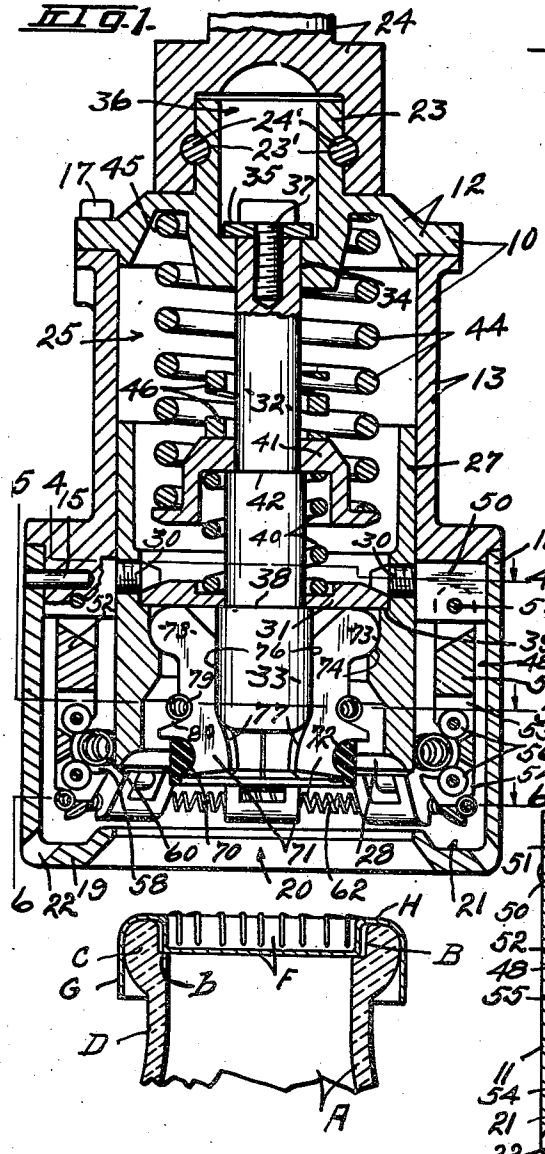


FIG. 2.

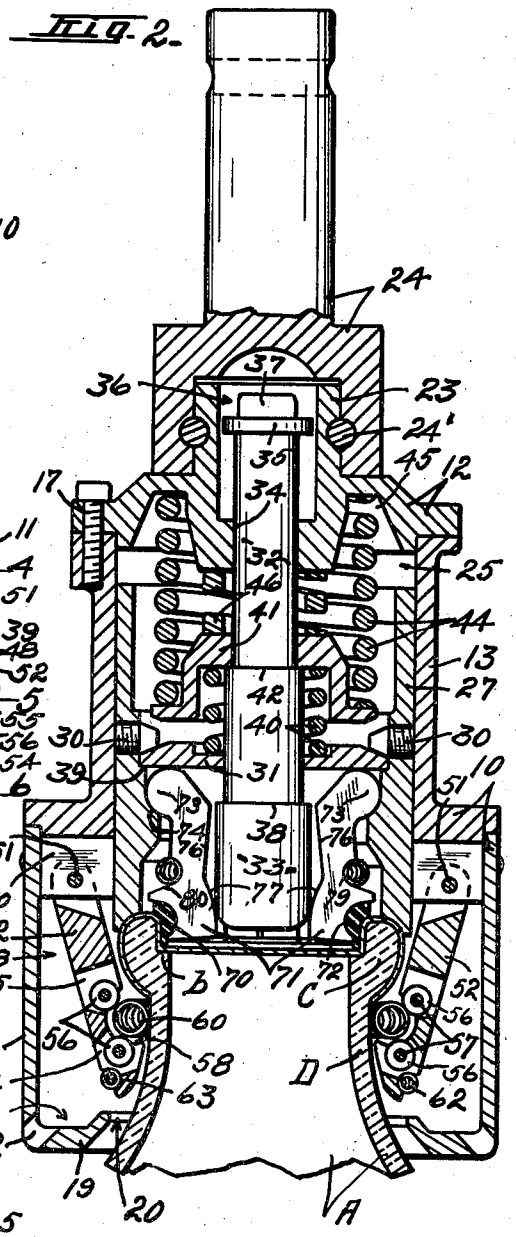
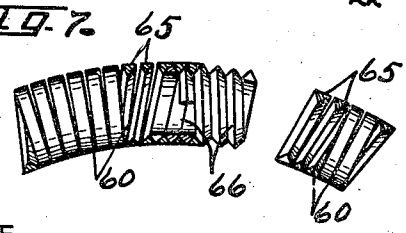


FIG. 7.



WITNESS

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Filed April 15, 1935 2 Sheets-Sheet 2

Fig. 3.

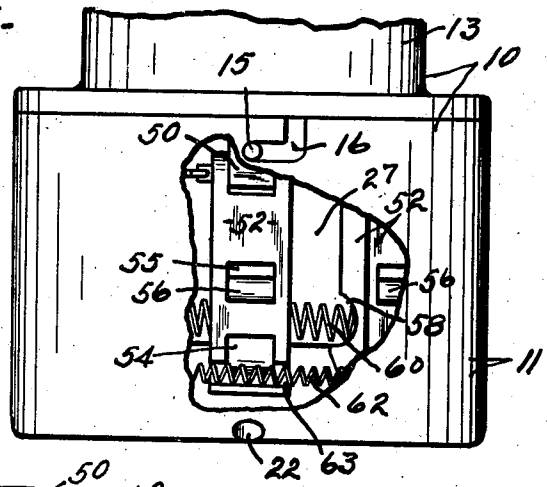


Fig. 4.

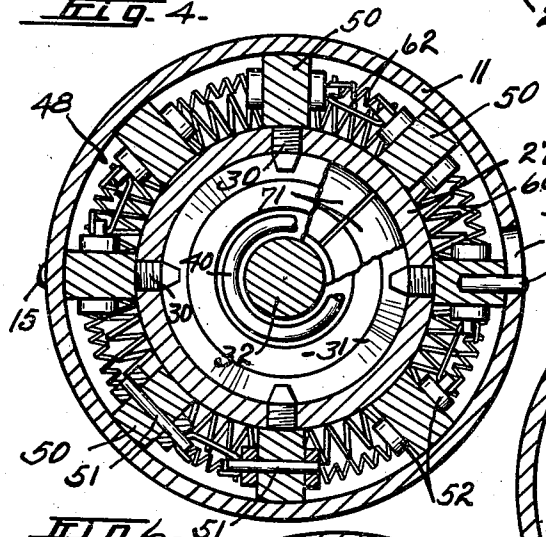


Fig. 5.

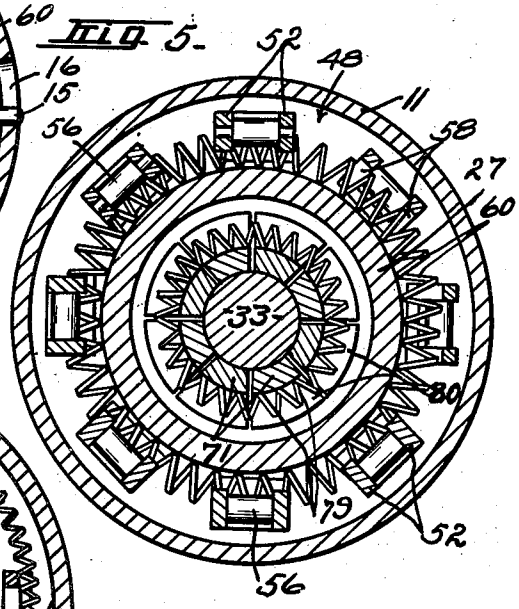
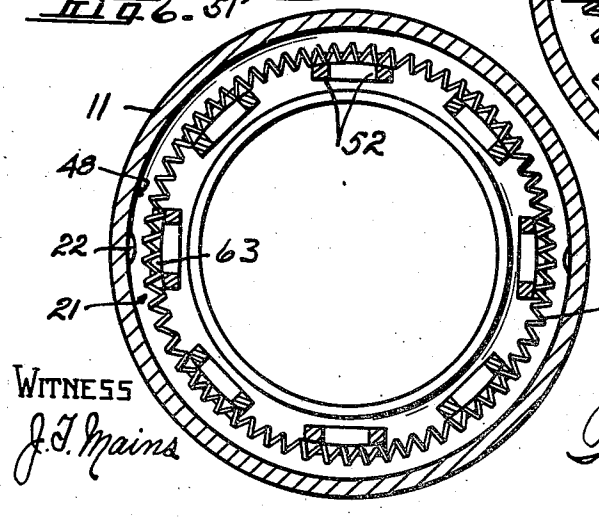


Fig. 6.



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2,085,879

BOTTLE CAPPING MACHINE

Edward N. Trump, Syracuse, N. Y.

Application April 15, 1935, Serial No. 16,294

18 Claims. (Cl. 226—85)

This invention relates to new and useful improvements in a bottle capping machine and pertains more particularly to an apparatus for applying hooded or over-all caps to the head of milk bottles or the like. The caps are pre-formed in one piece, preferably from a sheet of light, strong and non-corrosive metal having a high degree of ductility, malleability and tenacity, such for example, as tissue aluminum of about the thickness of the cellulose product commonly known as Cellophane or of thin tinfoil, and which is capable of being easily molded by pressure under atmospheric temperature to conform to the form or contour of the bottle and of retaining its form under ordinary usage.

In other words, the caps are of the type set forth in the pending application of Charles A. MacCordy, Serial No. 682,474, filed July 27th, 1933, and are formed with a central cup-shaped portion of slightly less exterior diameter than the interior diameter of the mouth of the bottle so as to loosely enter the mouth of the bottle and a depending skirt portion of slightly greater interior diameter than the exterior diameter of the head of the bottle to enable the cap to be easily placed by hand or otherwise over and upon the head of the bottle preparatory to the securement of the cap to the bottle.

In order that the caps may be successfully produced and marketed, it is, of course, necessary that the metal from which they are constructed be maintained as thin as possible, consistent with required rigidity to enable the cap to inherently remain in close conformity with the surface of the head of the bottle under normal usage to provide and maintain a fluid-tight connection with the bottle. It has been determined by extensive labor and experimentation that the thickness of the material from which these caps are made need not be over two or three thousandths of an inch and to enable the caps to be successfully applied to the bottles without tearing, cracking or mutilating the same, the metal comprising the cap must not be stretched to any appreciable degree during the forming of the cap or the application thereof to the bottle. Consequently, the peripheral wall of the cup-shaped portion of each cap is provided with relatively small circumferentially spaced coaxially disposed corrugations, to allow the same to be expanded against the adjacent portions of the bottle. Also, the skirt is rumpled about its circumference or provided with very fine corrugations so that during the application thereof to the head and neck of the bottle the same may not only be contracted without danger of buckling or cracking but will be re-enforced substantially uniformly throughout the area thereof whereby the cap will remain in conformity with the contour of the bottle under normal usage.

The main object of the present invention is to provide an improved capping machine for expeditiously applying metallic caps of the above mentioned class to milk bottles or the like in a fluid-tight manner.

A more specific object of the invention is to provide a capping head which automatically accomplishes the sealing of a skirted cup-shaped cap or closure to the bottle by simultaneously bringing the corrugated peripheral wall of the cup-shaped portion of the cap into close contact with the bore of the mouth of the bottle and to progressively roll the skirt portion of the cap against the outer peripheral surface of the bead or pouring lip contiguous to the bottle mouth and the neck of the bottle by an axially moving pressure.

In carrying out the above mentioned objects, I have provided two flexible annuli arranged substantially concentric one within the other and adapted to have relative axial movement. The inner annulus is comprised of a resilient ring and a plurality of independently mounted sectors adapted to extend into the central cup-shaped portion of the cap, said sectors being simultaneously moved radially outwardly for bringing the ring into engagement with the peripheral wall of said cup-shaped portion of the cap to press the same against the bore of the bottle mouth. The outer annulus comprises a contractible and expansible ring which is circular in cross section. The outer annulus may be composed, for instance, of elastic rubber, a coil spring or the like and which is preferably of less normal inside diameter than the exterior diameter of the head or neck of the bottle, and is supported by rolling members during the relative axial movement thereof and the inner annulus whereby the outer annulus may freely rotate about its own peripheral or circumferential axis in rolling engagement with the skirt of the cap to tightly press the same against the bead and neck of the bottle.

A further object of the invention resides in providing a normally expanded coil spring ring with means for yieldingly urging the coil spring ring toward the contracted or normal position thereof, whereby the effective action of said ring upon the cap will be increased.

A still further object is to provide means whereby the inner annulus will be expanded radi-

ally at a progressively decreasing rate of speed and increasing power to tightly press the peripheral wall of the cup-shaped portion of the cap against the adjacent wall of the bottle mouth.

Other objects and advantages pertaining to the structure of the device and to the form and relation of the parts thereof will more fully appear from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a longitudinal vertical sectional view of my improved capping head and the upper portion of a bottle with a cap positioned thereon, the capping head being shown in the uppermost or inoperative position with the upper portion thereof broken away.

Figure 2 is a sectional view similar to Figure 1 with the capping head in the lowermost position in operative relation with the bottle for supplying the cap thereto.

Figure 3 is a side elevation of the lower portion of the cap applying head illustrated in Figures 1 and 2, with a portion of the housing broken away to better illustrate the underlying mechanism.

Figures 4, 5 and 6 are horizontal sectional views taken respectively in substantially the plane of the lines 4—4, 5—5 and 6—6, Figure 1.

Figure 7 is an elevation partly in section, of adjacent end portions of a coil spring ring particularly adapted to be used in connection with my novel capping head, said ends of the spring ring being illustrated in spaced relation with a tie-insert for joining the ends together mounted in one of the end portions.

In order that the operation of the capping device may be clearly understood, I have shown the head portion of a bottle A having a circular recess B defining the mouth of the bottle, an annular outwardly extending bead or pouring lip C contiguous to the mouth or recess B and a contracted or reduced neck portion D below the bead C. The recess B is provided with the usual inwardly extending shoulder *b* spaced some distance inwardly from the upper or outer surface of the bead C adapted to form a seat for the central cup-shaped portion of the cap.

The cap is similar to that shown and described in the pending application previously referred to in that it is made of extremely thin sheet aluminum or equivalent non-corrodible material and that the peripheral walls of the cup-shaped portion F and skirt G are corrugated or rumpled to enable these parts to be compressed and expanded respectively without liability of stretching the material from which the cap is formed.

The cap, according to the application referred to, is made in such manner that the exterior diameter of the peripheral walls of the cup-shaped portion F is slightly less than the diameter of the mouth recess B of the bottle, while the normal inner diameter of the skirt portion G is slightly greater than the external diameter of the bead C of the bottle, thus permitting the cap to be easily placed by hand or otherwise over and upon the head of the bottle with the connecting web H of the cap resting upon the upper end of the head as shown in Figure 1.

The vertical depth of the cup-shaped portion F of the cap is practically equal to that of the recess B, whereby the marginal edge of the bottom of the cup-shaped portion may rest upon the shoulder *b* when the web portion H engages the bead C.

The capping device forming the subject matter of this invention may be mounted in any suitable manner to permit the same to be reciprocated vertically toward and from the head of the bottle A co-axially therewith and as shown in the drawings, comprises a sectional housing 10 composed of a lower tubular portion 11, an upper or cap portion 12 and an intermediate tubular portion 13.

The lower portion 11 of the housing is rotatably mounted upon the intermediate portion 13 as shown in Figures 1 and 2 and is releasably secured thereto by means of a pair of diametrically opposed pins 15 mounted in the intermediate section 13 and which have the outer ends thereof adapted to engage in a right angle slot 16 provided in the adjacent portion of the lower section 11 as shown in Figures 1, 3 and 4. The cap or upper portion 12 of the housing is mounted as shown in Figures 1 and 2, to extend across the upper end of the intermediate portion 13 and may be releasably connected thereto, in any suitable manner as by screws 17.

The lower end of the housing portion 11 is provided with in inwardly extending flange 19 provided with a central opening 20 co-axial with the housing portions 11 and 13 and which preferably flares upwardly and inwardly to enable it to receive the head of the bottle with the cap thereon when the capping device is brought downwardly to its capping position as shown in Figure 2. The interior diameter of the cylindrical opening 20 at the upper end thereof is approximately equal to the outer diameter of the skirt G of the bottle cap to permit the head of the bottle and said cap to readily pass therethrough while the inclined walls of said opening serve to center the head of the bottle with the interior of the housing 10 as the bottle and cap move axially therethrough.

It will be noted that the upwardly and inwardly inclined wall of the opening 20 forms a channel or annular recess 21 at the lower end of the housing portion 11 which is adapted to collect moisture, lubricant or dust which may accumulate within the housing 10 and prevent the same from passing downwardly directly upon the bottles A positioned beneath said housing. In order that such accumulation of foreign material may readily pass from the recess 21, the wall of the recess as the flange 19, may as shown in Figures 1 and 2, be provided with one or more apertures 22 which preferably extend downwardly and outwardly at an angle to the axis of the housing so as to deposit the foreign material as far from the bottle as possible.

The upper housing portion or cap 12 is provided with a centrally disposed hollow circular hub 23 to which is secured a post 24 adapted to be connected in any suitable manner to an actuating device not shown for supporting and actuating the housing 10. The post 24, in this instance, is releasably connected with the hub 23 by means of a U-shaped bolt 24' which has the legs thereof extended through corresponding holes provided in the lower portion of the post 24 in registration with an annular groove 23' provided in the hub 23 as shown in Figures 1 and 2.

The intermediate housing portion 13 is provided with a central cylindrical chamber 25 which extends axially therethrough. This chamber 25 is substantially equal in diameter to the upper end of the opening 20, or in other words, to the outer diameter of the skirt G of the bottle cap and has slidably mounted therein a cylindrical sleeve or tubular member 27 of uniform external diameter throughout its length. The interior diameter of the lower end portion of the sleeve or

tubular member 27 is preferably greater than the diameter of the recess B of the bottle A, while the lower end of said sleeve is provided with a recess 28 of convex cross section, corresponding approximately to the transverse curvature of the upper face of the bottle bead C so that when the sleeve 27 is brought to its capping position, the upper wall of the recess 28 will engage the marginal portion of the web H of the cap and thereby hold the cap firmly against the upper end of the head of the bottle as shown more clearly in Figure 2.

As hereinbefore stated, the sleeve 27 is reciprocally mounted in the intermediate section 13 and is maintained against downward axial movement in its lowermost position by a plurality of, in this instance, four screws 30 arranged in equal circumferential spaced relation about the sleeve 27 intermediate the ends thereof as shown in Figures 1 and 4. These screws have the inner ends thereof projecting into the interior of the sleeve member 27 in engagement with the upper surface of a circular plate or disk 31 mounted on the stem 32 of a plunger 33 which extends axially in a vertical plane through the interior of the sleeve 27 and intermediate housing section 13 with the upper end of said stem passing through a centrally disposed opening 34 provided in the cap 12. The stem 32 and plunger 33 are maintained against downward movement when in their lowermost position by a washer 35 mounted in the bore 36 of the hub 23 and which is secured to the stem 32 by a screw 37. The axial length of the stem 32 is such as to maintain the lower end of the plunger when in its normal lowermost position in upward spaced relation to the lower end of the pressure sleeve 27 as shown in Figure 1.

The plate 31 is mounted on the stem 32 adjacent to a shoulder 38 formed at the junction of said stem and the plunger 33. The outer peripheral edge of the plate is mounted between the screws 30 and a shoulder 39 formed in the wall of the inner chamber of the sleeve 27 beneath the screws. The inner ends of said screws and the adjacent surface of the plate are tapered as illustrated so that the plate may be securely clamped to the sleeve 27 by screw threading the screws 30 inwardly. The plate 31 which secures the sleeve 27 to the plunger 33 is slidably mounted upon the stem 32 for axial movement toward and from the shoulder 38 and is yieldingly maintained in contact with the shoulder by means of a relatively light spring 40 mounted on the stem 32 between the plate 31 and a supporting collar 41 which is slidably mounted upon the upper end of the stem 32 for engagement with a shoulder 42 provided on said stem intermediate the plunger 33 and the upper ends of the stem. The collar 41 is yieldingly maintained in engagement with the shoulder 42 by a relatively stiff spring 44 which surrounds the stem 32 with the lower end thereof mounted upon the supporting collar 41 while the upper end of said spring is positioned in an annular recess 45 provided in the bottom surface of the cap 12.

It will thus be seen that the plunger 33 is constantly urged toward its lowermost position by the action of the spring 44 while the sleeve 27 is constantly urged toward its lowermost position by the spring 40 and at the same time the sleeve 27 and plunger 33 are free to move upwardly against the action of the springs 40 and 44. In order that this upward movement may be yieldingly limited at a predetermined position of the plunger, I have provided a third relatively powerful spring 46 mounted on the upper end portion of the plunger stem in contact with the supporting collar 41. The axial length of the spring 46 is substantially less than the normal distance between the collar 41 and the adjacent surface of the cap 12 so as to permit a predetermined upward axial movement of the plunger before said spring engages the cap for limiting the upward movement of said plunger.

The lower end portion of the intermediate section 13 and the lower housing section 11 are of considerably greater diameter than the remaining portion of said intermediate section as illustrated in Figures 1 and 2 so as to provide the lower housing section 11 with an inner chamber 48 of considerably greater diameter than the inner chamber 25 of the intermediate section 13 and, therefore, of the exterior diameter of the tubular sleeve 27. The lower face of the intermediate section 13 is provided with a plurality of, in this instance, eight pendant lugs 50 which are arranged in substantially equal circumferential spaced relation and extend a relatively short distance into the chamber 48 of the housing section 11. To each of these lugs 50 is pivotally connected by a pin 51 the upper end of a downwardly extending arm 52 which is slotted at its upper end for the reception of said lug as shown in Figures 1, 2 and 4.

It will thus be seen that there are eight of these arms 52 arranged in substantially equal circumferentially spaced relation about the interior of the lower housing section 11 and that they are arranged in a vertical plane intermediate the sleeve 27 and the wall of the lower housing section 11. The lower ends of these arms terminate a short distance above the flange 19 of the section 11 and each arm is provided with a pair of slots or recesses 54 and 55 arranged in longitudinally spaced relation a short distance above the lower end thereof. In each of these slots or recesses is mounted a roller 56 which is rotatably mounted on a pin 57 which has the ends thereof secured in the wall of the arm. Each of the arms 52 is also provided with a recess 58 in the inner face thereof in a plane intermediate the recesses 54 and 55 and in communication with said recesses whereby the peripheral surface of the rollers 56 will extend into the recess 58 for supporting engagement with the peripheral surface of a coil spring ring 60 which is positioned within the chamber 48 in a horizontal plane a relatively short distance above the lower end of the sleeve 27 when said sleeve is in its lowermost position as illustrated in Figure 1.

This coil spring ring is preferably constructed with a normal interior diameter which is less than the diameter of the bead C and neck D of the bottle A and, therefore, considerably less in diameter than the outer diameter of the sleeve 27 so that when a relative axial movement of the sleeve 27 and the ring 60 is produced as by the contact of a bottle with the sleeve 27 whereby the sleeve is moved upwardly relatively to the spring ring out of engagement therewith, said spring ring may contact with a cap carried by the head of the bottle and thereby contract the skirt of the cap about said head under its own tension.

The function of the rollers 56 is to maintain the ring 60 against axial movement relative to the lower housing portion 11, and in order that said rollers may be maintained in operative relation with the coil spring ring so as to move radially therewith during the contraction and expansion thereof, I have provided a coil spring 62 of rela-

tively light tension which is mounted in suitable grooves or recesses 63 provided in the outer face of each arm 52 adjacent the lower end thereof.

The coil spring ring 60 may be of any suitable construction and as shown in Figure 7, is preferably composed of wire 65 triangular in cross section which is wound with the flat or base side thereof positioned exteriorly of the coil thereby positioning the apex of the wire at the interior of the coil. This arrangement of the wire 65 provides the ring with a substantially flat smooth exterior surface to be engaged by the rollers 56 and also for contacting with the skirt G of the bottle cap. The wire 65 is wound to form a coil spring of predetermined length so that when the ends thereof are secured together the inner diameter of the ring thus formed will be substantially equal to or slightly less than the neck D of the bottle A. The means for securing the ends of the coil spring together consist, in this instance, in forming a coupling 66 by winding wire similar in cross section to the wire 65 but arranged in the reverse manner of that when forming the ring 60, that is, with the flat or base portion thereof on the interior and the triangular portion or apex of the wire on the exterior of the insert or coupling.

It will thus be seen that the V-shaped portion of the wire forms exterior threads on the insert or coupling which are adapted to be screw threaded into the threads formed on the exterior of the ring 60 by the V-shaped portion of the wire When assembling the insert or coupling 66 in the ends of the coil spring ring the insert is first screw threaded into one of the end sections as illustrated in Figure 7 after which the other end portion of the coil spring ring is screw threaded on the insert or coupling by first unwinding the coil spring ring a number of turns equal to the number of threads on the exposed portion of the insert or coupling and then allowing the ring to wind to its normal position with the end pressed into engagement with the adjacent portion of the insert and thereby cause the said end of the ring to screw thread itself onto the insert.

It will thus be seen that the coil spring ring is provided with a smooth continuous outer surface throughout the circumferential length thereof and that the ring is free to expand and contract with substantially equal tension throughout its length with possibly the exception of the relatively short portion engaged by the insert or coupling 66 which also permits the required expansion and contraction of the ring to a certain degree.

Furthermore, it will be understood that when the rollers 56 are yieldingly maintained in engagement with the outer peripheral surface of the ring by the action of the contracting spring 62 upon the pivoted arms 52, the coil spring ring will be maintained thereby against axial movement relative to the housing 10 during the axial movement of the pressure sleeve 27 relative to said housing as the cap is being applied to the bottle and that the ring will be free to rotate about its own peripheral axis during the relative axial movement of said ring and the bottle and cap owing to the rollers 56 supporting the ring with a minimum degree of frictional resistance to said rotation of the coil spring ring thereby permitting the coil spring ring to move axially in both a downwa: y and upwardly directed movement in rollin: ngagement with the skirt of the cap for contrac g the skirt about the bead and neck of the bottl

The means for expanding the peripheral wall of the cup-shaped portion F of the cap tightly against the adjacent wall of the mouth recess B of the bottle comprises the hereinbefore mentioned plunger 33, an expansible and contractible ring 70 and a plurality of, in this instance, eight radially movable sectors or fingers 71 interposed between the plunger 33 and the ring 70. The ring 70 is preferably composed of soft rubber or equivalent material and is mounted in recesses 72 provided in the outer face of the lower end portion of the fingers 71 in substantially the horizontal plane of the lower end surface 28 of the pressure sleeve 27. The sectors or fingers 71, in this instance, are disposed in a vertical plane to extend upwardly from the ring 70 and each has the upper end thereof provided with a substantially semi-circular lug 73 arranged in the outer face thereof and which is rotatably engaged in a circular concave recess 74 formed in the interior wall of the sleeve 27 a relatively short distance below the shoulder 39 for the retaining plate 31. The fingers extend downwardly from the pivotal lugs 73 between the plunger 33 and the adjacent portion of the sleeve 27 and each has its inner vertical edges provided with a substantially straight portion 76 which extends downwardly from the upper end thereof to a position substantially in the plane of the lower end of the plunger 33 when the plunger and sleeve 27 are in their normal inoperative position as illustrated in Figure 1 for engagement with the adjacent portion of said plunger to limit the inward swinging movement of these members.

The fingers or sectors normally extend as shown in Figure 1, below the lower end of the plunger 33 and each has its inner vertical edge provided with an inwardly curved cam surface 77 which extends from the straight portion 76 downwardly to the lower end of the arm or sector in the path of movement of the plunger 33 so that when the fingers or sectors are moved upwardly relatively to the plunger 33, said plunger will force the lower ends of the fingers outwardly and thereby expand the ring 70 for pressing the peripheral wall of the cup-shaped portion F of the cap against the adjacent portion of the bottle.

The ring 70 is constructed with a normal exterior diameter which is less than the interior diameter of the cup-shaped portion F of the cap so that the arms or sectors 71 are urged by the ring 70 to their normal innermost position. However, the sectors or fingers may, as shown, be provided with additional means as the contracting spring 79 for yieldingly urging the fingers inwardly in contact with the plunger 33. This contracting spring 79 as shown more clearly in Figure 5, is a coil spring ring which is mounted in grooves 80 provided in the outer face of the sectors or fingers 71 intermediate the recess 72 and the lugs 73.

It will be noted that the degree of inward projection or extension of the upper portion of each cam surface 77 is greater at the upper end portion thereof than at the lower end so that as the fingers are moved upwardly relatively to the plunger 33, the ring 70 will be expanded at a relatively rapid rate during the initial relative movement of the plunger and fingers for quickly bringing the ring into contact with the peripheral wall of the cup-shaped portion of the cap after which the ring is expanded radially at a slower rate of speed whereby the pressure power of the plunger is increased upon the fingers and ring as these members approach the limit of the cap

applying movement and thereby bring the peripheral wall of the cup-shaped portion of the cap into tight contact with the wall of the recess B of the bottle with a minimum amount of pressure exerted upon the plunger.

Operation

Assuming that the capping device or head is in its normal uppermost inoperative position and that a bottle A having a pre-formed cap mounted thereon is positioned beneath the head in axial alignment therewith, then as relative axial movement of the bottle and head is produced as by moving the head downwardly, or the bottle upwardly, the bottle as it enters the opening **20**, will be first aligned with the pressure sleeve **27** and then brought into engagement with the lower end of the sleeve, that is, the curved surface **28** of the sleeve will engage the outer marginal portion of the web H of the cap as illustrated in Figure 2, thereby limiting the further downward movement of the sleeve and causing the cap to be held on the mouth of the bottle under yielding pressure by the action of the springs **40** and **44** while the plunger **33** and housing **10** are free to continue their downward movement. As the housing continues the downward movement, the coil spring ring or annulus **60** will be moved axially beyond the lower end of the sleeve **27** into engagement with the upper portion of the skirt G of the cap and thus caused to roll downwardly along the skirt to successively roll and press the skirt of the cap tightly around the bead C and neck D of the bottle under the tension of said ring and also tension of the contracting spring **62** until the coil spring ring **60** is brought to a position below or beyond the lower edge of the skirt as shown in Figure 2 when the bottle is in its innermost position relative to the housing after which the bottle may be removed from the housing, by reversing the movement of the head or the bottle.

During the relative movement of the housing and bottle away from each other, the coil spring ring or annulus **60** will again be rolled progressively over the skirt G of the cap in the reverse or an upward direction and thereby increase the effective sealing contact or engagement of the skirt of the cap with the neck and bead of the bottle. As the housing **10** and bottle are moved axially away from each other the pressure sleeve **27** will remain in contact with the cap on the bottle until the spring **60** has been returned into engagement with the sleeve out of contact with the bottle cap, whereupon the ring is maintained in engagement with the sleeve by the action of the arms **52** and rollers **56** in its expanded condition.

During the relative movement of the bottle and housing **10** toward each other, the ring **70** will be brought into the cup-shaped portion F of the cap as the cap and bottle approach the lower end of the sleeve **27** and as this relative movement of the housing and bottle toward each other is continued, the plunger **33** will be moved by the action of the spring **44** axially relatively to the fingers **71** toward the lower ends thereof into engagement with the cam surface **77** and thereby rapidly effect the outward rocking movement of said fingers or sectors and the expansion of the rubber ring **70** during the initial engagement of the plunger with the cam surfaces to effect a corresponding radial expansion of the peripheral wall of the cup-shaped portion of the cap. About the time the wall of the cap engages the peripheral wall of the bottle recess B the plunger **33** engages the lower relatively straight portion of the cam surface and the wall of the cap is expanded still further to press the same tightly against the adjacent wall of the mouth of the bottle as illustrated in Figure 2, with a relatively slow rate of speed but under increased power as the bottle and housing reach the limit of their relative movement toward each other.

If, however, the tension of the spring **44** is insufficient for any reason to effect the full expansion of the ring **70**, the more powerful spring **46** will be engaged by the cap **12** just prior to the housing **10** reaching the limit of its downward stroke and will thus be caused to exert an increased pressure upon the plunger **33** to complete the expansion of the wall of the cap. As the bottle and housing are now moved relatively away from each other, the rubber ring **70** and fingers **71** will remain in fixed relation with the cap and bottle, together with the sleeve **27** until said sleeve has reached the limit of its downward movement relative to the housing **10**. Before the sleeve **27** and fingers **71** reach their lowermost position, the plunger **33** will have been maintained against further axial movement relative to the housing **10** by the engagement of the washer **35** with the cap **12** and moved thereby upwardly relative to the fingers **71** so that before the bottle moves out of contact with the sleeve **27**, the fingers **71** and ring **70** will have moved inwardly to their normal inoperative position out of engagement with the cap thereby permitting said cap and bottle to move out of the operative relation with the sleeve **27** and ring **70** without frictional resistance from the ring.

It will be noted that when the spring **60** begins to engage the skirt of the cap, said spring will be more or less distended circumferentially, thereby opening the helixes thereof so that as these open helixes engage the skirt of the cap with a rolling motion, the spiral positions of the helixes will cause a more or less irregular rumpling and over-lapping of the skirt around and upon the bead and neck of the bottle and thereby effect a more secure attachment of the cap to the bottle without danger of tearing or cracking the skirt or mutilating or marring the surface of the skirt which is sometimes lacquered or otherwise treated in different colors to represent different grades of the contents, such as milk, of the bottle. Furthermore, it will be noted that the rolling action of the coil spring ring or of a rubber ring against these treated surfaces prevents excessive marring of the same so that the skirt of the cap retains its distinctive color.

Although I have shown and described the preferred embodiment of my invention, I do not wish to be limited to the exact construction shown as various changes both in the form and relation of the parts thereof may readily be made without departing from the spirit of the invention.

I claim:

1. In an apparatus for securing a skirted cap to the mouth of a bottle, means comprising a coil spring ring for engaging the skirt of the cap for compressing said skirt around the head of the bottle, rolling elements rotatably supporting said ring during the engagement thereof with the bottle cap, and means for yieldingly urging the rolling elements into engagement with the coil spring ring.

2. In an apparatus for securing a skirted cap to the mouth of a bottle, means comprising a coil spring ring for engaging the skirt of the cap for compressing said skirt around the head of the bottle, means rotatably supporting the coil spring

ring during the engagement thereof with the bottle cap, and spring means for yieldingly urging the coil spring ring into operative engagement with the cap.

3. A bottle cap applying mechanism comprising a resilient annulus which is circular in cross section, and means including rolling elements movable toward and from a bottle and supportably connected with the annulus for producing relative axial movement of the annulus and the bottle with the cap thereon to progressively roll a portion of the cap into tight contact with the bottle.

4. A bottle cap applying mechanism comprising a contractible and expansible annulus which is circular in cross section, means including rolling elements supportably connected with the annulus for producing relative axial movement of the annulus and a bottle with the cap thereon to progressively roll a portion of the cap into tight contact with the bottle, and means for yieldingly urging the rolling elements into engagement with the annulus.

5. A bottle cap applying mechanism comprising a contractible and expansible annulus which is circular in cross section and has a less normal interior diameter than the exterior diameter of the head and neck of the bottle, and means including rolling elements supportably connected with the annulus and movable therewith during the contraction and expansion thereof for producing relative axial movement of the annulus and a bottle with a cap thereon to progressively roll a portion of the cap axially into tight contact with the bottle.

6. In an apparatus for securing a skirted cap to the mouth of a bottle, a contractible and expansible annulus which is circular in cross section and has a less normal interior diameter than the exterior diameter of the head and neck of the bottle, means for holding the annulus expanded to an inner diameter about equal to the exterior diameter of the head of the bottle, and means including rolling elements supportably connected with the annulus and movable therewith during the expansion and contraction thereof for displacing said annulus axially from the holding means and around the skirt of the cap to progressively roll said skirt into tight contact with the head and neck of the bottle.

7. In an apparatus for securing a skirted cap to the mouth of a bottle, a contractible and expansible annulus which is circular in cross section and has a less normal interior diameter than the exterior diameter of the head and neck of the bottle, means for holding the annulus expanded to an inner diameter about equal to the exterior diameter of the head of the bottle, and means including a plurality of circumferentially disposed radially movable members and rolling elements carried by said members in supporting engagement with the annulus for displacing said annulus axially from the holding means and around the skirt of the cap to progressively roll said skirt into tight contact with the head and neck of the bottle.

8. A device as in claim 7 having means connected with the members for yieldingly maintaining the elements in engagement with the annulus during the contraction and expansion of said annulus.

9. A device as in claim 7 having spring means connected with the members for maintaining the elements in engagement with the annulus during the contraction and expansion of said annulus.

10. In an apparatus for securing a skirted cap to the mouth of a bottle, a contractible and expansible coil spring ring, and means for producing relative axial movement of the coil spring ring and a bottle with a skirted cap thereon to progressively roll the ring over the cap skirt for tightly pressing the same into contact with the head and neck of the bottle comprising radially movable members and a pair of rolling elements carried by each of said members in supporting engagement with spaced portions of the coil spring ring.

11. In an apparatus for securing a skirted cap to the mouth of a bottle, a contractible and expansible coil spring ring, means for producing relative axial movement of the coil spring ring and a bottle with a skirted cap thereon to progressively roll the ring over the cap skirt for tightly pressing the same into contact with the head and neck of the bottle comprising radially movable members, rolling elements carried by said members in supporting engagement with the coil spring ring, and spring means connected with the members for yieldingly maintaining the elements in engagement with the coil spring ring during the contraction and expansion of said ring.

12. An apparatus for securing a skirted cap to the mouth of a bottle comprising a coil spring ring having the outer peripheral surfaces of the helixes thereof substantially flat and smooth, and means including rolling elements supportably engaging said outer peripheral surfaces for progressively rolling the coil spring ring over the skirt of the cap to press the same into tight contact with the head and neck of the bottle.

13. An apparatus for securing a cup-shaped cap to the mouth of a bottle comprising an extensible and contractible annulus adapted to enter the cup-shaped portion of the cap, a pressure element movable into engagement with the cap to maintain said cap on the head of the bottle, and means supported by said element and operable independently of the cap for expanding the annulus radially with progressively decreasing rate of speed and increasing power to force the wall of the cap tightly against the peripheral wall of the mouth of the bottle.

14. An apparatus for securing a cup-shaped cap to the mouth of a bottle comprising an expansible and contractible annulus adapted to enter the cup-shaped portion of the cap, a pressure sleeve movable into engagement with the cap to maintain the same on the bottle, a plurality of radially swinging fingers journaled in said sleeve for supporting the annulus, and means engaging the fingers for expanding the annulus radially with progressively decreasing rate of speed and increasing power to force the peripheral wall of the cap tightly against the peripheral wall of the mouth of the bottle.

15. An apparatus for securing a skirted cup-shaped cap to the mouth of a bottle comprising a contractible and expansible annulus of less normal interior diameter than the exterior diameter of the head and neck of the bottle, movable holding means for releasably maintaining the annulus expanded to an inner diameter about equal to the exterior diameter of the head of the bottle, a second contractible and expansible annulus connected with the holding means to move therewith and adapted to enter the cup-shaped portion of the cap, means for producing relative axial movement of the holding means and

the first mentioned annulus for displacing said annulus axially from said holding means and around the skirt of the cap to progressively roll said skirt into tight contact with the head and neck of the bottle, and separate means actuated by said relative movement for expanding the second mentioned annulus radially to force the peripheral wall of the cup-shaped portion of the cap tightly against the peripheral wall of the mouth of the bottle.

16. An apparatus for securing a cup-shaped cap to the mouth of a bottle comprising an extensible and contractible annulus adapted to enter the cup-shaped portion of the cap, a pressure element movable into engagement with the cap to maintain said cap on the head of the bottle, annulus supporting means carried by the pressure element for movement toward and from the center of said annulus, and actuating means effective upon said engagement of the pressure element with the cap for producing movement of the supporting means to expand the annulus radially, at least one of said means having a cam surface of varying pitch whereby the annulus will be expanded with progressively decreasing rate of speed and increasing power to force the wall of the cap tightly against the peripheral wall of the mouth of the bottle.

17. An apparatus for securing a cup-shaped cap to the mouth of a bottle comprising an extensible and contractible annulus adapted to enter the cup-shaped portion of the cap, a pressure element movable into engagement with the cap to maintain said cap on the head of the bottle, a plurality of radially swinging fingers carried by the pressure element for supporting the annulus, said fingers having cam surfaces of varying pitch, and means engaging said cam surfaces for expanding the annulus radially with progressively decreasing rate of speed and increasing power to force the peripheral wall of the cap tightly against the peripheral wall of the mouth of the bottle.

18. An apparatus for securing a cup-shaped cap to the mouth of a bottle comprising an extensible and contractible annulus adapted to enter the cup-shaped portion of the cap, a pressure element movable into engagement with the outer margin only of cap to maintain said cap on the head of the bottle, a plurality of radially swinging fingers carried by the pressure element for supporting the annulus, and means effective upon said engagement of the pressure element with the cap for producing outward swinging movement of the fingers for expanding the annulus radially.

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