

Feb. 7, 1967

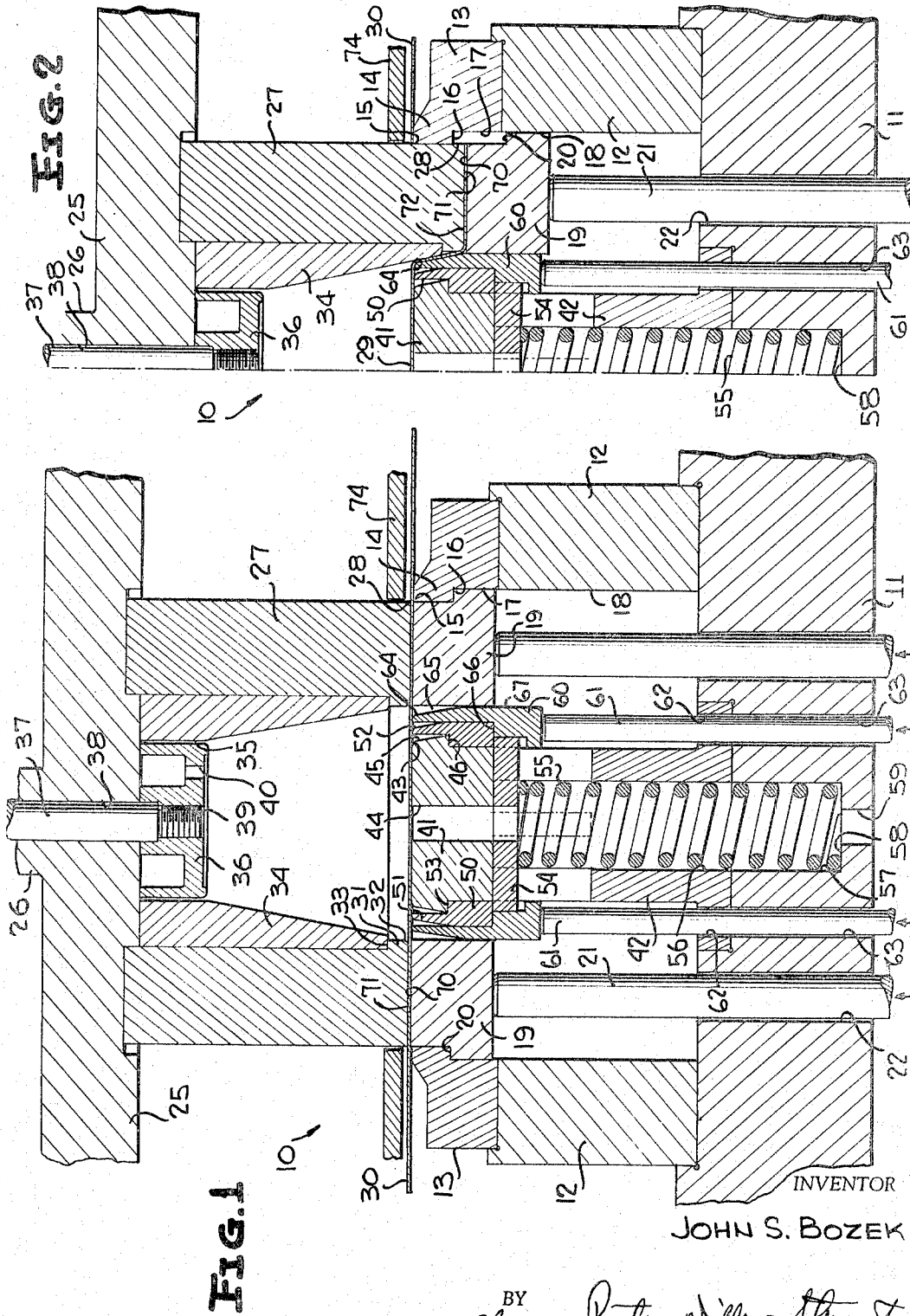
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3,302,441

DIE FOR DEEP DRAWN TAPERED CONTAINER

Filed July 9, 1963

2 Sheets-Sheet 1



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FIG. 4

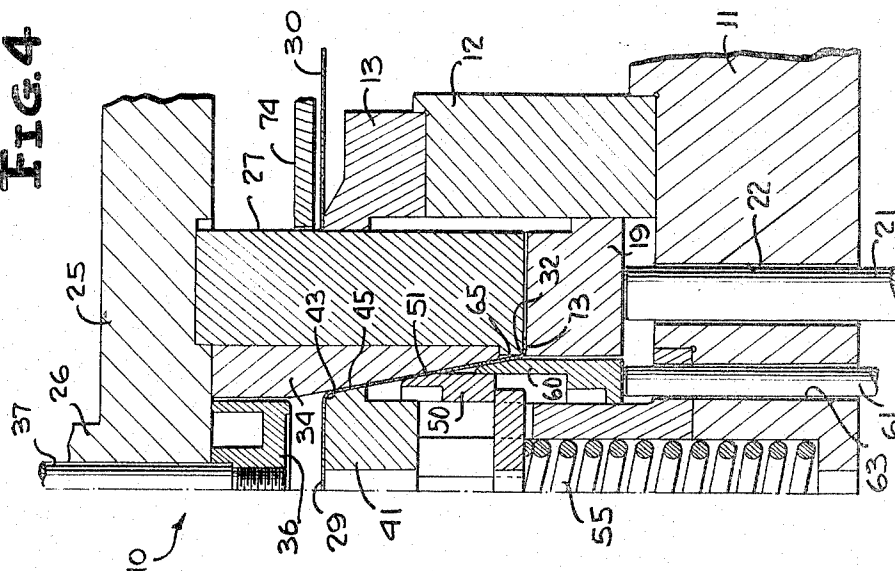
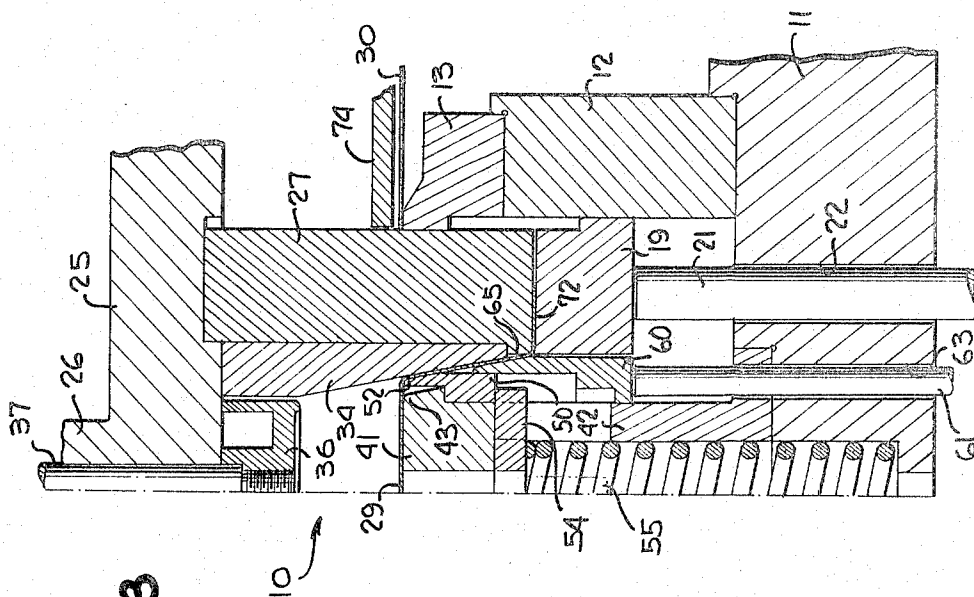


FIG. 3



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DIE FOR DEEP DRAWN TAPERED CONTAINER
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Filed July 9, 1963, Ser. No. 293,770
3 Claims. (Cl. 72-348)

This invention relates to a novel method and apparatus for forming a deep drawn tapered container and more particularly to a novel die structure for performing deep drawing of a container in one operation without the formation of undesirable wrinkles in the container.

In the container forming art it has previously been customary to form containers by performing a series of separate operations which included cutting a container blank from a sheet of material, subjecting the container blank to a series of separate but cumulative drawing operations and finally forming a flange on a side wall of the container. This prior method of forming deep drawn containers has a number of inherent disadvantages such as a large capital expenditure for equipment, inefficient use of the operator's time and multiple handling of the container resulting in damage thereto.

It is an object of this invention to overcome the above mentioned deficiencies by providing a novel die structure, which is incorporated within one machine, for forming a deep drawn tapered container in one operation.

Another object of this invention is to provide a die structure which includes a punch having a tapered female die and a cooperating male die which includes a plurality of telescoping elements and a stationary anvil, work engaging faces on the telescoping elements tapered to correspond to the female die, and means for successively drawing a blank over each of the telescoping elements.

Another object of this invention is to provide an outer die ring which circumscribes the male die and underlies and cooperates with the punch for yieldably gripping the blank therebetween, and mounting the punch and outer draw ring for movement relative to the telescoping elements for successively drawing the blank thereover.

A further object of this invention is to provide telescoping elements which include an inner draw ring circumscribing the stationary anvil and movable relative thereto, and a center draw ring which circumscribes the inner draw ring and is disposed for initial cooperation with the female die.

A further object of this invention is to provide the stationary anvil, the center draw ring and the inner draw ring with tapered work engaging faces which correspond to the tapered female die and cooperate therewith to preclude the formation of undesirable wrinkles in the container which is being formed.

Another object of this invention is to provide a male die, a blanking punch mounted for movement relative to the male die, and an outer draw ring which circumscribes the male die and is disposed in underlying cooperative relationship with the blanking punch to yieldably grip a container blank and draw the same over the male die, and in addition, the blanking punch and the underlying draw ring cooperate to remove a finished container from the male die.

A further object of this invention is to provide a novel method of forming a container from a metal blank by drawing the blank over a plurality of telescoped draw rings and a stationary anvil, wherein the method includes the steps of providing a container blank of sheet material, yieldably gripping the container blank along a marginal edge thereof, drawing the blank over an outer one of the telescoped draw rings prior to drawing the blank over an inner one of the draw rings, and subsequently

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drawing the container blank over the stationary anvil while maintaining the same yieldable grip throughout the various steps.

A still further object of this invention is to provide a method of forming a deep drawn container from a sheet of metal or the like, which method comprises the steps of cutting the sheet to provide a container blank, gripping the blank along the marginal edge thereof with suitable gripping means, moving the gripping means to draw the blank on a center draw ring which yields under the drawing pressure, continuing the movement of the gripping means to draw the container blank on an inner draw ring which has been exposed by the movement of the center draw ring, drawing the blank on a stationary anvil which has been exposed by the movement of the inner draw ring, and providing a flange on the container by maintaining the grip on the container blank throughout the various drawing steps.

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

In the drawings:

FIGURE 1 is a vertical sectional view taken axially through the die structure of the present invention, the view illustrating the position of the various parts prior to a container forming operation.

FIGURE 2 is a fragmentary sectional view, similar to FIGURE 1, illustrating the position of the various parts subsequent to the cutting of a container blank and at the completion of a first drawing operation.

FIGURE 3 is a fragmentary vertical sectional view, similar to FIGURE 2, illustrating the position of the various parts subsequent to a second drawing operation.

FIGURE 4 is a fragmentary vertical sectional view, similar to FIGURES 2 and 3, illustrating the position of the various parts subsequent to a third and final drawing operation and prior to the removal from the die structure of a deep drawn tapered container which has a flange formed thereon.

Referring to the drawings in detail, there is shown in FIGURE 1 a die structure, generally indicated by the numeral 10, which is mounted in a suitable press in a conventional manner.

The die structure 10 includes a stationary die shoe 11 having a pedestal 12 mounted thereon for supporting an annular blanking member 13. The blanking member 13 is provided with an inwardly extending projection 14 which has an annular cutting edge 15 thereon. The projection 14 includes a horizontal shoulder 16 which merges with a circular wall 17 of the blanking member 13. The wall 17 is aligned with an inner wall 18, of the pedestal 12, to provide a guideway for a reciprocating outer draw ring 19 which is located for sliding movement along the walls 17 and 18, and which is provided with a shoulder 20 that cooperates with the shoulder 16 to limit upward movement of the outer draw ring 19.

The outer draw ring 19 is supported by a plurality of draw pins 21 which are slidably mounted within apertures 22 formed within the die shoe 11. The draw pins 21 are resiliently supported upon a die cushion, not shown, which die cushion may be of any conventional type such as rubber blocks, spring means or fluid pressure means. The draw pins 21 are subjected to an upwardly directed pressure by the die cushion, as is indicated by the arrow in FIGURE 1, to constantly urge the outer draw ring 19 to its uppermost position which is defined by the engagement of shoulders 16 and 20.

The actuating elements of the die structure 10 include a die head 25 which is provided with a stem 26. The

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die head 25 reciprocates along a vertical axis in a conventional manner and is actuated by suitable pressure means, not shown, which are connected to the stem 26 in the usual manner.

A blanking punch 27 is secured to and depends from the die shoe 25. The blanking punch 27 is preferably annular in shape and has a cutting edge 28 which cooperates with the cutting edge 15 to cut a container blank 29 from a thin sheet of material 30 which may be of any ductile metal such as tin-plate or aluminum.

The blanking punch 27 has an inwardly directed annular projection 31 which has a smooth rounded portion 32 and an upwardly spaced shoulder 33. A frusto-conical tapered female die 34 is fixedly disposed within the blanking punch 27 and is confined therein between the die head 25 and the shoulder 33. A passageway 35 is provided in the die 34 for receiving thereon a knock-out pad 36 which is threadably connected to a knock-out stem 37. The knock-out stem 37 is slidably mounted within an aperture 38, in the die head 25, and is actuated by conventional means to remove finished containers from within the die 34. The pad 36 is threadably connected to the stem 37 as at 39, and is provided with a conventional vent 40.

An anvil 41 is integrally connected with a base member 42 and is fixedly supported upon the die shoe 11. The anvil 41 has a smooth rounded portion 43, for engaging the container blank 29, and a centrally disposed vent 44. A side wall 45 is tapered to correspond to the frusto-conical female die 34. The tapered wall 45 merges with the smooth rounded portion 43 and terminates at an annular shoulder 46.

An annular inner draw ring 50 circumscribes the anvil 41 and is slidably mounted thereon. The inner draw ring 50 has a tapered wall or work engaging face 51, which is tapered to correspond to the frusto-conical die 34, and terminates in a smooth rounded portion 52 which engages the container blank 29. An annular shoulder 53, on the inner draw ring 50, engages the shoulder 46 to limit the upward travel of the inner draw ring 50. A plate 54, which may be integral with or fixedly connected to the inner draw ring 50, is disposed beneath the anvil 41 and is resiliently biased by a helical coil spring 55 which is disposed within an aperture 56, in the base member 42, and in an aperture 57 in the die shoe 11. The spring 55 is supported on a ledge 58 and is concentric with a vent 59.

A center draw ring 60 circumscribes the inner draw ring 50 and is slidably mounted thereon. The center draw ring 60 is supported on, and is resiliently biased upwardly, by a plurality of draw pins 61 that are each slidably received within an aperture 62, in the base member 42, and in an aperture 63 in the die shoe 11. The draw pins 61 are supported upon a conventional die cushion and are resiliently biased upwardly, as is indicated by the arrow in FIGURE 1, by suitable means such as a rubber block, spring means or fluid pressure means. The center draw ring 60 has a smooth rounded portion 64, for engagement with the container blank 29, and which merges with a tapered wall or work engaging face 65 which is tapered to correspond to the frusto-conical die 34. The center draw ring 60 is also provided with an inner annular shoulder 66 which abuts against the underside of the inner draw ring 50 to limit the upward movement of the center draw ring 60. The tapered wall or work engaging face 65 merges with a side wall 67 upon which the outer draw ring 19 is slidably mounted.

The operation of the die structure 10 will now be described in detail. The various parts of the die structure 10 are shown in FIGURE 1 in their respective positions prior to the start of the container forming operation. The thin sheet of material 30 is positioned in place between the outer draw ring 19 and the blanking punch 27. A work engaging face 70 on the outer draw ring 19, and a work engaging face 71 on the blanking punch 27, co-

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operate to yieldingly grip the thin sheet of material 30.

A comparison of FIGURES 1 and 2 will reveal that the cutting edge 15, on the blanking member 13, and the cutting edge 28, on the blanking punch 27, cooperate to sever the thin sheet of material 30 to form the container blank 29. As is shown in FIGURE 2, a marginal portion 72, of the container blank 29, is yieldably gripped between the work engaging faces 70 and 71. Subsequent to the cutting operation, continued downward movement of the outer draw ring 19 and the blanking punch 27 draws the container blank 29 over the smooth rounded portion 64 until the female die 34 reaches the position which is shown in FIGURE 2. Subsequently, further downward movement of the die head 25 causes the female die 34 to force the center draw ring 60 downwardly against the resiliently biased draw pins 61.

FIGURE 3 is an illustration of the various parts of the die structure 10 subsequent to a second drawing operation. During the second drawing operation, the marginal portion 72 of the container blank 29, is yieldably gripped between the outer draw ring 19 and the blanking punch 27 such that the container blank 29 is drawn over the smooth rounded portion 52 of the inner draw ring 50. During this part of the container forming operation, the container blank is held in tension by the yieldable grip which is imposed upon the marginal portion 72, while the female die 34 and the work engaging face 65 on the center draw ring 60 move relative to the container blank 29 to prevent the formation of undesirable wrinkles therein. After the female die 34 has reached the position which is shown in FIGURE 3, further downward movement of the die head 25 will force the inner draw ring 50 downwardly against the action of the spring 55.

FIGURE 4 is an illustration of the die structure 10 subsequent to a third drawing operation. During the third drawing operation, the container blank 29 is drawn over the smooth rounded portion 43 on the anvil 41, and also slides relative to the female tapered die 34 and the work engaging faces 51 and 65 to prevent the formation of undesirable wrinkles. The outer draw ring 19, the inner draw ring 50 and the center draw ring 60 move simultaneously from the end of the second drawing operation to the end of the third drawing operation.

The final form of the container blank 29 is shown in FIGURE 4. It will be noted that the marginal portion 72, which was yieldably gripped between the outer draw ring 19 and the blanking punch 27, has been reduced in size such that the finished container is provided with a flange 73. The flange 73 merges with the container side wall along an arcuate portion which is formed by the rounded portion 32 of the blanking punch 27.

The three separate drawing operations, which have been illustrated in the drawings and described above, are performed during a single downward movement of the die head 25 without any interruption. The anvil 41 remains stationary at all times, and the outer draw ring 19 is constantly biased by the draw pins 21 so as to continually cooperate with the draw punch 27 to yieldably grip the marginal portion 72 of the container blank 29.

During the upward stroke of the die head 25, the finished container remains within the confines of the female tapered die 34 because of the upward movement of the outer draw ring 19 and the flange 73. Upward movement of the female die 34 releases the pressure on the inner draw ring 50 and center draw ring 60. These draw rings are returned to their original position, as is shown in FIGURE 1, by the biasing action of the draw pins 61 and spring 55. The unused portion of the sheet of material 30 is precluded from upward movement, with the blanking punch 27, by a conventional stationary stripper member 74.

It will be understood that upward movement of the die head 25, the blanking punch 27 and the tapered die 34 continues past the position which is illustrated in FIG-

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URE 1. However, further movement of the stem 37 is prevented by suitable means such that the knock-out pad 36 will eject the finished container from within the tapered die 34.

While preferred forms and arrangement of parts have been shown in illustrating the invention, it is to be clearly understood that various changes in details and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claimed subject matter.

I claim:

1. In a die structure for forming a deep drawn tapered container, a punch including a tapered female die, a male die, said male die including a plurality of telescoping elements and a stationary anvil, said telescoping elements having work engaging faces thereon tapered to correspond to said female die, and an outer draw ring underlying said punch and circumscribing said male die, said outer draw ring and said punch having cooperating faces thereon for gripping a blank therebetween, said punch and said outer draw ring being mounted for movement relative to said telescoping elements for successively drawing a blank thereover, said telescoping elements including an inner draw ring circumscribing said stationary anvil and movable relative thereto, a center draw ring circumscribing said inner draw ring and being disposed for initial cooperation with said female die, a base member integral with said anvil, said base member having an aperture formed therein, plate means disposed beneath said anvil and operatively connected to said inner draw ring, and spring means disposed within said aperture beneath said plate means and said anvil for resiliently biasing said inner draw ring.

2. In a die structure for forming a deep drawn tapered container, a die shoe, a pedestal on said die shoe, a blanking member supported on said pedestal, said blanking member having a cutting edge thereon, a die head, a blanking punch fixedly connected to said die head and including a tapered female die, said blanking punch having an external cutting edge thereon for cooperating with said cutting edge on the blanking member for cutting a

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container blank from a sheet of material, a knock-out stem slidably mounted in said die head and slidable within said female die, an outer draw ring disposed adjacent to said blanking member and slidably mounted with respect thereto, a gripping face on said blanking punch and a gripping face on said outer draw ring, said gripping faces cooperating to yieldably grip and tension a container blank, a stationary anvil including a base member mounted on said die shoe, an inner draw ring circumscribing said stationary anvil and being slidably mounted relative thereto, a center draw ring slidably mounted and disposed between said outer draw ring and said inner draw ring; said center draw ring, said inner draw ring and said stationary anvil having tapered work engaging faces thereon tapered to correspond to said tapered female die and disposed relative thereto for successive cooperation therewith; a first support pin supporting said outer draw ring and being slidably mounted in an aperture in said die shoe, a second support pin supporting said center draw ring and being slidably mounted in a second aperture in said die shoe, an aperture in said base member and compression spring means disposed therein between said die shoe and said inner draw ring to bias said inner draw ring into engagement with said stationary anvil.

3. In a die structure as defined in claim 2 further characterized in that said blanking punch and said outer draw ring comprise means for removing a finished container from said male die.

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