

April 25, 1961

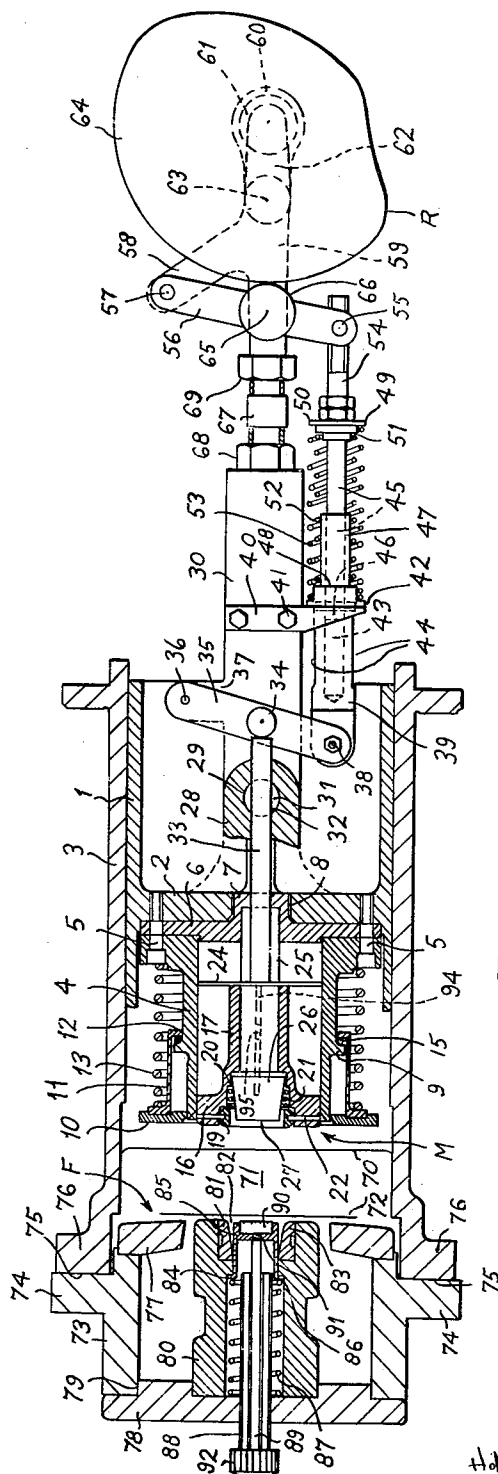
G. E. FORD ET AL

2,981,161

BOTTLE CAP FORMING APPARATUS

Filed Jan. 23, 1958

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

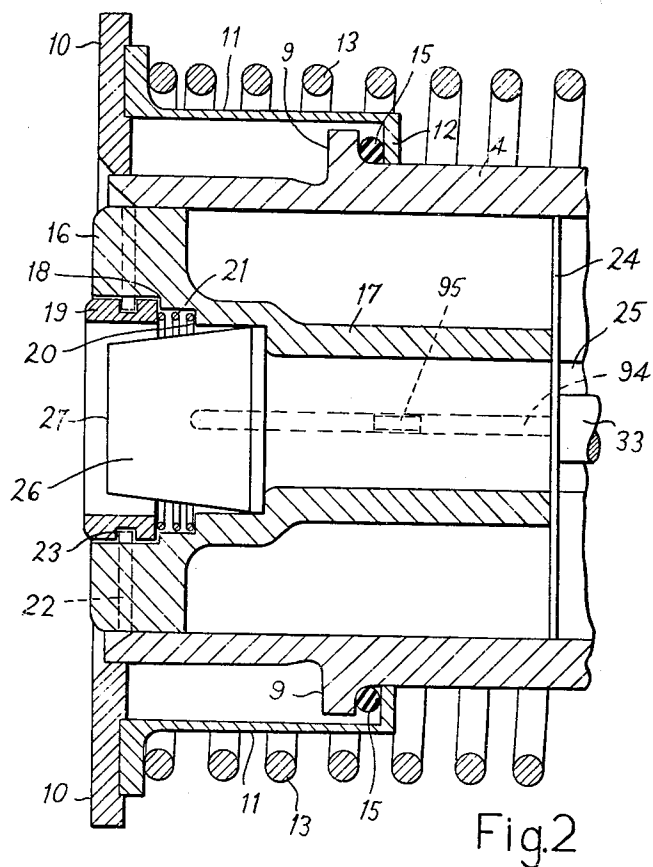


Fig. 2

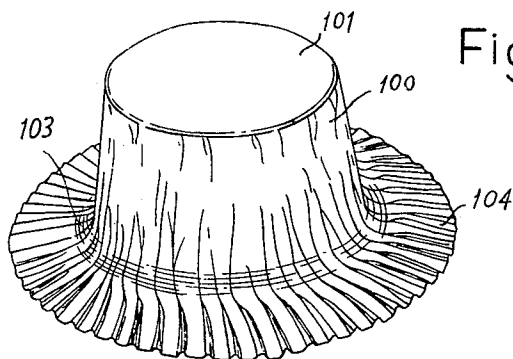


Fig. 5

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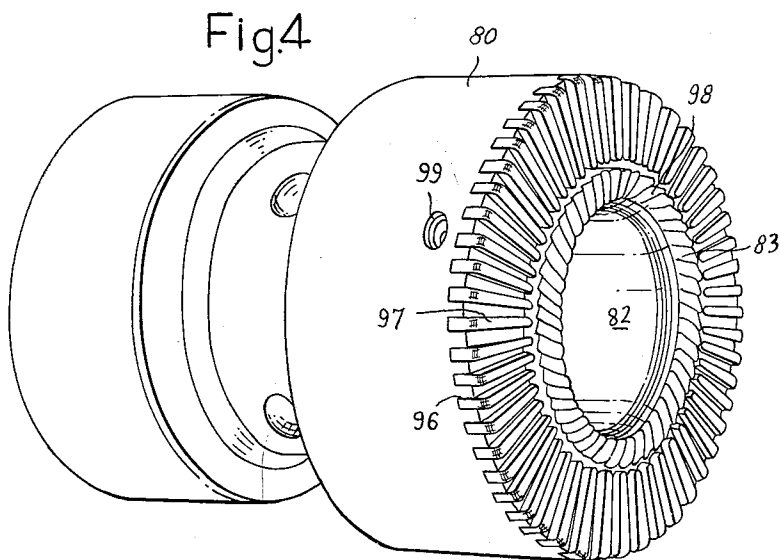
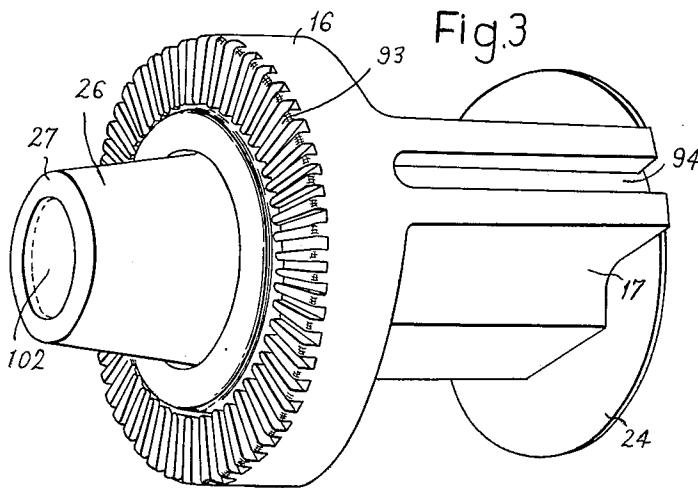
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BOTTLE CAP FORMING APPARATUS

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Claims priority, application Great Britain Jan. 24, 1957

8 Claims. (Cl. 93—1.3)

The present invention relates to apparatus for forming crimped or pleated metal foil caps for bottles or the like, said caps having a substantially cylindrical but slightly tapering portion closed at one end and a flange projecting radially outwards from the other end thereof. More particularly the invention relates to apparatus for forming caps according to co-pending application No. 654,156, filed April 22, 1957 by Geoffrey Ewart Ford for "Bottle Caps."

To form caps of this kind it is appropriate to use a pair of opposable crimping tools of similar diameter and of annular form, and to arrange a plunger member to pass through the common centre of the two annuli so as to draw the material of a blank into the substantially cylindrical but slightly tapering portion which is closed at one end. The coadjacent faces of the crimping tools are complementarily ribbed and grooved and the outer surface of the plunger also may be provided with longitudinal ribs and grooves whereby as a result of the cap-forming operation a cap having the above-mentioned characteristics will be produced, the flange at least being pleated or fluted. The cap somewhat resembles a top-hat, the substantially cylindrical but slightly tapering portion representing the crown and the flange representing the brim.

According to the invention there is provided apparatus for forming a crimped or pleated metal foil cap or capsule for bottles or the like and having a generally cylindrical portion slightly tapering towards one closed end and a flange projecting radially outwards from the other, open, end thereof, from a circular disc blanked from a strip of foil, comprising male and female tools including former bodies which are of similar diameter and of an annular shape, between which said blank is fed, means for effecting relative movement between the said male and female former bodies under crimping pressure, means for moving a forming plunger through the aperture of the annulus of the female body so as to form a cap of the kind referred to, means for releasing the pressure between said former bodies, means for separating the two bodies, means for retaining the formed cap on one of the bodies and means for ejecting the formed cap after complete separation of the tools.

Preferably the formed cap is retained over the said plunger which is part of the male tools and is passed through the male former body into the female former body.

Preferably means are provided to change the crimping pressure between the male and female tools throughout the forming cycle, and in a specific embodiment, the crimping pressure is initially at a maximum when the male and female former bodies fully meet.

As mentioned above, the caps or capsules have a generally cylindrical portion that tapers slightly towards one end which is closed by a flat top portion and a flange projecting radially outwards from the other, open, end, and advantageously the cap or capsule is radiused at the transition portion between the generally cylindrical por-

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tion and the projecting flange. The projecting flange is, and also the tapering cylindrical portion may be, crimped or pleated during formation. The caps or capsules in use are placed over the cork or other stopper of a bottle or like container and the projecting flange is folded or smoothed down upon the neck thereof. The advantage of forming the cap or capsule with a projecting flange as compared with the conventional long cylindrical form is that the new caps or capsules can be handled much more easily after formation and can be the more easily delivered from a forming station to a capping station of a complete forming and capping machine or, alternatively, can be readily stored in nested condition prior to use.

The press tools may be and preferably are such as to make the crimps or pleats lie flat at the radiused transition portion between the generally cylindrical portion and the projecting flange. This predisposes the crimps of pleats to lie down more easily when the cap or capsule is folded or flattened against the bottle. As a result the finished cap or capsule after sealing to the bottle is substantially improved in appearance.

In accordance with a further feature of the invention, therefore, the crimp or pleat-forming ribs of the female tool do not extend in a single straight line from the outer periphery towards the centre thereof but each rib is divided into two parts, an outer part running radially towards the centre and an inner part which is slanted at an angle to the outer part, but generally in the same plane. Preferably also the inner part is shallower than the outer part and may be given a twist: the inner part acts as a plough to turn over and flatten the formed crimp or pleat at the zone of the radiused transition portion.

Moreover, the aperture of the annulus of the female tool and the exterior of the male plunger may be smooth or substantially smooth.

According to a feature of the invention the outer rib parts are formed on a separate outer member that is securable to the body of the female tool the working face of which is formed with the said inner rib parts, the inner and outer parts being aligned before the said separate member is secured to the body.

Advantageously the outer rib parts are formed by separate fins or the like housed in parallel-sided slots cut or otherwise provided in the said separate outer member on its working face, said slots and fins extending radially towards the centre of the tool. The ribs on the male forming tool, which are positioned to engage between the ribs of the female tool when the tools are mutually advanced to crimp or pleat the projecting flange of the cap or capsule, may also consist of radially-extending wedge-shaped fins of a length commensurate with the lengths of the fins forming the outer rib parts of the female tool. Between the male ribs and the male plunger, on which the part containing the male ribs slides, there is a spring-loaded ejector ring which prevents the crimps or pleats on the formed cap or capsule sticking to the ribs on the tools.

In order that the invention may be more clearly understood reference will now be made to the accompanying drawings which show one specific embodiment thereof by way of example and in which:

Figure 1 shows a plan view of the male and female tool assemblies with their drive means, most of the parts being shown in section;

Figure 2 shows a detail from Figure 1 of the male ejector ring mechanism and associate parts and to a larger scale;

Figure 3 shows a perspective view of the male former member and plunger,

Figure 4 shows a perspective view of the female former plunger, and

Figure 5 shows a perspective view of a cap of the kind that the tools according to the invention can manufacture.

In order to render the construction and operation of the tools clear, the following description is divided into sections for ease of reference.

Male tool set

The male tool set, generally indicated at M in Figure 1 is carried by a cylindrical carrier member 1 which is hollow and has a disc-like transverse wall 2. The carrier member 1 is reciprocable within a sleeve 3 in which it is a good fit. The sleeve 3 is secured to an appropriate fixed part of the machine but this has not been shown so as to reduce complications on the drawings. Carried by the disc 2 is an annular blanking punch 4 secured to the disc by means of bolts 5 so that movement of the carrier 1 positively moves the punch 4. Between the punch 4 and the disc 2 there is provided a locating ring 6 which has a boss 7 passing through an aperture 8 in the disc 2. At a point about midway along the length of the punch 4 there is a radial projection 9 which forms a forward stop for a stripper ring assembly that is in two parts comprising the stripper ring 10 at the front and the retaining sleeve 11 at the rear: the parts 10 and 11 are secured together and the sleeve 11 has a rear flange 12 that engages behind the radial projection 9. The stripper ring assembly is reciprocable along the punch 4 and a compression spring 13 is interposed between the rear face of the part 11 and a shoulder 14 formed on the punch 4 as shown. The projection 9 and the rear flange 12 together form a limit stop to limit the forward movement of the stripper ring assembly and between the said projection 9 and flange 12 there is provided a cushioning ring 15 made, for example, from rubber or other compressible material.

Within the annular punch 4 there is located a former body 16 having a shank 17 the said body being recessed at 18 to carry a male ejector member 19 and at 20 to locate a compression spring 21. (See detail in Figure 2.) The ejector ring 19 is held in position by means of dowels 22 which pass through the former body 7 and into a groove 23 in the ejector ring. The forward limit of movement of the ejector ring is therefore controlled by the dowels 22 in the groove 23 and the ejector may move longitudinally within the recess 18 against the pressure of the spring 21. The ejector ring 19 normally projects slightly forward of the face of the former body 16. At the rear end of the shank 17 there is provided a backing plate 24 which has a central aperture through which passes a shank 25 of a male forming plunger whose head 26 tapers inwards towards the leading face 27. The conical portion of the head 26 may be ribbed or plain as desired. The drawings show the head plain. The shank 25 is secured within the boss 7 in any desired fashion.

Secured to the rear face of the transverse disc 2 is a boss 28 apertured at 29 to form the small end of a piston rod 30 for movement of the tools as will be described later. The gudgeon pin 31 connecting the rod 30 to the boss 28 has two transverse passages 32 one on each side of the boss 28 to allow the passage of two push rods 33 one above the boss and the other below it. Figure 1 shows only the upper push rod. The forward ends of the push rods 33 engage the backing plate 24 and the rear ends are engaged by pressure rollers 34 pivotally mounted each on a link 35. The two links are pivoted at 36 one above and one below an extension 37 from the piston rod 30 so that movement of the links 35 about the pivot 36 will cause longitudinal movement of the push rods 33 and thereby the former body 16. The other ends of the links 35 are pivoted above and below respectively at 38 to a sleeve 39 whose rear end is

located in a bracket 40 secured to the piston rod 30 by means of bolts 41. The bracket 40 carries at its rear face a stop ring 42 which acts as a bearing guide for the sleeve 39. The sleeve 39 has a bore 43 and lateral longitudinal slots 44. Within the bore 43 there is reciprocable an operating rod 45 carrying near its forward end a lateral projecting pin 46 passing into the slots 44 whereby rearward movement of the operating rod 45 is limited by the stop ring 42. The rear end of the sleeve 39 is reduced in diameter to form a shank 47 and a shoulder 48. The rear end of the operating rod 45 is provided with a collar 49 having two stops 50 and 51. Between the shoulder 48 and the stop 51 is provided a first compression spring 52 and between the rear face of the ring 42 and the stop 50 there is provided a second compression spring 53.

The operating rod 45 has a rearward extension 54 and pivoted to this rear extension at 55 is a cam-following link 56 which is pivoted at 57 to an extension 58 of a journal rod 59 terminating at its rear end in a journal 60 located around a pin 61 on an eccentric 62 secured to a main operating shaft 63 in the machine. Also mounted on the pin 61 is a cam 64 and pivoted at 65 to the cam-following link 56 is a cam-following roller 66 which is advantageously in the form of a ball-bearing race. The spring 53 applies the cam follower 65 to the surface of the cam 64 so that the latter are in engagement at all material times.

The journal rod 59 is connected to the piston rod 30 by means of a stud 67 and nuts 68, 69, the said stud being provided at its two ends with threads of different sense, i.e. lefthand and righthand threads respectively whereby the position of the stroke of the piston rod can be adjusted as desired by rotation of stud 67 in accordance with conventional practice.

The tubular sleeve 3 terminates at a leading edge at 70 to form a gap 71 through which metal foil 72 is passed to form capsules between the male tool set M just described and the female tool set generally indicated at F.

Female tool set

The female tool set comprises a die housing 73 having a projecting radial flange 74 which is secured to a forward shoulder 75 on lateral extensions 76 from the sleeve 3 in any convenient manner, for example by means of bolts (not shown). The die housing 73 carries a blanking die 77 and a centralizing plate 78. The blanking die 77 and the plate 78 are secured to the housing 73 in any convenient manner and the centralizing plate registers in the die housing by means of the shoulder 79. Secured to the centralizing plate 78 there is a female former 80 having an inner member 81 at its forward edge. The inner member 81 is secured to the former 80 and has a bore 82 to receive the male forming plunger head 26. The female former tool is thus also of annular form similarly to the male former. The leading edge of the inner member 81 is rounded at 83 and the bore 82 tapers inwards rearwardly as shown to conform to the conical shape of the head 26 of the male forming plunger.

Rearwardly of the inner member 81 the female former 80 has an inwardly-projecting radial shoulder 84 to carry a cylindrical ejector 85 which has at its rear end a radially outward projection 86 to engage behind the shoulder 84. Thus the member 85 is limited in its forward travel i.e. towards the foil, by engagement of the parts 84 and 86 and can move longitudinally under pressure against the spring 87 whose rear end abuts against the inner face of the centralizing plate 78. Also passing through the centralizing plate 78 is a guide rod 88 which carries an embossing pad rod 89 the forward end of which is screwed into an embossing pad 90 whose leading face can carry any desired configuration to emboss the top of the cap when formed. The rod 89 screws into the pad 90 passing through an aperture in a transverse wall

91 of the ejector 85. Thus the embossing pad 90 may easily be replaced by unscrewing rod 89 by turning milled knob 92.

Configuration of the tool sets

Referring to Figures 3 and 4 which respectively show the male and female forming tools, the former body 16 is of annular form and the working face is milled to provide a series of wedge-shaped flutes or ribs 93 which extend radially towards the centre of the tool. The shank 17 of the male tool is provided with longitudinal slots 94 forming keyways in which slide keys 95 (see Figure 1) to prevent rotation of the male tool member when forming the caps or capsules. The female forming tool, which is also of annular form, has a series of slots 96 cut into the face thereof, for example by milling, the said slots radiating towards the centre of the tool. In these slots there are located parallel-sided ribs 97 which form outer rib parts. The inner rib parts 98 which are formed on the inner member 83, are not colinear with the outer rib parts 97 but are slanted with respect thereto although they are substantially in the same plane. The inner rib parts 98 are formed for example by milling in the working face of the inner part 83 and extend to the lip of the bore 82 and they may be given a slight twist as shown whereby the crimps or pleats formed in the cap when the tools are advanced together are turned over and flattened in the reduced transition portion between the generally cylindrical but tapering portion and the radially-extending flange of the cap or capsule. The inner rib parts 98 therefore act like a plough to turn over the pleats in this area. The outer member 80 may be secured to the inner member 83 by screws or the like passing through the threaded apertures 99 after the part 80 has been placed over the part 83 and the inner and outer rib parts 97 and 98 brought into alignment.

The inside face of the bore 82 of the female tool and the outer face or head of the male plunger at 26 may be smooth or substantially smooth as shown in the drawings which will allow the upper or crown part of the formed cap or capsule to be substantially smooth, the material of the cap or capsule being folded up on the crown or upper part 100 as shown in Figure 5 during formation. The flat top portion of the cap or the capsule at 101 will be embossed by the embossing pad 90 and to assist in the embossing action, a recess is preferably formed in the end 27 of the male plunger as shown in Figure 3, to accommodate a rubber pad 102.

Figure 5 also clearly shows how the crimps or pleats are turned or ploughed over at the radiused transition portion 103 between the generally cylindrical portion or crown 100 of the projecting flange or brim 104. The regular nature of the crimps or pleats in the flange can also clearly be seen from Figure 5 which figure is, in fact, in line representation taken directly from a photograph of a cap or capsule made by tools similar to those shown, but Figure 5 is not to exactly the same scale as Figures 3 and 4.

It will be understood that various modifications may be made to the tool sets to give caps or capsules having shapes differing in detail but nevertheless conforming to the general pattern of an upper slightly conical crown portion and a radially projecting flange or brim portion.

Operation of the tools

When the machine is set up care must be taken to ensure that the male and female tool sets are in correct relationship so that the ribs 93 on the male tool are in register with the spaces between the ribs 97 of the female tool.

Referring now to Figure 1, the male tool set M is advanced upon rotation of the main drive shaft 63 which can be rotated in any desired fashion not forming part of the present invention, but would generally be effected by means of an electric motor drive of conventional form. Since such drive arrangements are well-known in the art

it has not been thought necessary to illustrate them here. Rotation of the said shaft 63 will cause the link 62 to rotate to move about shaft 63 thereby moving the journal rod 59 to reciprocate the piston rod 30 and thus the punch carrier 1. In due course the slightly-projecting ejector ring 18 will touch the foil 72 and apply it against the female tool set F whereupon the ejector ring will move back to compress spring 21 whereby the foil 72 will be held in position. It will be appreciated that, as well-known in the art, the foil 72 is intermittently moved and no axial drive is imparted thereto during the whole formation of a cap or capsule. Further movement forward of the piston rod 30 will cause the punch 4 to press the foil 72 against the blanking die 77 thus to blank out a disc of foil during which time the former body 16 presses the foil 72 against the female former 80 and is slightly retracted causing the spring 52 to compress very slightly. The stripper ring 10 is also moved back by contact with die 77, to compress spring 13.

The tool carrier 1 continues to move towards the female tool set (i.e. to the left of Figure 1), and hence the pivot 36 on the piston rod 30 also moves towards the left. The male former body 16 cannot move appreciably to the left because it is in contact with the female former body 80. It follows from this that the push rods 33 and the pressure roller 34 are also stationary. Since the pivot 36 is moving to the left, the opposite end of the link 35, which carries the pivot 38 and the sleeve 39, must be moving to the right. This movement compresses spring 52 against stop 51, which latter is positioned by the cam 64 and its associated following roller 66 and link 56. Further rotation of the driving shaft 63 causes further forward movement (movement to the left in Figure 1) of the piston rod 30 and thus of the male plunger 26, whereby the plunger 26 presses against the embossing pad 90 and commences to draw the foil into the bore 82 of the female former body. During this drawing operation, the male and female former bodies, 16 and 80 respectively, are pressed in firm contact with each other by the pressure exerted by the spring 52. It is possible, by giving the cam 64 the appropriate shape, to make the pressure between the male and female formers vary in whatever manner is desired during the drawing operation of the cap or capsule. It is desirable to apply a much greater force when the complete disc of foil is between the former bodies than when the area of foil between the formers has diminished substantially, as it does during the drawing operation. Continued rotation of the shaft 63 will eventually cause the male plunger 26 to move into maximum penetration within the female former body. At this point the rubber pad 102, located in the recess of the plunger 26, is pressed into contact with the embossing pad 90 which is carried by the ejector 85.

Further rotation of the shaft 63 will cause the press tools to open. At the point where the male tool changes its direction, it is necessary to remove all the spring pressure between the male and female former bodies 16 and 80. This is achieved by shaping the cam 64 so that the spring stop 51 is moved rapidly to the right, thus the tool opens with the formed cap or capsule held in contact with the male plunger 26 by means of the ejector 85 and spring 87. As the tools open, the former body 16 moves to the right of Figure 1 within the punch 4 towards the disc 2 so that the forward face of the former body is behind the leading edge of the punch 4. When the male tool set is clear of the female, a rise R on the cam 64 causes the link 56 and spring stop 51 to move towards the left, which causes spring pressure to be re-applied to the sleeve 39 and hence to the push rods which are in contact with the backing plate 24 of the male former body 16. This spring pressure causes the male former body 16 to recover its original position and, in so doing, to eject the capsule from the plunger 26. If there is any tendency for the capsule to stick in the flutes or ribs 93 of the male former 16, the capsule is ejected from this

former by the ejector ring 19. The ejected capsule will fall downwards, to be collected in any desired fashion. The tools are then in the same position as shown in Figure 1 and are ready to commence a further cycle.

Thus, during the formation of a cap or capsule, the tool contact pressure can be initially very high and this pressure is gradually decreased to substantially zero at the end of the formation. The characteristics of the material may make it desirable to vary the pressure between the tools in some other manner. For example, it might be preferable to start with a low pressure between the tools, to increase this gradually to a maximum and then to rapidly decrease to substantially zero at the end of the formation. Thus the crimping pressure between the tools is changed throughout the forming cycle of the cap or capsule.

We claim:

1. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for preventing forward movement of said plunger beyond a point where an appreciable portion of said disc is still remaining between said annular former bodies, to form a brim extending radially outwards from said conical centre portion, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

2. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for preventing forward movement of said plunger beyond a point where an appreciable portion of said disc is still remaining between said annular former bodies, to form a brim extending radially outwards from said conical centre portion, means for changing the crimping pressure between said male and female tools throughout the forming cycle, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on said plunger, and means for ejecting the formed cap after complete separation of said male and female tools.

3. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to

the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for preventing forward movement of said plunger beyond a point where an appreciable portion of said disc is still remaining between said annular former bodies, to form a brim extending radially outwards from said conical centre portion, means for applying maximum crimping pressure to said blank when said former bodies fully meet, means for decreasing said crimping pressure when said former bodies commence to separate, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

4. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer parts of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, a spring-loaded ejector ring carried by said forming plunger, push rods connected to said plunger, mechanism in operative contact with said push rods for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for preventing forward movement of said plunger beyond a point where an appreciable portion of said disc is still remaining between said annular former bodies, to form a brim extending radially outwards from said conical centre portion, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

5. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for preventing forward movement of said plunger beyond a point where an appreciable portion of said disc is still remaining between said annular former bodies, to form a brim extending radially outwards from said conical centre portion, a spring-loaded ejector plunger, means for reciprocating said spring-loaded ejector plunger into said female former body annulus, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

6. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including

former bodies of similar diameter and of annular shape radial ribs on the face of said female former body, each of said ribs being in two parts, an outer part running radially towards the centre of the face of said female body and an inner part slanted at an angle to said outer part, but generally in the same plane, complementarily located grooves in the face of said male former body, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

7. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including former bodies of similar diameter and of annular shape, said female former body comprising an outer part and an inner part, radial ribs on the face of said outer part, radial ribs on the face of said inner part, said radial ribs on said inner part being slanted at an angle to said ribs on said outer part but generally in the same plane, complementarily located grooves in the face of said male former body, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for releasing the pressure

between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

8. Apparatus for forming a pleated metal foil cap for a bottle from a circular disc blanked from a strip of metal foil, comprising male and female tools including complementarily ribbed and grooved former bodies of similar diameter and of annular shape, said female former body comprising an outer part and an inner part, radial fins located in to project from radial slots in the face of said outer part, radial ribs on the face of said inner part, said radial ribs on said inner part being slanted at an angle to said fins on said outer part but generally in the same plane, complementarily located grooves in the face of said male former body, means for holding said blank between said former bodies, means for effecting relative movement between said male and female former bodies under crimping pressure to form radial pleats in the outer part of said blank corresponding to the said ribs and grooves on said former bodies, a forming plunger, means for moving said forming plunger through the annulus of the female former body when said former bodies are closed together for drawing the centre portion of said blank into a central conical shape, means for releasing the pressure between said former bodies, means for separating said former bodies, means for retaining the formed cap on one of said former bodies, and means for ejecting the formed cap after complete separation of said male and female tools.

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