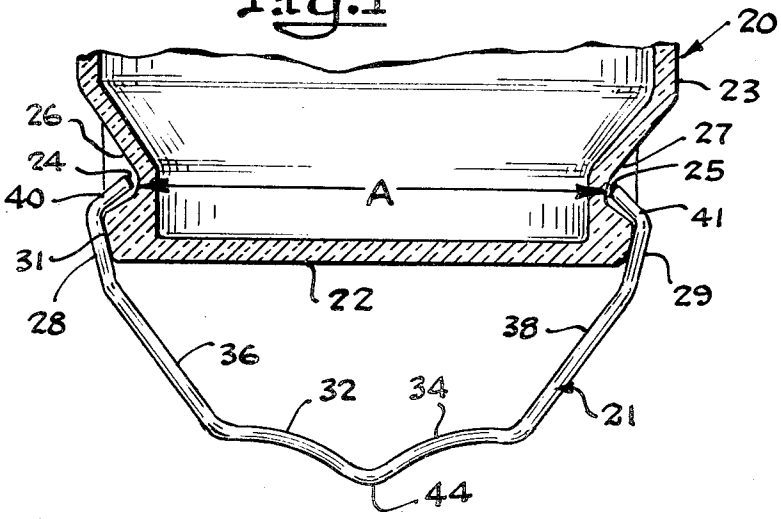
May 26, 1970 H. J. NAUTA 3,513,533

METHOD OF MAKING BAILED CONTAINER

Filed Aug. 9, 1967 2 Sheets-Sheet 1

Fig.1



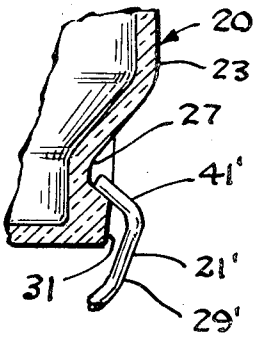


Fig.1A

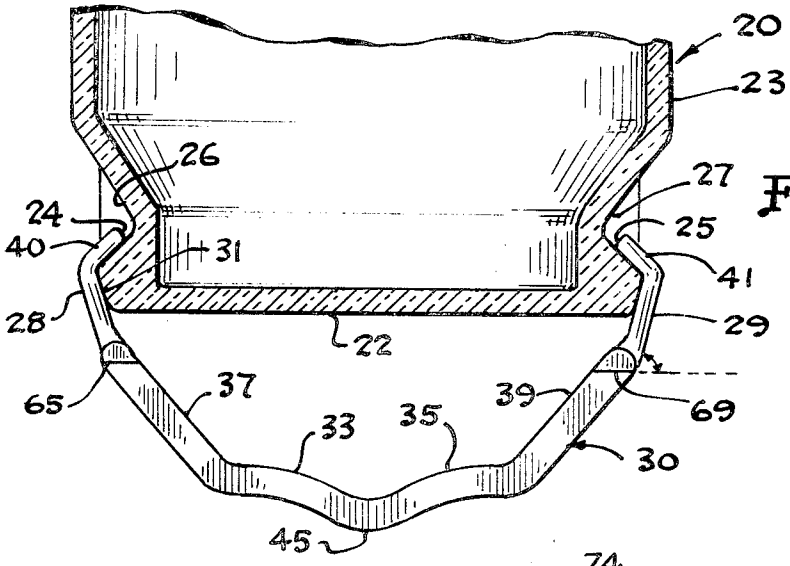


Fig.3

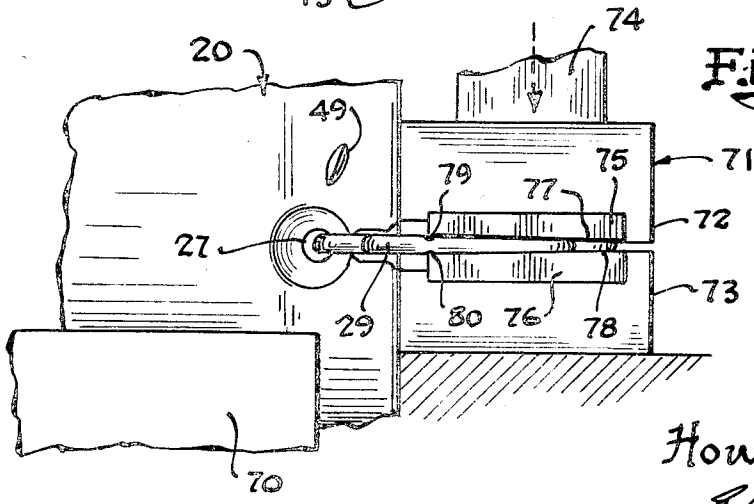


Fig.2

Inventor
Howard J. Nauta
By Edmunds & Reed
Attorney

May 26, 1970 H. J. NAUTA 3,513,533

METHOD OF MAKING BAILED CONTAINER

Filed Aug. 9, 1967 2 Sheets-Sheet 2

Fig.4

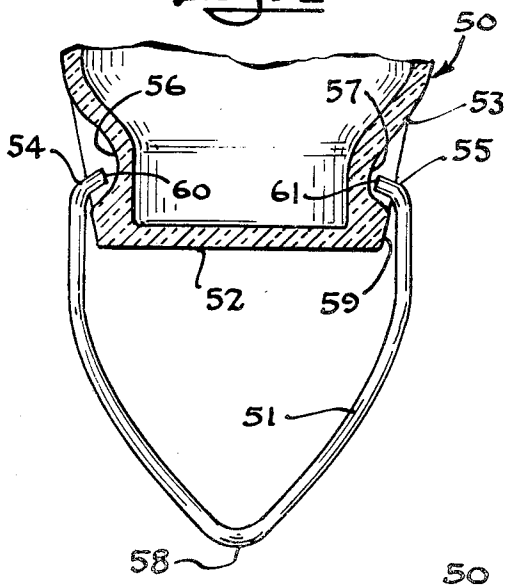
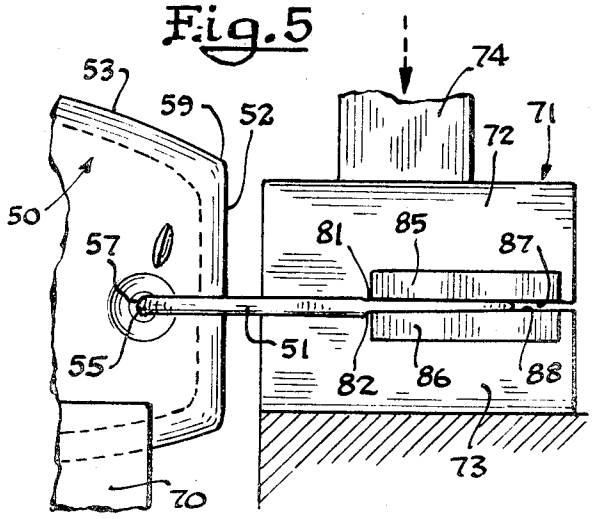


Fig.5



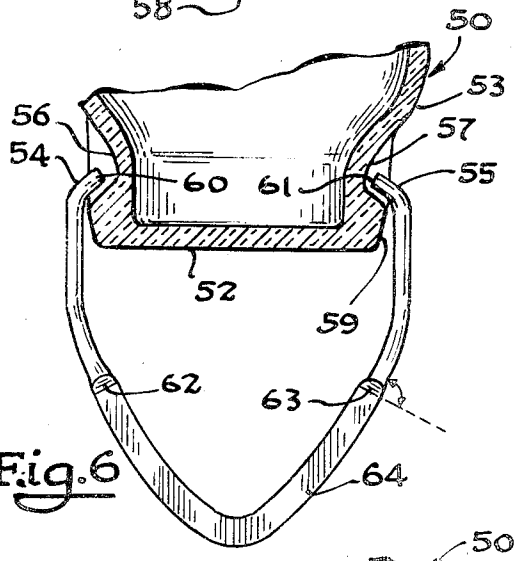


Fig.6

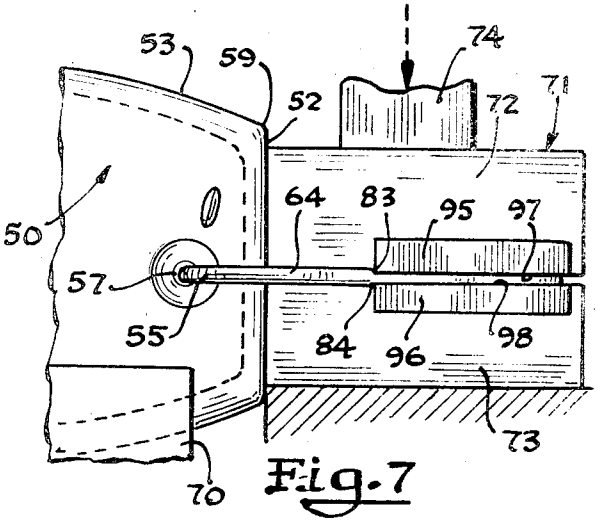


Fig.7

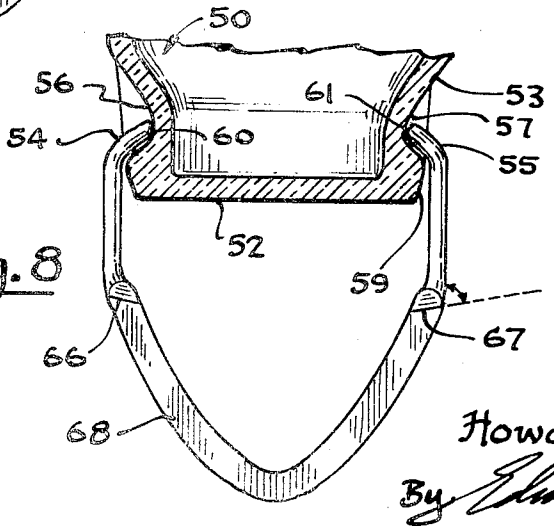


Fig.8

Inventor
Howard J. Nauta
By Edmunde D Reed
Attorney

United States Patent Office 3,513,533 Patented May 26, 1970

3,513,533

METHOD OF MAKING BAILED CONTAINER

Howard J. Nauta, Waukegan, Ill., assignor to Abbott Laboratories, North Chicago, Ill., a corporation of Illinois

Continuation-in-part of application Ser. No. 549,027, May 10, 1966, now Patent No. 3,341,047, dated Sept. 12, 1967. This application Aug. 9, 1967, Ser. No. 659,382

Int. Cl. B23p *11/00*

U.S. Cl. 29—437 9 Claims

ABSTRACT OF THE DISCLOSURE

A process for fabricating a bailed container by shaping a bail blank from round wire stock of the desired length so the ends thereof hook into bosses or recesses in the container. A portion of the bail between the hooked ends is then pressed between dies to a non-circular cross-section. A second pressing operation can be used to squeeze the hooked ends inwardly so they more tightly grip the container.

This invention relates to a method for making handles and assembling them upon containers and is a continuation-in-part of U.S. Pat. 3,341,047 issued Sept. 12, 1967. More particularly, this invention is directed to methods for making a handle which has a high resistance to bending and removal from the container to which it is attached by virtue of reshaping of the handle cross-section in the area subjected to the greatest bending stress. Especially, this invention relates to a process for shaping the handle by fabricating wire to the handle outline, securing the shaped wire to the container and forming the wire handle between dies to produce a non-circular cross-section segment of the handle having rigidity in the plane of the handle.

The bottles or containers with which this invention deals are used in medical practice for the purpose of containing blood and other liquid parenteral solutions. 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 the patient, and fluid in the bottle is administered by gravity flow. Secured to the base of the bottle is a means for suspending the inverted bottle. Formerly this means commonly comprised a semi-circular metal handle or 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.

There are among the shortcomings of prior art apparatus 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 is 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.

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 bail is formed by shaping wire 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 method for making 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 method for making a bail that has no tendency to disengage from the container it supports.

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:

FIG. 1 is a cross-sectional view of a container base having a bail blank depending therefrom, being shown at a time prior to subjecting the bail blank to the forming process of this invention;

FIG. 1A is a partial view similar to the view of FIG. 1, but showing an embodiment wherein the hooked end of the bail blank is fitted loosely to the container prior to forming;

FIG. 2 shows the container with the attached bail being formed from the bail blank shown in FIG. 1 into the bail shown in FIG. 3;

FIG. 3 shows a view of the bailed container of FIG. 1 after subjected to the forming process of FIG. 2;

FIG. 4 shows a container and bail blank that is to be processed by an alternate embodiment of this invention;

FIG. 5 shows the container and bail blank of FIG. 4 being pressed between dies;

FIG. 6 shows the container and bail blank of FIG. 4 after the pressing operation of FIG. 5;

FIG. 7 shows the bail of FIG. 6 being pressed again between dies; and

FIG. 8 shows the finished bail on the container.

Referring now to the drawings and particularly to FIG. 1, there is shown a more or less cylindrical container **20** having a bottom **22** and a sidewall **23**. Not shown at the top of container **20** is an attachment means such as, for example, a screw-type coupling for securing an administration set thereto. Proximate bottom **22**, a bail blank **21** is attached to container **20** at hook ends **40, 41**. Hook ends **40, 41** of bail blank **21** fit into diametrically opposed dimples **26, 27** that are spaced slightly above basewall **31** in sidewall **23**.

A bail blank, 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 **24, 25**. This piece is then bent to the desired shape and inserted into dimples **26, 27**. The shape of the bail blank is arcuate in general contour, planar, and opposing sections thereof preferably symmetrical with respect to its midpoint. The shape is not a critical factor of this invention; although generally arcuate, it may be described as an arc of a circle, an arc of an ellipse or as a portion of some other closed figure. Whatever its shape after bending, compressive and expansive forces may be created within the wire that would tend to cause it to relax and spring out of dimples **26, 27** when subjected to the later described pressing operation. The pressing operation gives sufficient rigidity to the bail so its ends cannot easily be pulled apart. Therefore, some looseness of the finished bail is tolerable, so long as the bail ends are well within the dimples. If a tighter fit of the bail to the container is desired, one can use the especially desirable shape of bail blank **21** which has a pair of inwardly curved sections **32, 34** immediately adjacent midpoint **44**. These sections are of a length sufficient to counterbalance the tensions created within the bail that, in the absence of sections **32, 34**, tend to open ends **24, 25** of the bail outwardly from dimples **26, 27** during the pressing operation.

In this embodiment curved sections **32, 34** together occupy about one-third of the total length of bail blank **21**. The remaining two-thirds of the length are taken up about equally by substantially straight sections **36, 38** and locking sections **28, 29**. By the term "substantially straight," it is intended to describe a section that follows the general arcuate shape of bail blank **21**.

For fabrication of bail blank **21**, rod or wire is cut into suitable lengths. These lengths are formed in a conventional wire-forming machine (not shown) to the contour of bail blank **21**. The entire cross-section of the wire remains substantially unchanged. In forming the wire to this configuration, the distance directly between the bail blank ends **24, 25** is made somewhat less than the normal distance A between the bottoms of dimples **26, 27**. Inasmuch as the bail blank is resilient and the distance between the ends is less than the distance A, the ends, when inserted into dimples **26, 27** can be snap-fitted into place and will apply a compressive force to the bases of the respective dimples.

Alternatively, as shown in FIG. 1A, locking section **29'** can fit loosely onto container **20**. In this embodiment the closing force of the dies in the forming operation together with the angle the die edges make on the bail blank turn hook end **41'** and section **29'** inwardly to tightly grip dimple **27**. Such an embodiment can make assembly easier since less force is required to slip bail blank **21'** upon container **20**.

As shown in FIG. 2, after the formed bail blank **21** has been attached to container **20**, the bottle is placed in a cradle **70** on a conveying apparatus (not shown) of conventional design and transportated to a hydraulic press **71**. The hydraulic press consists of upper and lower platens **72, 73**, platen **73** being mounted on a rigid base and platen **72** being dependingly mounted on the movable piston **74** of the hydraulic press cylinder assembly. Mounted in the opposing faces of the respective platens are opposed dies **75, 76** which are formed of a suitably hard material with flat, smooth, highly-polished surfaces **77, 78**. The front edges of the respective dies have chamfers **79, 80** formed along the front faces thereof. The contacting surfaces are inclined convergingly in straight lines from front to back to define a V-shaped space therebetween when the die **75** reaches the downward limit of its movement.

When the conveyer transports the cradle **70** with the container **20** and bail blank **21** mounted therein to the hydraulic press, the bail is placed between the opposing

dies, with the front faces of the platens **72, 73** in close proximity to bottom wall **22**.

At this time, the hydraulic press is actuated and piston **74** lowers platen **72** and die **75** with sufficient force to cold work a portion of bail blank **21** between hook ends **40, 41** to a non-circular cross section. As shown here, bail blank **21** is cold worked to form sections **32, 34, 36,** and **38** into a rounded triangular cross-sectional shape. Because of chamfers **79, 80** on dies **75, 76**, crimps **65, 69** are formed at the juncture of the cold worked sections **37, 39** and locking sections **28, 29**. When the bails have passed the hydraulic press, they can be rotated 90° upwardly until the locking sections are forced over protuberance **49** thereby holding bail **30** in a locked position above basewall **31**.

The dies are chosen so that the portion of the bail blank flattened between the dies is given a non-circular cross-section having its major dimension in the plane of the bail and its minor dimension in another plane. In finished bail **30**, as shown in FIG. 3, the cross-sectional shape of sections **33, 35, 37,** and **39** of the bail are of rounded triangular configuration, the wider face of the triangle extending inwardly toward the bottle and more narrow face extending outwardly from the bottle. Although the rounded triangular cross-section is preferred, these sections can also be rectangular, I-shaped, or T-shaped as well.

As previously stated the inwardly-curved sections prevent the portion of the bail blank **21** not pressed between the dies, namely locking sections **28, 29** and hook ends **40, 41** from relaxing and turning outwardly during the forming process. Nevertheless, it is highly desirable that die chamfers **79, 80** produce crimps **65, 69** such that the angle indicated in FIG. 3 between the line of the crimp and the outside edge of the bail **30** just outside the dies is 90° or less. An angle of more than 90° turns that portion of bail **30** extending outside the dies outwardly, hence drawing hook ends **40, 41** from the dimples.

Referring now to FIGS. 4 through 8, a process will be described that is suitable for bail blanks that do not have any compensation included in their design against relaxing of the ends during pressing.

In FIG. 4 there is shown a container **50** of cylindrical shape having a bottom **52**, a sidewall **53**, and a basewall **59**. In sidewall **53**, above basewall **59**, are diametrically opposed dimples **56, 57**. Mounted within the dimples are hook ends **54, 55** of bail blank **51**.

Bail blank **51** is made of a material like that previously described for bail blank **21** and is cut and bent to the semi-elliptical shape symmetrical to midpoint **58** as shown. It should be emphasized that for the process of this invention the particular configuration of the bail blank is not material, a semi-circular bail blank being suitable. The preferred process of this embodiment will produce a bail having hook ends that fit tightly against the side wall of the container and having desired rigidity.

Referring to FIG. 5, container **50**, having the formed bail blank **51** attached thereto, is carried on cradle **70** into hydraulic press **71**.

Cradle **70** carries container **50** only partway into press **71**, so that bottomwall **52** is spaced apart from press **71**. This is a matter of convenience with the press used, and the area of bail blank **51** subjected to pressing can be adjusted also by the size of dies **85, 86**, as well as by the extent of penetration of bail blank **51** into the press.

When piston **74** is lowered, the bail is pressed between the surfaces **87, 88** of dies **85, 86** held in platens **72, 73**.

A portion of bail blank **51** between hooks **54, 55** is pressed to a non-circular cross-section such as previously described. The front edges of dies **85, 86** have chamfers **81, 82** that bite into bail blank **51** to form crimps **62, 63**.

It should be noted that in the preferred embodiment the crimps are equidistant from each hook end. This, although desirable, is not necessary to an operative device.

If the crimps are not equidistant, the indicated angle of the crimp line and bail will need to be adjusted separately by experimentation to get uniform inward turning of the hook ends.

The preferred angle between the crimp line and the outside edge of the bail extending just beyond the die chamfer is 90° or less as is indicated at crimp **63**.

Bail **64** now has the requisite rigidity and is suitable for use but can fit loosely upon the container as shown in FIG. 6. If the loose fit is not entirely desirable, then the following additional steps are undertaken. To turn the hook ends **54, 55** inwardly so that the ends of the bail fit tightly against dimples **56, 57**, the bail **64** is subjected to a second pressing operation as shown in FIG. 7.

In this second pressing a portion of the bail between hook ends **54, 55** is flattened to the non-circular cross-section such as previously described.

This second pressing flattens some additional portion of bail **64** to the non-circular cross-section between crimp **62** and hook end **54** and crimp **63** and hook end **55**. The edge of the die bites bail **64** so the crimp line at crimps **66, 67** forms an angle of less than 90° with the outside of the bail, as indicated in FIG. 8. As shown in FIG. 7, cradle **70** positions the bottom **52** of container **50** flush against press **71**. Dies **95, 96** fit into platens **72, 73** respectively. Dies **95, 96** have surfaces **96, 98** and front faces have such that the bite of the die flattens an additional area of the bail **64** above crimps **62, 63** and produces new crimps **66, 67**.

The second pressing can produce a cross-section like or different to that of the first pressing. The second pressing need not necessarily include that area pressed by the first pressing operation.

The finished bail is shown in FIG. 8, and it will be noted that the hook ends **54, 55** now fit tightly against the container basewall **59** and dimples **56, 57**.

The paramount benefit obtained be 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-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 content will cause the bail to fail and release the container is negligible.

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.

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.

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 material such as thermoplastics, like polyethylene, nylon and styrenes, for example. When plastic materials are used, and deformation cannot readily be accomplished by cold working, a hot forming process useing heated dies may be satisfactory.

Although the method of this invention has been specifically described with regard to its use to form a bail for glass containers 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 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 method of bailing containers comprising the steps of mounting a bail blank on to a container and pressing a portion of the blank intermediate the ends of said blank to a non-circular cross-section having a major dimension in the plane of the bail, and a minor dimension in another plane.

2. A method according to claim **1** in which said bail is subjected to a second pressing in which an area intermediate each end of said bail and that area flattened by the first pressing is pressed to non-circular cross-section having a major dimension in the plane of the bail and a minor dimension in another plane.

3. A method according to claim **1** in which a second pressing operation forms a crimp in the bail and the line of said crimp between the pressed portion and the outside edge of the unpressed portion of the bail forms an angle of no greater than 90°.

4. A method according to claim **2** in which the second pressing operation forms a crimp in the bail and the line of said crimp between the pressed portion and the outside edge of the unpressed portion of the bail forms an angle of no greater than 90°.

5. A method for bailing a container, said container having two diametrically opposed dimples impressed in the sides thereof comprising the steps of forming an elongated rod of malleable material having a substantially uniform circular cross-section into an intermediate bail blank structure having two inwardly hooked ends and at least three apexes; curved end sections proximate each end of the intermediate bail structure, each end section being a segment of the same ellipse; a plural series of curved intermediate sections joining one another at an apex the first and last members of the series connected to the curved end sections at an apex, fitting the hooked ends into the dimples and pressing said intermediate bail setcion into a cross-sectional shape resistant to bending.

6. A method according to claim **5** in which the hooked ends of the intermediate bail structure are fitted loosely into said dimples and the crimping action in a line across the bail in a line parallel to the ends of the container turns the ends into said dimples to achieve a secure fit.

7. A process for bailing a container comprising the steps of cutting a length of wire from a stock supply, bending said cut piece into the shape of a bail blank, fitting the ends

of said piece on to receptacles on a container and flattening a portion of the bail blank intermediate the ends of said bail blank.

8. A method according to claim 5 comprising a second step of pressing the bail between dies so that a crimp line is formed in the bail, said crimp line forming an angle with the outside of the bail intermediate the crimp line and the end of the bail of less than 90° thereby turning the ends of the bail inward to more tightly grip the container.

9. A method according to claim 8 in which the crimps are equidistant from the dies of the bail.

References Cited

UNITED STATES PATENTS

2,122,082	6/1938	Bertram	140—75
2,623,274	12/1952	Henchert.	
3,192,960	7/1965	Woodward	140—75
3,195,228	7/1965	Beacham	29—430

THOMAS H. EAGER, Primary Examiner

U.S. Cl. X.R.

29—208; 140—75