Sept. 12, 1967 H. J. NAUTA 3,341,047

CONTAINER AND BAIL CONSTRUCTION

Filed May 10, 1966 2 Sheets-Sheet 1

Fig. 1

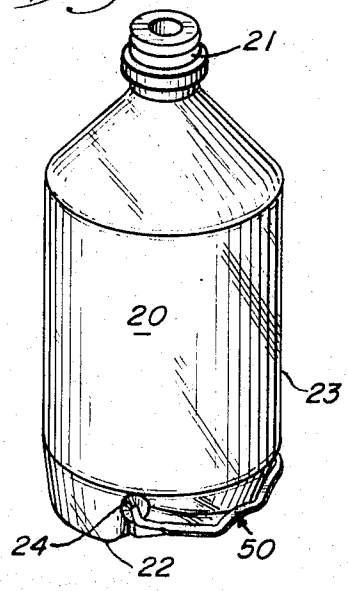


Fig. 3

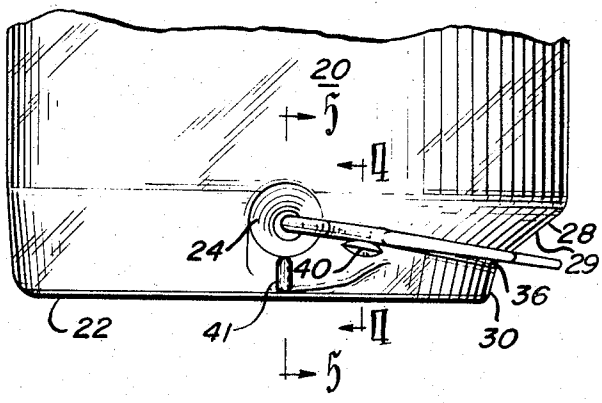


Fig. 4

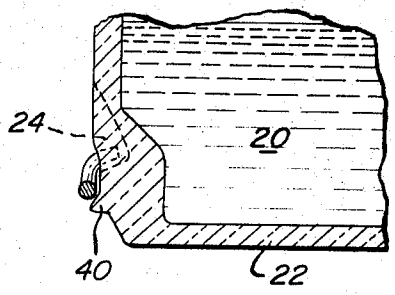
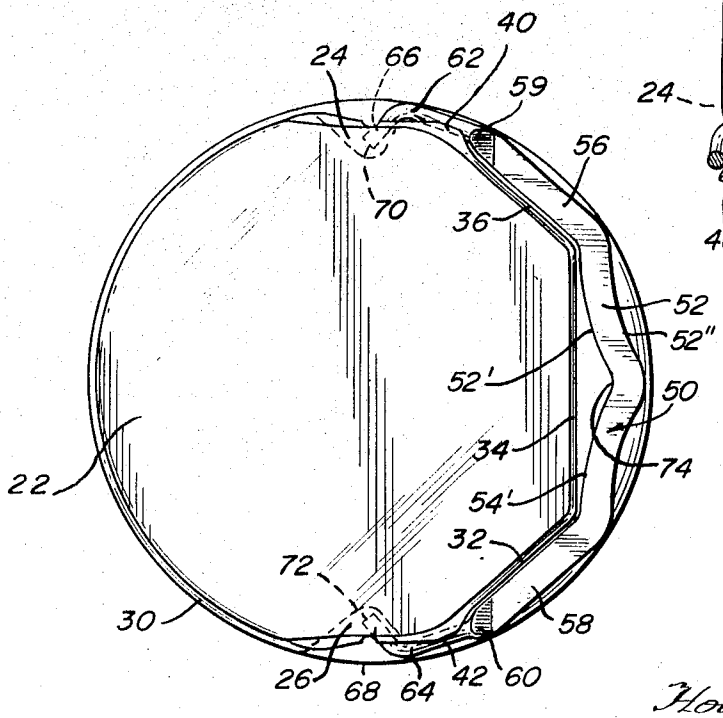


Fig. 2



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Fig. 5

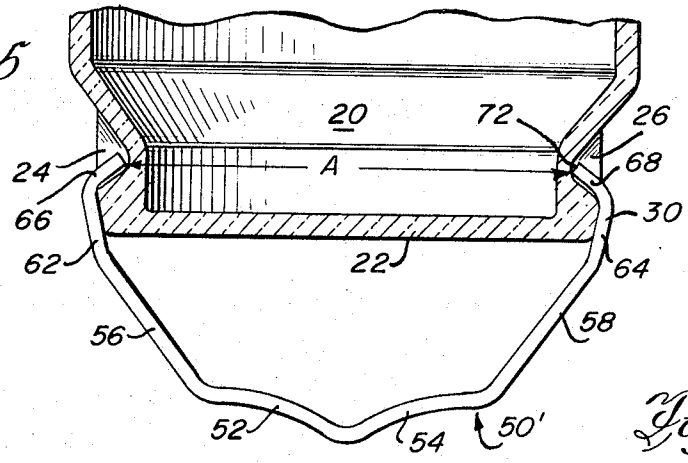


Fig 5A

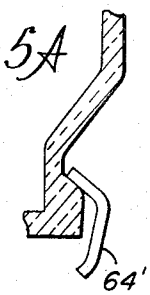


Fig. 6

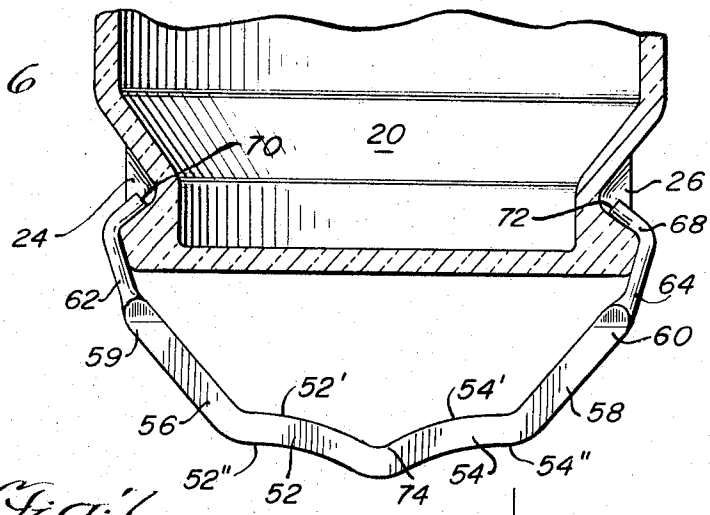
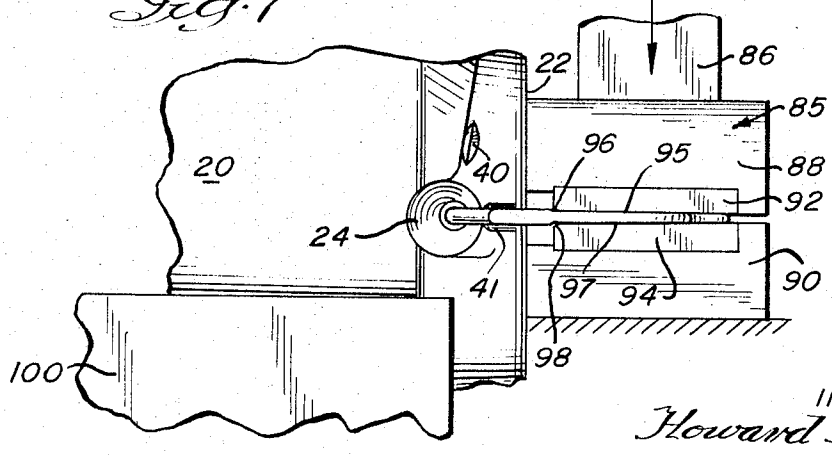


Fig. 7



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CONTAINER AND BAIL CONSTRUCTION

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9 Claims. (Cl. 215—100)

This invention relates to a container assembly incorporating a novel handle and a method for making such handles and assembling them upon containers. More particularly, this invention is directed to a handle for containers, the bail of which has high resistance to bending and removal from the container by virtue of the reshaping of the bail cross-section in the area subjected to the greatest bending stress; to a container constructed to receive the bail in locking engagement therewith and to release and again lock the bail in position for suspending the container; and to a process for shaping the handle by fabricating a round cross-section wire to the handle outline, securing the shaped wire to the container and forming the wire between a pair of dies to produce a non-circular cross-section segment of the bail having rigidity in the plane of rotation about the horizontal axis of the bail.

Bottles are used in medical practice for the purpose of containing blood and parenteral solutions for administration to a patient. The dispensing apparatus for transferring the liquid from the bottle to the patient is usually fastened to the neck or finish of the bottle by means of a screw-on cap. In normal practice, the bottle is suspended in the inverted position at a height several feet above a supine patient, and the fluid in the bottle administered by gravity or pressure flow. Secured to the base of the bottle is a means for suspending the bottle from a stand at a level above the patient. Formerly this means commonly comprised a semi-circular metal bail of round cross-section secured to a circular band girdling the bottle proximate its base. The bail was attached to the girdle at diametrically opposed points by means of the ends of the bail extending through apertures in opposed nipples in the girdle and hooked to prevent removal therefrom.

Among the shortcomings of the prior art apparatus was the requirement of several expensive, time-consuming steps to construct the handle assembly and secure it to the bottle; the large quantity of material comprising the handle assembly; and the unreliability of the assembly for securely supporting the bottle. This latter disadvantage was of paramount importance because a bottle of parenteral fluid or blood falling from a stand during infusion can dangerously complicate and delay medical procedures.

The present invention overcomes these shortcomings by providing a bail having very high resistance to bending moments caused when the container is suspended by the bail. This bail is nonetheless easier to fabricate and assemble and is less expensive in terms of quantity of material used in making the bail. Also, it has a construction wherein the bail can be snapped into a locked position above the base of the bottle so the bottle can be stored upright during periods of non-use, and the bail readily unlocked to rotate it into another locked position for the purpose of suspending the bottle for administration.

In practice the invention comprises a malleable metal bail having a substantially arcuate planar configuration and having a non-circular cross-section extending over a substantial length of the bail. The handle is formed by shaping a round rod to the desired outline, engaging the ends of the wire to the container to be supported and cold forming a substantial portion of the length of the wire to a cross-sectioned shape having the desired rigidity.

Accordingly an object of this invention is to provide a strong bail structure having high resistance to bending moments which is nonetheless reliable, simple and inexpensive to fabricate.

Another object of this invention is to provide a bail of such construction that there is no tendency of the bail itself to disengage from the container it supports.

Still another object of this invention is to provide a bail and container assembly wherein said bail can be locked in a storage position around the base of the container and yet readily be released and again locked in an operating position to support said container during administration.

Yet another object of this invention is to provide a process for forming and strengthening a bail while in an assembled position on the container.

Other objects and advantages of this invention will be apparent by reference to the following detailed description when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof, and wherein:

FIGURE 1 is a perspective view of a container and bail constructed according to this invention;

FIGURE 2 is a bottom plan view of the container and bail shown in FIGURE 1;

FIGURE 3 is a partial side elevational view of the container and bail shown in FIGURE 1;

FIGURE 4 is a partial sectional view along line 4—4 of FIGURE 3;

FIGURE 5 is a partial sectional view along line 5—5 of FIGURE 3 showing the bail prior to subjecting it to the forming process of this invention;

FIGURE 5A is a partial view similar to the view of FIGURE 5 but showing an embodiment wherein the bail end is fitted loosely to the container prior to forming;

FIGURE 6 is a view of the container and bail after having been subjected to the forming process of this invention; and

FIGURE 7 is a view of a container with the attached bail being formed between dies to the cross-section shown in FIGURE 6.

Referring now to FIGURES 1 and 2 of the drawings, there is shown a more or less cylindrical container **20** having a base **22** and a sidewall **23**. At the top of container **20** is attachment means **21** such as for example, a screw-type coupling for securing an administration set thereto. Proximate base **22** a bail **50** is attached at its ends **70**, **72** to container **20**. The ends **70**, **72** of bail **50** fit into diametrically opposed dimples **24**, **26** (shown in FIGURE 2) that are spaced slightly above base **22** in side wall **23**.

To provide a more compact package, bail **50** in the embodiment shown does not extend beyond the outer contour of container **20** defined by the perimeter of sidewall **23**. Thus, when bail **50** is in the closed position as shown in FIGURES 1, 2, and 3 it is tucked into the pocket **29** formed by the set back of base **22** to ledges **32**, **34** and **36** and the inwardly sloped wall portion **28**.

Furthermore, neither do locking sections **62**, **64** of bail **50** extend beyond the outer contour of container **20** either when bail **50** is in the closed position or when it is rotated about its horizontal axis because base **22** is also set back from sidewall **23** below dimples **24**, **26**. Beneath these edge portions and extending around the periphery of base **22** is a slightly inwardly inclined edge portion **30**.

Bail **50** in the preferred embodiment is formed from a malleable resilient material, and as is usual for bails for bottles of this type, from a stock roll of wire of suitable

gauge cut to the desired length at ends **70, 72**. This piece is then bent to shape and inserted into dimples **24, 26**. After bending, however, there remain compressive and expansive forces within the wire that would tend to cause it to spring out of dimples **24, 26**. Therefore, now will be explained one novel feature of this invention that when combined with container **20** provides a simplified and novel combination.

Bail **50** is arcuate in general contour, planar and opposing sections thereof are preferably symmetrical with respect to midpoint notch **74**. Immediately adjacent midpoint notch **74** of bail **50** is a pair of inwardly curved sections **52, 54**. These sections are of a length sufficient to counterbalance the spring tension of the bail that would in the absence of sections **52, 54** tend to open the ends **70, 72** of the bail outward from dimples **24, 26**.

In the preferred embodiment curved sections **52, 54** together occupy about one-third of the total length of bail **50**. The remaining two-thirds of the length are taken up about equally by substantially straight, curved, intermediate sections **56, 58** and locking sections **62, 64**. Straight sections **56, 58** are of the same cross-sectional configuration as curved sections **52, 54**.

Locking sections **62, 64** extend from the crimps **59, 60** to the ends **70, 72** of the bail. They are of a round cross-section and are bent inwardly into dimples **24, 26** at hooks **66, 68**. The portions of the locking sections from the ends of the intermediate curved sections **56** and **58** to the hooks **66** and **68** are segments of the same ellipse.

In the position shown in FIGURE 2 bail **50** is locked in the storage position so it is held above base **22** in pocket **29**. In this position locking sections **62, 64** rest upon and above protuberances **40, 42** molded in container **20**. Protuberances **40, 42** extend sufficiently far from wall portion **28** so that when bail **50**, having sufficient flexure, snaps over protuberances **40, 42**, they then support locking sections **62, 64** and prevent bail **50** from pivoting downwardly. Although bail **50** is sufficiently resilient to enable it to be readily snapped over protuberances **40, 42**, it has sufficient resistance to the bending moments caused by suspension of the bottle to prevent dislodging ends **70, 72** from dimples **24, 26**. Reference to FIGURE 3 makes apparent that the relative steep incline of wall **28** and the substantial space between wall **28** and bail **50** together with the indentations formed by ledge **34** provides room to manually grasp bail **50** at midpoint **74** and the sides **52', 54'** of sections **52, 54** and rotate it from the locked position shown in FIGURE 3 into the dependent position shown in FIGURE 6.

As best seen in FIGURE 6, midpoint notch **74** formed at the apex of bail **50** provides a convenient support for hanging the container and bail from the arm of a stand (not shown) for dispensing the contents from container **20**.

Bail **50** can be locked into the open position of FIGURE 6 by snapping locking sections **62, 64** into locking means provided below dimples **24, 26**. Such a means, notch **41**, is shown in FIGURE 3. This feature provides the aforementioned stability to the container and bail when hung from a support about midpoint notch **74**.

Also, the curvature of the arcuate sections **52, 54** provides a convenient handle gripping means, whereby a hand can comfortably grip the handle to transport container **20**. As seen, the cross-sectional shape of sections **52, 54, 56** and **58** of the bail are of rounded triangular configuration, the wider face of the triangle extending inwardly toward the bottle and narrow face extending outwardly from the bottle. Although this configuration is preferred, other suitable cross-sectional shapes may be given to sections **52, 54, 56** and **58**, some of these being rectangularly flat, I-shaped or T-shaped.

For fabrication of the bail, a length of rod or wire is cut into suitable lengths. These lengths are formed in a conventional wire forming machine (not shown) to

the contour of the intermediate bail structure **50'** shown in FIGURE 5. In the intermediate configuration of FIGURE 5, the entire cross-section of the wire remains substantially round. In forming the wire to the configuration of FIGURE 5, the distance between the bail ends **70, 72** is made somewhat less than the normal distance A between the bottoms of dimples **24, 26**. Inasmuch as the intermediate bail structure **50'** is resilient, and the distance between the ends **70, 72** is less than the distance A, the ends, when inserted in dimples **24, 26**, can be snap-fitted into the dimples **24, 26** and will apply a compressive force to the bases of the respective dimples.

Alternatively, as shown in FIGURE 5A, locking section **64'** can fit loosely onto container **20**. In this embodiment the closing force of the dies in the forming operation and the angle the die chamfers make at crimps **59, 60** turn the ends **70, 72** inwardly to tightly grip dimples **24, 26**. Such an embodiment makes assembly easier since less force is required to slip intermediate bail structure **50'** upon container **20**.

In the embodiment shown in FIGURE 6, the inwardly curved sections **52, 54** are of equal length. The inner face **52'** of section **52** and inner face **54'** of section **54** are in tension and their tendency is to contract to relieve the stress caused by this tension. Outer faces **52'', 54''** are in compression and tend to expand outwardly to release the stresses caused by the compression. Consequently, the result of these forces in the inwardly curved sections is to force hooked ends **66, 68** inwardly to retain them in satisfactory engagement with the respective dimples **24, 26**. If desired, more than one pair of arcuate sections or a single section which is symmetrical with respect to the midpoint of the bail can be utilized to prevent the bail ends from tending to spread apart and pull the hooked ends **66, 68** out of their respective dimples.

As shown in FIGURE 7, after the formed intermediate bail structure **50'** has been attached to the container **20**, the bottle is placed in a cradle **100**, on a conveying apparatus (not shown) of conventional design and transported to a hydraulic press **85**. The hydraulic press consists of upper and lower platens **88, 90**, platen **90** being mounted on a rigid base, and platen **88** being dependingly mounted on the movable piston **86** of the hydraulic press cylinder assembly. Mounted in the opposing faces of the respective platens **88, 90** are opposed dies **92, 94** which are formed of a suitably hard material with flat, smooth, highly polished faces **95, 97**. The front edges of the respective dies **92, 94** have chamfers **96, 98** formed along the front faces thereof. The contacting faces **95, 97** are inclined convergingly in straight lines from front to back to define a V-shaped space therebetween when the die **92** reaches the downward limit of its movement.

When the conveyor transport the cradle **100**, with the bottle **20** and intermediate bail structure **50'** mounted therein, to the hydraulic press, the bail is placed between the opposing dies, with the front faces of the platens **88, 90** in close proximity to base **22** of container **20**. At this time, the hydraulic press is actuated and piston **86** lowers platen **88** and die **92** with a force sufficient to cold work the sections of intermediate bail structure **50'** therebetween and form sections **52, 54, 56** and **58** to the rounded triangular cross-sectional shape. Because of the chamfers **96, 98** on dies **92, 94**, crimps **59, 60** are formed at the edges of the cold worked sections **56, 58**. When the bails have passed the hydraulic press, they can be rotated 90° upward until locking sections **62, 64** are forced over the respective protuberances **40, 42** to hold the bail in locked position above base **22** of the bottle.

Of course, other dies can be suitably selected to produce the alternative cross-sections previously described for sections **52, 54, 56** and **58**.

The cold working of the bail during the cold forging operation also serves to increase the tensile strength of

a steel bail. For example, when a round wire of 1030 carbon steel is utilized for the bail, this material will have a normal tensile and yield strength of approximately 100,000 pounds per square inch. After this material is subjected to the cold working operation incident to the forming of the cross-section of the bail material, the tensile and yield strengths are both increased to about 125,000 pounds per square inch. This enables the bail to withstand 25% greater load and deflection than otherwise, without failure or taking a permanent set. This feature also enables the use of a smaller diameter wire than would otherwise be utilized, with a concomitant cost saving due to the lower cost of smaller diameter wires of the same material.

The paramount benefit obtained by this process is the great increase in moment of inertia and consequent increase of resistance to bending moments which is obtained by altering the cross-section of the wire from the rounded cross-section wire normally used in the manner of this invention. For example, a .1055 inch diameter wire has a moment of inertia of .000006, whereas the same size wire flattened into a rectangle having dimensions of .042" x .218", which is equivalent in cross-sectional area, increases the moment of inertia of the cross-section to .000036, producing 600% increase in the strength and rigidity of the wire. This improved moment of inertia characteristic increases the resistance of the handle to bending moments to such an extent that the likelihood that the weight of the container and its contents will cause the bail to fail and release the container is negligible.

The preferred material from the standpoint of cost and ease of use would be a low carbon steel such as 1040 plain carbon steel. However, other malleable cold workable materials such as aluminum or stainless steel can be used, as well as utilizing plastic materials such as thermoplastics, like polyethylene, nylon and styrenes, for example. As plastic materials are used, deformation will not readily be accomplished by cold working, and a hot forming process would be necessary using heated dies.

In order to prevent corrosion of the handle in the event that a metal handle is desired, the handle material can be plated after it is cold formed, with a non-corrosive coating, or a plastic material.

Although the apparatus and method of this invention have been specifically described with regard to their use to form a handle for a glass container for medical solutions, it will be appreciated that the principles of this invention will be equally applicable to glass containers utilized for other purposes, such as glass bottles for carrying milk, and that the principles can be applied to containers of other materials such as metal paint containers. In the manufacture of paint containers, the cost of the metal of the handle is particularly significant in this highly competitive area where large numbers of containers are sold, and consequently large amounts of money expended buying the metal for the handle. By applying the principles of this invention, a length of metal of smaller diameter can be utilized to provide the same strength handle as would otherwise be used, utilizing prior art constructions and techniques. Consequently, a significant cost saving is effected by virtue of the use of smaller quantities of material.

Other modifications are contemplated and may be resorted to by those skilled in the art without departing from the spirit and scope of the invention as hereinafter defined by the appended claims.

I claim:

1. A bail for a container defined by two diametrically opposed dimples proximate one end thereof, comprising a planar member having two inwardly hooked ends and at least three apexes; curved end sections proximate each end of the member, each end section being a segment of the same ellipse; a plural series of curved intermediate sections joining one another at an apex and the first and last member of the series connected to the end sections; the intermediate sections having a curvature reverse to the curvature of the end sections and at least in part having a cross-section with a major and a minor dimension, said major dimension lying in the plane of the member and said minor dimension in another plane.

2. A bail according to claim 1 in which the bail has a crimp line parallel to a line extending between the ends of the bail.

3. A bail according to claim 1 in which the cross-section of the said intermediate sections has a rounded triangular configuration.

4. A bail for a container defined by two diametrically opposed dimples proximate one end thereof comprising a planar member having two inwardly hooked ends of round cross-section and three apexes; curved end sections proximate each end of the member, each end section being a segment of the same ellipse; two curved intermediate sections joining one another at an apex and each joining an end section at another apex; the intermediate sections having a curvature reverse to the curvature of the end sections and having a cross-section with a major dimension and a minor dimension, said major dimension lying in the plane of the member and said minor dimension in another plane.

5. A bailed container comprising in combination a container having a top, a sidewall defining the outer contour of the container and a base; two diametrically opposed dimples impressed into the sidewall proximate the base; a set back portion of the base set back from the outer contour extending around about one-half the container from one dimple to the other, a portion of the sidewall proximate the set back portion of the base sloping inwardly to join the set back portion of the base and define therewith a pocket; a bail adapted to fit within said pocket comprising a planar member having two inwardly hooked ends mounted in the dimples and at least three apexes; curved end sections proximate each end of the member, each end section being a segment of the same ellipse; a plural series of curved intermediate sections joining one another at an apex and the first and last member of the series connected to the end sections; the intermediate sections having a curvature reverse to the curvature of the end sections and at least in part having a cross-section with a major and a minor dimension, said major dimension lying in the plane of the member and said minor dimension in another plane.

6. A bailed container comprising in combination a container having a top, a sidewall defining the outer contour of the container and a base; two diametrically opposed dimples impressed into the sidewall proximate the base; a set back portion of the base set back from the outer contour that extends around about one-half the container extending from one dimple to the other; a portion of the sidewall proximate the set back portion of the base sloping inwardly to join the set back portion of the base in a series of straight ledges and define therewith a pocket; a bail adapted to fit within said pocket comprising a planar member having two inwardly hooked ends of round cross-section and three apexes; curved end sections proximate each end of the member, each end section being a segment of the same ellipse; two curved intermediate sections joining one another at an apex and each joining an end section at another apex; the intermediate sections having a curvature reverse to the curvature of the end sections and having a cross-section with a major dimension and a minor dimension, said major dimension lying in the plane of the member and said minor dimension in another plane.

7. A container comprising a top, a sidewall defining the outer contour of the container and a base; two diametrically opposed dimples impressed into the sidewall proximate the base; a set back portion of the base set back from the outer contour that extends around about one-half the container extending from one dimple to the

other, the dimples, in part, being formed in the set back portion, a portion of the sidewall proximate the set back portion of the base sloping inwardly to join the set back portion of the base and define therewith a pocket.

8. A container according to claim 7 in which there is a notch between one of the dimples and said base.

9. A container according to claim 7 in which there is a protuberance on the set back portion.

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