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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements relating to Overload Compensators for Cap Crimping Apparatus

We, AMERICAN FLANGE & MANUFACTURING Co. Inc., a Corporation organised under the laws of the State of Delaware, United States of America, of 30 Rockefeller Plaza, New York, New York 10020, 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 overload compensators for cap crimping apparatus for applying container closures and is particularly concerned with improved apparatus for crimping light-weight metal closure caps onto bottle or other receptacle necks.

In the closure cap applying field, and in particular those areas where high speed bottling operations are employed, there exists a problem of designing cap applying mechanisms that will function effectively and efficiently while accommodating a wide range of dimensional variation in the bottles to which caps are being applied. This variation is frequently manifested in a degree of oversize or ovality in the bottle neck which is then translated into an overload condition during the capping operation. If such bottle variation is not adequately compensated for during the normal operation of the cap applying mechanism there results the likelihood of either excessive bottle breakage, ineffective sealing or damage to the capping equipment.

Another problem heretofore presented by prior art cap crimping constructions particularly as employed in the beverage field has been the relative difficulty encountered in the routine cleaning and sterilization of those cap applying mechanisms coming in direct contact with the bottle or the contents thereof. Although partial disassembly prior to the actual cleaning operation would seem to offer the best protection in this regard no provision has been made in existing constructions for carry-

ing out this disassembly operation in an efficient and labour saving manner.

According to the invention there is provided an apparatus for securing a closure cap to a neck bordering the opening of a container, comprising an axially moveable mounting member, a plurality of circumferentially arranged sealing members pivotally connected to said mounting member, an axially movable segmented closing ring surrounding said sealing members for urging said sealing members radially inwardly into a contracted position forming a closed sealing annulus, an overload compensating spring including a cylindrical band of non-metallic resiliently deformable material surrounding said closing ring for yieldably limiting the force exerted by said closing ring on said sealing members, and a rigid cylindrical metal shroud completely surrounding said cylindrical band forming a positive stop for said deformable band.

Several problems are sought to be solved by the improved cap crimping apparatus of this invention embodying a plurality of annularly arranged crimping jaws which are pivotally mounted for radial contraction into a closed sealing annulus. Surrounding the jaws is a cylindrical overload spring formed of yieldable synthetic plastics material. This new and improved spring makes it possible to effect a tight seal despite the normal range of bottle finish dimensional variation encountered. Moreover the construction of this invention has proven to excel over constructions previously employed in that it is capable of compensating for such bottle variations in high speed bottling operations of sustained duration. The problem of sterilization has been alleviated by the provision of a quick acting snap lock connection as herein disclosed which enables easy removal of an annular retaining plate mounted at the lower end of the crimping head. This partial disassembly of the apparatus exposes the individual crimping jaws and other parts

[Price 5s. 0d.]

of the mechanism for thorough sterilization. This problem has become particularly acute in the brewing industry where the recent trend toward unpasteurized beer has necessitated more thorough and more frequent sterilization of bottling equipment.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawing, in which:—

Figure 1 is a vertical section of the cap crimping head showing the jaws in open or relaxed position above an unsealed bottle and cap;

Figure 2 is a sectional view of the cap crimping head taken on lines 2—2 of Figure 1 and looking in the direction of the arrows;

Figure 3 is a vertical elevational view of the crimping head with a portion cut away for clarity and showing the jaws in closed crimping position;

Figure 3a is an enlarged fragmentary view of the parts indicated by the circle in Figure 3;

Figure 4 is an elevational view of the quick release snap lock wire spring; and

Figure 5 is a bottom plan view of the crimping head with the jaws in open or relaxed position.

The crimping head of the invention is generally indicated by the numeral 1 and is detachably secured to a work imparting shaft 2. The shaft 2 is provided with an axially extending bore 3 having an internally threaded lower portion 4 terminating in a lowermost end 5 provided with an annular step as seen in Figure 1.

The crimping head 1 comprises an externally threaded bushing 6 having a radial flange 7 surrounding the lower end thereof. An annular, internally threaded collar 8 is threadedly engaged about the bushing 6 and seated against the bushing flange 7. The collar 8 is locked to the bushing 6 by means of a set screw 9. The uppermost end 10 of the collar 8 is provided with a circumferential recess for mating engagement with the lowermost end 5 of the shaft 2 upon threaded engagement of the bushing 6 within the internally threaded shaft portion 4. The bushing 6 is locked in the shaft 2 by the set screw 11.

Slideably received within the bushing 6 is closure cap-engaging spindle 12 having an internally threaded bore 13 at its upper end which receives the lower threaded end 14 of a locking stud 15. An annular flange 16 is formed about the centre portion of the locking stud 15. A pin 17 locks the stud 15 and the spindle 12 together and is accessible through openings 18 in the bushing 6 upon detachment of the crimping head 1 from the shaft 2. Surrounding the upper portion of stud 15 is a helical, work-performing compression spring 19 extending between the flange 16 and the upper end wall of the shaft bore 3 and adapted to be compressed therebetween so as to urge

the stud flange 16 against the upper end of the bushing 6.

The lower portion of the spindle 12 is provided with an axially extending internal bore 20 terminating at its lowermost end in a cap receiving nest 21. A radially outwardly extending supporting collar 22 is fitted about the spindle 12 adjacent the bore 20. A cap hold down member 23 consisting of a hollow tubular member closed at its lower end, is slideably received within the spindle bore 20 and retained therewithin by a pair of tangentially disposed roll pins 24. A lightweight helical compression spring 25 extending between the closed lower end of the tubular hold down member 23 and the upper end of the spindle bore 20, resiliently urges the hold down member to a downwardly extended position.

The peripheral surface of the supporting collar 22 has an arcuate convex contour upon which a plurality of annularly arranged sealing jaws 26 is pivotally supported, each jaw having a corresponding contoured pivot surface 27 adjacent its upper end. The jaws 26 are of identical construction and, in the illustrated embodiment, are twelve in number spaced about the cap receiving nest 21. Each jaw has a radially outwardly extending protuberance 28 adjacent its upper end which slideably contacts the inner surface of an overlying segment 29, described hereinafter, and serves to retain the upper end of the jaw in pivotal engagement with the collar 22. A radially inwardly facing crimping surface 30 is formed at the lower end of each jaw. The outer end portion of each jaw is formed with an inclined cam surface 31.

A segmented closing ring is provided for closing the jaws 26 and their crimping surfaces 30 about the cap skirt. As seen in Figure 2 this ring is made up of six segments 29, that is, each segment actuates two of the underlying jaws 26 by engaging the cam surfaces 31. The upper end of each segment 29 inclines inwardly into a pivot formation 32 which mates with a pivot seat 33 formed in the lower end of the collar 8. The pivot formation 32 is retained against movement away from the pivot seat 33 by the outer surface of the bushing flange 7. The inner surface of the lower end of each segment 29 is tapered outwardly in the axial direction so as to provide an inwardly facing cam surface 34 for coaction with the jaw cam surfaces 31.

An annulus 35 of resilient material is mounted about the lower portion of spindle 12 having a radially outwardly extending flexible flange which engages the inner surfaces of the jaws 26 and resiliently urges the jaws outwardly so that the jaw cam surfaces 31 are held in contact with the cam surfaces 34 on the segments 29.

A cylindrical overload compensating spring 36 surrounds the segments 29 and limits their radial outward movement when the crimping

jaws 26 are in open position and yieldably limits the extent of radial inward movement of the jaws towards closed sealing position. The spring 36 is a cylindrical band of resilient yieldable material. In actual practice the use of a urethane synthetic plastics material has been found to perform quite well due to its low compressibility characteristic and also its very high abrasion resistant quality. The spring 36 is encased by a cylindrical metal shroud 37. Vertical upward movement of the component spring 36 and shroud 37 is prevented by the locking band 38 secured to the collar 8 by set screw 39.

An annular bottom retainer plate 40 is floatingly mounted at the lower end of the closing ring by means of two threaded studs 41 which extend up into two of the closing ring segments 29. Each stud has a circumferential groove 42 adjacent the outer end thereof. The plate 40 has a pair of diametrically opposed holes 43 each surrounding a stud 41 and having a slightly greater diameter than the studs 41. This arrangement allows the two segments 29 retaining the studs 41 to shift radially relative to the plate 40 under the influence of the compensator spring 36. The plate 40 is detachably secured to the studs 41 by means of a snap action wire locking spring 44. As clearly seen in Figure 4 the wire spring 44 in its relaxed condition, is slightly curved and terminates at either end in a closed eye 45. Adjacent either end is a radially inwardly formed loop 46 which as seen in Figure 5 engages within the stud grooves 42 when the spring is flexed and snapped in place. An annular combination bottle guide and gripping ear wiper member 47 is in turn floatingly retained within the central opening in plate 40 by means of four radial supporting lugs 48 which nest within the retainer plate 40 below the jaws 26.

In operation the crimping head 1 is lowered by the work imparting shaft 2 with respect to a bottle 50 which has loosely seated thereon a light-weight metal tear-off cap 60 comprising a disc-like top 61 surrounded by a smooth depending cylindrical skirt 62 having a gripping ear 63 extending downwardly and radially outwardly from the lower free edge thereof. The cap hold down member 23 bears against the cap top 61 with the spring 25 being compressed until the cap nest 21 presses the cap against the underlying bottle lip and the anvils 30 surround the cap skirt 62. Continued downward movement of the segments 29 relative to jaws 26, cams the anvils 30 radially inwardly due to the interaction of the camming surfaces 34 and 31, crimping the cap skirt 62 into tight sealing engagement with the underlying bottle neck. It is at this point that the overload compensating spring 36 becomes effective. If the particular bottle being capped is slightly oversize or there is an ovality condition in the bottle lip, one or more of the

jaws 26 must yield in its radial inward travel. The resistance to inward radial jaw movement offered by the bottle variation creates an overload condition which is compensated for by one or more of the camming segments 29 pivoting radially outwardly about its pivot formation 32 instead of the corresponding underlying jaws 26 pivoting inwardly as would normally be the case. In so doing the portion of the cylindrical compensator spring 36 lying outside the yielding segment is squeezed against the metal shroud 37 and, as seen in Figure 3a, is caused to bulge out at 36a below the lower edge of the shroud. The cap skirt will thus be pressed in tightly against the bottle neck all the way around with no gaps or varying degrees of pressure but exertion of a force sufficient to break the bottle is prevented. Moreover the yielding action of the spring 36 can be exerted repeatedly for an indefinite duration without the occurrence of stress fatigue or other failure. Upward movement of the crimping head 1 and work imparting shaft 2 restores the parts to their initial relaxed position.

Partial disassembly of the crimping head 1 through removal of the bottom retainer plate 40 and the guide member 47 to facilitate cleaning and sterilization of the crimping mechanism is quickly and easily carried out by simply squeezing together the ends 45 of the snap lock wire spring 44 and disengaging the spring from the studs 41. After the cleaning operation has been performed the parts are easily replaced in the same manner.

WHAT WE CLAIM IS:—

1. An apparatus for securing a closure cap to a neck bordering the opening of a container, comprising an axially movable mounting member, a plurality of circumferentially arranged sealing members pivotally connected to said mounting member, an axially movable segmented closing ring surrounding said sealing members for urging said sealing members radially inwardly into a contracted position forming a closed sealing annulus, an overload compensating spring including a cylindrical band of non-metallic resiliently deformable material surrounding said closing ring for yieldably limiting the force exerted by said closing ring on said sealing members and a rigid cylindrical metal shroud completely surrounding said cylindrical band, forming a positive stop for said deformable band.

2. Apparatus according to Claim 1, wherein said sealing members are vertically elongated and pivotally connected at their upper ends to said mounting member so as to depend therebelow.

3. Apparatus according to Claim 1 or Claim 2, wherein said non-metallic resiliently deformable material is urethane synthetic plastics.

4. Apparatus according to any one of Claims 1 to 3, comprising an annular bottom

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jaws 26 are in open position and yieldably limits the extent of radial inward movement of the jaws towards closed sealing position. The spring 36 is a cylindrical band of resilient yieldable material. In actual practice the use of a urethane synthetic plastics material has been found to perform quite well due to its low compressibility characteristic and also its very high abrasion resistant quality. The spring 36 is encased by a cylindrical metal shroud 37. Vertical upward movement of the component spring 36 and shroud 37 is prevented by the locking band 38 secured to the collar 8 by set screw 39.

An annular bottom retainer plate 40 is floatingly mounted at the lower end of the closing ring by means of two threaded studs 41 which extend up into two of the closing ring segments 29. Each stud has a circumferential groove 42 adjacent the outer end thereof. The plate 40 has a pair of diametrically opposed holes 43 each surrounding a stud 41 and having a slightly greater diameter than the studs 41. This arrangement allows the two segments 29 retaining the studs 41 to shift radially relative to the plate 40 under the influence of the compensator spring 36. The plate 40 is detachably secured to the studs 41 by means of a snap action wire locking spring 44. As clearly seen in Figure 4 the wire spring 44 in its relaxed condition, is slightly curved and terminates at either end in a closed eye 45. Adjacent either end is a radially inwardly formed loop 46 which as seen in Figure 5 engages within the stud grooves 42 when the spring is flexed and snapped in place. An annular combination bottle guide and gripping ear wiper member 47 is in turn floatingly retained within the central opening in plate 40 by means of four radial supporting lugs 48 which nest within the retainer plate 40 below the jaws 26.

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2. Apparatus according to Claim 1, wherein said sealing members are vertically elongated and pivotally connected at their upper ends to said mounting member so as to depend therebelow.

3. Apparatus according to Claim 1 or Claim 2, wherein said non-metallic resiliently deformable material is urethane synthetic plastics.

4. Apparatus according to any one of Claims 1 to 3, comprising an annular bottom



plate floatingly mounted on said closing ring and a quick release connection between said bottom plate and said closing ring to facilitate partial disassembly of said apparatus for cleaning.

5. Apparatus according to Claim 4, wherein said quick release connection includes a unitary snap action wire locking spring.
6. 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.

JENSEN & SON,
Agents for the Applicants,
8, Fulwood Place,
High Holborn, London, W.C.1,
Chartered Patent Agents.

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