United States Patent [19]

Siemonsen et al.

[11] **3,850,340**

[45] **Nov. 26, 1974**

[54] **NESTABLE CONTAINER AND APPARATUS FOR AND METHOD OF MAKING SAME**

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[73] Assignee: **Reynolds Metals Company**, Richmond, Va.

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[21] Appl. No.: **272,060**

Related U.S. Application Data

[60] Division of Ser. No. 92,446, Nov. 24, 1970, Pat. No. 3,695,084, which is a continuation-in-part of Ser. No. 86,866, Nov. 4, 1970, abandoned.

[52] **U.S. Cl.** ..... **220/74,** 220/97 C

[51] **Int. Cl.** **B65d 7/48,** B65d 21/02

[58] **Field of Search** ..... 220/97 C, 97 F, 74; 229/43, 48 T

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Primary Examiner—George E. Lowrance

Attorney, Agent, or Firm—Glenn, Palmer, Lyne, & Gibbs

[57] **ABSTRACT**

A nestable container and an improved apparatus for and method of making same are provided wherein a blank is drawn to define a drawn container which is reverse redrawn to form the nestable container which has a side wall and an annular planar flange extending therefrom with a toroidal bead extending from the flange and having at least a portion thereof arranged within and beneath the peripheral edge of the flange. The container is adapted to be nested in a substantially identical container so that the toroidal bead separates the flange from the flange of a substantially identical container when the container is nested in the substantially identical container.

7 Claims, 17 Drawing Figures

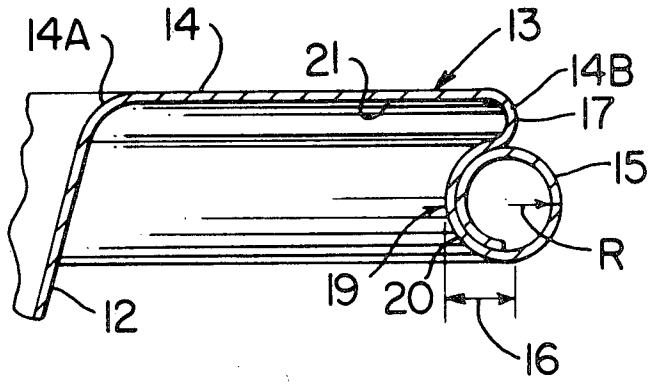


FIG. 1

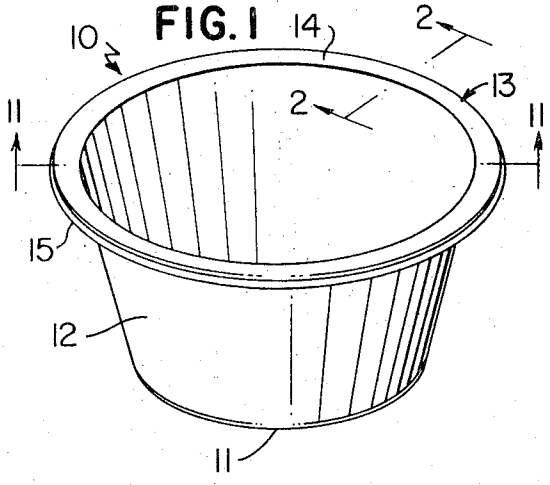


FIG. 2

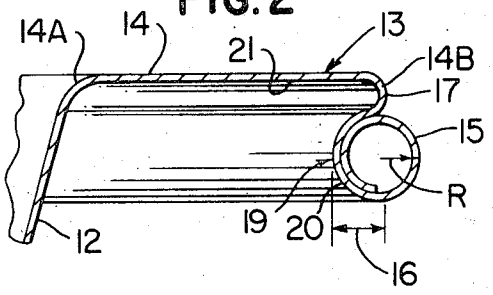


FIG. 3

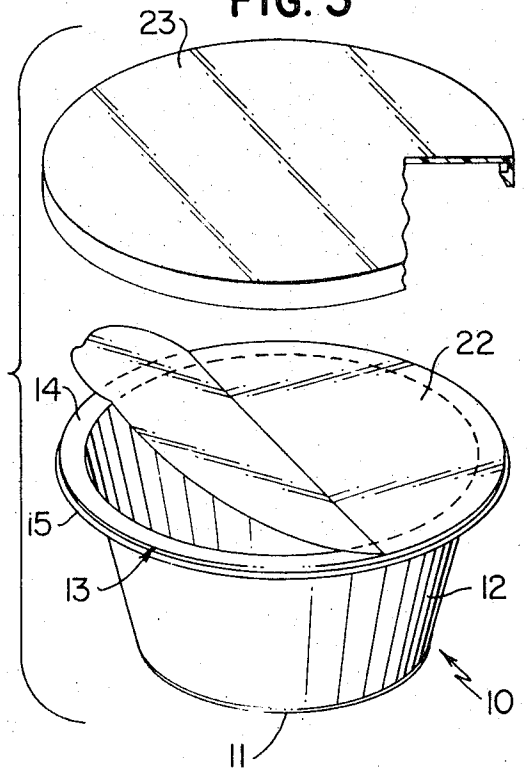


FIG. 4

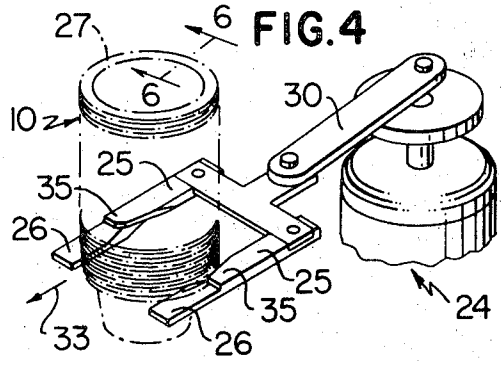


FIG. 5

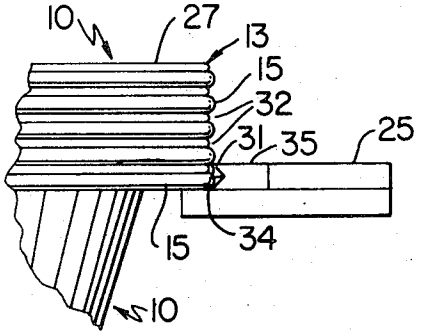


FIG. 6

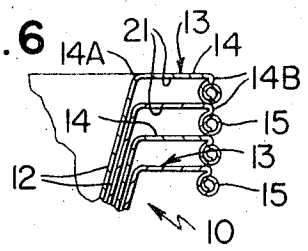


FIG. 7

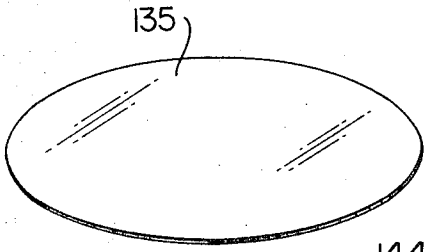


FIG. 8

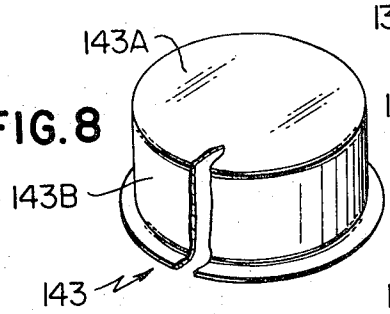


FIG. 9

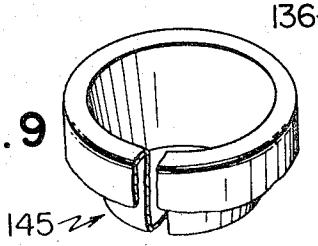


FIG. 10

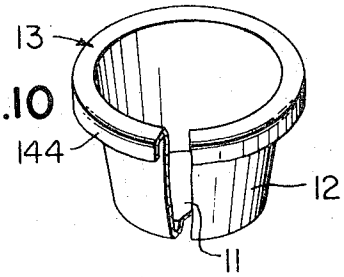


FIG. 11

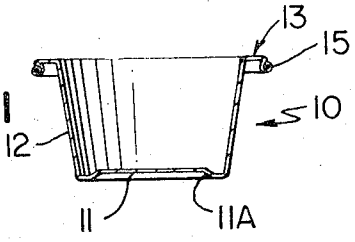


FIG. 12

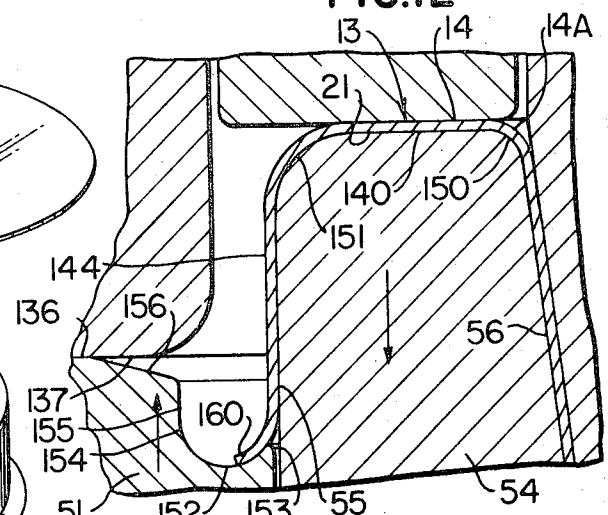


FIG. 13

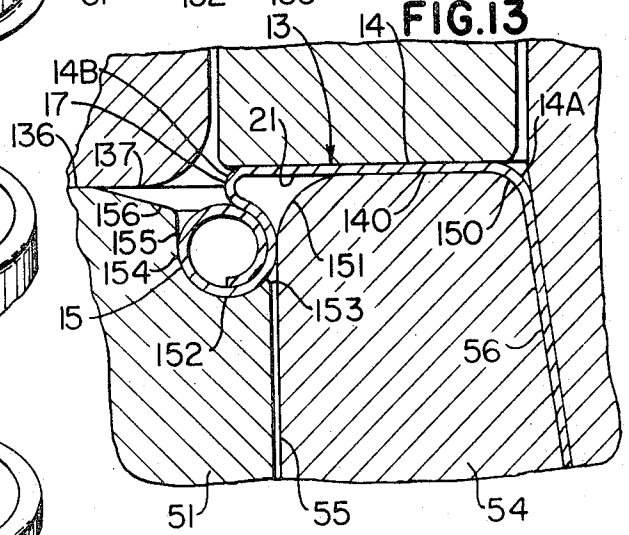


FIG. 14

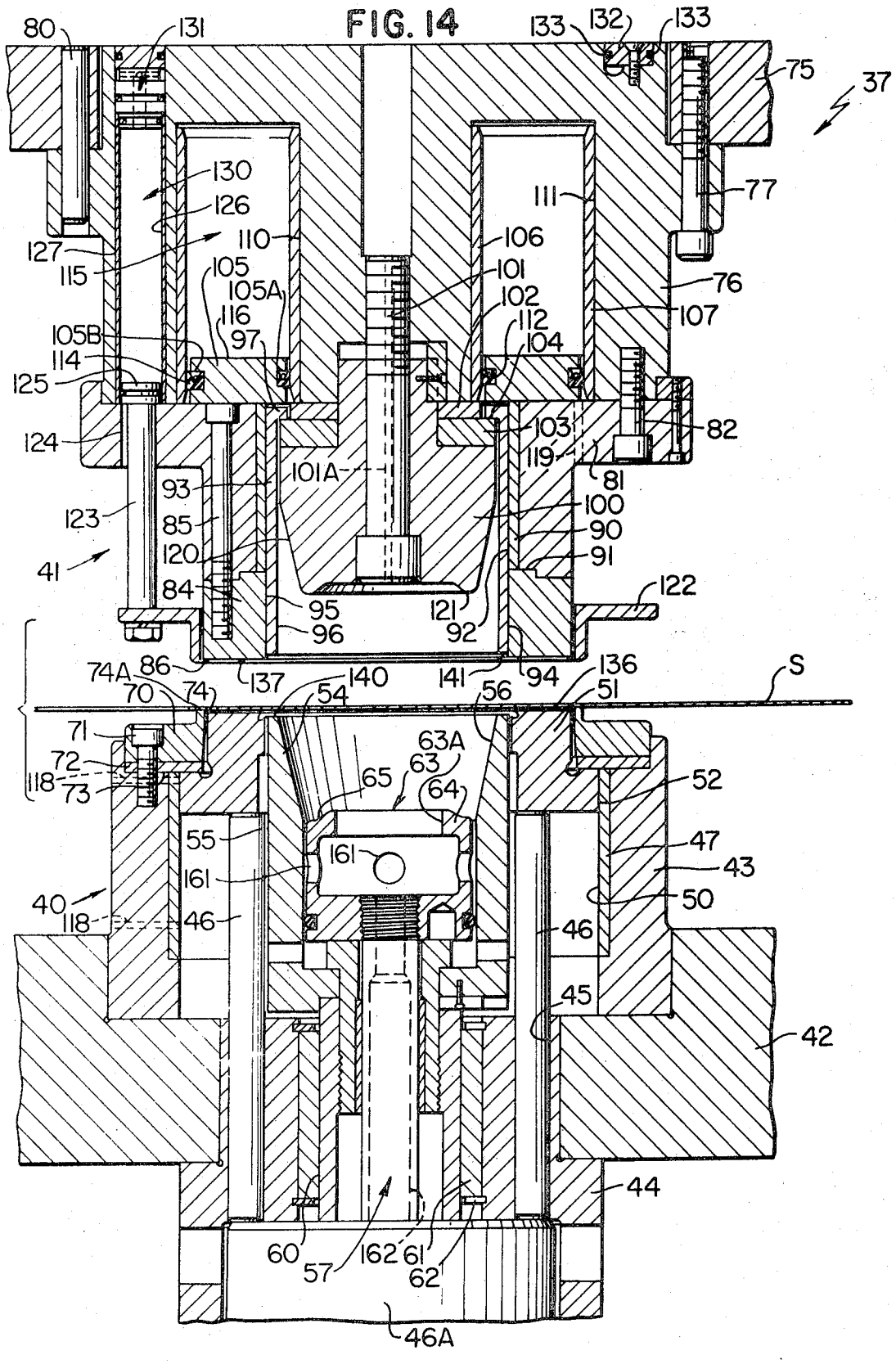

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FIG. 15

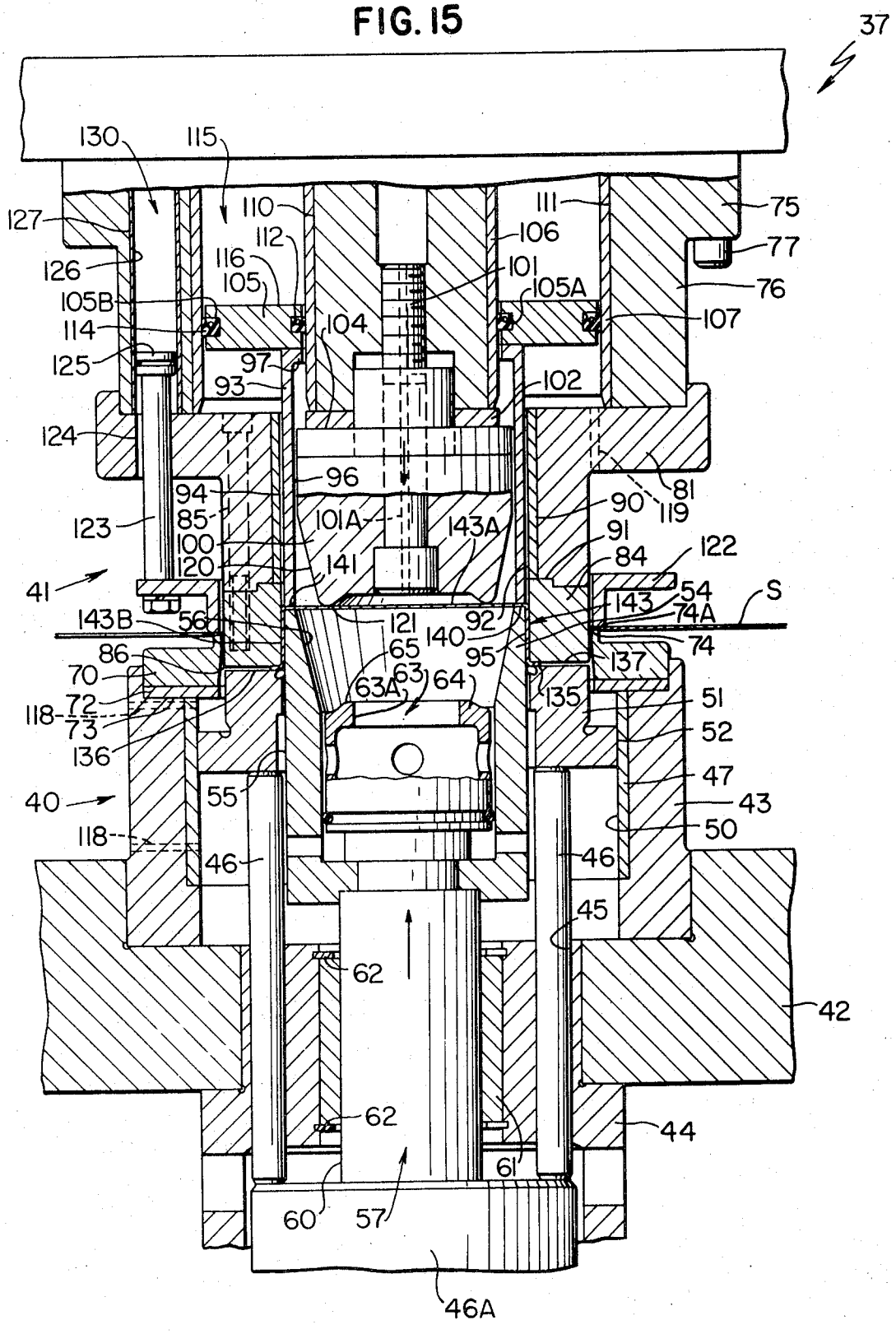

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FIG. 16

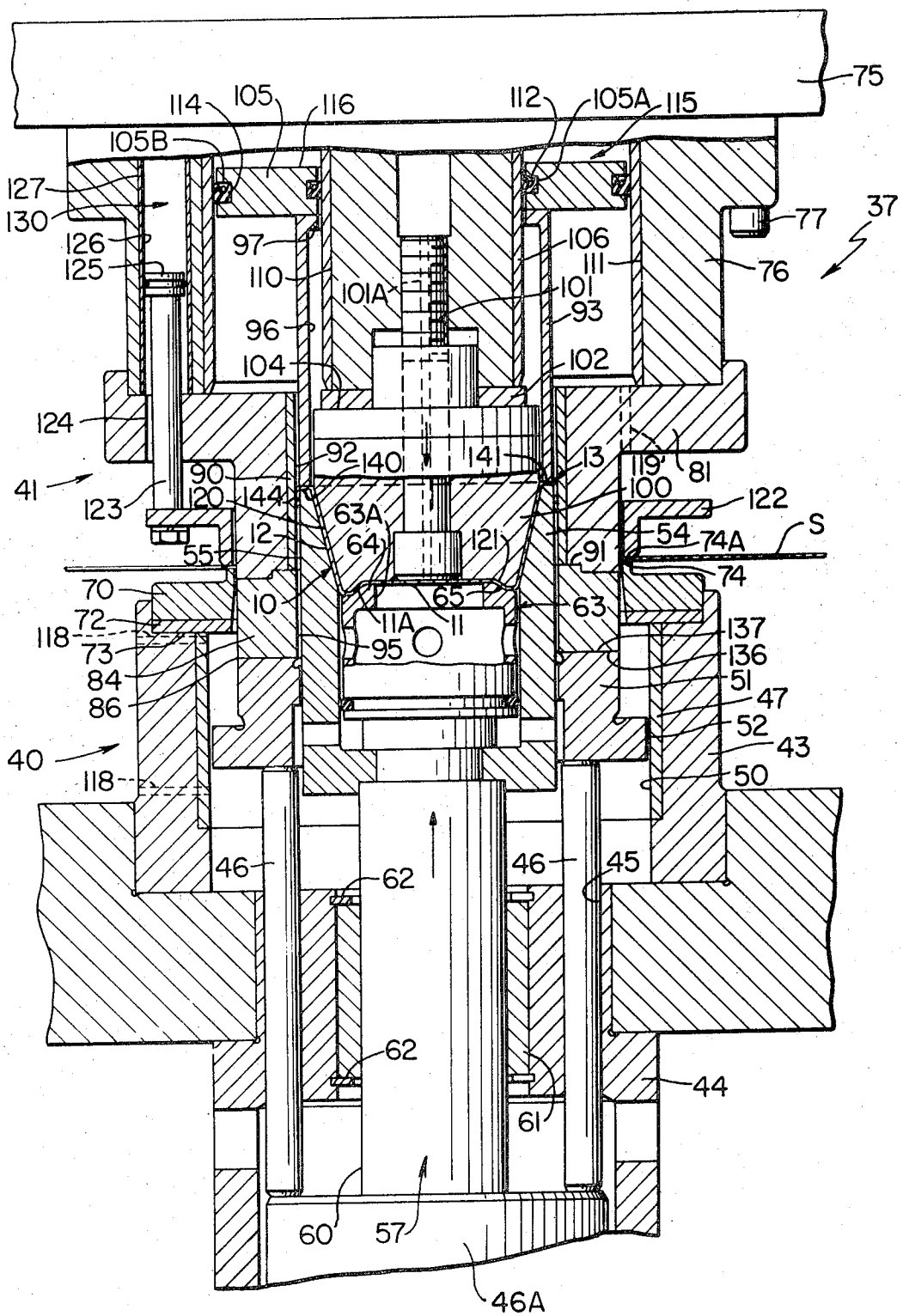
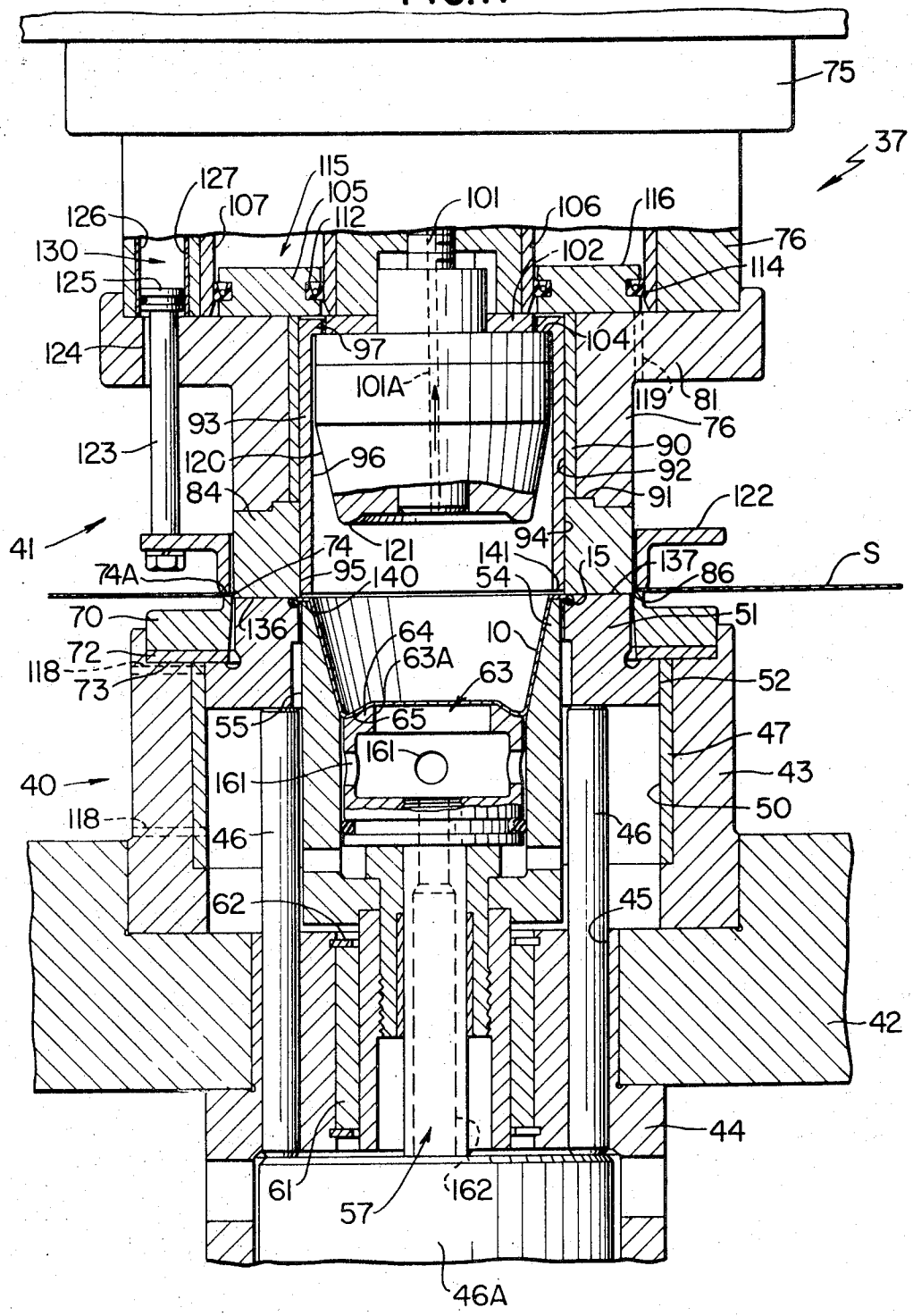

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FIG.17


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NESTABLE CONTAINER AND APPARATUS FOR AND METHOD OF MAKING SAME

This application is a divisional of applicants' copending patent application Ser. No. 92,446, filed Nov. 24, 1970 now U.S. Pat. No. 3,695,084 which is in turn a continuation-in-part of applicants' copending patent application Ser. No. 86,866, filed Nov. 4, 1970 now abandoned.

BACKGROUND OF THE INVENTION

Previously proposed containers made of comparatively thin gauge materials such as metallic foil, for example, are generally deficient because the peripheral flange extending from the top wall of each of these containers has an inadequate sealing area which makes it difficult to provide a satisfactory fluid-tight closure for each of these containers. Further, it is often necessary to provide special offset portions in the side walls of these previous containers to enable dispensing thereof using automatic equipment. In addition, the use of thin gauge materials together with the poor beads provided on peripheral flanges of these previous containers makes reclosure of these containers very difficult.

Currently used apparatus and methods for producing drawn containers are usually satisfactory when working with comparatively heavy gauge materials but cause excessive scrap when applied to the making of thin gauge containers using hardened metallic foil stock.

SUMMARY

This invention provides an economical container made of thin gauge materials and an improved apparatus and method for making such a container from a blank of hardened metallic foil wherein each blank is drawn to define a drawn container which is reverse redrawn to form a nestable container which has a side wall and an annular planar flange extending therefrom with a toroidal bead extending from the flange and having at least a portion thereof arranged within and beneath the peripheral edge of the flange. The container is adapted to be nested in a substantially identical container so that the toroidal bead separates the flange from the flange of a substantially identical container when the container is nested in a substantially identical container. Thus, the placement and construction of the toroidal bead gives additional rigidity to the flange of its container and enables easy dispensing of each container from a stack of nested containers.

Other details, uses, and advantages of this invention will become apparent as the following description of the embodiment thereof presented in the accompanying drawings proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings show a present preferred embodiment of this invention, in which

FIG. **1** is a perspective view of the container of this invention;

FIG. **2** is an enlarged fragmentary cross-sectional view taken on the line **2—2** of FIG. **1**;

FIG. **3** is an exploded perspective view with parts in cross section and parts broken away particularly illustrating a closure partially unfastened from a planar flange extending from the side wall of the container and illustrating a reclosure lid which is adapted to be used on the container;

FIG. **4** is a perspective view with parts broken away illustrating a dispensing device operatively associating with a stack of nested containers of this invention to provide dispensing of individual containers from the bottom of such stack;

FIG. **5** is a fragmentary end view particularly illustrating the manner in which an arm of the device of FIG. **4** operatively associates with the flanges and beads comprising a plurality of stacked containers;

FIG. **6** is a fragmentary cross-sectional view taken essentially on the line **6—6** of FIG. **4**;

FIG. **7** is a perspective view of a flat blank used to make the container of FIG. **1**;

FIG. **8** is a perspective view with a portion broken away showing the blank of FIG. **7** partially drawn to form a drawn container;

FIG. **9** is a perspective view with a portion broken away illustrating the drawn container of FIG. **8** partially redrawn in a reverse direction;

FIG. **10** is a perspective view with a portion broken away of the container construction of FIG. **9** completely redrawn to define a bottom wall and side wall while leaving a tubular wall portion extending outwardly from an annular flange provided at the top of its side wall prior to forming the tubular wall portion to define the toroidal bead and the completed container of FIG. **1**;

FIG. **11** is a cross-sectional view taken on the line **11—11** of FIG. **1** and drawn to the same scale as the container construction of FIG. **10**;

FIG. **12** is an enlarged fragmentary cross-sectional view illustrating cooperating components of a forming apparatus used to form the tubular wall portion to define the toroidal bead and illustrating the cooperating components at the beginning of the bead-forming action;

FIG. **13** is a fragmentary cross-sectional view similar to FIG. **12** illustrating the positions of the cooperating components of the bead-forming apparatus once the toroidal bead has been formed;

FIG. **14** is a fragmentary cross-sectional view illustrating an exemplary embodiment of the apparatus used in making the container of FIG. **1** prior to the beginning of the forming action and illustrating an elongated strip or web of metallic material arranged between cooperating die sets of the forming apparatus;

FIG. **15** is a view of the apparatus of FIG. **14** with the die sets partially moved together and operating to draw a blank (which was sheared upon initially moving the die sets together) to define a drawn container with the partial movement of such die sets being sufficient to define the container of FIG. **8**;

FIG. **16** is a view similar to FIG. **15** illustrating the die sets in a further stage whereupon such assemblies have moved together sufficiently to define the reverse redrawn container construction illustrated in FIG. **10**; and

FIG. **17** illustrates the position of the cooperating die sets after forming of the toroidal bead at the periphery of the annular flange extending from the top edge of the side wall of the reverse redrawn container to thereby define the completed container of FIG. **1**.

DESCRIPTION OF ILLUSTRATED EMBODIMENT

Reference is now made to FIG. **1** of the drawings which illustrates an exemplary nestable container of

this invention which is designated generally by the reference numeral **10**. The container **10** has a bottom wall **11** and a frustoconical side wall **12** which has an annular flange **13** extending outwardly from the top edge thereof.

The flange **13** has a planar annular top surface **14** adjoined at opposite ends by an inner arcuate portion **14A** and an outer arcuate portion **14B**, see FIG. **2**. A toroidal bead **15** extends from the flange **13** and has at least a portion **16** arranged within the peripheral outline or peripheral circular edge **17** of the flange **13**, i.e., the portion **16** is within a right circular cylinder having a diameter which coincides with edge **17**. The bead **15** has a double thickness throughout at least a portion of its cross-sectional outline and as indicated at **20**.

The portion **16** of the bead **15** which is arranged within the peripheral outline of the flange **13** is arranged substantially adjoining the bottom surface **21** of the flange **13**. In particular, the top surface of bead **15** is arranged beneath the plane of the bottom surface **21** by a distance which is less than the cross-sectional radius R of the bead **15**.

As will be apparent from FIG. **2** of the drawings, substantially all of the planar annular top surface **14** is usable to provide a sealing surface area for a lid or closure such as the exemplary closure **22** shown in FIG. **3**; and, the closure **22** may be fastened against surface **14** using techniques known in the art. The surface **14** has a large area which is greater than the major portion of the area of a top plan view of the flange **13** with its bead **15**. The surface **14** has an area which is substantially larger than a similar seal area of about half this size which is available on metallic foil containers proposed heretofore.

Not only does the container **10** have a large seal area provided on its annular flange **13** but the construction and arrangement of the toroidal bead **15** also effectively supports the flange **13** to thereby increase its strength and rigidity. In addition, the provision of toroidal bead **15** which has substantial strength enables a reclosure lid, such as the lid **23** illustrated in FIG. **3** to be easily placed on the container **10** once the closure **22** has been removed and only a portion of the contents of the container removed.

The container **10** may be made of any suitable material; however, it is preferably made of metallic foil such as **3003-H19** aluminum foil which may have a wall thickness in the range of 0.0035 inch, for example. The container **10** is preferably made from a flat blank which may have suitable layer means such as a coating on either one or both of its surfaces. The container **10** is preferably made by first drawing the blank to define a container and the container is then reverse redrawn. During the return of the cooperating forming dies used to make the container to their initial position following the reverse redrawing action, the toroidal bead **15** is formed in the peripheral flange **13** and it will be appreciated that such bead is in essence a reverse bead. With such a reverse bead the first annular increment of metal, such as annular increment **19**, see FIG. **2**, always faces toward the side wall **12** of the container.

The container **10** may have a thermoplastic material in the form of a coating, layer, or the like defining its inside surface. The thermoplastic material, such as a thermoplastic vinyl, may be locally heated and used as the adhesive means for heat sealing the closure **22** against the top surface **14**. The container **10** may also have a suitable protective thermosetting material in the form of a coating or a laminated layer defining its outside surface.

The inside of the side wall **12** of the container may have one appearance or color and the outside of such side wall may have another appearance or color. Upon forming the reverse toroidal bead **15** the two colors are presented one to the other in contrast. Thus, the appearance of the outside surface of the bead will be the same as the outside surface of the container and this is arranged immediately adjacent the top planar surface which has the same appearance as the inside surface of the container.

The container **10** may be easily dispensed from a stack of nested containers using a dispensing device such as the device designated generally by the numeral **24** in FIG. **4** of the drawings and such device may comprise automatic dispensing machinery. The device **24** has a pair of parallel arms **25** arranged on opposite sides thereof and the arms **25** have forward portions or surfaces **26** which are adapted to support the bottom surface of the toroidal bead **15** of each container.

A stack of containers may be suitably supported to prevent horizontal movement thereof essentially as illustrated at **27** in FIG. **4** whereupon the arms **25** are reciprocated forwardly by an eccentric cam mechanism **30** of the device **24** causing wedge-shaped portions **31** of the arms **25** to move in the space **32** defined between container **10** and a substantially identical container **10** stacked therebeneath. Thus, the lowermost container **10** is dispensed from the stack **27** onto a suitable means such as a conveyor or the like (not shown) for advancement of the empty container to a filling station or other suitable station for further processing. The dispensing is achieved by moving the arms **25** forwardly in the direction of the arrow **33** causing the wedge-shaped portions to move into an associated space **32** and causing the bottom surface **34** of the bead **15** of a container **10** nested within the lowermost container **10** to be supported on a surface **35** of arms **25** to thereby support the entire stack **27** of containers **10**. The arms **25** are then reciprocated rearwardly by the cam mechanism **30** in a direction opposite the direction of the arrow **33** causing the entire stack to drop onto the surfaces **26** enabling the entire procedure to be repeated and thereby enable dispensing of individual containers **10** from the bottom of stack **27**.

From the above description, it is apparent that the bead **15** serves to reinforce the flange **13** and assure that the surface **14** retains its planar form. In addition, the construction and arrangement of the bead **15** with respect to the planar surface **14** enables the flange **13** to be used as a spacing means having a height which defines the space **32** within which the wedge-shaped portions **31** of the reciprocating arms **25** may be freely moved whereby the containers **10** may be automatically dispensed. Further, the bead **15** assures that once a plurality of containers are stacked together in nested relation a space is provided between the side walls **12** of adjoining containers, see FIG. **6**, whereby the containers **10** may be more easily dispensed.

The container **10** illustrated in FIG. **1** preferably is made using the apparatus and method of this invention, which is designated generally by the reference numeral **37** in each of FIGS. **14–17** of the drawings. The apparatus **37** comprises a lower die set or structure **40** and a cooperating upper die set or structure **41** and such die

sets may be readily used on a die press of standard construction.

The lower die set **40** comprises a fixed support **42**, see FIG. **14**, which has a die holder **43** fixed thereto and die set **40** also has a cushion **44** fixed to the support **42**. The cushion **44** has a plurality of cylindrical bores **45** extending vertically therethrough with each bore receiving a pressure pin **46** therethrough and the cylindrical surfaces defining the bores **45** support the pins **46** for axial sliding movement vertically. The die holder **43** has a wear bushing or sleeve **47** fixed thereto which may be considered as defining an inside cylindrical surface **50** for such die holder.

The die set **40** has a curling ring **51** supported concentrically within the die holder **43** and the curling ring has an outside surface **52** which is slidably supported for vertical movement along the cylindrical surface **50**. The curling ring **51** also has a portion which is particularly adapted to define the reverse toroidal bead **15** in the container **10** and such portion will be described in detail subsequently.

The die set **40** has a first die member which, in essence, is a dual purpose die member **54** and such die member has an outside forming surface **55** of right circular cylindrical configuration and an inside forming surface **56** of substantially frustoconical configuration. The die member **54** is fixed to a shaft assembly **57** which may be actuated using any suitable means to move the member **54** vertically upwardly and downwardly relative to the fixed support **42** of its die set **40**.

The shaft assembly **57** has an outer cylindrical surface **60** which is supported for vertical sliding movements by a cylindrical wear sleeve **61** which is axially confined in the cushion **44** by a pair of snap rings **62** arranged at its opposite ends. The member **54** also has a member **63** which is fixed thereto and includes a forming portion **64** which has a contoured forming surface **65**. The portion **64** is arranged adjacent the bottom edge of the frustoconical inside forming surface **56** and its contoured surface **65** is used to define the contoured configuration **11A** in the periphery of the bottom wall **11** of the container **10**, see FIG. **11**.

The die set **40** also has a female blanking die **70** which is attached to the die holder **43** by a plurality of threaded bolts **71** and a spacer **72** is disposed between the bottom surface of the blanking die **70** and a supporting shoulder **73** on the die holder **43** to assure correct positioning of the blanking die **70**. The blanking die **70** has an inside cutting edge **74** which, in this example of the invention, has a circular outline.

The upper die set **41** comprises a support structure **75** which has a punch holder **76** fixed to structure **75** by a plurality of threaded bolts **77** and a plurality of dowel pins **80** are provided to assure that the punch holder **76** is correctly aligned in the structure **75** prior to attachment thereof by the threaded bolts **77**. The die set **41** has a holding ring **81** which is attached to the punch holder **76** by a plurality of threaded bolts **82** and another die member **84** which may be referred to as the second die member of the apparatus **37** is provided and fixed to the holding ring **81** by a plurality of threaded bolts **85**. The die member **84** may be considered a blanking punch inasmuch as it has a cutting edge **86** of circular outline which is adapted to cooperate with the cutting edge **74** of the blanking die **70**.

The upper die set **41** has a wear sleeve **90** which has its lower edge supported on a shoulder **91** of its die member **84** and such sleeve is suitably fixed to prevent axial movement thereof. The sleeve **90** has a cylindrical inside wear surface **92**.

The upper die set **41** also has a blank holder **93** which has an outside cylindrical surface **94** which is slidably supported on the surface **92** of the wear sleeve **90** and inside forming surface **95** of the die member **84** which is aligned with surface **92** and vertically therebeneath. The blank holder **93** has an inside cylindrical surface **96** and an annular shoulder **97** is provided as an integral part of holder **93** and projects radially inwardly from the inside surface **96**.

The die set **41** includes a forming punch **100** which is fixed to the punch holder **76** by a threaded bolt **101**. The bolt **101** has a longitudinal passage **101A** extending therethrough to assure that air is not trapped between the forming surfaces of punch **100** and the container being formed. A spacer **102** and a stop ring **103** are interposed between the punch holder **76** and the punch **100**. The stop ring **103** has a surface **104** which projects radially outwardly beyond the spacer **102** and is adapted to engage shoulder **97** of the blank holder **93** to limit the downward movement of such blank holder. The upward movement of the blank holder **93** within the punch holder body **76** is controlled by an annular ring **105** and in a manner to be described in detail subsequently.

The punch holder **76** has an inner wear sleeve **106** and a larger diameter wear sleeve **107** which are suitably fixed in position against surfaces **110** and **111** respectively of the punch holder **76**. The ring **105** has a seal construction **112** carried within an associated groove **105A** and the seal construction **112** supports the inside surface of the annular ring **105** for sliding movement along the outside surface of the wear sleeve **106**. The member **105** also has another seal construction **114** which is suitably supported in a groove **105B** provided in the outside periphery of the member **105** and the seal construction **114** slidably supports the outside surface of member **105** along the inside surface of the wear sleeve **107**.

During operation of the apparatus **37** with its cooperating die sets **40** and **41**, a fluid (air in this example) under pressure is supplied and maintained in an annular chamber **115** defined between sleeves **106** and **107**. The air in chamber **115** is provided in a controlled manner as determined by the operating cycle for the press in which the apparatus **37** is used to maintain pressure on the top surface **116** of the member **105** and thereby maintain a pressure on the blank holder **93** to resist vertical axial movement thereof within the annular chamber **115**.

To assure proper operation of the apparatus **37** a plurality of vent passages **118** are provided through die holder **43** and sleeve **47** of the lower die set **40**. A plurality of vent passages **119** are also provided in the horizontally extending flangelike portion of member **81** and the passages **119** vent the space between members **105** and **81**.

The punch **100** has a convex substantially frustoconical forming surface **120** and an outer annular forming surface **121** which corresponds in configuration to the contoured configuration of the surface **65** comprising member **63** fixed to the die member **54**. The surfaces **121** and **65** cooperate to define the contoured periph-

eral edge 11A in the bottom wall 11 of the container 10 as previously mentioned.

The upper die set 41 also has a stripper 122 which is supported concentrically around the outside surface of the die member 84 and the outside surface of the lower portion of the holding ring 81. The stripper 122 has a plurality of rods 123 suitably fixed thereto and each of such rods is supported for vertical sliding movement in a cylindrical bore 124 provided in a horizontally extending flange portion of member 81.

The upper end of each rod 123 has a piston 125 which is slidably received within the inside cylindrical surface of a wear sleeve 126 which is fixed in position within an associated bore 127 in the punch holder 76. Air under regulated pressure is supplied within a chamber 130 defined by the inside surface of the wear sleeve 126 and such air acts against the top surface of each piston 125 to control the position of its associated rod 123 and, hence, the vertical position of the stripper 122. The air under pressure is supplied into each piston chamber 130 through an associated assembly 131 and a ring cap 132 is provided at the top of the punch holder 76 and has seals 133 on opposite sides thereof to prevent air leakage from the cylinders 130.

Having described the detailed construction and arrangement of the various cooperating component parts comprising the lower die set 40 and the upper die set 41 of the apparatus 37, the detailed description will now proceed with a description of the manner in which the method of this invention is employed to define the container of this invention and the manner in which the component parts of the apparatus 37 cooperate to carry out this method.

In particular, a suitable web or strip of sheet stock S such as a strip of 3003–H19 aluminum foil alloy having a thickness in the range of 0.0035 inch is provided between the die sets 40 and 41 and such die sets in this example will be described as comprising components of a standard forming press. The support 42 and die holder 43 are fixed to and comprise the bed of the forming press while the structure 75 and punch holder 76 comprise the moving press ram whereby it will be appreciated that with this construction the forming members 54 and 84 are, in essence, relatively movable toward and away from each other.

With the stock S interposed between the die sets 40 and 41, the die set 41 is moved toward the die set 40 causing the die member 84 to be used as a blanking punch whereupon its cutting edge 86 cooperates with cutting edge 74 of the female blanking die 70 to shear a flat blank which, in this example of the invention, has a circular peripheral outline and such blank is illustrated in FIG. 7 of the drawings and is designated generally by the reference numeral 135. Simultaneously with this shearing or cutting action to define the blank 135, a peripheral edge of such blank is clamped initially between an annular clamping surface 136 on the curling ring 51 and a cooperating annular clamping surface 137 on the die member 84.

Continued movement of the die sets 40 and 41 toward each other causes an annular clamping surface 140 defining the outer or top edge of the die member 54 to clamp an inner annular portion of the blank 135 against a cooperating annular holding surface 141 on the blank holder 93. As the die sets are moved further together an intermediate product or drawn container is defined which is designated by the reference numeral 143 in FIGS. 8 and 15 even though it will be seen that such container has not been completely formed.

The drawn container 143 has a bottom wall 143A and a side wall 143B and is defined by the outside forming surface 55 of the die member 54 cooperating with the inside forming surface 95 of the die member 84. During the drawing of container 143 the outer portion of the blank 135 is clamped between the annular clamping surfaces 136 and 137, see FIG. 15, while the surfaces 140 and 141 define the bottom wall 143A and serve to draw that portion of the blank 135 arranged outwardly of the surfaces 140 and 141 through surfaces 136 and 137 to define the side wall 143B. The drawing action may be achieved using a double action cushion system (not shown) which operates in a known manner so that as the die set 41 is moved downwardly the shaft assembly 57 and its associated die member 54 is moved upwardly causing the drawing of container 143 between cooperating forming surfaces 55 and 95 of the die members 54 and 84 respectively.

At the point in the forming of the drawn container 143 where the major part of side wall 143B has been defined, i.e., the position shown in FIG. 15, the punch 100 engages the bottom wall 143A of the drawn container 143 to start forming the reverse redrawn container 10. The reverse redrawing is achieved by the convex frustoconical surface 120 of the punch 100 cooperating with the concave frustoconical surface 56 of the die member 54 and during this reverse redrawing action the clamping surface 140 and the holding surface 141 on the members 54 and 93 respectively define what may be considered as an annular forming passage through which that portion of the drawn container 143 initially arranged outwardly of the peripheral outer edges of the surfaces 140 and 141 is drawn to define the redrawn container 10 and essentially in the manner illustrated in FIG. 16 of the drawing.

During the redrawing action the cooperating surfaces 56 and 120 define the side wall 12 of the container 10 and prior to completely forming side wall 12 the container is redrawn so that for an instant during redrawing it has the configuration shown at 145 in FIG. 9. At the completion of the redrawing action the contoured surface 121 of the punch 100 cooperates with the contoured surface 65 of member 63 to define the contoured peripheral configuration 11A in the bottom wall 11 of the container 10; and, the surfaces 140 and 141 cooperate to define the planar annular flange 13 of container 10.

The bottom wall 11 and side wall 12 of the redrawn container 10 are completed with the cooperating components in the positions illustrated in FIG. 16 and it will be noticed that the annular flange 13 defined between the surfaces 140 and 141 has a tubular wall portion 144 extending to one side of the plane of the annular flange 13. In this example, the tubular wall portion 144 extends beneath the horizontal plane of flange 13.

At the completion of the reverse redrawing action (which is the position of the cooperating die sets illustrated in FIG. 16 of the drawings), the die set 41 is returned to its original position by moving the ram of the forming press upwardly. During this upward movement a portion of the curling ring 51 engages the lower edge of the tubular wall 144 to form the reverse toroidal bead 15 and complete the container 10.

The curling ring 51 is actuated by the pins 46 which are moved simultaneously by the action of ram 46A en-

gaging their lower end. In addition, the construction of the components used to form the bead cooperate to assure that the completed toroidal bead lies beneath the plane of the flange **13** and has at least a portion thereof arranged within and beneath the outer peripheral edge **17** of such flange. Further, the curling ring is constructed so that the portion thereof which engages the tubular wall portion **144** may define the bead **15** which has either a single thickness or may have a multiple thickness through portions thereof as viewed in cross section.

Reference is now made to FIGS. **12** and **13** of the drawings which illustrate in enlarged view parts of the curling ring **51** and associated die members which enable the forming of the flange **13** and toroidal bead **15.** In particular, it will be seen that the die member **54** has an arcuate portion **150** as viewed in cross section extending between its concave frustoconical forming surface **56** and its clamping surface **140** and the arcuate surface portion **150** defines the inner arcuate portion **14A** of the flange **13.** The member **54** also has an arcuate portion **151** extending between its outer forming surface **55** and clamping surface **140** and portion **151** is defined by an arc having a larger radius than the portion **150** and such larger radius assures the formation of the arcuate portion **14B** in the flange **13** without obstruction once the cooperating components of the die sets are moved together in the manner mentioned above.

The curling ring **51** has a concave curling surface **152** (as viewed in cross section) one end of which terminates in a slightly rounded wedge-like edge **153.** The opposite end **154** adjoins a substantially vertically extending cylindrical surface portion **155** of controlled length. The surface **155** adjoins an inclined surface **156** which is inclined at an angle which may be generally of the order of 10° to 20° from a horizontal plane defined by the horizontal plane of the clamping surface **136.**

Once the cooperating die sets **40** and **41** have formed the bottom wall **11** and side wall **12** of the container **10** with the wall portion **144** being arranged essentially in the position illustrated in FIG. **16,** the press is returned to its initial position whereupon pins **46** restore the curling ring to its original position causing edge **153** to engage a lower edge **160** of the wall portion **144** as illustrated in FIG. **12** of the drawings and commence curling of the wall portion **144** in what may be considered a reverse manner until the curled bead **15** illustrated in FIG. **13** has been formed. During the last increment of travel of the curling ring **51** the flange **13** is maintained in a clamped manner between clamping surfaces **140** and **141** to thereby assure that the annular surface **14** remains planar and has a maximum surface area. At the completion of the forming of the bead **15** the outer arcuate portion **14B** is formed in the flange **13** by compressing the formed bead **15** upwardly toward the bottom surface **21** of the flange **13.** Thus, the bead **15** is arranged substantially adjoining bottom surface **21** and the cooperating arrangement of the components of the die sets is such that the toroidal bead is arranged substantially adjoining the bottom surface **21** by a distance which is less than the cross-sectional radius R of the bead **15.**

With the container **10** completely formed, see FIG. **17,** the stripper **122** is constantly yieldingly urged downwardly by its rods **123** which are urged by air under pressure supplied to the top surface of associated pistons **125** whereby the web or sheet S of material is held firmly against the surface **74A** of the female blanking die **70** until after die set **41** disengages die set **40.** The sheet S is then free of the die sets and may be suitably advanced a predetermined increment and the forming operation repeated to define circular blank **135,** intermediate drawn container **143,** and reverse redrawn container **10** essentially as described in detail above.

The die sets **40** and **41** are then returned to their initial positions so they are vertically spaced apart a distance greater than the amount illustrated in FIG. **14** and such distance is greater than the height of the completed container **10** to enable removal of the completed container.

Referring to FIG. **17,** it will be seen that member **63** with forming portion **64** is threadedly fastened to the shaft assembly **57.** Member **63** has a central opening **63A** and a plurality of radially extending openings **161** which together with an opening **162** extending axially through the shaft assembly **57** provide venting to atmosphere during forming of the container. The completed container **10** is removed from within the die **54** of the lower die set **40** by moving shaft assembly **57** upwardly thereby raising member **63** and container **10.** The raised container **10** may then be removed from the lower die set **40** by either a horizontal jet of air or mechanical fingers in preparation for another forming cycle.

The apparatus **37** enables the forming of the container **10** by first drawing the flat blank **135** to define the intermediate drawn container **143** and prior to completely forming the side wall **143B** of such container **143,** the redrawing action is commenced in a reverse direction whereby the total stroke of the cooperating components of the die sets **40** and **41** is kept at a minimum. In addition, the unique cooperating arrangement of the components of the die sets enables the forming of containers made of metallic foil which is in a hardened condition whereby the completed container **10** is less susceptable to damage and has greater structural strength.

The sheet stock S of metallic foil from which the reverse redrawn container **10** is made and, hence, the blanks **135** sheared therefrom may be coated with any suitable material or have a layer laminated thereagainst. The layer or coating may be such that it serves as a lubricant during the drawing and redrawing action while serving to improve the scuff resistance of the final container.

Although the container **10** has been described as being made from a sheet S of metallic foil which may either be coated or may have a layer of material bonded against either one or both of its surfaces, it will be appreciated that the container of this invention may be made utilizing stock and blanks which are either uncoated or made as a laminated construction such as a laminated construction using paper, foil, plastics, or similar materials in any desired combination and arrangement of layers. Further, the apparatus and method may be used to form containers from such laminated constructions.

The container **10** has a substantially circular peripheral outline and a frustoconical side wall. In addition, such container is made from a flat blank **135** having a circular peripheral outline. However, it will be appreciated that the apparatus and method of this invention

may be used to make containers having different configurations and using blanks having correspondingly different configurations.

While present preferred embodiments of this invention, and method of practicing the same, have been illustrated and described, it will be recognized that this invention may be otherwise variously embodied and practiced within the scope of the following claims.

What is claimed is:

1. A container comprising

a. a side wall,

b. an annular flange extending outwardly from said side wall,

1. said annular flange having a substantially planar top surface and a bottom surface,

c. an outer arcuate portion having an outer surface adjoining said substantially planar top surface and an inner surface adjoining said bottom surface,

d. and a reverse toroidal bead adjoining said outer arcuate portion,

1. said bead having a first annular increment facing toward said side wall so that the extension of said inner surface becomes the first annular increment of said bead and a second annular increment facing away from said side wall so that the extension of said outer surface becomes the second annular increment of said bead,

2. said bead lying beneath the substantially planar top surface and having at least a portion thereof arranged within and beneath the outer peripheral edge of said outer surface,

e. and said outer arcuate portion providing vertical spacing between said flange and said bead.

2. A container as set forth in claim **1** in which said bead has a double thickness throughout at least a portion of its cross-sectional outline.

3. A container as set forth in claim **1** in which said first annular increment of said bead is arranged substantially adjoining the bottom surface of said annular flange by a distance which is less than the cross-sectional radius of said bead.

4. A container as set forth in claim **1** in which said side wall comprises a substantially frusto-conical side wall and said bead also has a portion thereof arranged outwardly of the outer peripheral edge of said outer surface, said container being adapted to be nested in a substantially identical container so that said bead separates said flange from the flange of a substantially identical container when the container is nested in the substantially identical container.

5. A container as set forth in claim **1** having a thermoplastic material defining its inside surface and having a thermosetting material defining its outside surface.

6. In combination: a container and a closure for said container; said container comprising:

a. a side wall,

b. an annular flange extending outwardly from said side wall,

1. said annular flange having a substantially planar top surface and a bottom surface,

c. an outer portion having an outer surface adjoining said substantially planar top surface and an inner surface adjoining said bottom surface,

d. and a reverse toroidal bead adjoining said outer arcuate portion,

1. said bead having a first annular increment facing toward said side wall so that the extension of said inner surface becomes the first annular increment of said bead and a second annular increment facing away from said side wall so that the extension of said outer surface becomes the second annular increment of said bead,

2. said bead lying beneath the substantially planar top surface and having at least a portion thereof arranged within and beneath the outer peripheral edge of said outer surface,

e. said outer arcuate portion providing vertical spacing between said flange and said bead,

f. and means sealing said closure against said substantially planar top surface.

7. A combination as set forth in claim **6** in which said nestable container has a thermoplastic coating comprising its inside surface and said sealing means comprises a portion of said coating on said top surface heat sealed against said closure.

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