Dec. 16, 1969 P. DAVIS 3,484,018

NESTABLE CONTAINERS

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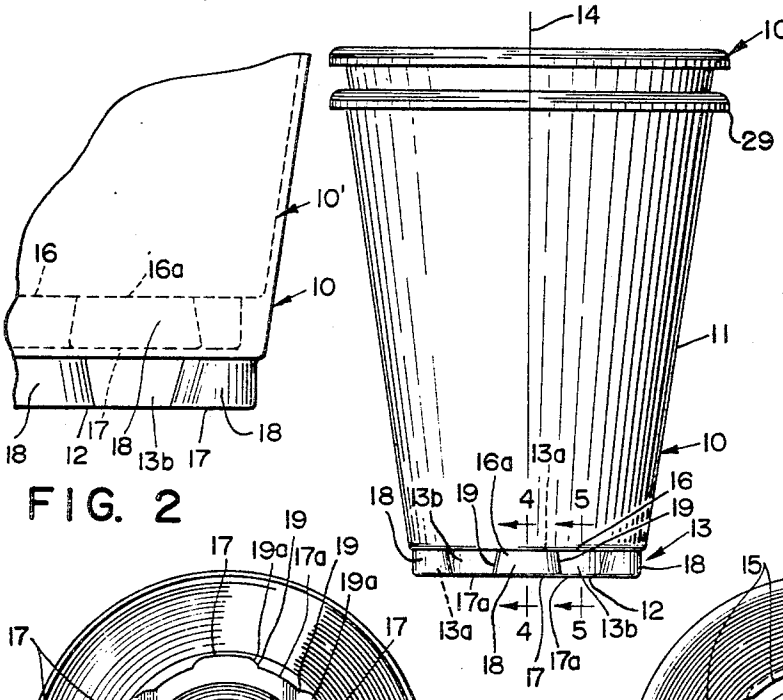

FIG. 1

FIG. 2

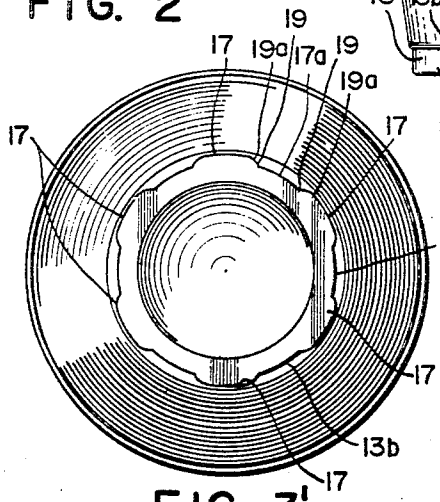

FIG. 3'

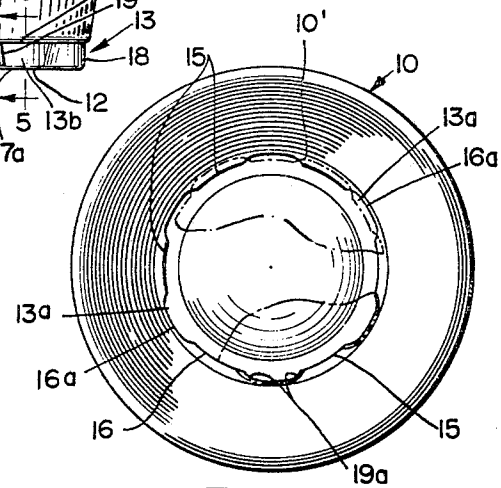

FIG. 3

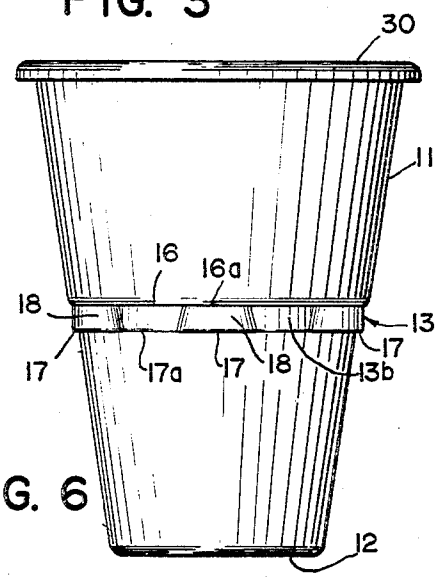

FIG. 6

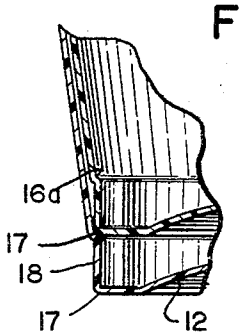

FIG. 4

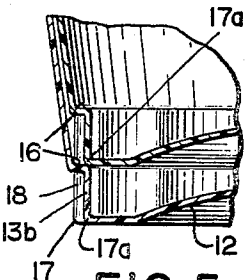

FIG. 5

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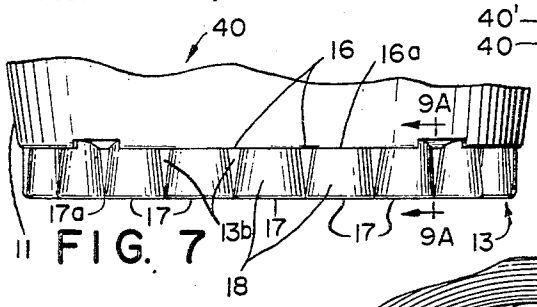

FIG. 7

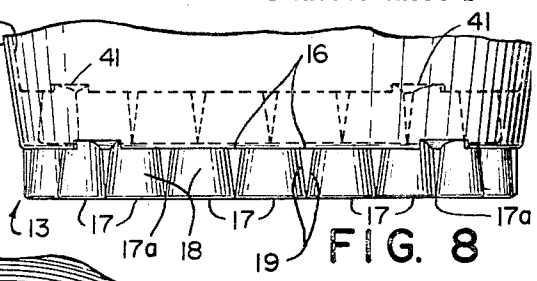

FIG. 8

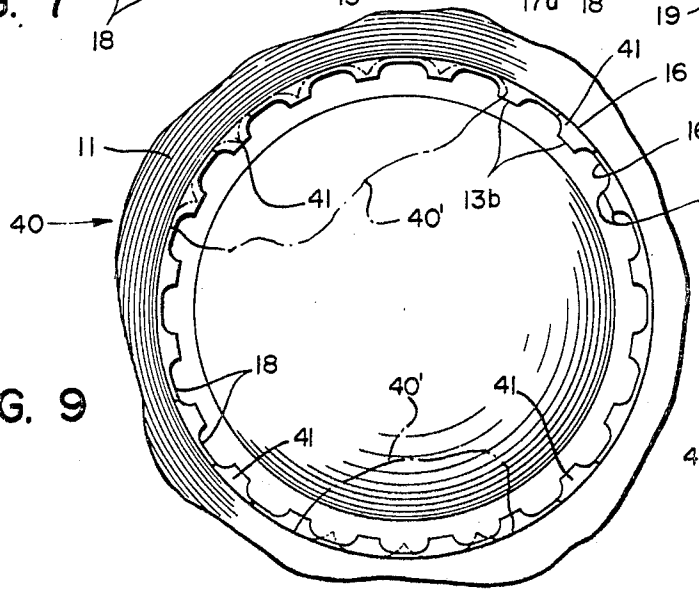

FIG. 9

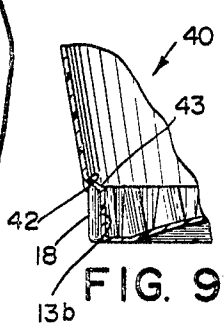

FIG. 9A

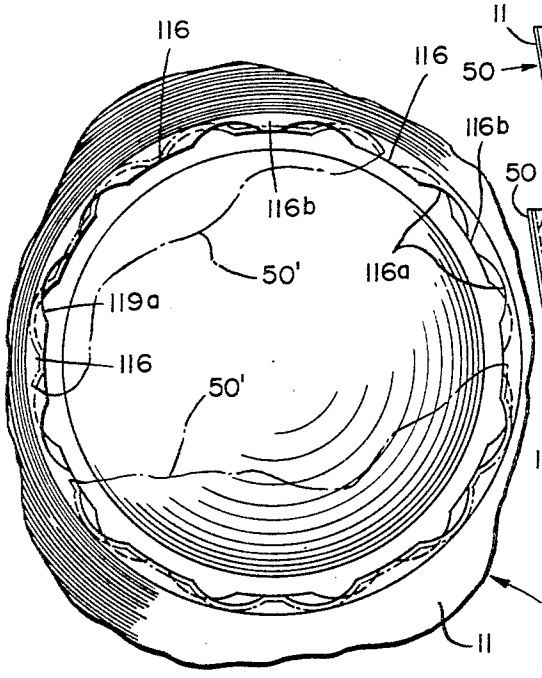

FIG. 12

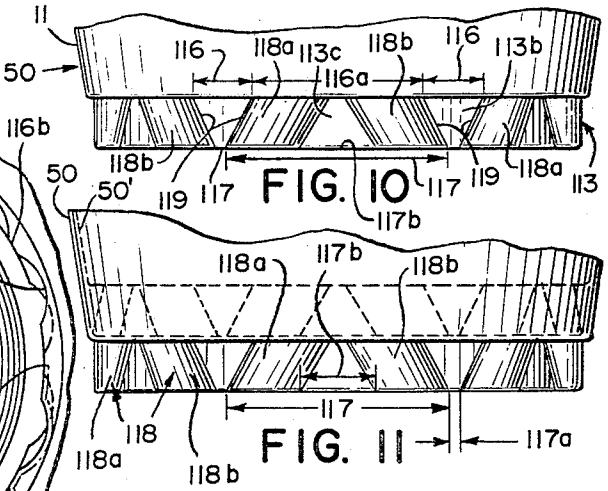

FIG. 10

FIG. 11

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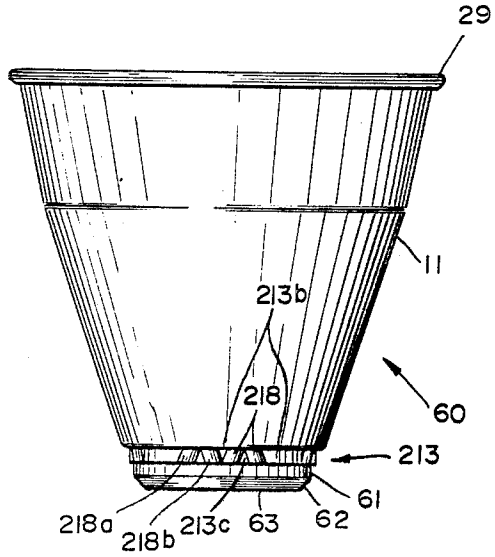

FIG. 13

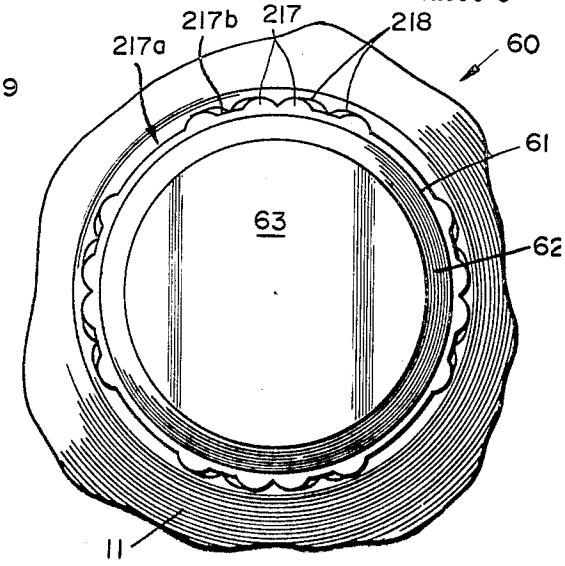

FIG. 14

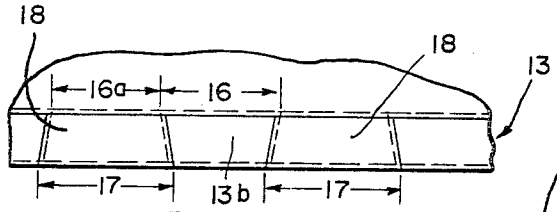

FIG. 16

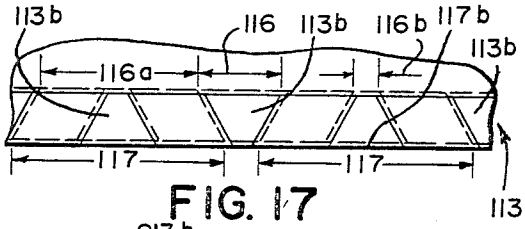

FIG. 17

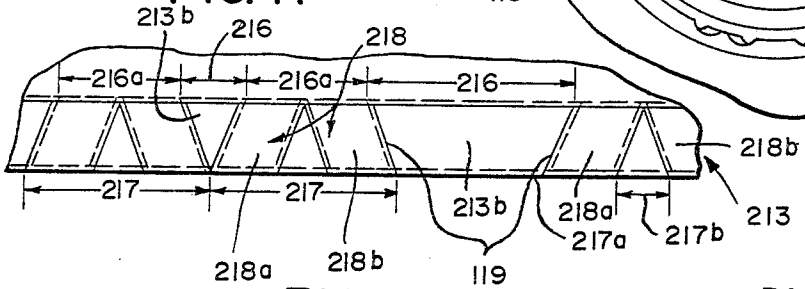

FIG. 18

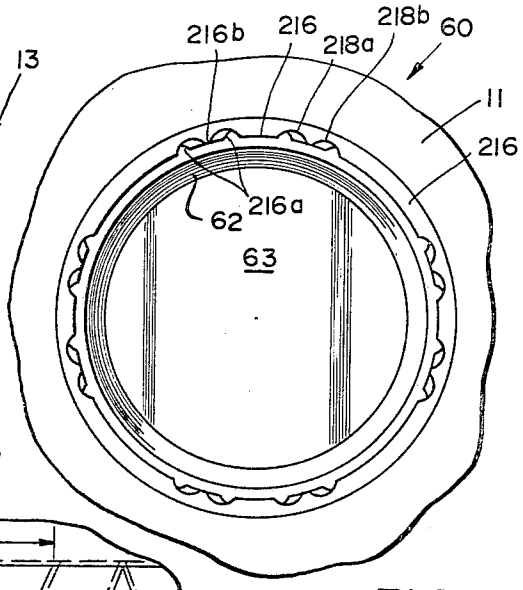

FIG. 15

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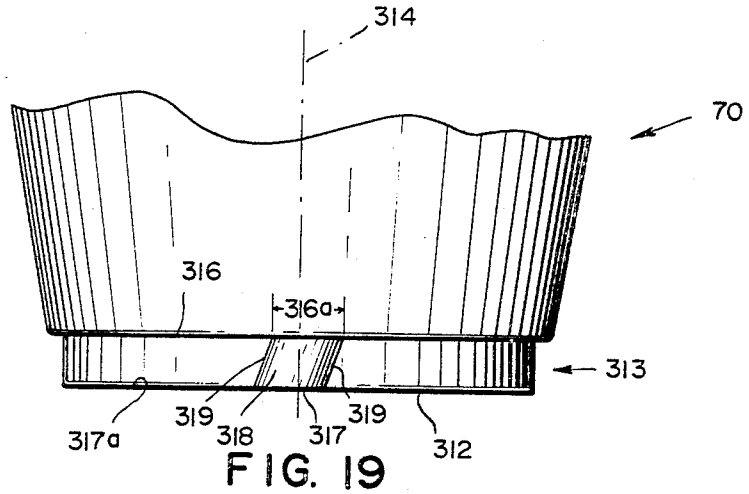

FIG. 19

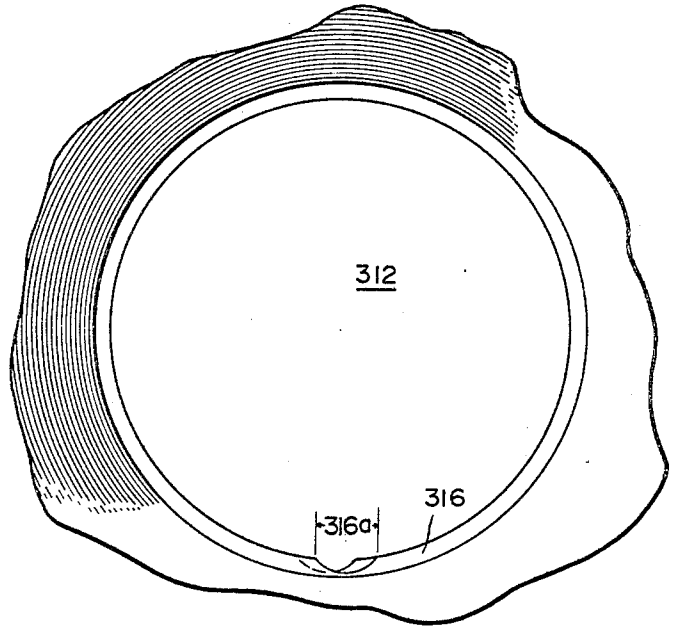

FIG. 20

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United States Patent Office 3,484,018 Patented Dec. 16, 1969

3,484,018

NESTABLE CONTAINERS

Paul Davis, Swampscott, Mass, assignor to Sweetheart Plastics, Inc., Wilmington, Mass.

Filed Nov. 28, 1967, Ser. No. 686,080
Int. Cl. B65d 21/00, 3/06
U.S. Cl. 220—97 4 Claims

ABSTRACT OF THE DISCLOSURE

A one-piece, thin wall plastic container is provided having an upwardly flared side wall and a transversely extending bottom wall with a stacking ring in the side wall forming internal and external shoulders each being circumferentially undercut and having a radial extent to provide an interference with another when two like containers are nested together with the external shoulders of one resting on the internal shoulders of the next lower container.

BACKGROUND OF THE INVENTION

A plurality of nestable plastic containers such as drinking cups are known in the art. Such plastic containers which may be vacuum or pressure formed of thin stock sheet material, frequently employ stacking ring means in the side wall to provide internal and external shoulders so that the external shoulders of one cup rest on the internal shoulders of the next lower cup in a stack. Sufficient interference is provided by the internal shoulders due to the use of an upwardly and axially inwardly extending stacking ring forming a generally Z-shape in cross section. Many variations of this basic stacking ring means are known in the art and include the use of inturned ridges and projecions of all sorts to form inwardly directed undercuts in the side walls of thin wall plastic containers to provide the necessary interference and permit stacking.

Problems sometimes arise with inwardly undercut stacking ring shoulders when large stacks of containers are shipped and the stacks subjected to severe pressures at ends thereof as by dropping of a stack. In some cases, forces on the stack will tend to jam containers together carrying the external shoulder of one container beyond the interference provided by the internal shoulder of its adjacent container whereupon a wedge action locks the containers together making it extremely difficult to separate them. In some cases, vending machines are jammed because of the tight interlock between two or more containers in a stack which interlock cannot be overcome by the normal separating apparatus in conventional vending machines

SUMMARY OF THE INVENTION

A thin wall, integral, plastic container is provided with an upwardly flared side wall and a transversely extending bottom wall. An inwardly extending shelf is provided in the side wall defining a plurality of internal shoulders dimensioned to provide interference to a like container nested in said container with each shoulder having a predetermined circumferential length. A preferably vertical stacking ring extends coaxially with the container and downwardly from the internal shoulders. The stacking ring has a plurality of spaced protuberances preferably extending from top to bottom thereof with each defining a greater circumferential distance at the bottom than at the top whereby a plurality of circumferential undercuts are formed at edges of the shoulders in the shelf to provide the required interference. Preferably the bottom of each protuberance is continuous with an inwardly extending shelf or with the bottom of the container to form

external shoulders. Thus, in each of the containers of this invention, the internal shoulders which form a shelf on which another container rests are undercut circumferentially and not radially of the container axis.

In another embodiment of the invention, the internal and external shoulders have substantially equal circumferential length and a circumferential undercut is provided in the stacking ring to permit stacking.

In the preferred embodiment, the stacking ring and the outer portions of the protuberances are substantially coaxial and vertically extending. Thus, if one container should be forced within another, one of the two containers tends to deform and be crushed axially and radially whereby no tight jamming into engagement occurs. This feature is important since feeds of conventional vending machines would tend to discharge containers made in accordance with the present invention successively, even if stacks of such containers have been subjected to sever handling shocks and certain of the containers are moved axially with respect to others.

The particular stacking rings and nestable features of containers made in accordance with the present invention have the advantage of a circumferentially extending undercut making the containers of the present invention easier to strip from a mold than conventional radially undercut containers. Moreover, the protuberances provide for air passage between stacked containers enhancing ease of removing one container from a stack of containers.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the present invention will be better understood from the following specifications when read in connection with the accompanying drawings in which:

FIG. 1 is a front perspective view of a preferred embodiment of two nested cups of the present invention;

FIG. 2 is a front view thereof with the outside cup shown as transparent;

FIG. 3 is a top view thereof showing portions of the inside cup in dotted outline in two positions about the axis;

FIG. 3' is a bottom view thereof;

FIG. 4 is a cross sectional view taken through line 4—4 of FIG. 1;

FIG. 5 is a cross sectional view taken through line 5—5 of FIG. 1;

FIG. 6 is a perspective view of an alternate embodiment thereof;

FIG. 7 is a fragmentary front view of an alternate embodiment of the invention showing the novel stacking ring;

FIG. 8 is a fragmentary front view of two nested cups of the embodiment of FIG. 7 with the outside cup shown as transparent;

FIG. 9 is a top view of the cup of FIG. 7;

FIG. 9A is a cross sectional view taken through line 9a—9a of FIG. 7;

FIG. 10 is a front fragmentary view of still another cup of this invention;

FIG. 11 is a front view of two nested cups of the embodiment of FIG. 10;

FIG. 12 is a top plan view of the cup of FIG. 10;

FIG. 13 is a front view of still another embodiment of this invention;

FIG. 14 is a bottom view of the embodiment of FIG. 13;

FIG. 15 is a top view of the embodiment of FIG. 13;

FIG. 16 is a fragmentary projection of the stacking ring of the cup of FIG. 1 showing the stacking ring in flat form;

FIG. 17 is a fragmentary projection of stacking ring of the cup of FIG. 10 showing the stacking ring in flat form;

FIG. 18 is a fragmentary projection of the stacking ring of the cup of FIG. 13 showing the stacking ring in flat form;

FIG. 19 is a fragmentary side view of a container as shown in FIG. 1 but with an alternate embodiment of the stacking ring of this invention; and

FIG. 20 is a top view of the embodiment of FIG. 19.

BRIEF DESCRIPTION OF PREFERRED EMBODIMENTS

With reference now to the drawings, a thin wall thermoformed plastic drinking cup **10** is illustrated in FIG. 1 having a side wall **11** tapering upwardly and outwardly along its central axis **14** from a bottom wall **12** extending transversely of the cup. The bottom wall preferably has a central dome portion. A stacking ring **13** separates the bottom wall from the upper portion of the side wall which can be straight as shown or provided with decorative or functional, molded or embossed configurations as is known in the art. An inner container **10'** identical to cup **10** is shown to illustrate a stacked position of two or more cups.

The cup **10** is preferably of a thin wall plastic such as polystyrene having an over-all wall thickness of approximately 0.010 inch thermoformed from a 0.030 inch thick polystyrene sheet. However, various other plastics such as polyethylene, impact polystyrenes, polypropylene, foam plastics and the like can be used in accordance with the present invention. The containers themselves may have several uses and configuration; thus, cottage cheese containers, bowls, plates and drinking cups can be formed in a variety of sizes.

In the preferred embodiment, the stacking ring **13** is a right cylinder coaxial with the cup axis **14** and lies between the bottom wall **12** and the top of the side wall **11** as best seen in FIG. 1. Above the stacking ring **13** is an inwardly extending preferably horizontal shelf **15** which is substantially circumferentially discontinuous at its inner edge and is defined by a plurality of circumferential extending internal shoulders **16** and spaces **16***a*. The bottom wall defines circumferentially extending external shoulders **17** and spaces **17***a*. Spaced protuberances **18** extend from top to bottom of the cylindrical portion of the stacking ring and radially outwardly therefrom.

The protruberances **18** are delimited by side lines **19** which are substantially straight and form the intersections of the protuberances and the cylindrical portions of the stacking ring. Lines **19** are offset from the vertical or a line parallel to the axis of cup **10** by an angle of about 10° to 25° and preferably about 18° so that the internal shoulders **16** are spaced apart by internal generally trapezoidal-shaped notches **13***a* of the stacking ring portion defined by protuberances **18** as best seen in FIGS. 1–3. The angle of lines **19** defines the amount of circumferential undercut under the internal shoulders with larger angles providing greater interference than smaller angles.

As may be seen in FIGS. 1, 2, 3, 3', 4 and 5 the protuberances **18** extend upwardly and are in fact cylinder-like sections or columns as are the stacking ring cylindrical wall portions which portions are recessed in front view shown at **13***b* in FIG. 1. The protuberances or columns **18** are narrower at their tops than at their bottoms to make the resulting external shoulders **17** have a greater circumferential length than the circumferential length of gaps or spaces **16***a* thus providing the desired interference. Lines **19** are reverse portions of helically extending lines about the stacking ring drawn on a center axis coaxial with axis **14** of the cup. Left and right helical lines are provided. Since right and left helical lines are used as edges of portions **18**, sufficient interference is provided by the undercut areas of the circumferential undercuts at edges **19***a* to prevent jamming action as shown in FIG. 3.

In use of the cups of this invention, when the cups are stacked and two or more containers nested, the lower or external shoulders **17** which each have a longer circumferential length than each of the upper spaces **16***a* between shoulders **16** rest on the internal shoulders **16** as shown in dotted outline in FIG. 3 and in FIGS. 4 and 5. Thus, shoulders **16** of the shelf **15** prevent downward travel of the inner container and the undercuts **19***a* below each end or edge of the internal shoulders **16** assure that no matter what the angular position of the inner cup about its axis with respect to the outer cup, the external shoulders **17** of one cup cannot pass beyond the internal shoulders **16** of an adjacent cup. Moreover, since the external walls of protuberances **18** are parallel to the stacking ring wall **13** and both are vertical or parallel to the axis of the cup, when substantial forces are exerted on ends of a stack of cups, there walls will tend to collapse axially and the inner container is deformed radially allowing passage of the inner container beyond the internal shoulders. Locking of the cups together is prevented since there is no inwardly and upwardly directed stacking ring which would tend to interlock the undercut with a crushed end of an inner container and thus, slightly crushed ends of cups can be easily separated by hand or

Turning now to FIG. 6, an alternate embodiment **30** is shown wherein like numerals represent like parts. In the embodiment of FIG. 6, the stacking ring, protuberance and shoulder structures are identical to that described above with reference to FIG. 1 except that instead of lying at the bottom of the cup, these members are placed further up along the side wall of a cup. It should be understood that the stacking rings and nestable structures of this invention can be located at the mouth of the cup, at any point along the side wall, or at any point on the bottom or projection therefrom if so desired.

In a specific example of the preferred embodiment of this invention, a 7-ounce cup is used as shown in FIG. 1 having an average wall thickness of 0.010 inch with a rolled over rim **29** having an axial extent less than the axial extent of the stacking ring **13**. The cup has a height of 3½ inches, a top inner diameter of 2½ inches and a bottom diameter of 1¾ inches at shelf **15**. The internal shoulders extend inwardly approximately 1/16 inch and each has a circumferential extent of approximately 7/16 inch. Six protuberances **18** are provided defining external lower shoulders **17** each having a circumferential extent of 9/16 inch. Lines **19** lie at 20° angles to the vertical axial length and the stacking ring is 3/16 inch. When a plurality of cups as above described are stacked, jamming is avoided in normal usage and when destructive forces are applied, no interlocking of the cups occurs although collapsing of the ends is sometimes evidenced.

Turning now to another embodiment of a stacking means in accordance with the present invention, a thin wall, thermoformed plastic cup **40** is illustrated in FIGS. 7–9A wherein like reference numerals refer to like components of the cup **10** described above. The cup **40** is generally identical to the cup **10** except that the stacking ring **13** is modified so that the protuberances **18** are spaced closer together and are substantially adjacent at their bases so that spaces **17***a* become points. In addition, recesses or inward projections **41** are provided at equally spaced intervals extending above spaced internal shoulders **16**. These recesses **41** shown in cross section in FIG. 9A provide for positive air passage between the bottom of one cup and the upper portion thereof when the cups are stacked as shown in FIG. 8. In addition, the projections **41** define sliding surfaces **42** which act as cam means to center a cup when placed within another cup. Thus the external shoulders **17** slide down the wall **42** shown in FIG. 9A and are centered when placed above the internal shoulders **16** of an underlying cup. The surfaces **42** cushion the inner cup and preferably act as a shock

absorbing means when the base portions **43** lie on a circle having a diameter slightly smaller than the outside diameter of a circle defined by edges of shoulders **17**.

Three recesses **41** are used in cup **40** spaced uniformly apart about the 360° circumference of the cup; however, the number of recesses can vary although when used, preferably three to six recesses are provided.

The embodiment shown in FIGS. 10–12 is again basically similar to that described with reference to FIG. 1. Cup **50** is identical to cup **10** and like parts are indicated by like reference numerals. The difference lies in the stacking ring **113** of the cup **50** which has the same function as stacking ring **13**. In connection with the stacking ring, portions similar to stacking ring **13** are denoted by adding a "1" in front of the numbers indicated for those portions in stacking ring **13**. Protuberances **118** formed by separate portions **118***a* and **118***b* are provided adjacent the bottom wall **12** of the cup of define upper internal shoulders **116** which are circumferentially undercut and extend circumferentially as do interrupted gaps or spaces **116***a*. Because of the reverse left and right helical directions of adjacent protuberance portions **118***a* and **118***b*, internal shoulders such as **16** of FIG. 1 are separated by what is termed here subinternal shoulders **116***b* which are not undercut and which interrupt gaps **116***a* as best shown in FIG. 12. Similarly the lower shoulders **117** are interrupted by subgaps or subspaces **117***b* and are spaced from each other by lower spaces **117***a* which correspond to spaces **17***a*. In this embodiment, recessed portions **113***b* and **113***c* of cylindrical portions of the stacking ring form successive alternately inverted trapezoids about the circumference of the cup as viewed in FIGS. 10 and 11. The interrupted protuberances **118** are delimited by lines **119** on either side thereof which define alternate reverse helical lines in the stacking ring to provide undercuts **119***a* as indicated in FIG. 12 for the upper internal shoulders **116**.

In the embodiment of cup **50**, the same principle previously used has again been provided undercut areas as above described in a circumferential direction rather than a radial direction to provide a circumferential interference for external shoulders. In this case, each interrupted protuberance has side lines **119** which define portions of helices drawn about the central axis of the cup with alternate helical portions being reversed from left to right to prevent threading of one cup within another. Actually each interrupted protuberance is formed by a set of reverse helically extending columns of smaller protuberances extending on reverse helices.

In still another embodiment of the invention, a conical cup **60** is provided with a stacking ring **213** generally similar to the stacking ring described with reference to FIGS. 10–12. In this embodiment, as in the embodiment of FIG. 10, the stacking portions similar to stacking ring **13** are denoted by adding a "2" in front of the numbers indicated for those portions in stacking ring **13**. The cup **60** is a conventional conical cup having a side wall **11** defining an upper generally cylindrical slightly conical section and a lower conical section joined to the upper section. A conventional rolled over rim **29** is provided having an axial extent less than the axial extent of the stacking ring **213** similar to the other embodiments of this invention. In this embodiment, a lower cylindrical portion **61** is joined to the stacking ring **13** and lies above a conical-shaped portion **62** and flat bottom **63**. Portions **61** and **62** are useful for engaging the cup **60** with a conventional conical cup holder as is known in the art.

The stacking ring **213** is generally similar to the stacking ring **113** except that the protuberances are spaced in four groups as best seen in FIG. 14 with the protuberances **218** being interrupted by spaces **213***c*. Alternate cylindrical portions of the stacking ring **213** denoted at **213***b* correspond to portions **13***b* and are nonuniform in size due to the spacing of the protuberances. Recessed portions **213***b* provide internal shoulders **216** which are alternately nonuniform in circumferential length and subinternal shoulders **216***b* equivalent to shoulders **116***b*.

The interrupted protuberances **218** are formed in the same manner as the interrupted protuberances of the embodiment of FIG. 10 to define interrupted upper gaps and interrupted lower shoulders as previously described.

Turning now to the sketches shown in FIGS. 16–18, the circumferential extent of the upper shoulders, spaces, lower shoulders and spaces, are indicated to show corresponding parts in each of the embodiments of this invention. FIGS. 16–18 more clearly indicate the fact that each lower or external shoulder whether it be interrupted or continuous, has a greater circumferential extent than each gap defined between the upper or internal shoulders, whether it be continuous or interrupted. Thus, in FIG. 16, which is a flattened strip of stacking ring **13**, each length of external shoulders **17** is greater than each gap or space **16***a*. Similarly, in FIG. 17, showing stacking ring **113**, each external shoulder **117** even though it be interrupted by subgaps **117***b* is greater than each interrupted space **116***a*. In FIG. 18, each external shoulder **217** formed by two protuberance portions on the circumference of the stacking ring **213**, defines a circumferential extent greater than each gap **216***a*.

In the embodiments of FIGS. 19 and 20, the broadest aspect of the present invention is illustrated wherein a stacking ring is used having a single protuberance which provides a single circumferentially undercut shelf which is preferably horizontal as is shelf **15**. In this embodiment, the cup **70** is provided with a cylindrical stacking ring **313** preferably defining a right cylinder coaxial with the axis **314** of the cup. Cup bottom **312** extends across the stacking ring. Extending from top to bottom of the stacking ring is a single protuberance **318** generally similar to the protuberances **18** described above. Thus, a single internal shoulder **316** is provided interrupted at one point by gap **316***a*. The shoulder **316** is undercut due to the angular arrangement of lines **319** which define the intersection of the protuberance with the cylindrical stacking ring and preferably lie on uniformly inclined helical portions coaxial with the axis **314**.

As can be determined from the drawings, in this embodiment the single lower external shoulder **317** does not have a circumferental length any greater than the single upper internal gap **316***a* and shoulder **316** and gap **317***a* have exactly the same circumferential length since the lines **319** are parallel to each other. However since there is a circumferential undercut underlying the internal shoulder **316** formed by the protuberance **318**, when two like cups are stacked, and pressed together in an axial direction, the cups will nest and the inner cup will not move beyond the stacking ring shelf provided by the single internal shoulder **316**. However, the inner cup will move beyond the shelf only if one cup is rotated with respect to its axis so as to screw thread into the other. The only bar to screw threading is stock thickness; however, inherent flexibility of the thin side wall permits somestretching and allows screw threading. Here again, no radially extending undercut is provided and only a circumferential undercut is used; yet, nesting can be accomplished. Moreover, when interlocking means are used on the cup side wall or bottom to prevent rotation of one cup with respect to another, there is no chance of an inner cup passing beyond a selected point of an outer cup. Of course, a plurality of protuberances **318** can be used in the cup **17** or if desired, alternately reversed angled protuberances **118** can be used to prevent screw threading of one cup into another.

While specific embodiments of the present invention have been shown and described, it should be understood that many variations thereof are possible. For example, any number of protuberances such as **18**, **118**, **218** and **318** can be used depending upon the size of the cup and the amount of interference desired. It is preferred to

maximize the undercut area in order to provide maximized interference as by increasing the angles of lines **19**, **119** and **219** from the vertical and/or providing many protuberances. The stacking ring structures of this invention are preferably located at the cup bottom but can be provided at any point along the side walls or at a central or other projection from the cup bottom. The number of protuberances can be varied as can their cross section configuration taken on a horizontal plane with the cup upright. It should be understood that although the protuberances have been described as extending outwardly from the cylindrical stacking ring, circumferential undercuts can also be provided by protuberances which extend inwardly of the stacking ring and should be considered the full equivalent of the embodiments described and claimed. The spacing, size and shape of protuberances in any one cup can vary. Although the side lines of each protuberance are each stated to lie on portions of a helix, it should be understood that the term "helix" is used to best clarify the invention and the lines may not be portions of true helices. The angle from the vertical or cup axis of the side lines is a feature in providing a circumferential undercut. The term "circumferential undercut" is meant to indicate a non-inwardly extending undercut but rather one that extends arcuately from side to side of a radius or about the circumference of a ring. While generally cylindrical containers have been described and a stacking ring referred to, it should be understood that the stacking ring of this invention need not be circular, and square or other shaped containers can be modified to incorporate the stacking ring of this invention. In addition the stacking ring structures of this invention are useful in lids and other devices or articles to be stacked or nested.

What is claimed is:

1. A thin wall, integral, plastic container having an upwardly flared side wall and a transversely extending bottom wall,

said container having a vertical axis in an upright position,

an inwardly extending shelf defined by at least one internal shoulder dimensioned to provide circumferential interference to a like container nested in said container with each internal shoulder having a predetermined circumferential length,

a stacking ring extending coaxially with said container and downwardly from said internal shoulder,

said stacking ring having at least two protuberances each defining side lines on said stacking ring extending from top to bottom thereof and defining a circumferential gap in said shelf at the top of said protuberances between outer side lines thereof and further defining a lower interrupted external shoulder having a greater circumferential length than the length of said circumferential gap,

said side lines of each said protuberance lie on helices with the helices of one protuberance being reversely extending with respect to the helices of the other protuberance.

2. A thin wall, integral, plastic container in accordance with claim **1** wherein said stacking ring defines a right cylindrical wall.

3. A thin wall, integral, plastic container having an upwardly flared side wall and a transversey extending bottom wall,

said container having a vertical axis in an upright position,

an inwardly extending shelf defined by at least one internal shoulder dimensioned to provide circumferential interference to a like container nested in said container with each internal shoulder having a predetermined circumferential length,

a stacking ring extending coaxially with said container and downwardly from said internal shoulder.

said stacking ring having at least two protuberances each defining side lines on said stacking ring extending from top to bottom thereof and defining an interrupted circumferential gap in said shelf at the top of said protuberances between outer side lines thereof and further defining a lower interrupted external shoulder having a greater circumferential length than the length of said circumferential gap,

said side lines of each said protuberance lying on helices with the helices of one protuberance being reversely extending with respect to the helices of the other protuberance.

4. A thin wall, integral, plastic container in accordance with claim **3** wherein said stacking ring defines a right cylindrical wall.

References Cited

UNITED STATES PATENTS

3,045,887	7/1962	Caine	220—97 X
3,083,888	2/1963	Miller	229—1.5
3,091,360	5/1963	Edwards	220—97
3,353,707	11/1967	Eyles	229—1.5

FOREIGN PATENTS

254,306	10/1964	Australia.

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229—1.5