

# United States Patent

Siemonsen et al.

[15] 3,695,084  
[45] Oct. 3, 1972

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

[72] Inventors: Frederik A. Siemonsen, Richmond; Robert F. Bublitz, Chester, both of Va.

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

[22] Filed: Nov. 24, 1970

[21] Appl. No.: 92,446

## Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 86,866, Nov. 4, 1970.

[52] U.S. Cl. .... 72/348, 113/120 G, 229/3.5 MF

[51] Int. Cl. .... B21d 22/24

[58] Field of Search 113/120 R, 120 G; 72/347, 348, 72/349; 220/74, 67; 229/3.5 MF

## References Cited

### UNITED STATES PATENTS

460,551	10/1891	Bodge	113/120 H
532,355	1/1895	Bellinger	72/349
2,226,155	12/1940	Bjornson	53/6
2,602,411	7/1950	Schnell	72/349
2,739,557	3/1956	Staubitz	72/349

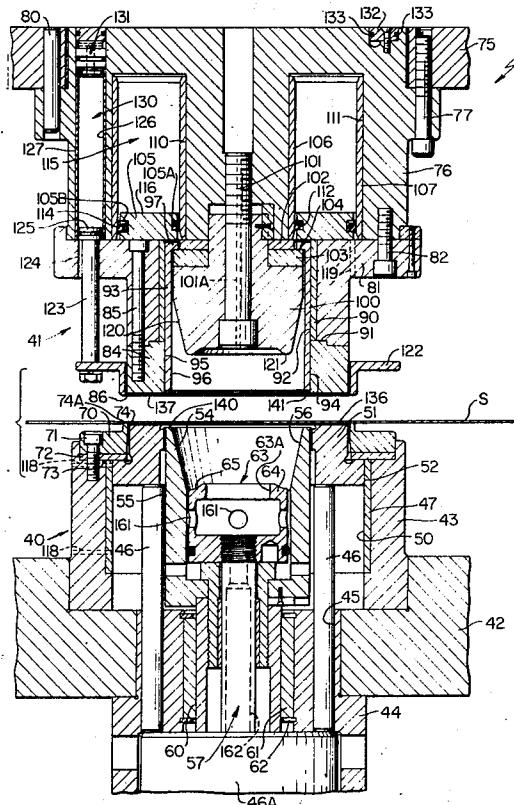
2,761,406	9/1956	Schnell	72/349
2,905,124	9/1959	Henchert	113/120 R
2,968,270	1/1961	McChesney	72/348
2,979,224	4/1961	Henchert	220/67
3,147,721	9/1964	Holmes	72/347
3,229,886	1/1966	Grobel	229/3.5 MF
3,233,813	2/1966	Wolford et al.	229/3.5 MF
3,420,088	1/1969	Hoffman	72/349
3,438,543	4/1969	Buff	220/74
3,496,896	2/1970	Smith	113/120 G

Primary Examiner—Richard J. Herbst  
Attorney—Glenn, Palmer, Lyne, Gibbs & Thompson

## [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.

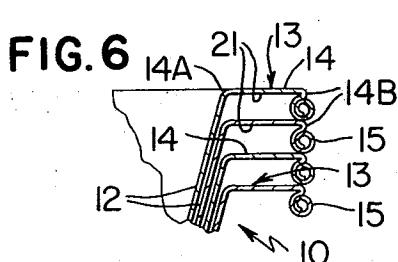
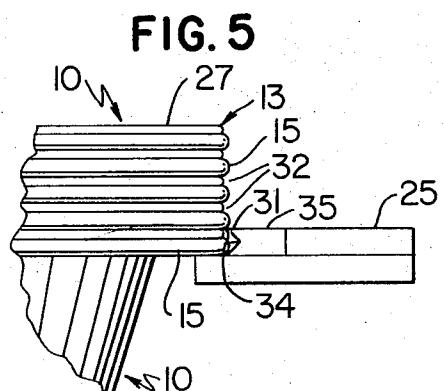
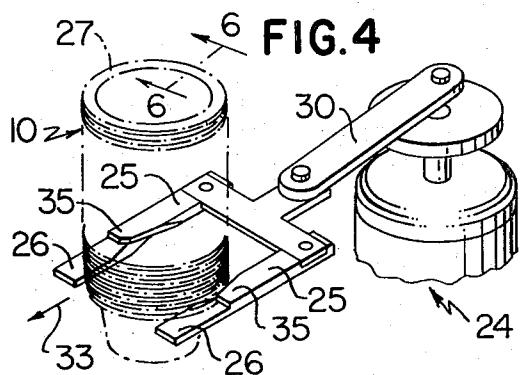
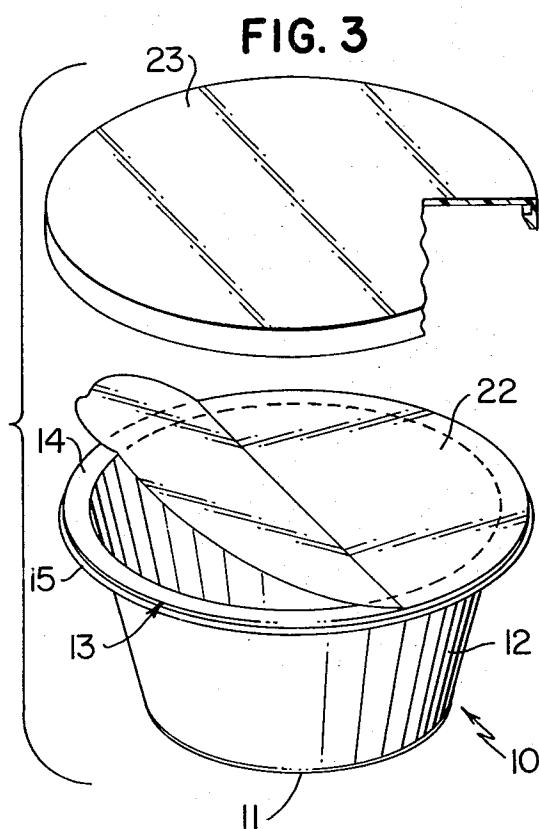
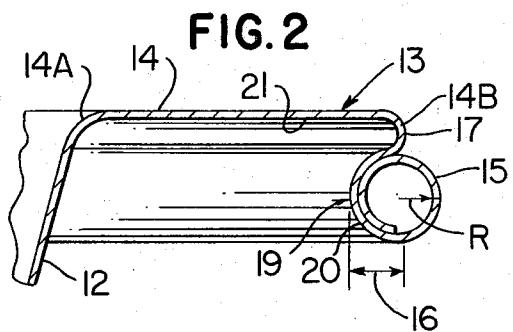
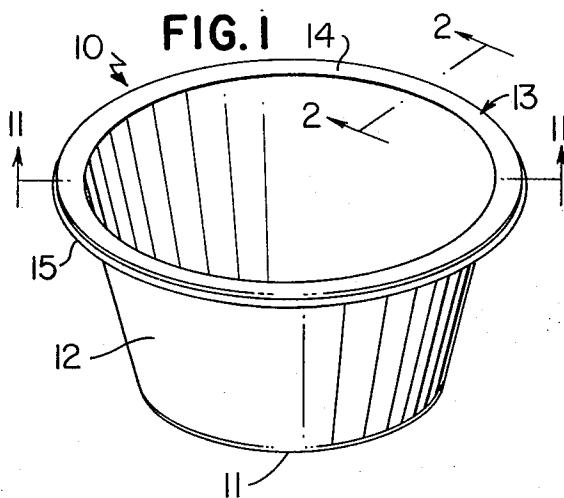
17 Claims, 17 Drawing Figures



PATENTED OCT 3 1972

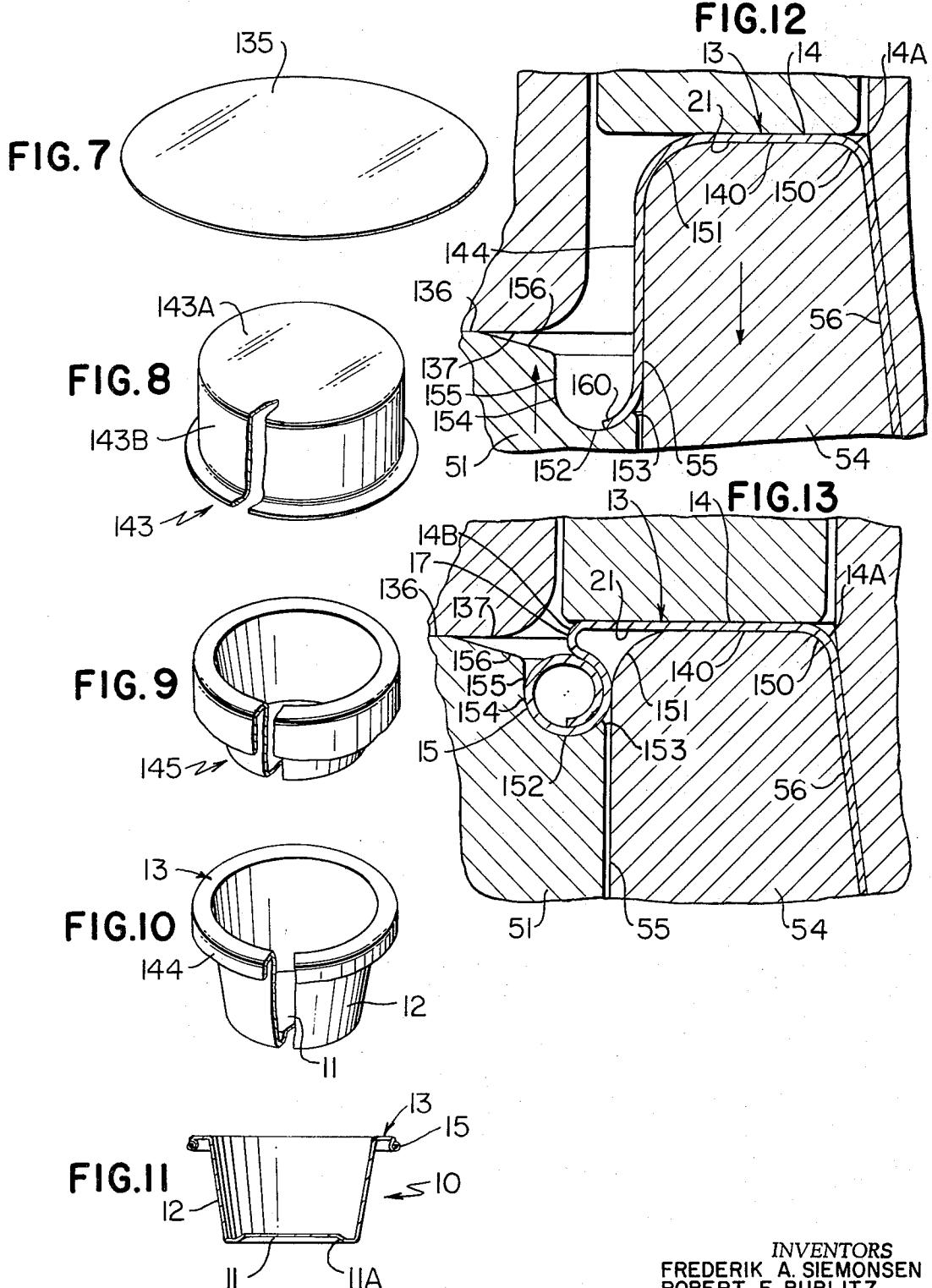
3,695,084

SHEET 1 OF 6



INVENTORS  
FREDERIK A. SIEMONSEN  
ROBERT F. BUBLITZ  
BY *Glenn Palmer, Lyne,  
Gibbs & Thompson*

THEIR ATTORNEYS

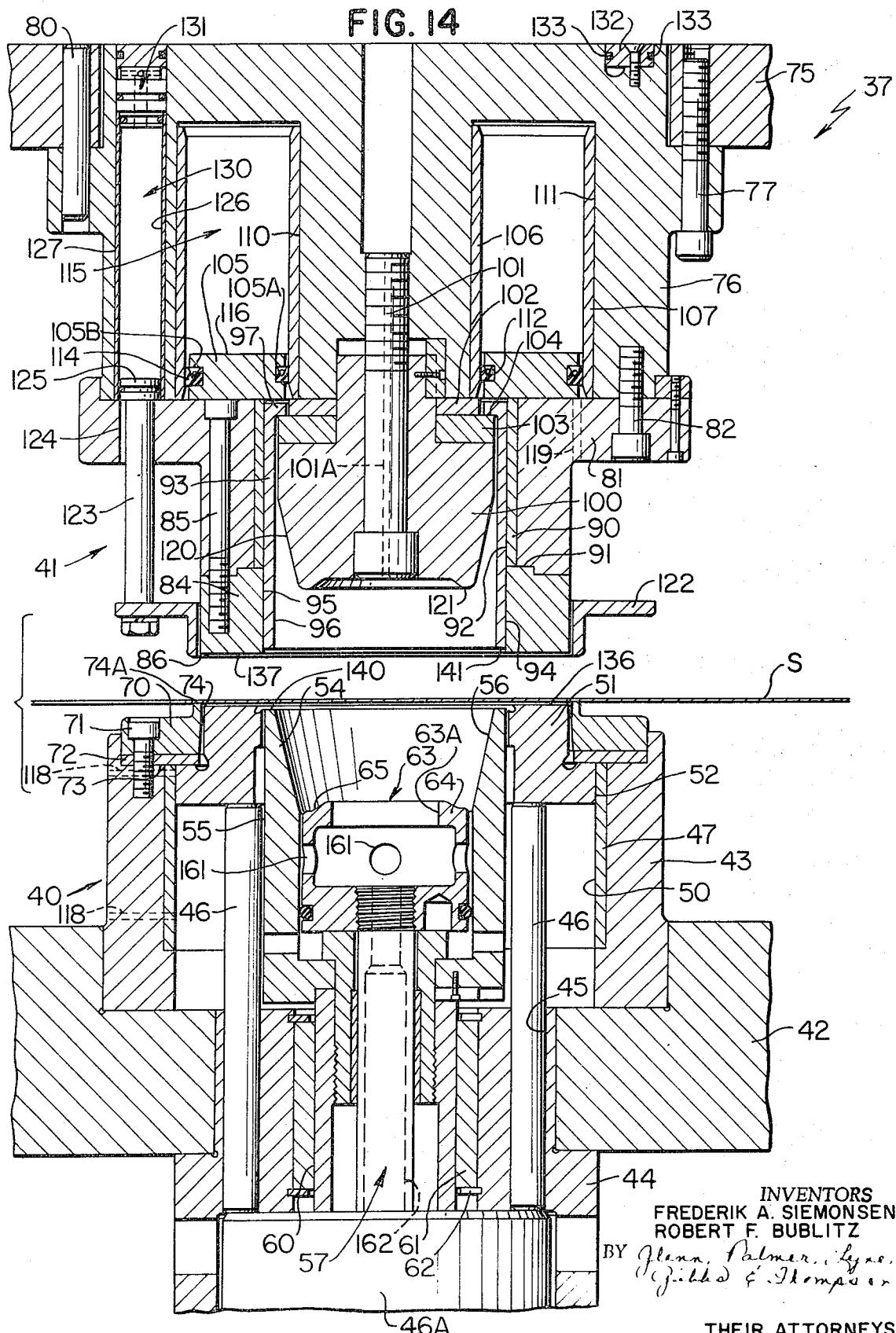


INVENTORS  
FREDERIK A. SIEMONSEN  
ROBERT F. BUBLITZ

BY *Glenn, Palmer, Lyne,  
Gibbs & Thompson*

THEIR ATTORNEYS

FIG. 14



INVENTORS  
FREDERIK A. SIEMONSEN  
ROBERT F. BUBLITZ

BY *Glenn Palmer, Jr.  
J. L. Thompson*

THEIR ATTORNEYS

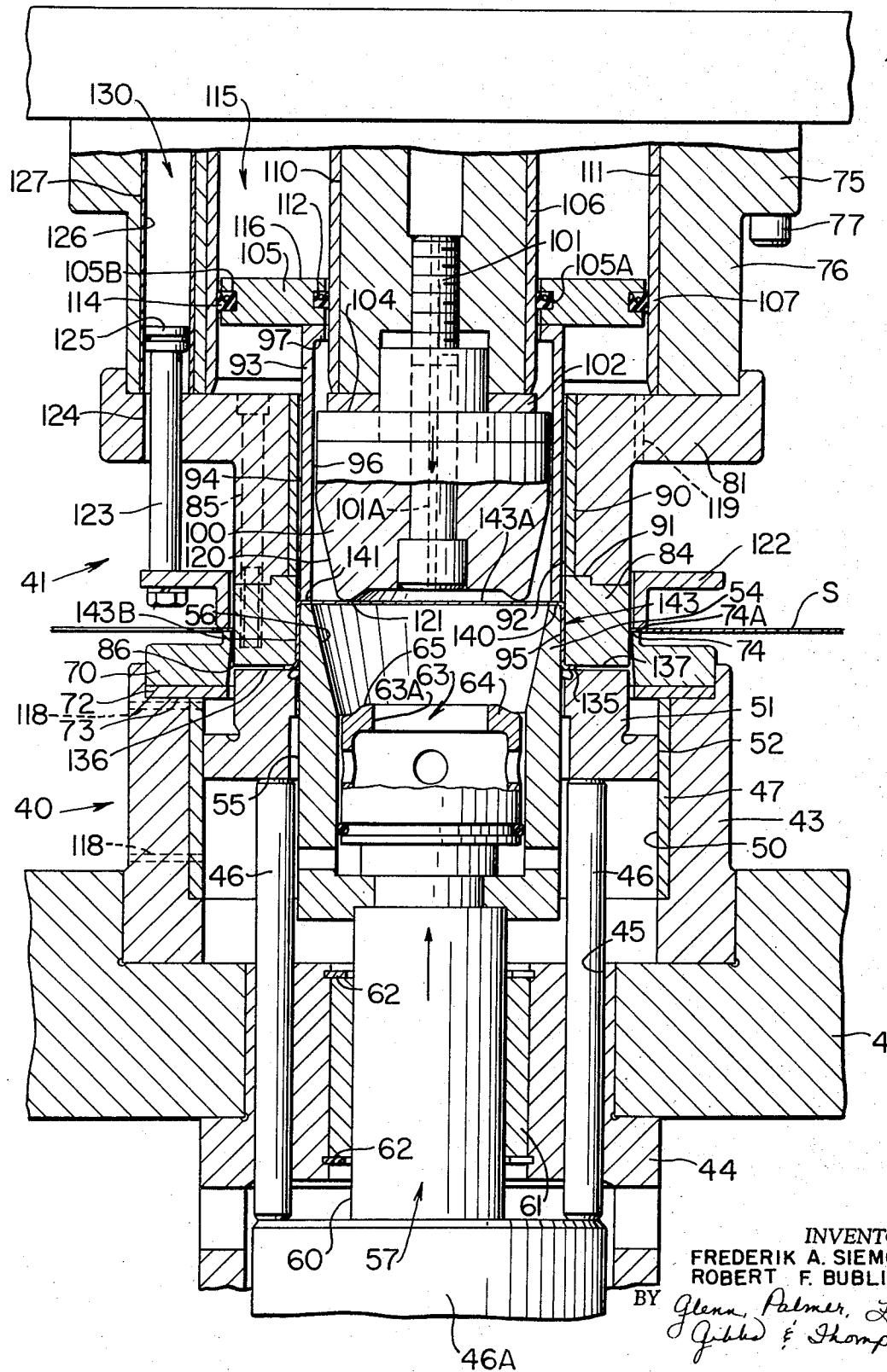
PATENTED OCT 3 1972

3,695,084

SHEET 4 OF 6

FIG. 15

37



## INVENTORS

**FREDERIK A. SIEMONSEN  
ROBERT E. BUBLITZ**

ROBERT F. BUBELITZ  
Glenn, Palmer, Lyne,  
Gibbs & Thompson

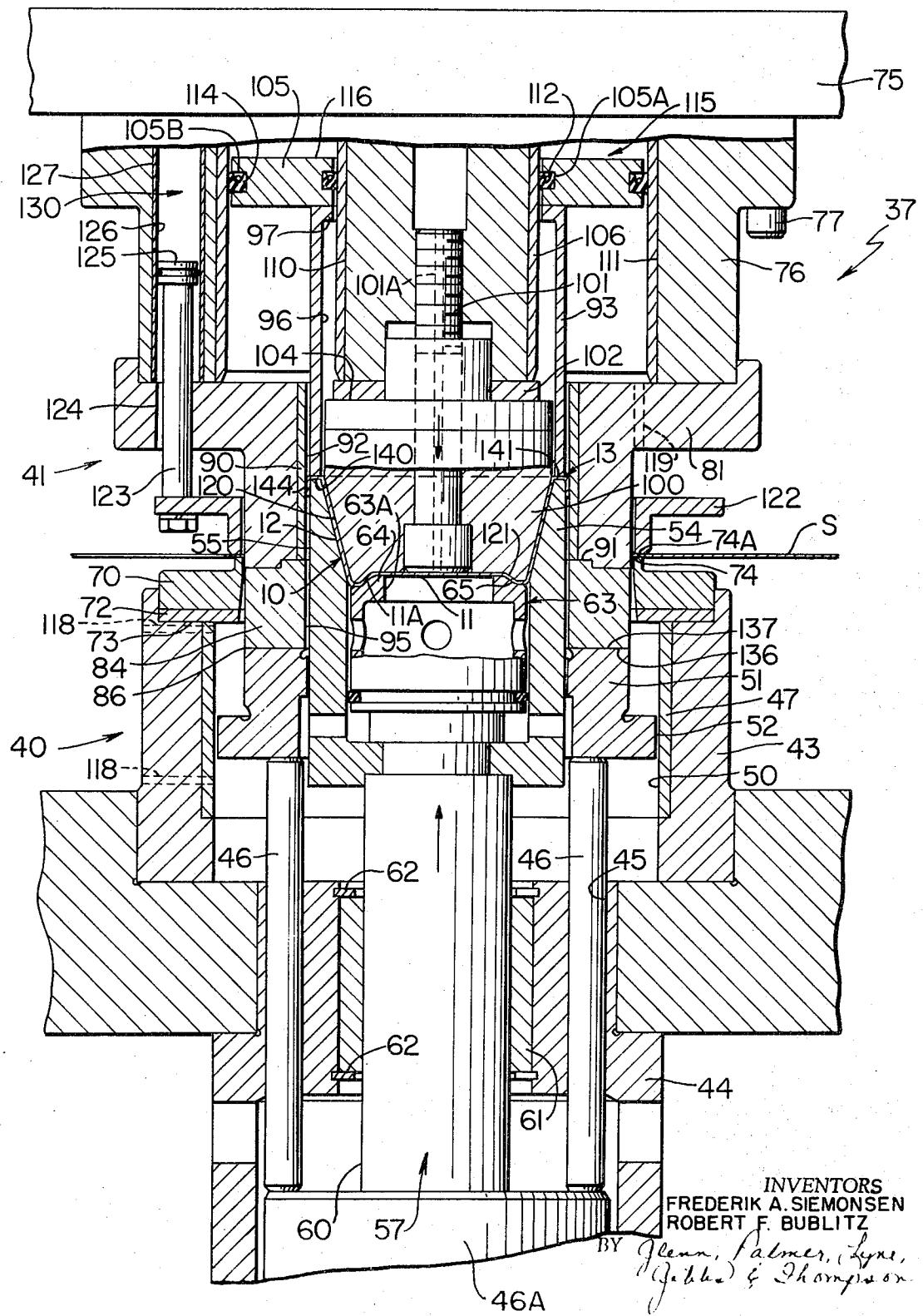
## THEIR ATTORNEYS

PATENTED OCT 3 1972

3,695,084

SHEET 5 OF 6

**FIG. 16**



INVENTORS  
FREDERIK A. SIEMONSEN  
ROBERT F. BUBLITZ

BY Glenn, Palmer, Lyne,  
(J. B. L.) & Thompson.

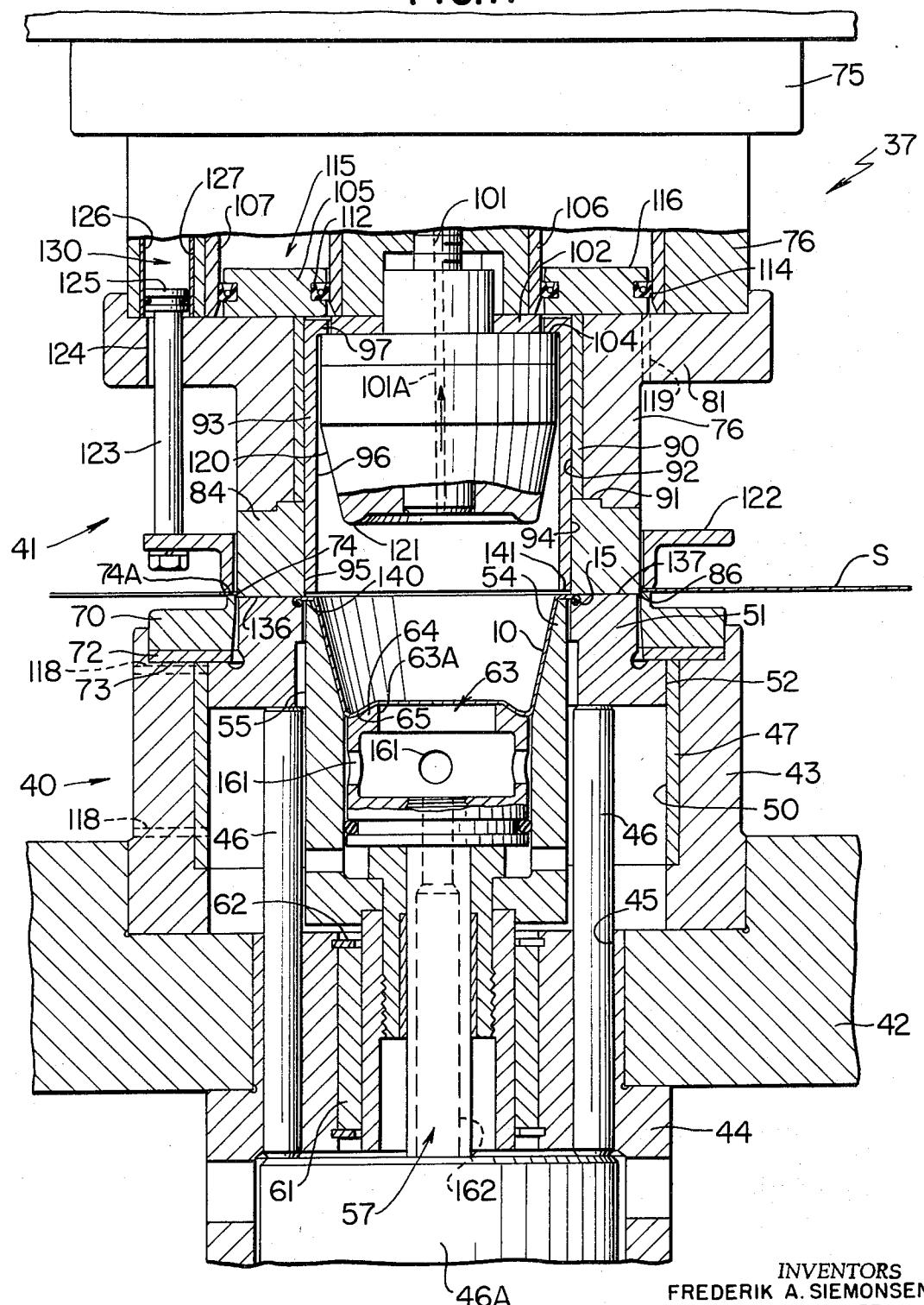
## THEIR ATTORNEYS

PATENTED OCT 3 1972

3,695,084

SHEET 6 OF 6

FIG.17



## NESTABLE CONTAINER AND APPARATUS FOR AND METHOD OF MAKING SAME

This application is a continuation-in-part of applicants' copending patent application Ser. No. 86,866, filed Nov. 4, 1970. 5

### 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. 15

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. 20

### 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. 30

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. 35

### 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; 40

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; 45

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; 50

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; 55

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; 60

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; 65

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; 70

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; 75

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; 80

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. 85

## 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 in-

side 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 flange-like 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 peripheral 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

35 100 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 40 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.

45 50 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.

55 59 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 preipheral configuration 11A in the bottom wall 11 of the container 10; and, the surfaces 140 and 60 141 cooperate to define the planar annular flange 13 of container 10.

65 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 engaging 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 threaded 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 susceptible to damage and has greater structural strength.

60 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. An apparatus for making a nestable container from a blank comprising, a first die member having an inside and an outside forming surface, a second die member, said members being supported for relative movement toward and away from each other, said second die member cooperating with said outside surface to form a drawn container from said blank, a punch, said punch and first die member being supported for relative movement toward and away from each other, said punch cooperating with said inside surface to form a reverse redrawn container by redrawing said drawn container while keeping a tubular wall portion of the drawn container outwardly of said outside forming surface, and a curling ring supported concentrically around said first die member, said curling ring having a portion which is adapted to engage said tubular wall portion to define a reverse bead having a toroidal configuration.

2. An apparatus as set forth in claim 1 in which said first die member also has an outer annular clamping surface and said apparatus further comprising a holder having an annular holding surface which cooperates with said clamping surface to define an annular forming passage through which a portion of said drawn container is drawn to define said redrawn container having a bottom wall adjoined by a side wall, said holding and clamping surfaces also cooperating to define a planar annular flange extending from the side wall of the redrawn container with said flange having said tubular wall portion extending to one side of the plane thereof.

3. An apparatus as set forth in claim 1 and further comprising a plurality of pressure pins engaging said curling ring, said pins operating to urge said portion of said curling ring against said tubular wall to form said toroidal bead.

4. An apparatus as set forth in claim 1 in which said inside forming surface of said first die member comprises a concave frustoconical forming surface, said outside forming surface comprises a cylindrical form-

ing surface, said punch has a convex frustoconical forming surface which cooperates with said concave forming surface, and each of said forming surfaces cooperates with its associated forming surface to form 5 said drawn container having a cylindrical side wall and said redrawn container having a substantially frustoconical side wall.

5. An apparatus as set forth in claim 1 in which said portion comprises a concave curling surface adjacent 10 an inside surface of said ring.

6. An apparatus as set forth in claim 5 in which said portion further comprises a wedge-like edge adjoining said concave curling surface at one end and a vertically extending cylindrical surface portion adjoining the opposite end of said concave curling surface.

7. An apparatus as set forth in claim 2 in which said punch and first die member are relatively moved toward each other to define said redrawn container simultaneously with the relative movement of the first 20 and second die members toward each other to define said drawn container.

8. An apparatus as set forth in claim 1 in which said second die member also serves as a blanking punch and further comprising a blanking ring supported concentrically around said first die member, said blanking punch and blanking ring having cooperating cutting edges which are adapted to engage a strip of sheet metal disposed therebetween to define said blank.

9. An apparatus as set forth in claim 8 in which said cutting edges comprise cooperating circular edges which define a blank having a circular peripheral outline.

10. A method of making a nestable container from a blank comprising the steps of, drawing a blank between an outside forming surface of a first die member and a second die member to define a drawn container, reverse redrawing said drawn container between an inside forming surface of said first die member and a punch while keeping a tubular wall portion of the drawn container outwardly of said outside forming surface, and forming said tubular wall portion with a portion of a curling ring arranged concentrically around said first die member to define a reverse bead therein 45 having a toroidal configuration.

11. A method as set forth in claim 10 in which said first die member also has an outer annular clamping surface and said method comprising the further step of holding an annular portion of a bottom wall comprising said drawn container between an annular holding surface of a holder and said clamping surface to define an annular forming passage through which a portion of said drawn container is drawn during said redrawing step to define said redrawn container having a bottom wall adjoined by a side wall, said holding and clamping surfaces also cooperating during said holding step to define an annular flange extending from an edge of the side wall of the redrawn container with said tubular wall portion extending to one side of the plane of said annular flange.

12. A method as set forth in claim 10 in which said reverse redrawing step is commenced prior to completion of said drawing step.

13. A method as set forth in claim 10 in which said forming step is achieved after completion of said reverse redrawing step and during return of said die members and punch to their starting positions.

14. A method as set forth in claim 10 in which said drawing step comprises drawing a blank of metallic foil which has been hardened.

15. A method as set forth in claim 10 and comprising the step of shearing said blank from a web of metal foil interposed between said die members by relatively moving said second die member toward an associated blanking die supported concentrically around said first die member.

16. A method as set forth in claim 11 in which during 10

said forming step, said bead is formed adjacent the bottom surface of said annular flange by a distance which is less than the cross-sectional radius of said bead.

17. A method as set forth in claim 11 in which during 5 said forming step said bead is formed beneath the plane of said annular flange and has at least a portion thereof arranged within the outer peripheral edge of said flange.

\* \* \* \* \*