United States Patent [19]

Kneusel et al.

[11] **3,812,696**

[45] **May 28, 1974**

[54] **METHOD OF AND APPARATUS FOR FORMING CONTAINER BODIES**

[75] Inventors: **Raymond H. P. Kneusel**, Flourtown, Pa.; **Vinson S. Potts**, Cherry Hill, N.J.

[73] Assignee: **Crown Cork & Seal Company, Inc.**, Philadelphia, Pa.

[22] Filed: **Oct. 30, 1972**

[21] Appl. No.: **302,479**

Related U.S. Application Data

[63] Continuation of Ser. No. 82,986, Oct. 22, 1970, abandoned.

[52] **U.S. Cl.** ..... **72/57**, 113/120 AA, 72/354

[51] **Int. Cl.** **B21d 41/04**

[58] **Field of Search** ..... 113/1 G, 120 H, 120 M, 113/120 AA; 72/54, 58, 60, 61, 62, 57, 354

[56] **References Cited**

UNITED STATES PATENTS

795,020	7/1905	Barthelmes	72/58
865,257	9/1907	Kohl	113/120 H
887,950	5/1908	Lindenborg	72/58
1,229,292	6/1917	Kirkby	113/1 G
1,687,690	10/1928	Petry	72/61
1,711,445	4/1929	Burvenick	72/58
2,175,746	10/1939	Darling	113/1 G
2,407,855	9/1946	Stephens	72/63
2,495,059	1/1950	Grant	29/421
3,196,819	7/1965	Lechner et al.	113/120 H
3,581,542	6/1971	Wahler et al.	72/94

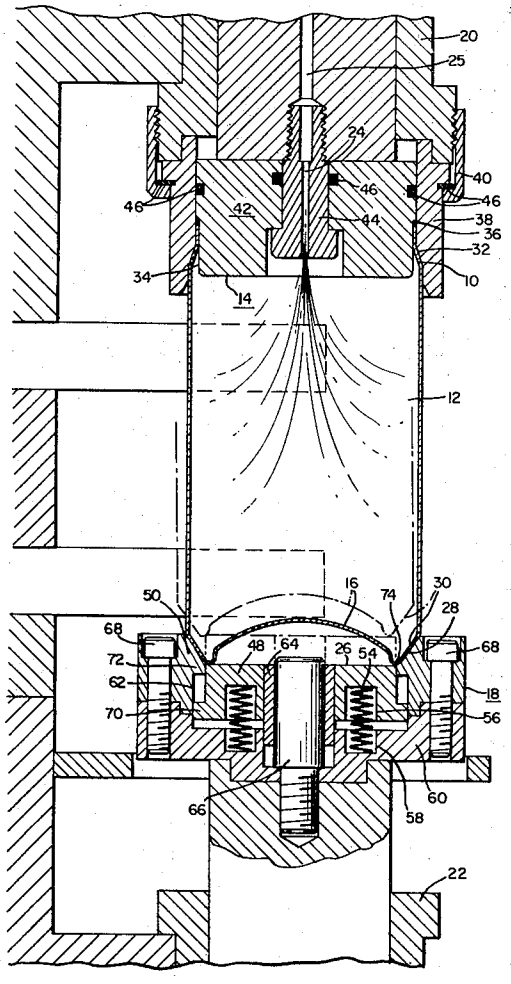
Primary Examiner—Richard J. Herbst

Attorney, Agent, or Firm—Woodcock, Washburn, Kurtz & Mackiewicz

[57] **ABSTRACT**

The open end of a container body is deformed by a die having a passageway connected to a source of air under pressure. As the die approaches the open end, the air under pressure passes through the die and into the container to depress a central container supporting surface with respect to a peripheral positioning surface. At the time the die engages the open end, the peripheral positioning surface has properly guided the container body into alignment with the die. The air under pressure continues to enter the container as the die forms a seal with and deforms the open end in order to prevent collapse of the container body.

20 Claims, 9 Drawing Figures



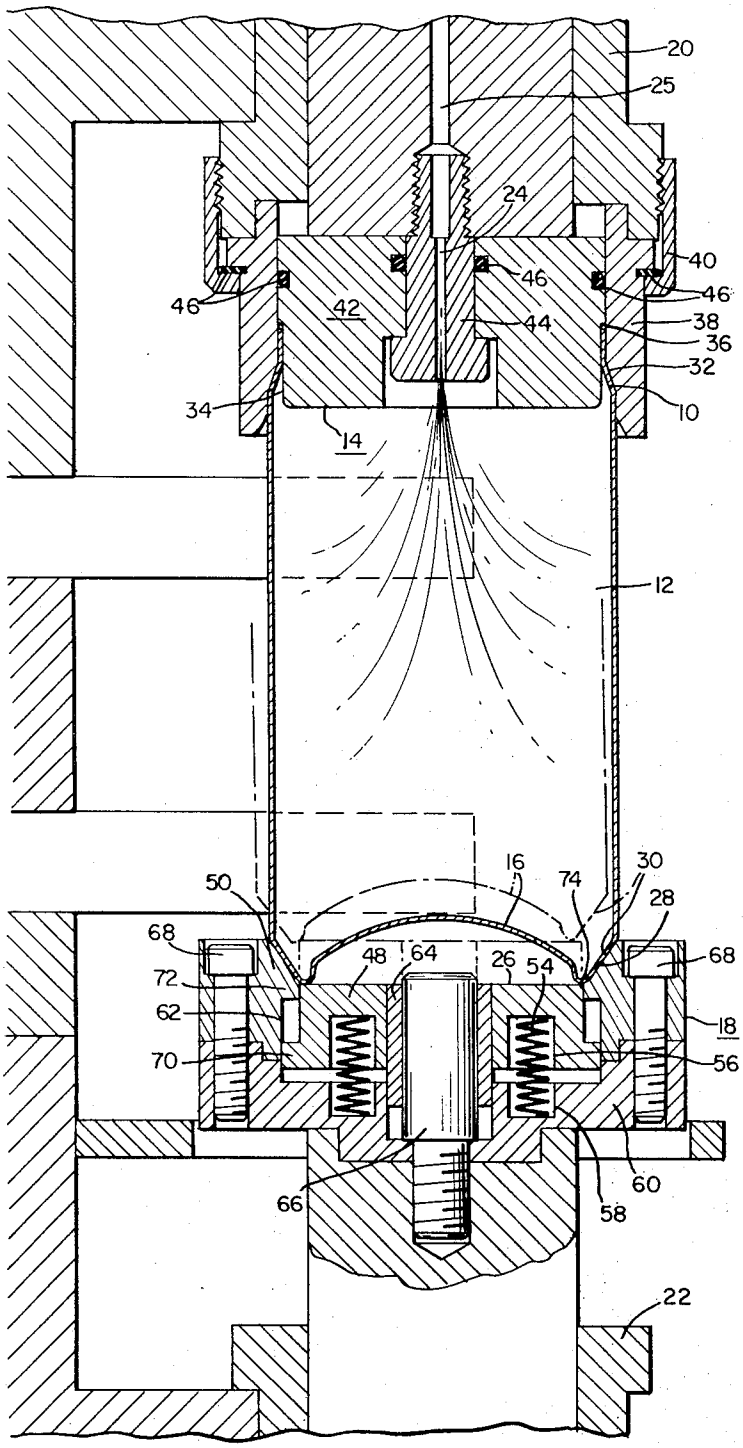


Fig. 1

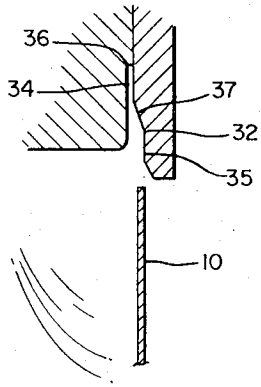


Fig. 1a

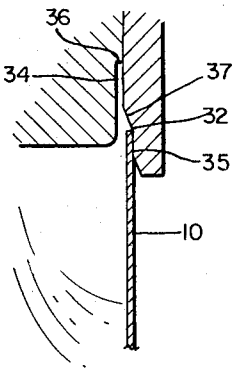


Fig. 1b

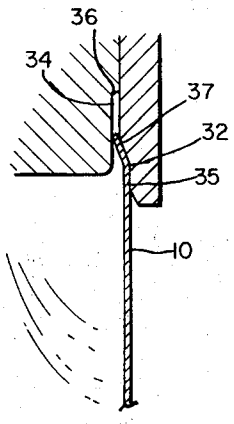


Fig. 1c

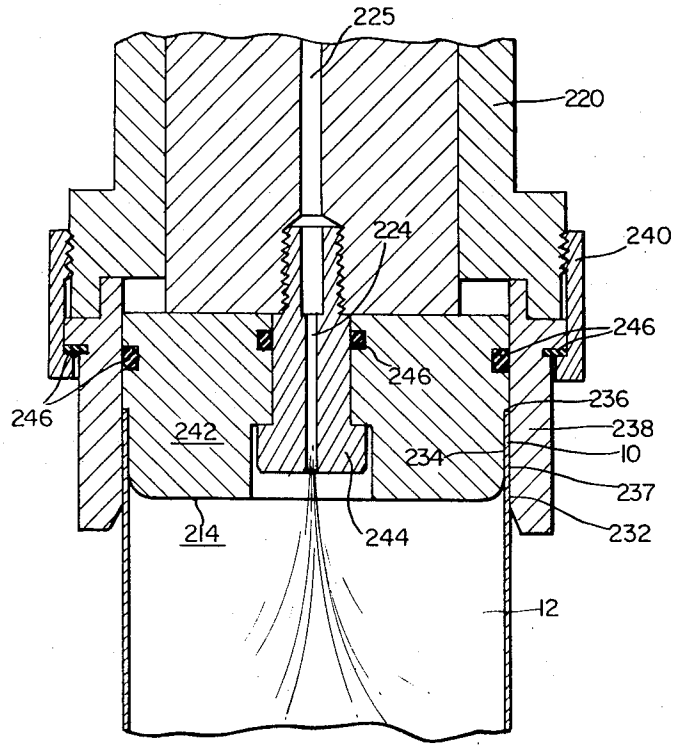


Fig. 3

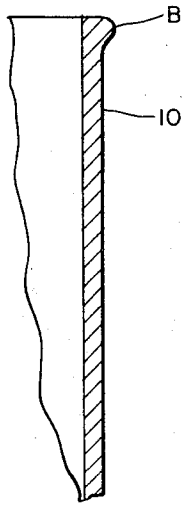


Fig. 3a

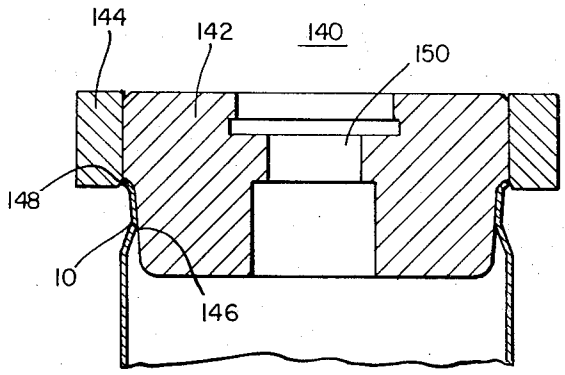


Fig. 2

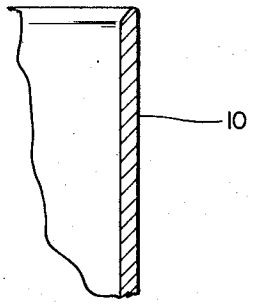


Fig. 3b

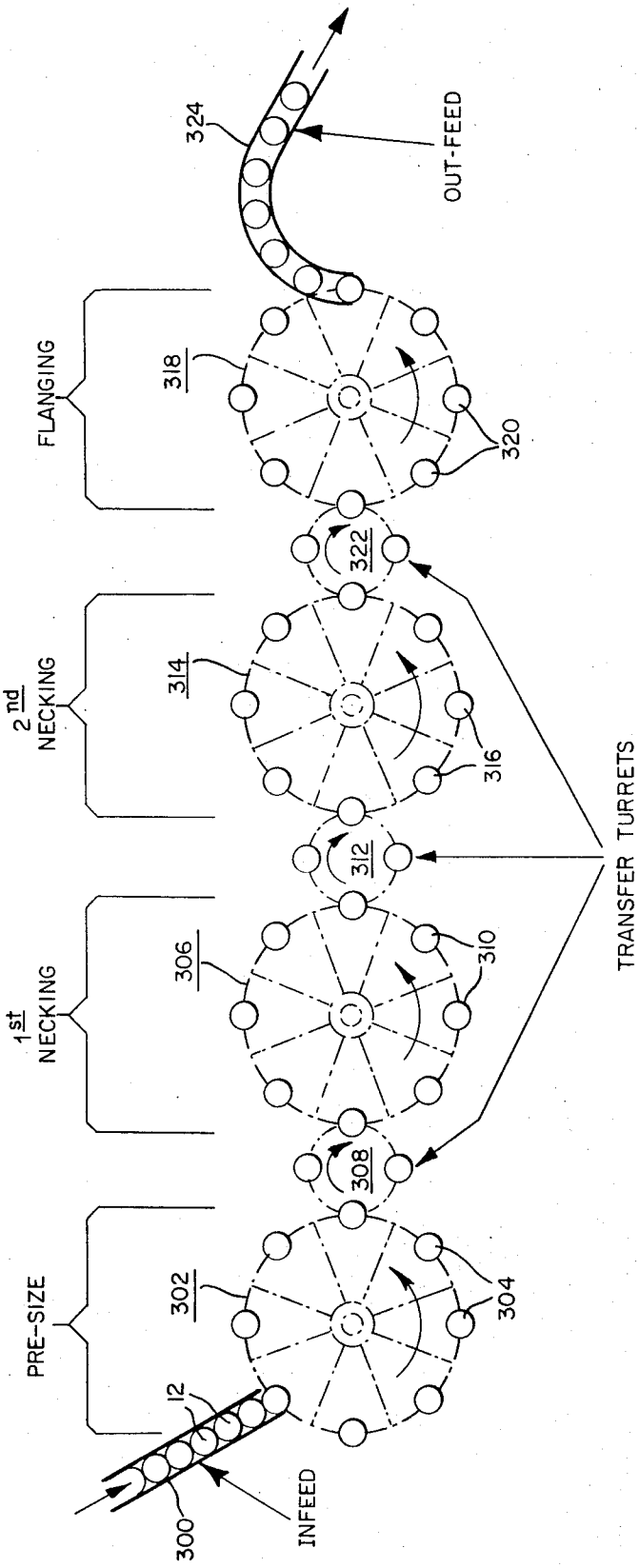

PRE-SIZE
1st NECKING
2nd NECKING
FLANGING
INFEED
OUT-FEED
TRANSFER TURRETS
300
302
304
306
308
310
312
314
316
318
320
322
324
12

Fig. 4

METHOD OF AND APPARATUS FOR FORMING CONTAINER BODIES

BACKGROUND OF THE INVENTION

This is a Continuation of application Ser. No. 82,986, filed Oct. 22, 1970, now abandoned.

This invention relates to the forming of container bodies, and more particularly, to deforming open ends of container bodies.

Various operations may be performed on the open end of a container body. In some cases, these operations are adapted to deform the container body to achieve a desired shape. One such operation is necking-in which reduces the diameter of the container body at the open end to, in effect, form a neck on the container body. Other operations which are performed on the container body at the open end are intended to reshape the container body to receive a suitable end member. One such operation is flanging which turns the open end of the container body outwardly in preparation for a suitable operation such as double seaming to an end member. Still other operations such as presizing and deburring prepare the open end of the container body for the previously mentioned operations.

Presently, the operations of necking-in, flanging, presizing, and deburring are utilized to a very great degree in the beverage or bear can industry. Necking-in has become popular as a means of reducing the diameter of the can end member thereby effecting the cost savings in the can. Furthermore, the necking-in permits the cans to be positioned side-by-side with the side wall or one can body being flush with the side wall of the other can body without interference from the chime created by double seaming can ends to the container body. Of course, flanging is necessary in preparation for the double seaming operation which is utilized for at least one end of the can. Pre-sizing and deburring are important to eliminate wrinkling which might otherwise result during necking-in.

In order to neck-in the open ends of the can bodies as well as the open ends of other containers, a spinning or rolling technique has been utilized heretofore. The spinning or rolling technique involves the use of a rotating die which engages the open end of the container body and rolls the open end inwardly. In some instances, the die may include revolving rollers which engage the open end as the die rotates. These prior arts techniques of necking-in by spinning or rolling the open end of a container body have generally been inefficient and slow.

Another technique for necking-in and flanging container bodies has involved the use of a nonrotating deforming die which engages the open end of the container body. This technique is somewhat difficult to utilize since the container body may collapse under the pressure of the die, particularly necking-in. In the beverage and beer can industry, the likelihood of can collapse is very great due to the emphasis on very thin walls so as to minimize the amount of metal in each can. Furthermore, any slight error in positioning the container body with respect to the die further increases the chances of collapse.

SUMMARY OF THE INVENTION

It is a general object of this invention to provide an improved method of and means for deforming the open end of a container body.

It is one specific object of this invention to prevent collapse of the container body during deformation of the open end.

It is another specific object of this invention to stabilize and to achieve proper alignment for a container body during deformation of the open end.

It is a further specific object of this invention to achieve the foregoing objects with respect to a beer or beverage can of the drawn, wall-ironed type having an integral can body bottom and very thin can side walls.

In accordance with the objects of the invention, fluid under pressure is introduced into the interior of a container body as a deforming die engages an open end of the container body. By maintaining sufficient pressure in the interior of the container body through the use of fluid under pressure, collapse of the container body may be prevented. In a preferred embodiment of the invention, fluid under pressure is introduced through the die means which serves as a plug at the open end of a drawn can with the other end of the can closed by the integral can bottom.

In further accordance with one object of the invention, the container body is appropriately positioned by the fluid under pressure before the die means engages the open end of the container body. By providing a container body platform having a central supporting surface capable of being depressed with respect to a peripheral positioning surface, the fluid under pressure entering the interior of the container body depresses the central supporting surface thereby permitting the peripheral positioning surface to engage and appropriately position the container body prior to engagement of the open end by the die means. In accordance with a preferred embodiment of the invention, the peripheral supporting surface is substantially frustoconical so as to conform with a substantially frustoconical surface of the integral bottom in a drawn can.

As shown in one embodiment, the die means may comprise a necking-in die. In other embodiments, the die means comprises a flanging die, a pre-sizing die, and/or a deburring die.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectioned elevation of one embodiment of the invention depicting a necking-in operation;

FIGS. 1(*a–c*) are fragmentary views of various phases in the necking-in operation of FIG. 1;

FIG. 2 is a sectional view of a flanging die for another embodiment of the invention;

FIG. 3 is a sectional elevation of yet another embodiment of the invention depicting a deburring operation.

FIG. 3*a* and 3*b* depict a container body before and after removal of a burr; and

FIG. 4 is a schematic view of a system incorporating various embodiments of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

In the embodiment of FIG. 1, an open end 10 of a container body 12 is being necked-in by a die means 14. An integral bottom 16 of the container body 12 rests upon a platform 18. In accordance with techniques well known in the art, the die means 14 may be mounted on a movable slide 20 of a turret with the platform 18 being fixed to the turret base 22.

In accordance with one very important aspect of the invention, fluid under pressure is applied to the interior

of the container body **12** so as to prevent collapse during the forming or necking-in operation. The fluid which may comprise air is introduced into the container body of the interior by means of a passageway **24** extending axially through the die means **14** which is in turn connected to a source of fluid under pressure including passageway **25** of the slide **20.**

In accordance with another important aspect of the invention, the platform **18** comprises a central surface **26** for supporting the container bottom **16** and a container peripheral surface **28** for positioning and stabilizing the container body **12** upon the application of fluid under pressure to the interior of the container body **12.** More specifically, the central supporting surface **26** which is spring biased to the position shown in phantom before the introduction of fluid under pressure to the interior of the bottom **12** is depressed to the position shown in full so as to permit the peripheral positioning surface **28** to engage a frustoconical portion **30** of the container bottom **16** as also shown in full. As shown in phantom, the container body **12** may be off center and inclined with respect to the axis of the punch means **14.** However, once the central supporting surface **26** is depressed to the position shown in full, the peripheral positioning surface **28** will guide the frustoconical portion **30** to an appropriate position resulting in an upright, stable, and properly positioned container body **12.**

The nature of the die means **14** will now be discussed in some detail. As shown, the open end **10** of the container body **12** is received between opposing die surfaces including an outer die surface **32** which converges toward the container body axis at the open end **10** and a substantially cylindrical inner die surface **34** which is terminated at a shoulder **36.** As shown in FIG. **1***a*, the open end **10** is spaced from the outer die surface **32** as the fluid under pressure enters the interior of the container body for purposes of aligning and stabilizing the container body. Then as shown in FIG. **1***a*, the open end **10** of the container body **12** rides upwardly along a sealing portion **35** of outer die surface **32** as the slide **20** moves downwardly toward the bolster **22** making a substantial seal between the die surface and the open end **10.** Nearer the end of the stroke for the slide **20,** the open end **10** is deformed by a deforming portion of the outer die surface **37** as shown in FIG. **1***a*. Fluid under pressure continues to be applied to the interior of the container to prevent collapse.

The outer die surface **32** which is part of another die element **38** is held in place on the slide **20** by means of a threaded cap **40.** The inner die surface **34** which is part of the inner die element **42** is held in place on the slide **20** by means of a bolt **44** which is received by threads within the slide **20.** The bolt **44** is of particular significance since it includes the passageway which passes the fluid under pressure. Since it is important to maintain the pressure of this fluid, a number of seals **46** are provided between the cap **40,** the outer die element **38,** the inner die element **42,** and the bolt **44.**

At the platform **18,** the central supporting surface **26** is part of a spring biased piston **48** which moves through a limited stroke within a ring **50** providing the peripheral positioning surface **28.** The spring bias for the piston **48** is provided by spring **54** which is located within an annular groove **56** of the piston **48** and an annular groove **58** of a base **60.** The path of the piston **48** is limited to an axial motion by the walls **62** of the ring **50** as well as a bearing surface **64** at a central bolt **66** which engages the bolster **22.** Additional bolts **68** are provided to secure the ring **50** to the base **60.**

At the bottom of the stroke for the piston **48,** the spring **58** will be compressed with some space remaining between the bottom of the piston **48** and the top of the base **60** in the vicinity of the groove **58** and **56.** Prior to the application of fluid under pressure to the interior of the container body or after such application, the piston element **48** will rise to the position shown in phantom due to the bias provided by the spring **54.** The piston **48** will be prevented from further rising by ears **70** and **72** on the piston **48** and the ring **50** respectively.

The pressure of the fluid to be applied to the interior of the container will vary depending upon the pressure needed to prevent collapse of the container and appropriately position and stabilize the container on the platform **18.** For the particular container shown which comprises a drawn, wall-ironed can having very thin walls a pressure of 60 to 80 PSI has been found desirable. In particular, it has been found that such a pressure will prevent collapse of the very thin walls in such a can. This particular can is described in substantial detail in copending application Ser. No. 57,124 filed July 22, 1970.

The details of the bottom **16** including the near 40° angle of the frustoconical surface **30** with respect to the axis of the container **12** is also described in detial. For such a frustoconical configuration, it is desirable to provide a conforming configuration for the peripheral positioning surface **28** also. Of course, the central panel **26** must be sufficiently small to allow the peripheral positioning surface **28** to provide the positioning function. In this connection, it is noted that as the area for diameter of the surface is substantially the same diameter as the bead **74** of the container bottom **16.** In some cases, it may be desirable to provide a yoke for the container body **12** to prevent the container from falling off the relatively small supporting surface **26.**

In FIG. **2,** a flanging die **140** has been partially shown as comprising a flanging die element **142** located within a ring **144.** The die element **142** includes an interior die surface which diverges outwardly in the area of engagement with the open end **10** of the container body which has been shown in phantom. The open end **10** which is flared outwardly reaches the point adjacent a shoulder **148** of the ring **144** at the bottom of the stroke for the flanging die **140.** In this connection, it should be understood that the flanging die means **140** may be mounted on a ram such as that shown in FIG. **1.**

Also as shown in FIG. **2,** fluid under pressure may be applied through a suitable passageway in the interior of the die element **142** not shown. For example, elements such as the bolt **44** may be utilized in the opening **150** of the die element **142** so as to provide air or another suitable fluid under pressure to the interior of the container body **12** prior to and/or during the flanging operations to prevent the collapse of the container body **12** and/or properly positioning the container body **12.**

As shown in FIG. **3,** a deburring operation is performed by a die means **214.** In the interest of simplicity and clarity in description, those elements of the die means **214** which are substantially identical with the die means **14** will carry the same reference character preceded by the number **2.** The primary difference between the die means **214** and the die means **14** resides in the outer die surface **232.** Rather than provide an in-

wardly tapering die surface above the sealing portion **235,** a substantially cylindrical surface **237** is provided which defines a substantially cylindrical opening in combination with the inner die surface **234.** This opening has a width in substantial conformance with the open end **10** below any burr to removed. FIGS. **3a** & **3b** show a portion of the container body **12** before and after removal of an outside burr B respectively. The same dies **238** and **242** may be used to remove an inside burr.

As the slide **220** descends to the position on the container body **12** shown in FIG. **3,** a fluid such as air under a pressure of 60 to 80 PSI is introduced into the interior of the container body **12** to prevent container body collapse. Once the open end **10** reaches the shoulder **236,** and the burr B is removed, the slide **220** begins to rise while the pressure of 60 to 80 PSI is maintained on the interior of the container body **12.** This pressure may then be used to eject the body **12** once the bottom **16** rises above a platform not shown.

The foregoing embodiments of the invention may be combined in the system of FIG. **4.** The container bodies **12** enter the system on an infeed conveyor **300.** Initially, the open ends **10** of the bodies **12** are presized at a turret **302** including a plurality of positions **304.** Each of the positions **304** include a slide carrying presizing die or a flanging die such as that shown in FIG. **3.** The bodies **12** are then advanced to a first necking turret **306** by a transfer turret **308.** The positions **310** of the necking turret **306** include a slide **20** carrying the die **14** and a platform **18** shown in FIG. **3.** After the first necking-in operation is completed, the bodies **12** advance through another transfer turret **312** to a second necking turret **314.** The second necking turret includes dies at stations **316** of slightly smaller diameter than the dies of the turret **306.** By performing the necking-in in two operations, the necking-in is performed gradually so as to reduce the chances of fracturing of collapsing the container bodies **12.** Finally, a flanging turret **318** having die elements as shown in FIG. **2** at various positions **320** is provided, which receives the bodies **12** from a transfer turret **322.** An outfeed conveyor **324** removes the bodies **12** from the flanging turret **312.**

Although a drawn container body having a closed end in the form of an integral bottom is disclosed, the container body need not be of this type. For example, the closed end may be provided by a double seamed end or other suitable means.

It will be understood that a suitable source of fluid under pressure may be provided as will occur to those of ordinary skill in the art along with suitable means for controlling the application of fluid to the interior of the container body.

Although particular embodiments of the invention have been shown, various modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

What is claimed:

1. Apparatus for deforming the open end of a container body having side walls and a closed end comprising:

a source of fluid under pressure;

a deforming die means for deforming the open end of said container including means for applying said fluid from said source to the interior of said container through said open end before and during deformation of said open end for purposes of positioning and preventing collapse of said container body;

a platform means opposite said die means for supporting said container at said closed end including a supporting surface and a positioning surface, said container resting on said supporting surface before the application of said fluid under pressure, said supporting surface being depressed with respect to said positioning surface during the application of said fluid under pressure to the interior of said container and permitting said container to be guided by said positioning surface; and

a means for moving said die means relative to said platform means to engage the open end of said container body by said deforming die means after said container has been engaged and appropriately positioned by said positioning surface.

2. The apparatus of claim **1** wherein said positioning surface is located at the periphery of said supporting surface.

3. The apparatus of claim **2** wherein said positioning surface conforms with shape of said container body at said closed end.

4. The apparatus of claim **3** wherein said die means comprises a necking-in die having an outer die surface converging inwardly toward and an inner die surface, said outer die surface engaging the outer side wall of said container body and said inner die surface engaging the inner side wall of said container body, said outer side wall forming a seal with said body at the open end during deformation.

5. The apparatus of claim **3** wherein said die means comprises a flanging die having an inner die surface converging outwardly toward the axis of the container body and an outer die surface, said inner die surface engaging the exterior side wall and said outer die surface engaging the exterior side wall so as to form a seal with said container body at the open end during deformation.

6. The apparatus of claim **5** wherein said die means comprises a presizing die having a substantially cylindrical outer die surface and a substantially cylindrical inner die surface.

7. A method of forming the open end of a drawn can body comprising the steps of:

forming a seal between the open end of the can body and a die;

applying fluid under pressure to the interior of the can body;

deforming the open end of said container body with said die element while said fluid under pressure prevents collapse of said can body;

supporting said can body on a supporting surface;

applying fluid under pressure to the interior of said can body prior to engagement of the open end of said can body by said die element;

depressing said supporting surface and said can body upon application of said fluid under pressure to the interior of said can body; and

engaging said can body at the bottom thereof with a positioning surface as said supporting surface is depressed so as to properly position the open end of said container body before engagement by said die.

8. The method of claim **7** wherein the pressure of the fluid applied to the interior of the container body exceeds from 60 to 80 PSI.

9. The method of claim 8 wherein the step of deforming comprises a necking-in of the open end of said cam body.

10. The method of claim 8 wherein the step of deforming comprises an outward flanging of the open end of said can body.

11. The method of claim 8 wherein the step of deforming comprises a presizing of the open end of said can body.

12. The method of claim 8 wherein the presizing comprises deburring.

13. A system for forming the open end of a container body in a plurality of operations at a plurality of apparatuses respectively, each of said apparatuses comprising:

a die means for deforming the open end of a container body, said die means including inner and outer die surfaces for receiving said open end of said container body, at least one of said surfaces including a sealing portion having a diameter substantially conforming with the undeformed diameter of said container body so as to form a seal with said open end of said container before deformation thereof, said sealing portion extending a substantial distance parallel with the axis of the container body;

means for moving said die means through a stroke bringing said die means into engagement with the open end of said container body; and

means for applying fluid under pressure to the interior of said container body while said sealing portion is in contact with said open end creating a substantial fluid pressure on the interior of said container body before applying any substantial deforming force parallel to the axis of said container so as to prevent collapse of said container body during deformation.

14. The system of claim 13 wherein the other of said die surfaces of said die means in one of said apparatuses for performing one operation is radially outwardly spaced from said one die surface in said one of said apparatuses so as to receive said open end therebetween, said other die surface in said one of said apparatuses converging inwardly toward the axis of the container so as to neck-in the open end of said container body at the open end of said container body.

15. The system of claim 14 wherein said one die surface of said die means in another of said apparatuses for performing another operation is radially inwardly spaced from the other die surface in said other of said apparatuses so as to receive said open end therebetween, said one die surface in said other of said apparatuses diverging outwardly from said axis of said container body so as to outwardly flange the open end of said container body.

16. The system of claim 15 wherein said one die surface of said die means in yet another of said apparatuses for performing yet another operation is substantially cylindrical and radially spaced from said other die surface in said yet another of said apparatuses for deburring the open end of said container body.

17. The system of claim 13 wherein said means for applying fluid under pressure applies said fluid before said die means engages said open end of said container body.

18. A system for forming the open end of a container body comprising:

a die means for deforming the open end of a container body, said die means including inner and outer die surfaces for receiving said open end of said container body, at least one of said surfaces including a sealing portion having a diameter substantially conforming with the undeformed diameter of said container body so as to form a seal with said open end of said container body before deformation thereof, said sealing portion extending a substantial distance parallel with the axis of the container body;

means for moving said die means through a stroke bringing said die means into engagement with the open end of said container body; and

means for applying said fluid under pressure to the interior of said container body while said sealing portion is in contact with said open end creating a substantial fluid pressure on the interior of said container body before applying any substantial deforming force parallel to the axis of said container so as to prevent collapse of said container body during deformation.

19. The system of claim 18 wherein said means for applying fluid under pressure applies said fluid before said die means engages said open end of said container body.

20. A system for forming the open end of a container body comprising:

die means having at least one die surface for deforming the open end of a container body, said die surface including a substantially cylindrical sealing portion having a diameter substantially similar to the diameter of the undeformed open end of the container body and a deforming flared portion;

means for moving said die means through a stroke relative to said container body so as to bring said cylindrical sealing portion into sealing engagement with the open end of said container body thereby forming a substantially fluid-tight seal between said cylindrical sealing portion and the open end of said container body before engagement by said deforming flared portion; and

means for applying fluid under pressure to the interior of said container body before said open end of said container body is engaged by said deforming flared portion so as to prevent collapse of said container body during deformation.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,812,696 Dated May 28, 1974

Inventor(s) RAYMOND H. P. KNEUSEL ; VINSON S. POTTS

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, claim 5, line 36, "exterior" should read --interior--.

Column 7, claim 9, line 2, "cam" should read --can--

Signed and sealed this 17th day of June 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks