

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,185,988



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COMPLETE SPECIFICATION

Improvements relating to Container Closure Cap Crimping Apparatus

We, AMERICAN FLANGE & MANUFACTURING Co., INC., of 30, Rockefeller Plaza, New York, New York 10020, United States of America, a corporation organised under the laws of the State of Delaware, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for securing container closures and is particularly concerned with an improved apparatus for crimping lightweight metal closure caps on to the necks of containers.

One problem heretofore encountered in the crimping of closure caps onto containers, particularly in automated bottling operations, is the provision of effective guide means for accurately locating the bottle and loosely applied cap in properly aligned position within the crimping head. In order for the radially contracting jaws of the crimping head to encircle the skirt and form the same into sealing engagement with the underlying container neck, it is essential that the lateral positioning of the neck relative to the head be closely controlled. It has been found that in many cases due to lack of precision in the commonly used bottle feeding mechanisms and to dimensional variations in the bottles themselves, the bottle neck is not positively positioned in axial alignment with the crimping head. Frequently this misalignment condition causes the jaws to strike the top of the bottle through the unsecured cap and close on top of the cap resulting in an unsealed bottle which must be detected at some later point.

The various prior art constructions heretofore advanced attempting to carry out this positioning function in a general sense have

lacked the necessary precision. This invention seeks to provide a crimping head for the high speed capping of bottles or other containers despite the inherent dimensional variations in such containers and the relatively inaccurate positioning of bottle feeding mechanisms.

Of equal importance, in applying closure caps of the type having an outwardly extending gripping ear to facilitate removal by tearing, is the provision of means for wiping the ear down against the container neck as the cap is secured. The closer the ear is wiped down on to the container neck the less chance there is of the seal being inadvertently broken through interference with the ear during subsequent handling of the container. On the other hand, if the ear is wiped down too far and forcibly pressed against the container by the crimping head the likelihood of damaging or completely destroying the container is great. The problem then is to wipe the ear down as close as possible to the container neck during the cap applying operation without actually striking the container.

According to the invention there is provided an apparatus for securing a closure cap to a neck bordering the opening of a container, said apparatus comprising an axially movable plunger member, a plurality of circumferentially arranged segmental sealing members movable both axially and radially and operatively connected to said plunger member, actuating means surrounding said sealing members for moving said sealing members radially inwardly into a constricted position to form a sealing ring, and a member providing a downwardly and outwardly tapered continuous annular working surface adapted for coaction with a container neck and an unsecured closure cap loosely applied thereto, said working surface

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being concentric with and axially spaced from and below said sealing members during the axial and radial movements thereof.

5 An embodiment of the invention will now be described by way of an example, and with reference to the accompanying drawings; in which

10 Figure 1 is a vertical section of the cap securing head and associated workpiece showing the crimping jaws in an open or expanded position and with the guiding and wiping ring in the raised position;

15 Figure 2 is a bottom plan of the cap securing head alone taken on the line 2-2 of Figure 1 and looking in the direction of the arrows;

20 Figure 3 is a vertical elevational view of the crimping head having a portion cut away and showing the jaws in the closed or crimping position and the guiding and wiping ring in the final operative position;

25 Figure 4 is a perspective view of the guiding and wiping ring and retainer plate therefore with a section cut away to show the contour of the ring working surface; and

30 Figure 5 is an enlarged fragmentary section of the parts indicated by the circle in Figure 1.

The crimping head assembly herein shown and described is adapted for use either in conjunction with standard bottle filling lines to replace the normal crowners in the 35 crowner head casing such as manufactured by the Crown Cork and Seal Company under the trade name "Cemco" or in a hand actuated device of the type also manufactured under the "Cemco" trade name. As shown and described in more detail in our 40 copending application No. 1,079,120 (52308/65), the crimping head is carried by a hollow shaft 1 which is mounted in the standard crowner head casing. The lower 45 end of the shaft 1 is integrally and radially outwardly enlarged into an annular portion 2 having a diameter greater than the diameter of the remainder of the shaft 1. A bore 3 formed in the shaft is threaded at 50 4 to receive the threaded portion of a sleeve 5. A circumferential flange 5a around the lower end of sleeve 5 engages the lower end of the shaft 1 when the sleeve 5 is fully seated within the shaft.

55 Slideably received within the sleeve 5 is a plunger member comprising a spindle 6 having at its upper end an internally threaded bore 7 which receives the lower threaded end of a connecting member 8. A collar 9 is 60 formed about the center portion of the connecting member 8 with the upper end thereof terminating in a shank 10. A pin 11 locks the connecting member 8 and the spindle 6 together. This pin is accessible through the 65 shaft 1 and sleeve 5 by means of the pas-

sages 12 closed by the threaded plugs 13. Surrounding the shank 10 is a helical compression spring 14 extending between the collar 9 and the upper end wall 15 of the bore 3 and adapted to be compressed therebetween and to normally retain the collar 9 in contact with the inner end of sleeve 5.

The lower end of the spindle 6 is provided with an internal bore 16 extending 75 downwardly and terminating at its lower free end in a cap receiving nest 17 having a downwardly extending side wall 17a. An outwardly extending collar 18 is fitted about the wall of the spindle 6 opposite the upper part of the bore 16 being positioned 80 vertically by seating on the annular shoulder 19 formed outwardly on the spindle 6. A cap hold-down member consisting of a sleeve 20 having an upper end 21 of enlarged outside diameter is slideably received within the 85 bore 16. The lower portion of the sleeve 20 has an end wall 22 which supports on its inner surface the lower end of compression spring 23. The outer surface of the end wall 22 contacts the top of the cap 24 90 upon downward movement of the head. The upper end of spring 23 engages the upper end wall 25 of the bore 16. The sleeve 20 is slideably retained within the bore 16 by means of a pair of pins 26 which are seated 95 in bores 27 extending horizontally through the lower cylindrical wall of the spindle 6. Each of said bores 27 is so positioned that only half of its diameter extends into surface of bore 16, the other half underlies the 100 enlarged collar 21 of the sleeve 20. The pins 26 thus retain the sleeve 20 in place in the bore 16 while allowing vertical reciprocation of the sleeve.

The periphery of the collar 18 has an 105 arcuate convex contour upon which are pivotally mounted mating concave surfaces 28 formed in the upper ends of a plurality of annularly arranged sealing members or jaws 29. The jaws 29 are of identical construction and in this embodiment are twelve 110 in number spaced about the cap receiving nest 17. The number of jaws may of course be varied without departing from the scope of the invention. Each jaw has formed at its upper end a radially outwardly extending protuberance 30 which slidably contacts the inner surface of the adjacent segment 34, described hereinafter, and serves to retain 115 the upper end of the jaw in pivotal engagement with the collar 18. Each jaw at its lower end, is formed with a radially inwardly facing crimping or sealing surface 31 having a convexly curved configuration. The outer end portion of each jaw is formed with an 125 inclined cam surface 32.

A segmental closing ring or sleeve generally indicated at 33 is provided for closing the jaws 29 and their crimping surfaces 31 about the bottle finish. The ring 33 is for- 130

med of a plurality of individual arcuately shaped segments 34 of equal dimension. Six of these segments are shown, that is, each segment 34 actuates two of the jaws 29 by engaging the jaw cam surfaces 32. Here again the number of segments may be varied without departing from the scope of the invention. The upper end of each segment 34 inclines inwardly into a segmental collar portion 35 having an outwardly facing convex arcuate periphery which mates with a concave channel 37 formed into the interior surface of the enlarged annular portion 2. The segmented ring 33 is retained in mated and pivotal relationship with the concave channel 37 by the abutment of the outwardly extending flange 5a at the lower end of the sleeve 5 with the inner end surfaces of the collar portions 35. The lower end of each segment 34 is enlarged radially outwardly and provided with inwardly facing cam surfaces 38 for coaction with the cam surfaces 32 of the jaws 29. Extending radially inwardly from the interior of each segment 34 is a center, wedge shaped partition 39 and two wedge shaped side partitions 40 each being of half the width of the center partition 39, as best seen in Fig. 2. These partitions 39 and 40 provide slideways to guide the jaws 29 in their movement between the open and closed positions.

An annulus 41 of resilient material is mounted about the lower portion of the spindle 6 and has a radially outwardly extending flexible collar 42 of reduced thickness which engages the interiors of the jaws 29 and continuously resiliently urges those jaws outwardly so that the jaw cam surfaces 32 are held in contact with their mated cam surfaces 38 on the segments 34.

The segments 34 forming the ring 33 are resiliently restrained from pivotal outward movement away from the jaws 29 by means of an annular spring collar 43 which overlies and encircles the greater portion of the segments 34. The spring collar 43 has a solid upper portion 43a from which a plurality of downwardly extending resilient fingers 44 extend, as clearly seen in Fig. 3. These fingers 44 have radially inwardly extending ledges at their lower ends terminating in surfaces 46 which contact the outer surface of the segments 34 so that the fingers 44 resiliently restrain the segments 34 against excessive radial outward movement. A locking screw 45 inserted between two of the fingers 44 into a tapped hole in one of the segments 34 prevents circumferential movement of the spring collar 43. Vertical upward movement of the spring collar 43 away from the lower enlarged portion of the segments 34 is prevented by the locking collar 43b secured to the enlarged annular portion 2 by the set screw 43c. With this spring

arrangement, should one or more of the jaws 29, upon being swung radially inwardly to have its crimping surface 31 crimp in a cap skirt overlying a bottle neck, be brought to a stop by the bottle neck before the segments 34 have completed their downward travel, they would yield due to the yieldability of the fingers 44 thus allowing the segments 34 to swing outwardly enough to continue moving downwardly with no further inward movement of the underlying jaws. This yielding effect enables a uniform crimping pressure to be applied around the entire cap skirt regardless of dimensional variations which commonly occur in bottle necks. Thus the cap skirt will be tightly crimped all around the bottle while exertion of a force sufficient to break the bottle is prevented.

An annular retainer plate 47 is floatingly mounted on the lower end of the segments 34. The floating mounting is effected by a pair of elongated openings 48 provided in the plate 47 for the reception of screws 49 which are threadedly engaged with the segments 34. The elongated openings 48 open downwardly into elongated counterbores 49a to accommodate a screw adaptor 50 seated over the screws 49 and having head portions 51 loosely seated in the counterbore 49a and shanks 50 loosely seated in the opening 48 as seen in Fig. 5. A resilient washer 52 is interposed between the adaptor head 51 and the bottom of the counterbore 49a. Thus the segments 34 are permitted to shift radially relatively to the plate 47.

A combination bottle guide and gripping ear wiper generally in the form of an annulus is in turn floatingly retained within the opening in plate 47. This combination member comprises a ring 53 having a flat upper surface 54 and an under-conical working surface 55 inclining upwardly and inwardly. Four radial guiding lugs 56 having upper surfaces forming continuations of the surface 54 seat loosely in slots 57 in the upper surface of the retainer plate 47 when the crimping head is raised and the jaws 29 are in open position thus holding the ring 53 closely adjacent and in substantially radial alignment with the lowermost ends of the jaws 29 as shown in Fig. 1.

As downward movement of the crimping head commences, to effect securing of the cap 24 to the bottle finish 58, the end wall 22 of the cap hold down member is brought into contact with the cap top causing the bore 16 of the spindle 6 to move down around the sleeve 20 through compression of the spring 23. Continued downward movement of the crimping head brings the conical surface 55 of the ring 53 into radially opposed relation with respect to the bottle finish. The inner circular edge 55a

of the conical surface 55 is dimensioned to provide a minimum amount of clearance around the bottle finish 58 with the cap 24 loosely applied thereto. Unless the bottle 5 already happens to be in proper axial alignment with the cap receiving nest 17, the bottle through cap 24, will be struck by some portion of the conical surface 55. As the ring 53 descends, still located radially in the plate 47, the off-center bottle is pulled by contact with the conical surface 55 into axial alignment with the nest 17. During this movement the bottle remains in a vertically erect position due to the stabilizing effect of the spring loaded hold down member 20 which tends to hold the bottle upright. It is to be noted however that the pressure exerted by the spring 23 does not prevent the bottle from easily sliding under the hold down member end wall 22.

In the open or expanded position of the crimping jaws as seen in Fig. 1 the rounded crimping surfaces 31 extend radially inwardly of the innermost edge 55a of the conical surface 55 so that the last increment of bottle guiding is performed by the jaws themselves. The sidewall 17a of the cap receiving nest 17 is in substantially vertical alignment with the conical surface edge 55a. Thus it can be seen that the bottle and unsecured cap is accurately and positively guided into precise axial alignment with the central axis of the crimping head. Furthermore any possibility is eliminated of the jaws striking the top of the cap and thus being caused to close at this point due to the resistance offered by the underlying bottle. The ring 53 and retainer plate 47 are carried downwardly by the crimping head causing the conical surface 55 to strike the cap gripping ear 59. Continued downward movement pushes or deflects the ear down against the container wall until the cap receiving nest 17 becomes properly seated on the cap and the camming action of the segments 34 commences.

When the crimping head reaches the lowermost limit of its downward travel, the nest 17 is firmly seated on the cap 24 and the spring 14 starts to compress causing the shaft 1 and sleeve 5 to move downwardly a short distance relative to the spindle 6. The resulting downward movement of the segments 34 pivots the fingers 29 radially inwardly about the collar 18 with the surfaces 31 crimping the cap skirt in against the lower surface of the lip 58. During this camming action the plate 47 carried by the segments 34 continues to move downwardly away from the ring 53 so that the ring, now supported by the ear 59, is lifted out of the grooves 57 and held against further movement by the lower ends of the jaws 29 as seen in the crimping position of Fig. 3. During this downward movement of the seg-

ments 34 relative to the jaws 29 the ring lugs 56 ride up within the spaces between the ends of the partitions 39 and 40 which guide the ring laterally the spaces being previously occupied by the lower portions of the jaws 29 when in their open position. It is also at this point, as described above, that any variations in the bottle height or lip diameter, either one of which would vary the vertical travel of the segments relative to the jaws, are compensated for by the expandable spring collar 43 and the floating connection thereto of the retainer plate which allow the segments 34 to yield outwardly when such an overload condition occurs.

Upon completion of the crimping action the ear 59 is wiped down closely adjacent the neck of the bottle so that the capped bottle may be subsequently handled without interference with the ear. Most importantly however, in regard to the ear wiping function of the ring 53, is the accuracy with which the ear 59 is wiped down to its desired position adjacent the bottle neck. As seen in Figure 3 during the final part of the axial movement of the jaws 29 during which they press on the ring 53, the distance relationship between the conical surface 55 and the lower surface of the bottle finish 58 is always controlled since the axial movement of the ring 53 is dependent solely on the axial movement of the jaws 29 which also prevent the ring from tilting. Regardless of the amount of downward travel of the segments 34, and end plate 47, which is caused to vary by dimensional changes in both the bottle height and the lip diameter, the ear 59 is always wiped down to precisely the same position relative to the bottle finish, closely adjacent the bottle neck. To wipe the ear down, in accordance with known constructions, short of that precise position adjacent the bottle neck presents the possibility of interference with the ear and even destruction of the seal during subsequent bottle handling operations, while on the other hand, to wipe the ear down much beyond the desired position usually results in a broken bottle.

Retraction of the crimping head after completion of the crimping operation restores the respective elements to the position illustrated in Figure 1 with the jaws 34 being urged radially outwardly by the flexible collar 42 of the annulus 41.

It will be readily apparent to those skilled in the art and from a consideration of the foregoing that the cap applying apparatus of this invention substantially improves upon prior art cap crimping arrangements and greatly enhances the efficiency of such high speed capping operations.

Both of the container guiding and ear wiping functions are advantageously per-

formed by the above described crimping head of this invention in a simple and unique manner. More specifically these two functions are advantageously performed by a single element and its mounting. Furthermore the required precision has been achieved while accommodating normal variations in containers and in the equipment feeding such containers.

- 10 Thus this invention provides a new and improved apparatus for the sealing or crimping of closure caps on to bottle or other container necks, having improved guide means for positioning container necks in proper axial alignment for the crimping operation, and being adapted to apply closure caps formed with outwardly extending tearing ears and having improved means for wiping such ears against the container neck, the guiding and wiping means being one and the same, and being operative in a controlled vertically spaced relationship to the crimping jaws.

WHAT WE CLAIM IS:—

- 25 1. Apparatus for securing a closure cap to a neck bordering the opening of a container, said apparatus comprising an axially movable plunger member, a plurality of circumferentially arranged segmental sealing members movable both axially and radially and operatively connected to said plunger member, actuating means surrounding said sealing members for moving said sealing members radially inwardly into a contracted position to form a sealing ring, and a member providing a downwardly and outwardly tapered continuous annular working surface adapted for coaction with a container neck and an unsecured closure cap loosely applied thereto, said working surface being concentric with and axially spaced from and below said sealing members during the axial and radial movements thereof.
- 45 2. Apparatus according to claim 1, wherein said working surface has an internal diameter greater than the closed annulus of said sealing members whereby axial alignment of said container and cap for proper operation of said sealing members is effected.
- 50 3. Apparatus according to claim 1, wherein a downwardly open cap receiving nest is

positioned at the lower end of said plunger member said nest having a top wall and a side wall and the axis of said working surface is in substantially vertical alignment with the axis of said side wall.

4. Apparatus according to claim 1, wherein said closure cap has a radially extending gripping ear and said working surface deflects said gripping ear downwardly to a position closely adjacent said container during said axial movement.

5. Apparatus according to claim 4, wherein said working surface is formed on an annular member supported below said sealing members and adapted to be driven downwardly over said ear by direct contact by said sealing members.

6. Apparatus according to claim 1, wherein said working surface has a radially inwardly and downwardly facing conical surface formed on a ring member mounted in concentric axial alignment below said sealing means.

7. Apparatus according to claim 1, wherein said sealing members depend below said plunger member and said actuating means include an axially movable camming sleeve surrounding said sealing members and which acts on camming surfaces provided on said sealing members.

8. Apparatus according to claim 7, wherein an annular retainer plate is mounted at the lowermost end of said camming sleeve.

9. Apparatus according to claim 8, wherein said working surface is freely vertically supported on said retainer plate and vertical displacement of said plate relative to said working surface is effected by contact by said working surface with the closure cap during radial movement of said sealing members.

10. An apparatus for securing a closure cap to a neck bordering the opening of a container, substantially as hereinbefore described with reference to the accompanying drawings.

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