

Feb. 13, 1945.

R. E. SLATER

2,369,260

TUBE DRAWING APPARATUS

Filed March 7, 1944

3 Sheets-Sheet 1

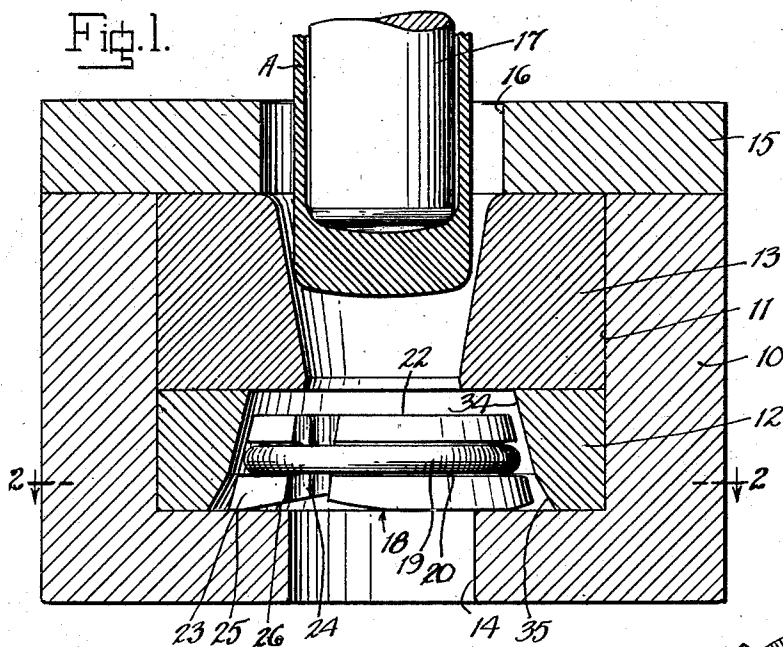
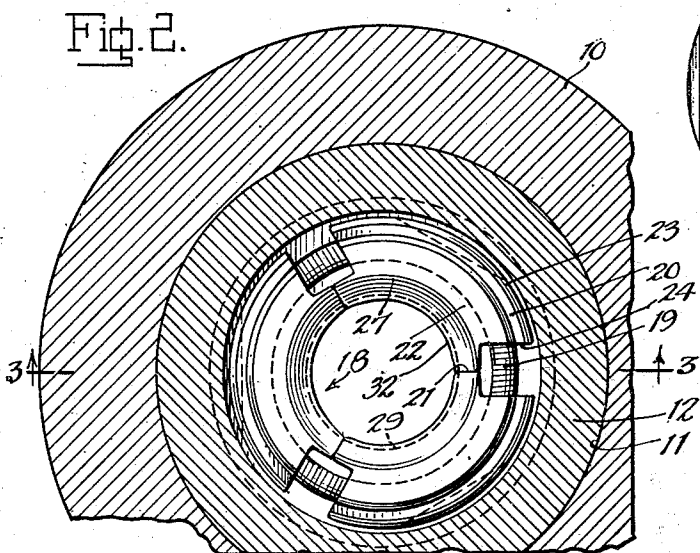
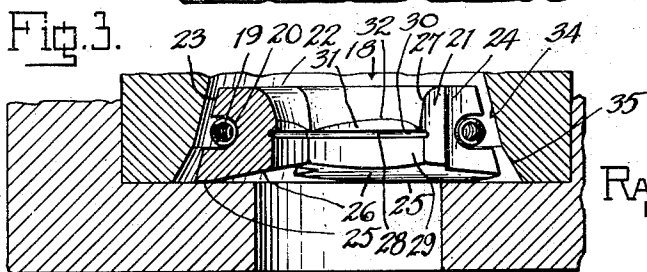
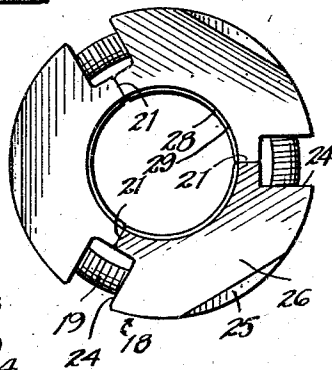


Fig. 4.



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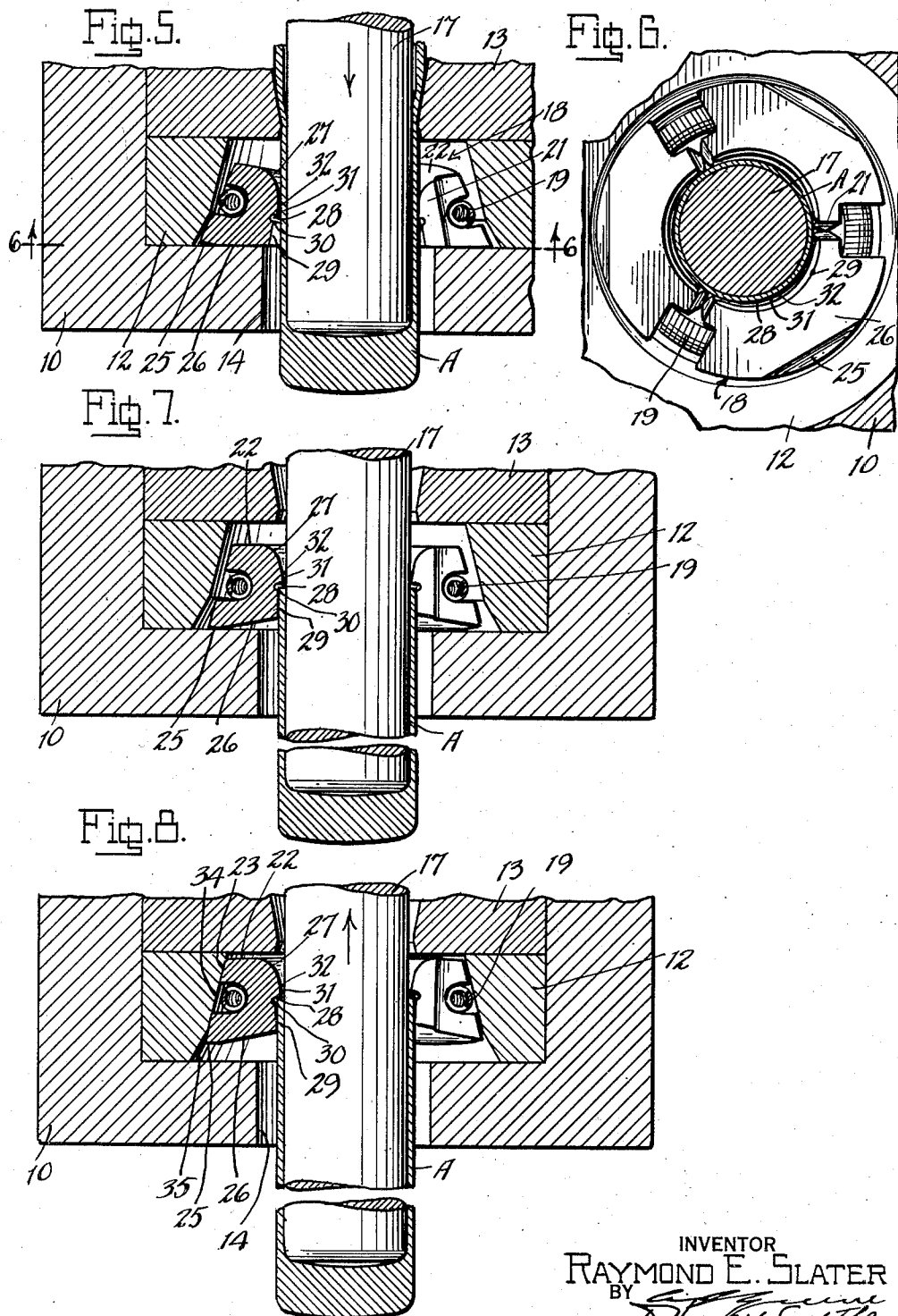
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3 Sheets-Sheet 2



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TUBE DRAWING APPARATUS

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3 Sheets-Sheet 3

Fig. 9.

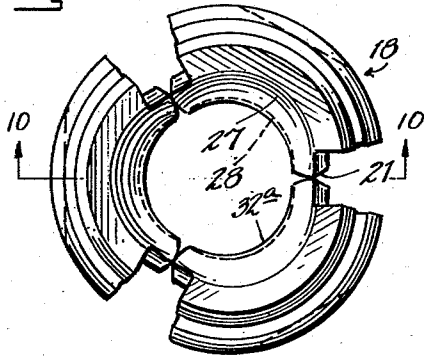


Fig. 11.

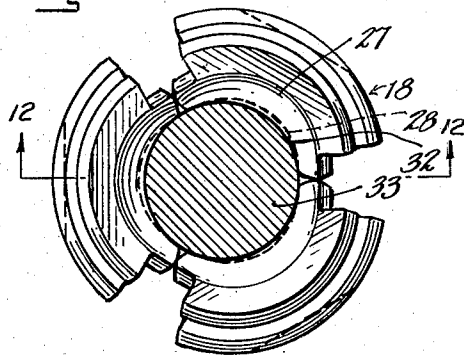


Fig. 10.

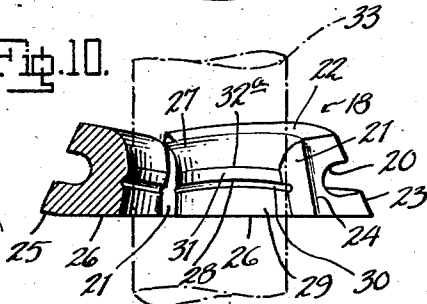


Fig. 12.

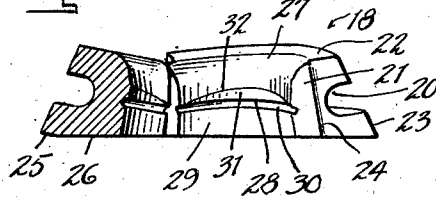


Fig. 13.

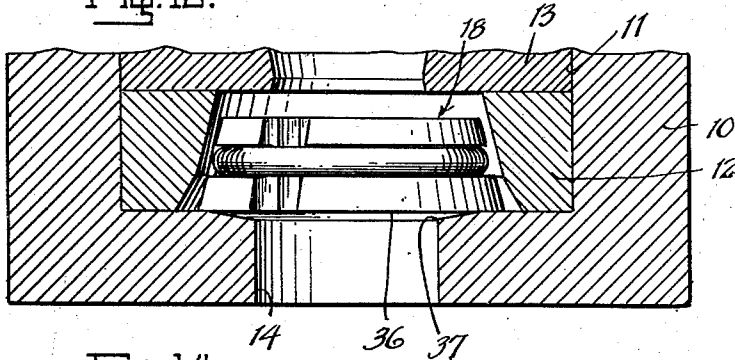
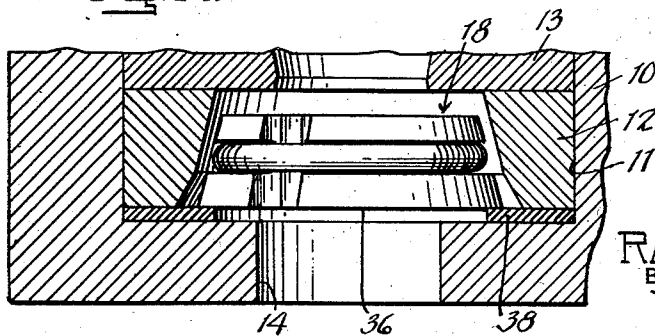


Fig. 14.



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TUBE DRAWING APPARATUS

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13 Claims. (Cl. 205—4)

The present invention relates to tube drawing apparatus for the forming of tubular or shell shaped articles, and particularly to a segmental stripper means employed in such apparatus for removing a drawn article from the punch during the upstroke of the punch following the passage of the article through the drawing die. While the apparatus is adapted to the drawing of any type of article, the present description is by way of example directed to the drawing of cartridge case shells, which in the course of manufacture are subjected to a series of drawing, annealing, and trimming operations, and which from their nature require the highest precision standards, both from the standpoint of dimensions and metal characteristics. It is also of the greatest importance that the drawn tubular article be protected against damage to its wall, such as galling, excessive abrasion, and strain of the metal, and also that the drawing tool and the stripper parts be protected from such galling and excessive abrasion. In the case of the shell, such damage may extend to a portion of the finished product thereby creating a potential point of failure, and in the case of the tool and stripper surfaces, such damage may result in producing corresponding damage to the shells engaged therewith.

The usual type of stripper consists of a plurality of segments, usually three, disposed within an internally tapered ring or fixture, the segments being provided with an opening having a ledge surface adapted to be engaged over the edge of the drawn article after it has passed through the forming die and to be held in contracted relation about the punch through the upstroke of the punch in the tapered ring, the shell being thus stripped from the punch. The segments have lateral opening and closing movement, opening laterally to allow the article on the punch to pass through the stripper, and closing laterally to dispose the ledge above the end of the article. As the diameter of the opening above the ledge and which engages about the punch is of smaller radius than the radius of the article, the outward lateral movement of the segments causes the end corners of the arcuate ledge surfaces of the respective segments to engage the surface of the article while the arcuate edge of the ledge between these end corners is arched over the surface of the article, and consequently there is a tendency to gall or abrade the surface of the article, particularly where there is excessive frictional resistance as the article is passed through the stripper.

It is an object of the present invention to provide stripper means wherein the several segments are rockably supported to rock downwardly as the article is forced therethrough, so that the ledge surfaces are rocked outwardly away from the surface of the article to prevent any possibility of abrasion through contact of these edges with the article. It is further proposed to provide an entrance surface above the ledge adapted to substantially conform to the diameter of the article, as the segments are rocked downwardly through the passage of the article through the stripper.

A further object is to provide a stripper means wherein a more positive stripping action takes place through the cooperation of the stripper segments with the tapered ring, and to this end it is proposed to provide unlike angles upon the segments and the tapered ring, whereby the segments are caused to have slight upward rocking movement during the withdrawal movement of the punch, causing the segments to engage against the wall of the article below the ledge, and with increasing force as there is increase in the upward thrust of the article upon the ledge. In practice this engaging point is in the end portion of the shell which is subsequently trimmed off and the clamping action of the stripper is such as to prevent the possibility of damaging strain being created in the metal of the shell during the upstroke of the punch.

With the above and other objects in view embodiments of the invention are shown in the accompanying drawings, and these embodiments will be hereinafter more fully described with reference thereto, and the invention will be finally pointed out in the claims.

In the drawings—

Fig. 1 is a vertical sectional view, partially in side elevation, showing the punch with a cartridge case shell engaged thereon at the beginning of the drawing operation and before engagement of the shell with the stripper means, the latter being shown in its normal contracted rest position.

Fig. 2 is a fragmentary horizontal sectional view, taken along the line 2—2 of Fig. 1, showing the segmental stripper means in top plan.

Fig. 3 is a fragmentary vertical sectional view, taken along the line 3—3 of Fig. 2.

Fig. 4 is a bottom plan view of the segmental stripper means in its normal closed position and removed from the die.

Fig. 5 is a fragmentary vertical sectional view, showing an advanced position of the punch,

wherein the shell being drawn is engaged with the stripper means.

Fig. 6 is a fragmentary horizontal sectional view, taken along the line 6—6 of Fig. 5, showing the stripper means in bottom plan as engaged by the shell.

Fig. 7 is a fragmentary vertical sectional view, showing the completed drawn shell disposed beneath the stripper means at the completion of the downstroke of the punch.

Fig. 8 is a fragmentary vertical sectional view, showing the punch partially withdrawn from the drawn shell during the upstroke of the punch.

Fig. 9 is a plan view of the three segments making up the stripper means at a point in their manufacture preparatory to having the opening through the stripper ground to its finished shape according to the invention.

Fig. 10 is a vertical sectional view taken along the line 10—10 of Fig. 9, and showing in dot-and-dash lines the relative position of a finishing grinding tool, or the like, as it engages the stripper opening to produce the finished surface thereon.

Fig. 11 is a plan view of the segmental parts of the stripper means as shown in Fig. 9, and showing the finishing tool engaged therein.

Fig. 12 is a vertical sectional view, taken along the line 12—12 of Fig. 11, showing the finished segments, the finishing tool being disengaged therefrom.

Fig. 13 is a fragmentary vertical sectional view, partially in elevation, of a modified form of stripper means according to the invention.

Fig. 14 is a fragmentary vertical sectional view, partially in side elevation, of another modified form of stripper means according to the invention.

Similar reference characters indicate corresponding parts throughout the several figures of the drawings.

Referring to the drawings, the tube drawing apparatus, of the punch and die type illustrated by way of example in the present disclosure, comprises a die holding block 10 provided with a downwardly extending cylindrical pocket 11, in the lower portion of which is engaged a stripper sleeve or ring 12 and in the upper portion of which is engaged a drawing die 13 of conventional type, the base of the block being provided with a central opening 14, disposed axially of the opening of the sleeve 12 to allow passage of the drawn shell carried upon the punch therethrough. On the top of the die holding block there is secured a plate 15 to hold the die and stripper sleeve in position, being provided centrally with a cylindrical passage 16 to allow passage of the shell carried upon the punch to the die. The punch 17 is of conventional type and is adapted to be reciprocated by means of the usual press commonly used in the art.

The segmental stripper means comprises three identical segments, indicated generally as 18, the segments being split with respect to each other along radial planes and being normally contracted into closed position by means of an elastic closing ring 19, of coiled spring wire, rubber, or the like, engaged in a circumferential groove 20 in the outer sides of the stripper segments. In the normal closed position of the stripper, as shown in Figs. 1 to 4, the contacting end surfaces 21 of the segments are disposed in radial planes, the upper surfaces 22 are in a flat horizontal plane, and the outer peripheral surface 23 is in the form of a frustum of a cone, preferably at a relatively

steep angle, shown for example as 15°. Angular clearance cut-outs 24 are provided upon the end surfaces of the segments to allow clearance gaps across which the elastic holding ring 19 extends between the segments. The under surface of each of the segments is provided at its outer edge portion with a flat supporting surface 25, parallel to the upper surface of the segment, and with an inclined surface 26 extending inwardly from the surface 25 to the inner periphery of the segment, this inclined surface adapted to permit downward rocking of the segment about the straight edge between the surfaces 25 and 26 as a fulcrum, and as will presently more fully appear. While the inclined surface 26 may be at any desired relative angle, the angle shown by way of example is approximately 10°.

The passage through the stripper comprises an upper divergent and rounded entrance portion 27, extending at its lower convergent end to a ledge 28 projecting inwardly from the upper end of the lower outwardly offset cylindrical portion 29 of the passage, there being a clearance groove 30 between the upper end of the cylindrical portion 29 and the ledge. Above the ledge 28 there is provided a cylindrical surface 31, which meets the surface of the divergent entrance portion 27 along an arcuate line 32, calculated as constituting a circular outline in the downwardly rocked position of the segments with their lower inclined surfaces 26 disposed in a horizontal plane. This circular outline corresponds substantially to the cylindrical outer surface of the drawn shell as it is forced downwardly through the stripper, the edge of the ledge 28 disposed beneath this arcuate line, and which has a diameter in the normal closed position of the stripper slightly larger than the diameter of the punch and smaller than the diameter of the drawn shell, being rocked outwardly out of contact with the surface of the shell during its downward passage therethrough, so that there is no possibility of the sharp edge of the ledge or its end corners abrading the surface of the shell.

In order to understand fully the formation of the surface of the passage through the stripper the method of grinding the passage is illustrated in Figs. 9 to 12. As shown in Figs. 9 and 10 the passage is provided above the edge of the ledge 28 with the cylindrical surface 31 having its upper edge 32^a parallel to the edge of the ledge and of the same diameter, so that in the rocked position, with the lower inclined surfaces 26 of the segments resting upon a flat horizontal support, the edge 32^a is disposed inwardly with respect to the edge of the ledge. It will be seen from the plan view in Fig. 9 that in this rocked position the edges 28 and 32^a of the segments do not form a circle but form a clover-leaf shape. With the segments supported in this rocked position in a suitable fixture a suitable finishing tool 33 is engaged in the passage through the segments, as indicated by the dot-and-dash lines in Fig. 10, the diameter of the tool being calculated as corresponding substantially to the outside diameter of the drawn shell to be engaged with the stripper. This tool is operated to grind the passage, resulting in cutting away portions of the entrance surface 27 and also preferably cutting back slightly the end portions of the edge of the ledge 28, thus producing the arcuate line 32 between the cylindrical surface 31 and the entrance surface 27 and providing cut back clearance corners at the ends of the edge of the ledge of each segment. Thus the stripper in the downwardly

rocked position of its segments presents a passage corresponding substantially to the surface of the shell while the smaller radius segmental edges of the ledge are entirely free from abrading contact therewith.

The opening 34 through the stripper ring 12 is in the form of a frustum of a cone tapering inwardly from the bottom to the top of the ring, the opening being provided at its lower end with a clearance angle portion 35, inclined at a relatively greater angle than the inclination of the opening 34. The angle of the opening 34 is calculated as being a slightly smaller angle than the angle of the tapered peripheral surface of the segmental stripper, the angle shown for example as being 14°, or 1° less than the 15° angle of the taper of the stripper. The purpose of the unlike angles is to permit of a slight upward rocking movement of the stripper elements during the upstroke of the punch to facilitate the removal of the shell from the punch, as will presently more fully appear.

In operation, the punch with the cartridge case shell A thereon is moved downwardly through the die; the wall of the shell being drawn between the punch and the die to a wall thickness corresponding substantially to the annular space between the punch and the die. As the shell is carried below the die it passes through the segmental stripper, the downward movement of the punch, indicated by the arrow in Fig. 5, causing the expanded segments to rock downwardly as shown in Figs. 5 and 6, and in which downwardly rocked position the arcuate edges 32 forming the lower edge of the convergent entrance portion are of substantially circular outline corresponding to the cylindrical outline of the shell. At the same time the sharp edge of the ledge 28 is rocked outwardly, so that it is entirely free of contact with the downwardly moving shell, and hence there is no possibility of galling or abrading its surface. As the drawing of the shell is completed through the die and its upper edge carried below the stripper, the stripper contracts to dispose the ledge 28 above the upper edge of the shell, as shown in Fig. 7, wherein is illustrated the position of the punch and stripper at the completion of the downstroke of the punch. In this position the stripper rocks upwardly to its normal position. As the punch starts its upstroke, the mouth edge of the shell is brought into engagement with the ledge 28 and the stripper is carried upwardly to engage its tapered peripheral surface with the tapered opening 34 of the stripper ring, the unlike angles of the opening and the stripper causing the stripper segments to tilt upwardly slightly, as shown in Fig. 8, causing the lower edge of the outwardly offset lower cylindrical portion 29 of the passage through the stripper to grip upon the outer surface of the shell slightly below its upper end. This gripping action takes place at each 120° point of the edge midway between the ends of each segment. Increase in pressure upon the stripper ledge increases the pressure upon the 120° points of contact, and hence effectually holds the shell as the punch is withdrawn without producing excessive metal strain lengthwise of the shell, and such as might occur when excessive pressure is exerted upon the end of the shell, particularly in the case of an uneven or scalloped edge. As the punch is withdrawn from the shell upward pressure upon the stripper ceases and it contracts and drops to its normal position.

In Fig. 13 there is illustrated a modified form of

the invention in which the lower surfaces 36 of the segments of the stripper are in a flat plane parallel to their upper surfaces, the base of the pocket 11 being provided with a downwardly and inwardly inclined dished portion 37 having an outer diameter less than that of the stripper, thus providing a clearance space in which the segments of the stripper may rock downwardly as the drawn shell is passed therethrough in substantially the same manner as in the first embodiment.

In Fig. 14 there is shown another modified form of the invention in which a spacer ring 38 is provided in the base of the pocket 11, beneath the ring 12 and extending beneath the outer marginal portion of the bottom of the stripper, the stripper having a flat lower surface 36, similar to the stripper shown in Fig. 13. This ring supports the outer marginal portions of the segments while providing a clearance space beneath the inner portions, thus permitting the segments to rock downwardly as the drawn shell is passed therethrough, in substantially the same manner as the other embodiments of the invention.

The form of the invention illustrated in the drawings and described herein is typical and illustrative only, and it is evident that the invention is capable of embodiments in other forms, all falling within the scope of the appended claims, which are to be broadly construed.

What is claimed is:

1. In a drawing punch and die apparatus, stripper means comprising a sectional stripper element including a plurality of circumferentially arranged stripper members adapted to engage about substantially the entire circumference of the punch adjacent the mouth edge of the drawn article, said segments having a substantially continuous circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, said members being rockably mounted to move the edge of said ledge out of engagement with the surface of the drawn article passing therethrough.

2. In a drawing punch and die apparatus, stripper means comprising a sectional stripper element including a plurality of circumferentially arranged stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article and having a circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, said members each having a fulcrum support at its under side permitting rocking movement thereof to move the edge of said ledge out of engagement with the surface of the drawn article passing therethrough.

3. In a drawing punch and die apparatus, stripper means comprising a sectional stripper element including a plurality of circumferentially arranged stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article and having a circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, said members each having a fulcrum support at its under side adjacent its outer periphery and an upwardly inclined surface extending inwardly from said fulcrum support, whereby said members are adapted to have rocking movement to move the edge of said ledge out of engagement with the surface of the drawn article passing therethrough.

4. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper including a plurality of circumferentially

arranged segment stripper members adapted to engage about substantially the entire circumference of the punch adjacent the mouth edge of the drawn article, said segments having a substantially continuous circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, means to yieldably hold said segment members in contracted assembled relationship, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed therethrough whereby the edge of said ledge is moved out of engagement with the surface of the article passing therethrough, and holder ring means to positively constrict said segment members during the withdrawal reciprocation of the punch.

5. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving the punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relationship, said segments defining a passage including an upper and a lower portion joined by a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the passage below said ledge being substantially the diameter of the drawn article to engage about it, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed therethrough whereby the edge of said stripper ledge is moved out of engagement with the surface of the article passing therethrough, and holder ring means to positively constrict said segment members during the withdrawal reciprocation of the punch.

6. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving the punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relationship, said segments defining a passage including an upper and a lower portion joined by a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the passage below said ledge being substantially the diameter of the drawn article to engage about it, and the passage above said ledge being substantially the diameter of the punch adjacent the edge of said ledge and including an upwardly divergent entrance portion, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed therethrough whereby the edge of said stripper ledge is moved out of engagement with the surface of the article passing therethrough, and holder ring means to positively constrict said segment members during the withdrawal reciprocation of the punch.

7. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving the punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the

mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relationship, said segments defining a passage including an upper and a lower portion joined by a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the passage below said ledge being substantially the diameter of the drawn article to engage about it, and the passage above said ledge being substantially the diameter of the punch adjacent the edge of said ledge and including an upwardly divergent entrance portion having an article engaging surface spaced above the edge of said ledge and defining in a rocked position of said segments an opening of circular plan outline substantially conforming to the outer surface of the drawn article, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed therethrough whereby the edge of said stripper ledge is moved out of engagement with the surface of the article passing therethrough, and holder ring means to positively constrict said segment members during the withdrawal reciprocation of the punch.

8. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving the punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relationship, said segments defining a passage including an upper and a lower portion joined by a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the passage below said ledge being substantially the diameter of the drawn article to engage about it, and the passage above said ledge being substantially the diameter of the punch adjacent the edge of said ledge and including an upwardly divergent entrance portion having an article engaging surface spaced above the edge of said ledge and defining in a rocked position of said segments an opening of circular plan outline substantially conforming to the outer surface of the drawn article, the surface of the passage between the edge of the ledge and said article engaging surface being of corresponding radius to the radius of the edge of said ledge, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed therethrough whereby the edge of said stripper ledge is moved out of engagement with the surface of the article passing therethrough, and holder ring means to positively constrict said segment members during the withdrawal reciprocation of the punch.

9. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving a punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relation, said segments defining a passage including a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the exterior surface of said contracted assembled segments being in the form of a truncated

cone, and holder ring means having an opening in the shape of a truncated cone for cooperation with said segments and inclined at an unlike angle to the angle of the truncated cone surface of said stripper segments, whereby during withdrawal reciprocation of the punch and relative axial movement between the assembled segments and the holder ring the unlike angles cause the segment members to tilt upwardly at their inner peripheries relatively to their normal contracted position.

10. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving a punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relation, said segments defining a passage including an upper and a lower portion joined by a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, the passage below said ledge being substantially the diameter of the drawn article to engage about it, the exterior surface of said contracted assembled segments being in the form of a truncated cone, and holder ring means having an opening in the shape of a truncated cone for cooperation with said segments and inclined at an unlike angle to the angle of the truncated cone surface of said stripper segments, whereby during withdrawal reciprocation of the punch and relative axial movement between the assembled segments and the holder ring the unlike angles cause the segment members to tilt upwardly at their inner peripheries relatively to their normal contracted position to clamp the lower segmental ends of said passage below said ledge about said article.

11. In a drawing punch and die apparatus, stripper means comprising a sectional segmental stripper element having an axial opening therethrough for receiving a punch and drawn article thereon, and including a plurality of circumferentially arranged segment stripper members adapted to engage about the punch adjacent the mouth edge of the drawn article, means to yieldably hold said segments in contracted assembled relation, said segments defining a passage including a stripping ledge adapted to be disposed in opposition to the mouth edge of the drawn article, said segment members being rockably mounted for rocking movement in the direction of movement of the punch as the article is passed

therethrough whereby the edge of said stripper ledge is moved out of engagement with the surface of the article passing therethrough, the exterior surface of said contracted assembled segments being in the form of a truncated cone, and holder ring means having an opening in the shape of a truncated cone for cooperation with said segments and inclined at an unlike angle to the angle of the truncated cone surface of said stripper segments, whereby during withdrawal reciprocation of the punch and relative axial movement between the assembled segments and the holder ring the unlike angles cause the segment members to tilt upwardly at their inner peripheries relatively to their normal contracted position.

12. In a drawing punch and die apparatus, a holder block having a pocket therein, stripper means disposed in said pocket comprising a sectional stripper element including a plurality of circumferentially arranged stripper members adapted to engage about substantially the entire circumference of the punch adjacent the mouth edge of the drawn article, said segments having a substantially continuous circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, said pocket having in its base a downwardly and inwardly inclined clearance recess disposed beneath said stripper members inwardly of their outer periphery and permitting downward rocking movement of the inner peripheries of said stripper members to move the edge of said ledge out of engagement with the surface of the drawn article passing therethrough.

13. In a drawing punch and die apparatus, a holder block having a pocket therein, stripper means disposed in said pocket comprising a sectional stripper element including a plurality of circumferentially arranged stripper members adapted to engage about substantially the entire circumference of the punch adjacent the mouth edge of the drawn article, said segments having a substantially continuous circumferential ledge adapted to be disposed in opposition to the mouth edge of the drawn article, and a spacer ring disposed in the base of said pocket beneath the outer marginal portion of the under side of said stripper element permitting downward rocking movement of the inner peripheries of said stripper members to move the edge of said ledge out of engagement with the surface of the drawn article passing therethrough.

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