

[54] **APPARATUS FOR AND METHOD OF DIE FORMING AND PERFORATING PILFER-PROOF BAND OF CLOSURE CAPS**

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 [51] Int. Cl. **B21d 51/00**
 [58] Field of Search.... **113/1 D, 121 A, 15 R, 15 A; 83/695; 72/348, 324; 220/48; 215/42**

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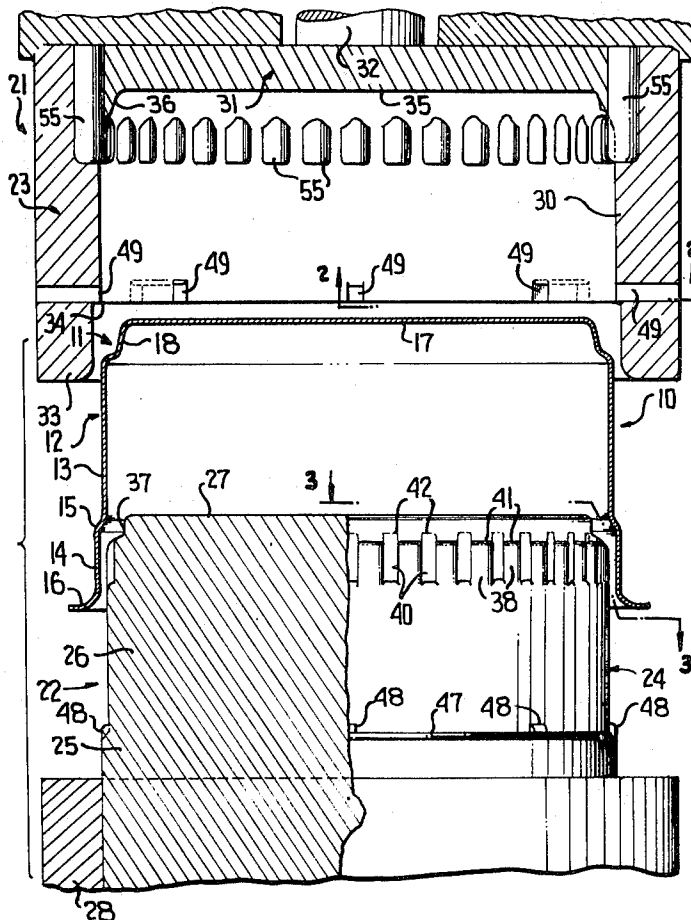
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[57] **ABSTRACT**

This disclosure relates to a closure cap having a pilfer-proof band wherein the closure cap is formed entirely by a die punching operation, including the perforation thereof to define the pilfer-proof band. The cap is initially die formed with an intermediate shoulder formed in the skirt, after which in a simultaneous operation the upper portion of the cap body is provided with knurling and the lower portion of the cap body or skirt is sheared through the shoulder to define a circumferential line of perforation interrupted by connecting tabs. The shoulder formation is such that when severed, reinforcing curls are provided on opposite sides of the perforation. Another feature of the die is that the knurling is effected by cooperating projections on the die with certain of the projections being in the form of pins.

7 Claims, 8 Drawing Figures



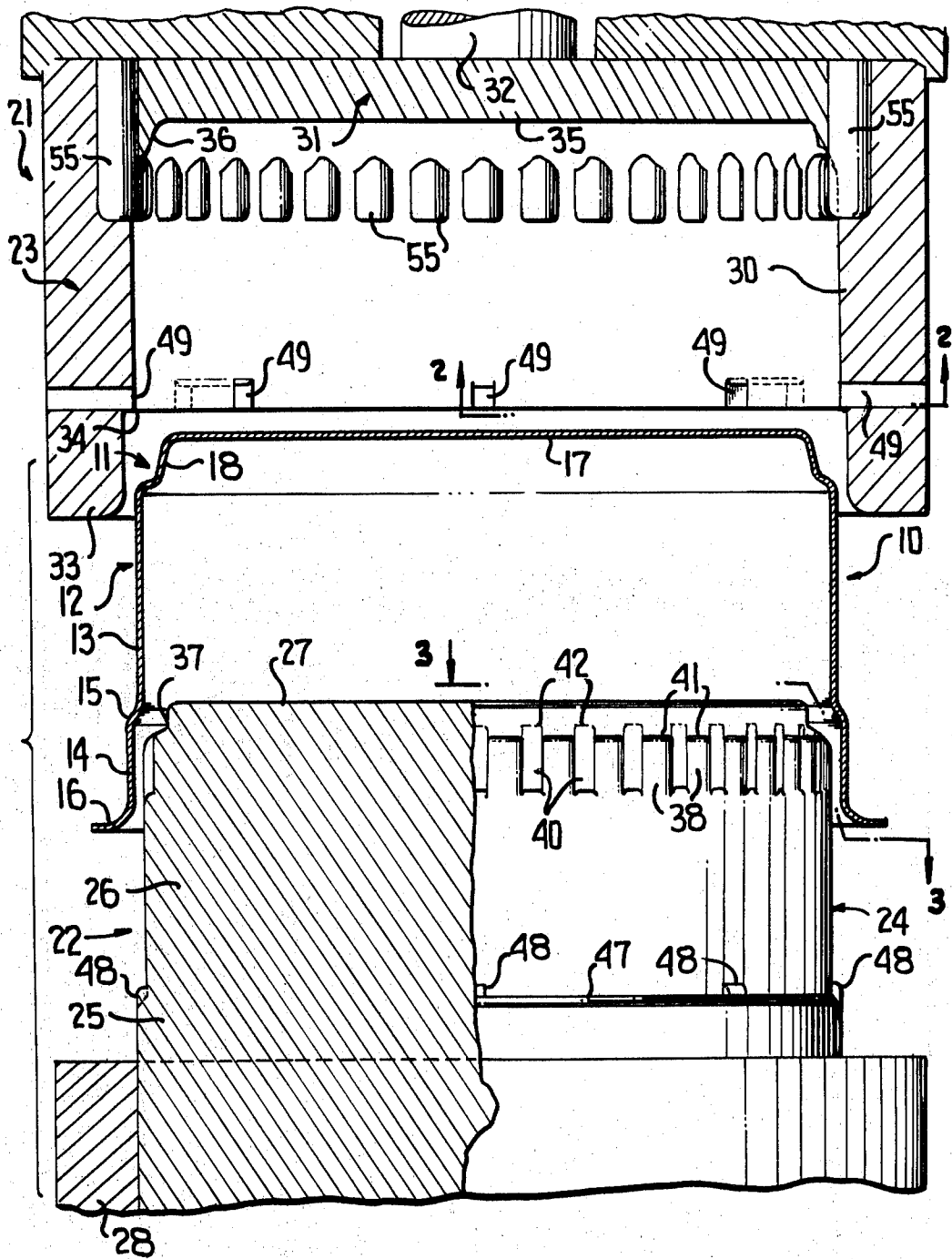


FIG. 1

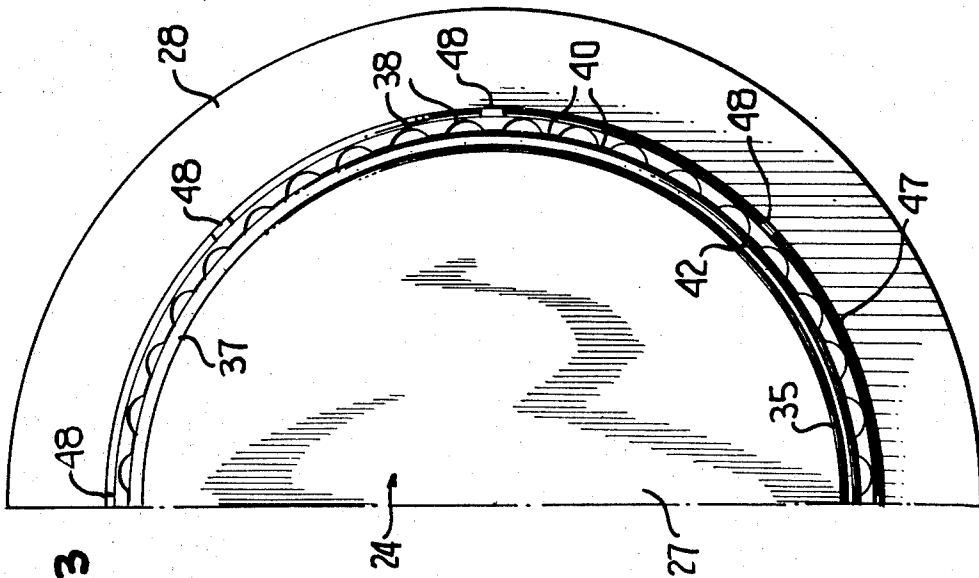


FIG. 3

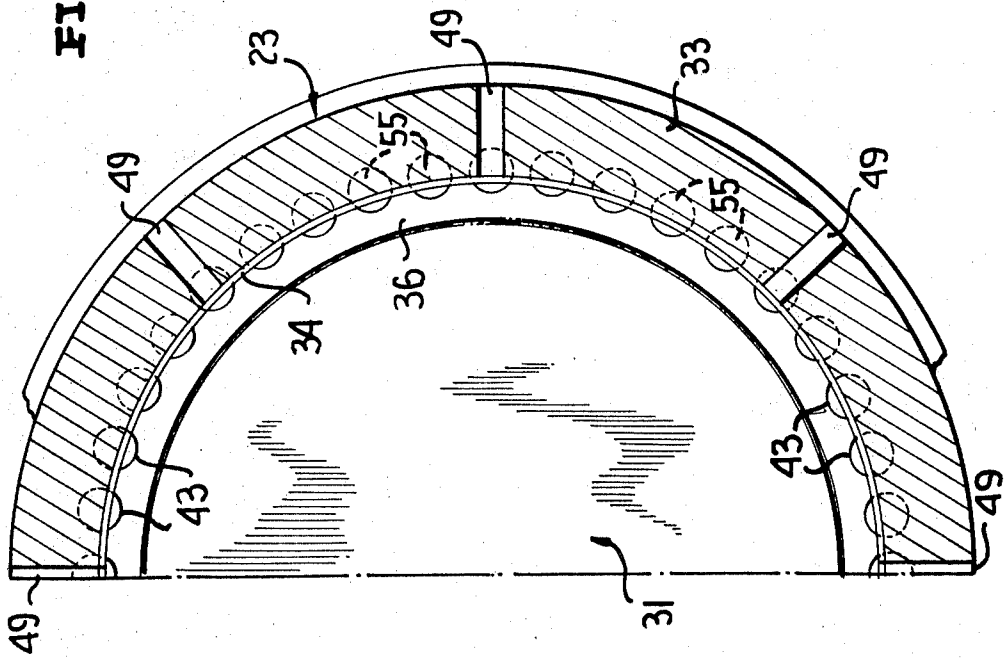
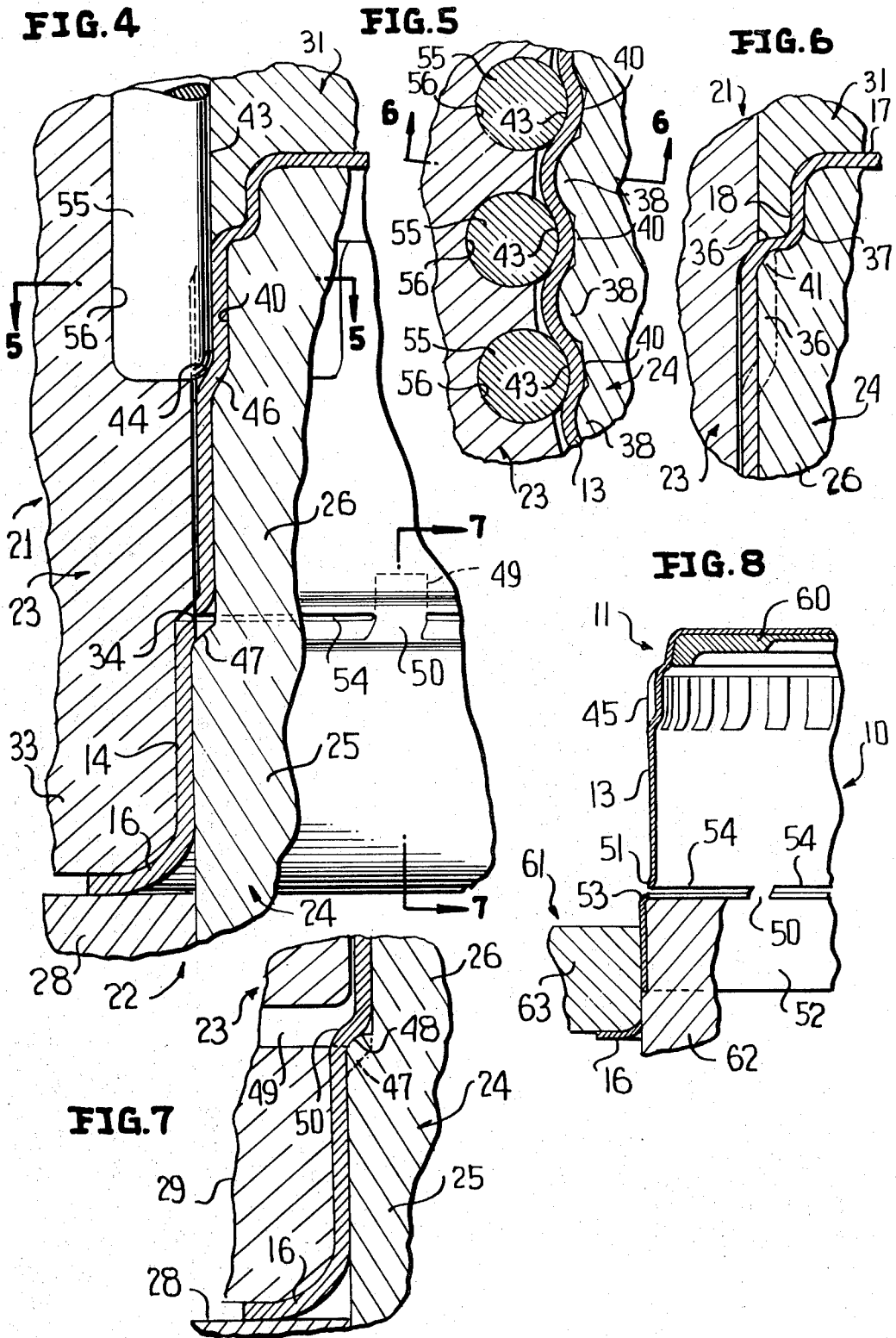


FIG. 2



APPARATUS FOR AND METHOD OF DIE FORMING AND PERFORATING PILFER-PROOF BAND OF CLOSURE CAPS

This application is a division of my copending application Ser. No. 148,604, filed June 1, 1971, now U.S. Pat. No. 3,746,202.

This invention relates in general to new and useful improvements in containers, and more particularly to closure caps of the type having pilfer-proof bands, an apparatus for and method of making same.

BACKGROUND OF THE INVENTION

It is well known to provide closure caps, each having a pilfer-proof band integrally connected to the lower edge of the skirt thereof by frangible tabs and wherein in the application of such closure cap to a bottle, the pilfer-proof band is interlocked with the bottle neck and the connecting tabs must be broken in order to unthread the closure cap from the bottle.

The pilfer-proof band is formed as an extension of the skirt of the closure cap and is separated therefrom except for the connecting tabs by perforating the skirt of the closure cap. This is normally accomplished in a rolling operation which requires rotation of either the closure cap or the perforating die.

The closure caps are also normally provided with a roughened peripheral configuration, normally in the form of knurling, in order to facilitate the turning thereof. This knurling is normally also performed by rotating the closure cap and requires separate tooling from that utilized in perforating the closure cap to form the pilfer-proof band.

It is also well known that closure caps are formed from flat sheet blank material by a series of punch and die operations. These punch and die operations, of necessity, require different mechanism from that which has heretofore been utilized in the knurling and perforating of the closure cap.

SUMMARY OF THE INVENTION

In accordance with this invention, it is proposed to provide a punch and die assembly which is capable of simultaneously forming in a single compound operation both the desired knurling and perforation of a closure cap.

In accordance with this invention, it is proposed that compound, reciprocating punch and die sets be provided for effecting the perforation and knurling of closure caps wherein the die sets may be incorporated with other die sets utilized in blanking and forming the closure caps so that closure caps may be formed in a series of simultaneously acting punching operations.

In accordance with this invention, in the formation of a closure cap, the closure cap is provided with an elongated skirt with the lower portion of the skirt being set off by an outwardly sloping shoulder. Thereafter, during the punching sequence, the die sets formed in accordance with this invention will function to engage and sever the shoulder except for a plurality of narrow circumferentially spaced portions, and thereafter move the partially severed skirt portion or pilfer-proof band axially with respect to the remainder of the closure cap so as to provide a spacing between the two except for the remaining unperforated areas which are in the form of connecting tabs.

Another feature of this invention is that the shoulder formation is such that when it is severed intermediate its edges, the lower edge of the skirt of the closure cap and the upper edge of the pilfer-proof band have reinforcing flanges or curls.

The closure cap, having already been shaped before arriving at the perforating and knurling die station, may be simultaneously knurled and perforated. Accordingly, the die sets provided in accordance with this invention have formed in the upper part thereof suitable means for effecting the knurling of the upper portion of the closure cap in a punching operation, which punching operation is performed simultaneously with the perforating operation.

A particular feature of the perforating and knurling die sets is that the punch of the upper die set is provided with projections which cause radial inwardly directed indentations in the closure cap, and these projections are formed as hardened pins which are readily insertable and replaceable in the punch.

The net result of the compound perforating and knurling punch and die sets includes a novel method of perforating and knurling closure caps and a novel closure cap which is of a reinforced construction.

With the above and other objects that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

IN THE DRAWINGS:

FIG. 1 is an exploded elevational view taken through the die sets with parts broken away and shown in section and with a preformed closure cap in position to be operated on by the die sets.

FIG. 2 is a fragmentary bottom plan view of the upper die set taken along the line 2—2 of FIG. 1 and shows further the details thereof.

FIG. 3 is a plan view of the lower die set taken along the line 3—3 of FIG. 1 and shows further the details thereof.

FIG. 4 is a fragmentary vertical sectional view taken through the die sets in its fully telescoped position and shows the same at the conclusion of the knurling and perforating action thereof.

FIG. 5 is a fragmentary horizontal sectional view taken along the line 5—5 of FIG. 4 and shows specifically the details of the knurling operation.

FIG. 6 is a fragmentary vertical sectional view taken along the line 6—6 of FIG. 5 and shows the specific supporting of the closure cap in the knurling area during the knurling operation.

FIG. 7 is a fragmentary vertical sectional view taken along the line 7—7 of FIG. 4 and shows the manner in which the closure cap is supported in the area of the connecting tabs during the perforating operation.

FIG. 8 is a fragmentary sectional view taken through another die set showing the closure cap being trimmed as a final step in the formation of the closure cap.

Referring now to the drawings in detail, it will be seen that there is illustrated in FIG. 1 a partially formed closure cap in accordance with this invention, the closure cap being generally identified by the numeral 10. The closure cap 10 includes an end wall portion 11 and a body portion 12. The body portion 12 is cylindrical and is in the form of a skirt of which a major part is identified by the numeral 13. The body portion 12 includes

a skirt extension 14 which is connected to the body part 13 by an outwardly offset shoulder 15 which is generally S-shaped in cross section. The skirt extension 14 has integrally connected to the lower edge thereof an outwardly directed flange 16.

The end wall portion 11 includes an end panel 17 and a generally stepped portion 18 which is integrally connected to the body portion 12.

It is to be understood that the closure cap 10, as illustrated in FIG. 1, is only partially formed. It is further to be understood that the closure cap 10 is formed from a flat blank by a series of punching operations by other die sets which may be mounted within a single punch press and simultaneously actuated.

In accordance with this invention, further operations are performed on the closure cap 10, as illustrated in FIG. 1, by compound, reciprocating punch and die sets which include an upper die set 21 and a lower die set 22. The die set 21 includes a punch 23 while the die set 22 includes a cooperating die center 24. The punch 23 is suitably connected to the ram of a punch press and the die center 24 is suitably mounted on the punch press platen.

The die center 24 is particularly configured to provide adequate support for the closure cap 10 during both the knurling and perforating operation which is performed by the die sets 21 and 22. The die center 24 includes a base portion 25 which is of a configuration to be snugly received within the skirt extension 14.

A central part of the die center 24 is identified by the numeral 26 and is of a configuration to support the lower part of the skirt extension 13 during the combined knurling and perforating operation. The upper part of the die center 24 is configured to cooperate with the punch 23 in the perforating step and will be described in more detail hereinafter. The die center 24 terminates in a top wall 27 which is engaged by the underside of the end panel 17 and serves to axially position the closure member 10.

The lower die set 22 also includes a draw ring 28 which is telescoped over the die center 24 and is mounted for floating movement relative thereto in a conventional manner for cooperation with the punch 23.

The punch 23 is of a generally cylindrical configuration and includes a cylindrical body portion 30 and has telescoped in the upper portion thereof a knock out 31 which is suitably separately supported by a rod 32. The body portion 30 is of an internal diameter to be freely passed over in closely adjacent relation the skirt portion 13 of the closure cap 10. The body portion 30 terminates in a lower portion 33 of an increased internal diameter and internally configured to cooperate with the die center 24 in shaping the skirt extension 14. The increased internal diameter of the lower portion 29 results in the body portion 30 having a sharp annular corner which functions as an annular shearing edge 34.

The underside of the knock out 31 terminates in a lower surface 35 which opposes the top wall surface 27 of the die center 24 and in cooperation therewith supports the end panel 17 of the closure cap 10. The knock out 31 also has an inner generally frusto-conical surface 36 extending radially outwardly and downwardly from the undersurface 35 for engaging and supporting the stepped wall portion 18 of the closure cap 10.

With particular reference to FIGS. 4, 5 and 6, it will be seen that the upper portions of the punch 23 and the

die center 24 are configured so as to knurl the upper portion of the body part 13 as the punch 23 axially telescopes over the die center 24. In order to properly support the stepped end wall portion 18 of the closure cap, the upper part of the die center 24 is of a stepped configuration as at 37. Below this portion of the die center 24 and above the central part 26 of the die center 24, the upper part of the die center 24 is circumferentially recessed and is in the form of a plurality of circumferentially spaced projections 38 and recesses 40, as is best shown in FIG. 5. The projections 38 are part cylindrical in configuration and terminate in upper corners 41 which are opposed to the surface 36 of the knock out 31 and cooperate therewith to support the lower part of the stepped end wall portion 18 of the closure cap.

Those parts of the die center 24 which define the recesses 40 extend up above the corners 41 and are disposed radially inwardly of the corners 41 in the form of corners 42 which also cooperate with the surface 36 of the knock out 31 to support the stepped end wall portion 18 of the closure cap. This is clearly shown in FIGS. 4 and 6.

It will be readily apparent from the foregoing that the die center 24 is configured to permit the radially inwardly directed deformation of the upper part of the closure cap 10, including portions of the stepped end wall portion 18 in order to effect the knurling of the upper part of the closure cap. In order to effect the knurling by an endwise relative movement of the punch 23 and the die center 24, as is best shown in FIGS. 1, 2 and 5, the punch 23 is provided with internal circumferentially spaced projections 43 which are part circular in cross section. Each one of these projections 43 terminates in a lower rounded corner 44, as is best shown in FIG. 4. As is best shown in FIG. 5, each projection 43 is radially aligned with a recess 40 in the die center 24.

It will be readily apparent from FIGS. 4, 5 and 6 that during the initial telescoping of the punch 23 over the die center 24, there is no further forming of the partially formed closure cap 10, as illustrated in FIG. 1. However, after the body portion 30 has telescoped over the body part 13 of the closure cap 10 sufficiently to cooperate with the central part 26 of the center 24 to support the upper part of the body part 13 of the closure cap against radial outward deformation, the rounded lower ends 44 of the projections 43 come into contact with the peripherally outer parts of the stepped side wall portion 18 and effect an initial inward and downward deflection thereof at circumferentially spaced points. As the punch 23 and the die center 24 continue to telescope, the projections 43 progressively force the metal of the upper portion of the closure cap into the recesses 40 in the manner shown in FIG. 5. At the same time, the metal of the closure cap is drawn about the projections 38 with the end result being that the upper part of the closure cap 10, in transverse section, is of a sinisoidal configuration or is knurled. The knurling of the closure cap 10 is illustrated in FIG. 8 and is identified by the numeral 45.

It is also to be noted from FIG. 4 that the bottom of each recess 40 is defined by a downwardly and outwardly sloping shoulder 46 which cooperates with the rounded lower end of each projection 43 to provide for a smooth transition of the knurling 45 back into the cy-

lindrical body part 13 of the closure cap 10, as is best illustrated in FIGS. 4 and 8.

It is to be understood that prior to the completion of the knurling operation, perforation of the lower part of the closure cap 10 is initiated in a manner to be described hereinafter. The knurling operation is completed simultaneously with the completion of the perforating operation.

With particular reference to FIGS. 4 and 7, it will be seen that the central part 26 of the die center 24 merges into the base portion 25 thereof by a generally conical shoulder 47. The shoulder 47 is located below the shoulder 15 of the closure cap 10 when the closure cap 10 has the end panel 17 thereof fully seated on the top wall 27 of the die center 24.

At a number of circumferentially spaced points, the die center 24 is provided with rounded seats 48 which project up from the shoulder 47 and are of a configuration and location to engage and support the shoulder 15. The seats 48 are narrow in circumferential extent.

With particular reference to FIG. 4, it will be seen that when the punch 23 approaches a position of almost complete telescoping with respect to the die center 24, the shear edge 34 thereof engages the shoulder 15 of the closure cap 10 supported on the die center 24 with the shear edge 34 engaging the shoulder 15 generally at the midpoint thereof. At this time it is also pointed out that the shoulder 15 is of a configuration so that the skirt extension 14 is disposed radially outwardly of the body part 13 a distance which is slightly greater than the thickness of the metal forming the closure cap 10. It will be readily apparent from FIG. 4 that the shear edge 34, as it moves downwardly with respect to the shoulder 15 with the upper portion of the closure cap 10 being restrained against downward movement by the die center 24, shears the shoulder 15 in half. As the shoulder 15 of the closure cap 10 is sheared in half, the skirt extension 14 and the lower half of the shoulder 15 are moved downwardly by the punch 23. During this movement, the skirt extension 14 is supported by the flange 16 which is seated on the draw ring 28 which moves downwardly therewith. The lower half of the shoulder 15 finally seats on the shoulder 47 of the die center 24.

It is to be understood that the shearing of the shoulder 15 by the shear edge 34 is not circumferentially complete, but is interrupted at intervals. As is shown in FIG. 7, the undersurface of the body portion 30 is interrupted by radially extending slots 49 which are aligned with the seats 48. Thus, in the areas of the seats 48 the shear edge 34 is interrupted and the shoulder 15 is not severed. However, as the skirt extension 14 is moved downwardly by the punch 23 after the interrupted severing of the shoulder 15 occurs, there will be a stretching of the unruptured portions of the shoulder 15 in a generally axial direction. The metal remaining along the shoulder 15 will be in the form of integral connecting tabs which are identified by the numeral 50 in FIGS. 4, 7 and 8.

It will be readily apparent that the action of the punch 23 is more than a severing action inasmuch as the punch 23 moves the severed material axially downwardly. Thus, the function of the die set is more than merely a severing operation, but is in a true sense of the word a perforating operation.

It is to be noted that in the shearing of the shoulder 15 of the closure cap 10, the configuration of the sev-

ered halves of the shoulder remain with the result that in the final closure cap, as is best illustrated in FIGS. 4 and 8, between the tabs 50 the lower edge of the body part 13 is reinforced by an outwardly directed flange 51 and the upper edge of the pilfer-proof band, which is identified by the numeral 52, is reinforced by an inwardly directed flange 53. The flanges 51 and 53 oppose each other on opposite sides of the associated perforation 54 and the flange 53 and the adjacent portion of the band 52 serves to protect the raw edge of the flange 51 until the closure cap is removed from an associated container.

Referring once again to FIGS. 1 through 5, it will be seen that the projections 43 are not integrally formed with the punch 23, but are in the form of separately formed pins 55. Each pin 55 is seated in a bore 56 formed in the die punch 23. By separately forming the pins 55, which are the components of the die set 21 subject to wear, the pins 55 may be formed of a hardened material so as to be long lasting. Also, it is feasible to removably retain the pins 55 within their respective bores 56 in any desired manner.

After the formation of the closure cap has been completed, the end wall portion 11 of the closure cap is provided with a suitable lining 60 in any desired manner. Thereafter, the closure cap 10 is subjected to a trimming die set 61 which includes a die center 62 of a configuration to support the pilfer-proof band 52, and a trimming member 63 which is of a size to closely surround the pilfer-proof band 52 and support the same while cooperating edge portions of the die center 62 and the trimming member 63 shear off the flange 16, as is best shown in FIG. 8.

It will be readily apparent that by providing suitable tooling of the punch and die type which will effect the formation of the necessary knurling and cut the necessary perforation to define the pilfer-proof band, the manufacturer of the closure caps may be accomplished by much simpler tooling all of the same type. The die sets which are specifically disclosed herein may be incorporated in a punch press with similar types of die sets for the progressive blanking, drawing, knurl formation and perforating.

Although only a preferred embodiment of the invention has been specifically illustrated and described herein, it is to be understood that minor variations may be made in the apparatus, method and closure cap formed therewith without departing from the spirit and scope of the invention, as defined by the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A die forming apparatus for perforating a closure cap skirt and forming thereon an integral pilfer-proof band, said die forming apparatus including a first die member for receiving and internally supporting a closure cap having an end panel and an outwardly enlarged lower skirt portion connected to the remainder of the closure cap by a single thickness peripheral shoulder, said first die member being of a configuration to be received within a closure cap in close fitting relation with respect to both the enlarged skirt portion and the remainder thereof with the end panel seated thereon, and a second die member having means for shearing a closure cap through the shoulder thereof

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along peripherally elongated and spaced areas upon relative endwise movement of said die members.

2. The die forming apparatus of claim 1 wherein the relative movement of said die members is such that said second die member is removable beyond the point of shoulder shearing for axially separating sheared but interconnected shoulder sections.

3. The die forming apparatus of claim 2 wherein said first die member has means for supporting and reshaping severed but still connected lower portions of a closure cap shoulder after the severing and axial displacement thereof.

4. The die forming apparatus of claim 1 wherein said first die member has peripherally spaced support means for engaging and supporting a closure cap shoulder during the shearing thereof, said shearing means being interrupted in radial alignment with said support means.

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5. A method of forming a pilfer-proof band on a closure cap comprising the steps of forming a closure cap having an axially elongated skirt of which a lower portion is of an increased diameter and is connected to the remainder of said skirt by a single thickness shoulder, internally supporting said closure cap, and then in a single simultaneous step shearing said shoulder along peripherally elongated and spaced areas whereby said lower skirt portion becomes a pilfer-proof band secured to the remainder of said closure cap by peripherally spaced tabs.

6. The method of claim 5 wherein said lower skirt portion is axially displaced and said severed shoulder portions are axially displaced.

7. The method of claim 6 wherein said tabs are axially elongated during the displacement of said lower skirt portion.

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