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CONTAINER

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Fig. 2.

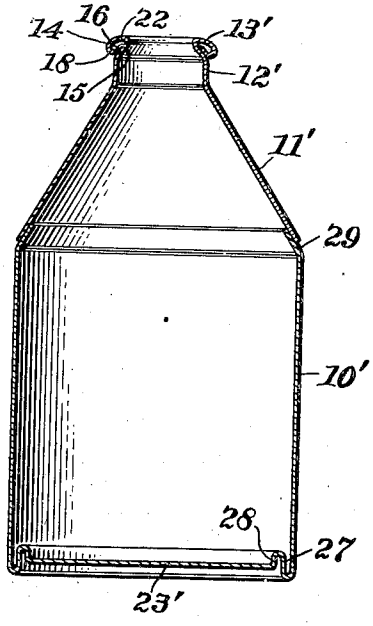


Fig. 3.

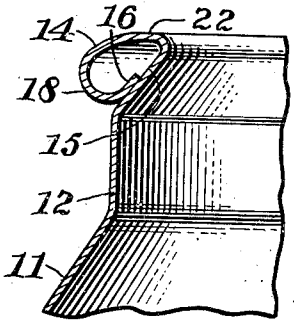


Fig. 6.

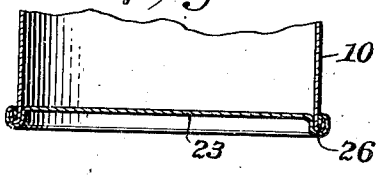


Fig. 4.

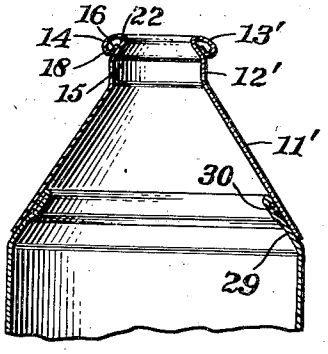


Fig. 5.

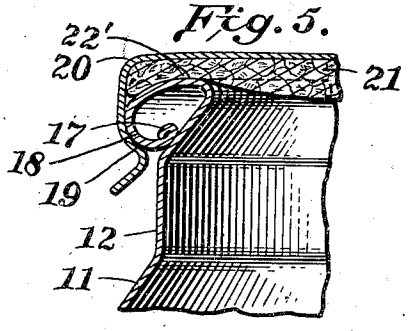
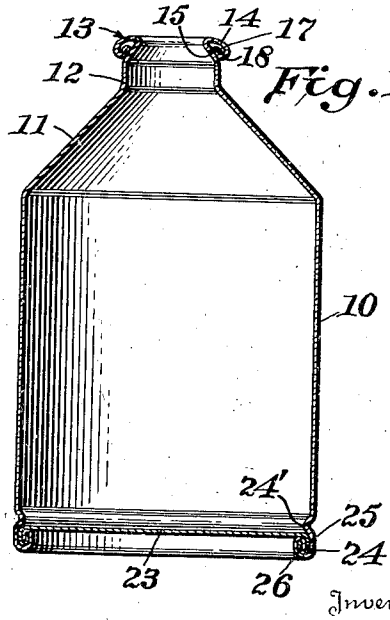


Fig. 1.



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CONTAINER

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Fig. 7.

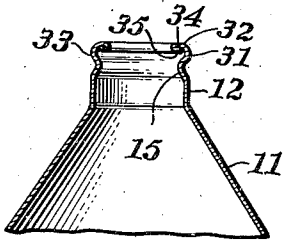

Fig. 8.

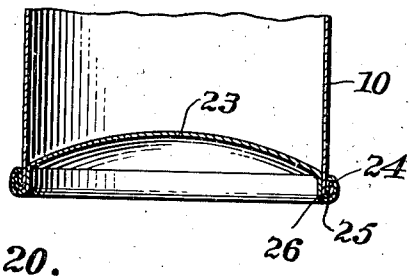

Fig. 20.

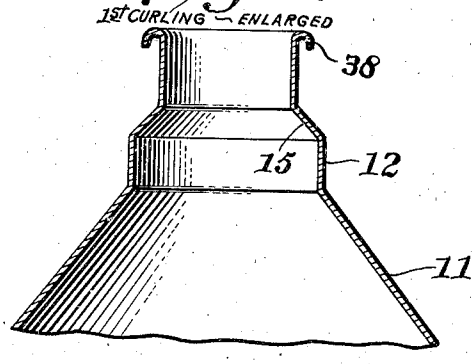

Fig. 21.

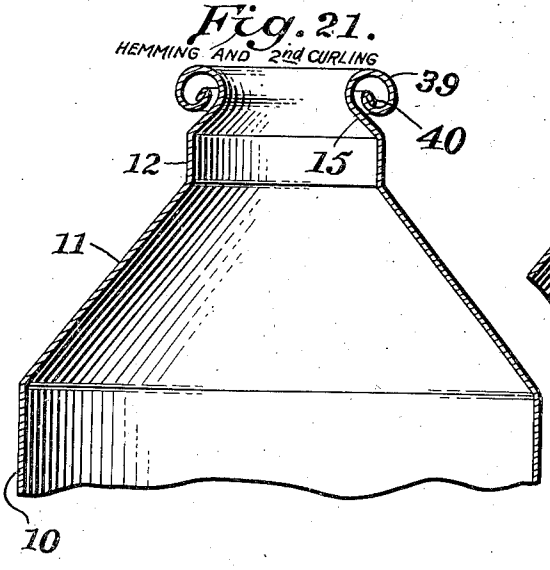

Fig. 22.

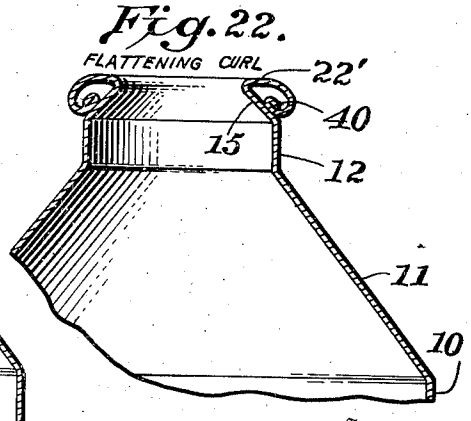

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Fig.9.

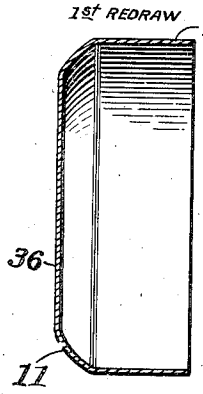

Fig.10.

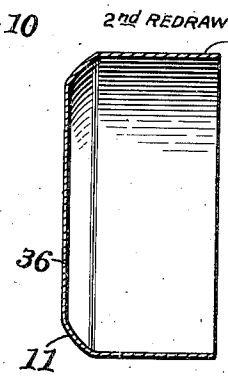

Fig.11.

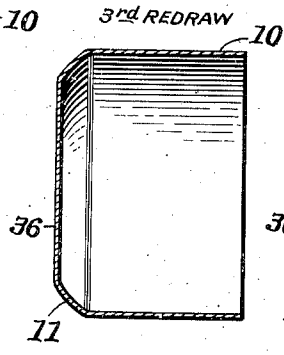

Fig.12.

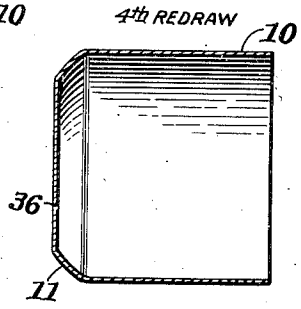

Fig.13.

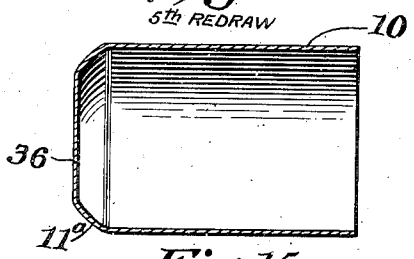

Fig.14.

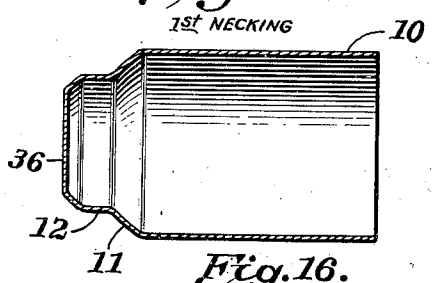

Fig.15.

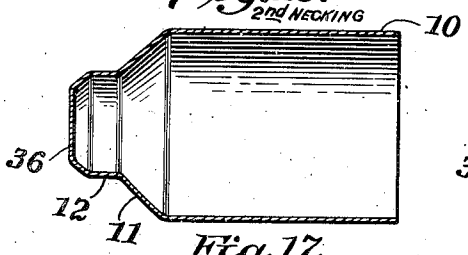

Fig.16.

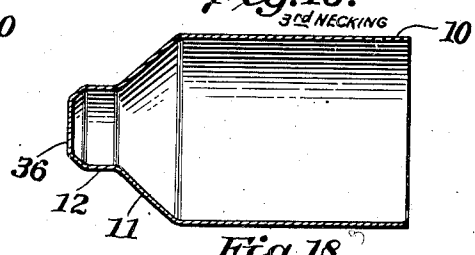

Fig.17.

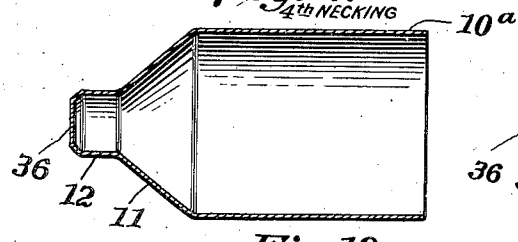

Fig.18.

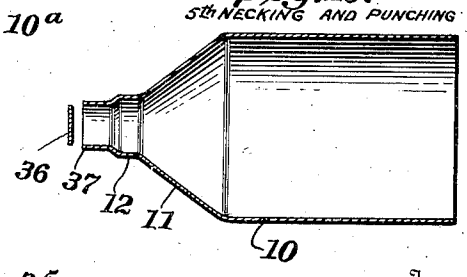

Fig.19.

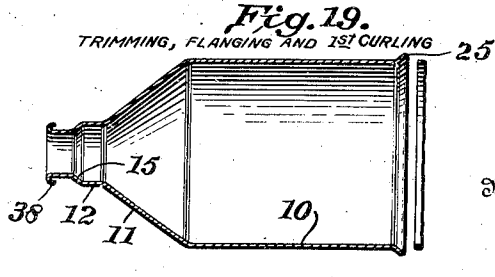

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Fig. 23.

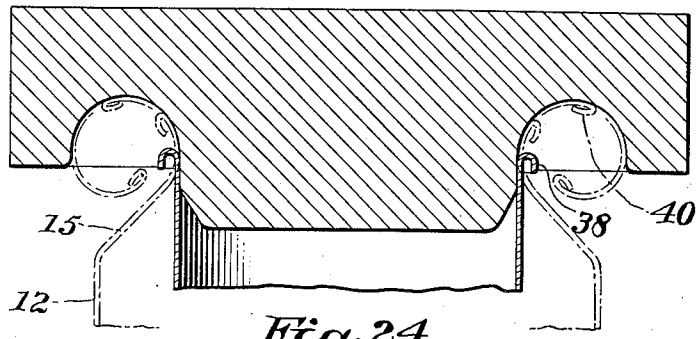


Fig. 24.

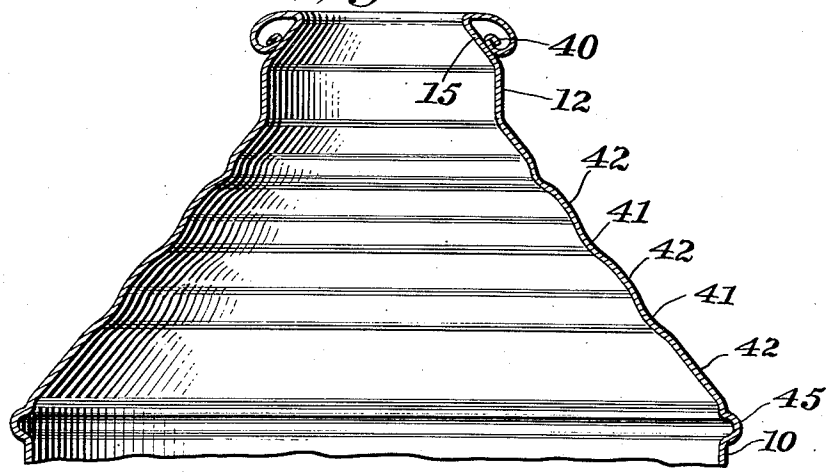
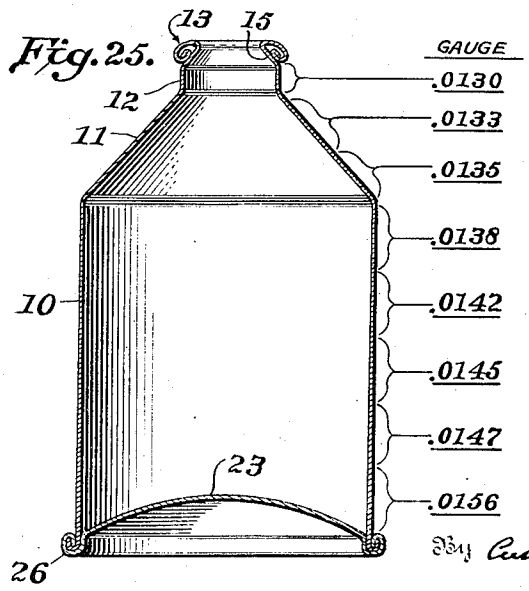


Fig. 25.



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Patented Sept. 18, 1945 2,384,810

UNITED STATES PATENT OFFICE

2,384,810

CONTAINER

Amos Calleson and Edgar A. Calleson, Merrick, N. Y., assignors to Crown Cork & Seal Company, Inc., Baltimore, Md., a corporation of New York

Application May 13, 1940, Serial No. 334,876

35 Claims. (Cl. 220—1)

This invention relates to containers and is particularly directed to improvements in metal receptacles of the can type.

It is an important object of the invention to provide a metal container which is devoid of the usual conventional side and top seams generally associated with metal cans, whereby the container is strong, presents a nice appearance, and is capable of simple and cheap production.

Another object of the invention is to provide a container having but two parts. In the case of the preferred construction the can includes (1) a body portion having an integral top in which is located an integral filling and pouring mouth and closure receiving means, the entire axial and circumferential dimensions being drawn from a single cup-shaped blank, and (2) a bottom which may be suitably secured to the body as by welding or seaming. In a modified form of the invention, the container has (1) an integral bottom and body likewise drawn from a single cup-shaped blank and (2) a top similarly drawn from a cup-shaped blank and united as by welding or soldering to the body to form a substantially integral structure, the top also having an integral pouring mouth or spout and closure receiving finish.

A further object of the invention is to provide a drawn container having a cap-receiving finish which permits the container to be sealed by means of a "crown" or crimped cap, and characterized by a relatively flat sealing surface extended outwardly to form an overhanging shoulder of greater diameter than the portion of the container immediately therebeneath, whereby the cap may be tightly locked thereon, the locking shoulder being preferably in the form of a curled bead rigidly supported by the container wall.

Also, it is an object of the invention to provide a metal container of this character drawn in such a manner that the end used to form the cap-receiving finish is the least-drawn and most ductile end, and, therefore, the more suitable end for that metal working operation, because it has characteristics such as gauge, hardness and ductility more nearly approaching those of the metal in the original sheet from which it is drawn than the metal at the other end of the container.

Another object is to provide such a container in which the side wall, top and cap-receiving finish are drawn from a single blank, and in which the metal at the mouth and cap-receiving finish are relatively undrawn or worked as compared to the metal at the other end of the container, thus providing metal for forming the lip-finish and in the finished lip which is more ductile and more readily workable than the metal at the other end of the container.

It is also an object of the invention to provide a container of this type in which the metal of the container wall increases in gauge from the mouth to the bottom of the container, the metal at the mouth being unincreased in gauge as compared to the metal of the original stock, whereas the metal of the wall from the top to the bottom of the container is substantially increased in gauge from that of the original stock.

An additional object of the invention is to provide a container drawn from a single cup-shaped blank having a cylindrical body terminating in an integral frustro-conical top provided at its apex with an integral cap receiving finish in the form of an external bead of larger diameter than the portion of the container wall immediately therebelow, whereby to provide a locking shoulder, and preferably overlying and supported upon an inwardly and upwardly inclined wall which forms the container mouth and closes the bead.

An additional object of the invention is to provide a pouring opening or mouth for the container which is defined by an inwardly and upwardly inclined wall merging into the body portion without interruption whereby the contents may readily flow without danger of collecting or foaming in the container or around the mouth thereof, the wall being extended to form an overlying closed bead by which it is substantially concealed.

It is another object of the invention to provide a container in which the entire interior wall is smooth and unobstructed. Hence, the bottle may be provided with a continuous protective lining and may also be thoroughly washed and drained without permitting collection of the washing fluid within the container or about the pouring opening thereof. In like manner, the exterior of the container is smooth and easy to maintain clean. This is important, in that where the containers are placed directly upon ice or set upon a shelf, the container may be readily wiped with a cloth to remove dust and/or moisture and produce a nice appearing package.

A further object of the invention is to provide a container which may be better decorated than the usual "tin cans." That is to say, with the present container, the decorating may be accomplished after the body is formed, and the decoration may cover the entire body and top portion of the container. This is a decided improvement, in that in the decoration of conventional metal cans it is necessary to apply the decoration to

the metal before it is formed to shape and in such seamed containers, it is required that areas adjacent the seams be left vacant because the soldering heat injures any decorative coating along the seam lines.

The container is useful for dry, liquid or plastic contents, such as foods, medicines, oils, etc., and finds particular utility in the case of pressure or carbonated beverages, e. g., beer. Because of the strength of the container, the contents may be heated therein, for example at sterilizing or pasteurizing temperatures without danger of causing leakage or distorting the shape of the container.

Before explaining in detail the present invention, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings:

Figure 1 is a sectional view of a preferred form of metal container.

Figure 2 is a similar view of a modified form of container.

Figure 3 is a detail sectional view of the top and a preferred form of cap receiving portion of the container of Figures 1 and 2.

Figure 4 is a detail view of a modified construction associated with the container of Figure 2.

Figure 5 is an enlarged detail view of the top and cap receiving portion having a crown cap applied thereto, for the containers shown in Figures 1 and 2.

Figure 6 is a sectional view partly broken away showing one form of seam construction for securing the bottom of the container shown in Figure 1 to the body.

Figure 7 is a sectional view of the top partly broken away and showing a modified form of mouth and closure receiving finish.

Figure 8 is a sectional view of the body partly broken away and particularly showing a preferred form of the bottom and the manner in which the same is secured to the body.

Figures 9 to 22 illustrate the manner in which the container is formed from a blank of metal, Figures 20, 21 and 22 showing in detail the formation of the mouth and crown receiving bead shown in connection with Figures 1 to 5.

Figure 23 is a view illustrating the formation of the hemmed edge of the cap receiving bead during the curling of the bead.

Figure 24 is a fragmentary vertical sectional view showing a modified form of top, or top portion, and

Figure 25 is a view diagrammatically showing the varying gauge or thickness of the metal forming the container wall, as hereinafter described.

Referring to Figure 1, the preferred form of the container of the present invention has a body 10 which is devoid of seams and is preferably cylindrical or of uniform diameter, but may be of any desired cross-sectional shape such as square, oval, etc., and has an integral frustro-conical top 11. The top has an upper portion forming a vertically extending cylindrical neck 12 integral with the conical top 11 and terminating in an integral cap receiving portion or finish denoted as a whole at 13. The body, top, neck and cap-receiving portions are drawn from a single blank of metal as shown in Figures 9 to 22 so that this part of the container is completely devoid of seams.

Referring to Figures 3, 5 and 20 to 22, the cap-receiving portion is in the form of a hollow sealing bead 14 which is circumferentially seamless or devoid of joints or seams of any character. The interior wall 15 of the bead is inclined inwardly and upwardly from the neck 12 forming a smooth, continuous, conical inwardly tapering pouring opening or mouth for the contents. This bead is formed as shown in Figures 20 to 23 by curling the free edge 16 of the metal beyond the end of the inclined wall 15 outwardly, downwardly, upwardly and inwardly about the neck into a circumferentially continuous and circular hollow sealing lip or bead disposed adjacent to and overlying the entire surface of the inclined wall 15, as shown.

The sealing bead, as shown most clearly in Figures 3 and 5, preferably overlies so as to conceal substantially completely, the inwardly and upwardly inclined wall 15 with the outer surface of which it is preferably substantially in contact so as to be supported when under pressure. In other words, the inner edge portion 16 of the bead overlies substantially in contact the lower portion of the inclined wall 15 approximately where it joins the straight wall of the neck 12. In this manner, there is provided a support for the bead to resist crowning pressures at the under-wall portion nearest the greatest diameter of the bead and substantially directly from the straight wall 12 of the neck. Thus, there is a minimum amount of radially projecting unsupported portion of the bead. Not only is the appearance of the container improved by the concealment of the inclined wall 15, but the bead is rigidified and the contact of its inner edge portion with the wall 15 closes the bead and prevents ingress of foreign matter which would otherwise tend to collect within the bead. Since the bead is of larger diameter than the portion of the container, i. e., the neck, immediately therebelow, it provides a freely engageable locking shoulder for a crown cap having the desired maximum rigidity, because of the formation above described.

The free edge 16 of the sealing bead may be plain, as shown in Figures 3 and 4, but it is preferably folded or hemmed as shown at 17 in Figures 1 and 5. This free or folded edge preferably is substantially in contact with, so that in use it may rest upon and be supported by, the outer surface of the inclined wall 15 adjacent its juncture with the neck 12. This support is obtained by turning the inner edge portion of the bead, so that, as shown in Figures 3 and 5, one bead surface near the inner bead edge substantially parallels and overlies the inclined wall 15 in contact, or substantially so, therewith. The hemmed edge of Figure 5 not only avoids splitting of the metal during forming of the bead, but also aids in preventing distortion when a crown cap is applied or pried off of the bead, since the reinforce of the hem resists distortion of the bead under pressure and also assists in the formation of a bead of the desired contour.

The hemmed edge precludes the formation of cracks or splits in the edge during formation of the bead or during use of the container. If, incident to this forming operation, there takes place slight or incipient cracking of the free edge of the bead which is not readily observable, because

the free edge is turned under, the hemmed or folded formation prevents such splits from enlarging and breaking the body of the bead, as when the bead is strained during application of a crown cap. Moreover, the hemmed edge maintains the shape of the bead under the high crowning pressures, and thus insures that at all times an effective seal will be provided, since it affords a stronger lip which will have and retain the desired contour while the container is in use.

The bead 14 is of sufficient area or diametrical cross-section to extend beyond the wall of the neck, and, as shown, forms a cap-receiving finish including a continuous, circular crown-locking shoulder 18. Since the bead is of greater overall diameter and circumference than the portion of the neck immediately therebelow, the inwardly bent locking shoulders 19 of the crown cap 20, as shown in Figure 5, may be firmly locked or crimped beneath the continuous shoulder 18 to form a highly satisfactory seal. The crown cap 20 has a cushion liner 21 engaging the top 22 of the bead 14 and flowing downwardly therefrom about the bead. In some cases, a center spot is affixed to the cushion liner 21, as well known.

It is to be noted that the bead is firmly supported on the top of the container by having its free or hemmed edge overlying or resting upon the lower end of the inclined wall 15 and that capping strains are transferred directly from the bead to the neck 12 and thence to the container body.

The bead 14 is not uniformly curved, as will be noted, but it extends outwardly from the mouth with a relatively flat top surface indicated at 22 in Figure 3 and at 22' in Figures 5 and 22, and then curves continuously downwardly, inwardly and upwardly, so that its inner edge portion rests upon the outer surface of the inclined wall 15 approximately at its lower edge where it joins the neck 12. The inclined wall 15 and the top surface of the bead thus form a bead of such cross-section that its area increases in dimension along axial lines of the container outwardly from the mouth and the upper and inner portion of the bead at the mouth is substantially V-shaped in cross-section. Such a formation affords a bead which is very rigid to resist deformation in use and particularly under crowning pressure. Moreover, this formation provides a relatively wide substantially flat top-sealing surface, indicated at 22' in Figures 5 and 22. This flat surface assists in obtaining a suitable seal, particularly with closures of the center spot type in which the sealing surface must be engaged entirely around the mouth, partly by the center spot and partly by the cushion liner of the cap.

In drawing the container to its final body diameter and length (Figure 17) where it is ready for the neck and cap-finish formation, we maintain the metal of the neck 12 and top 36 substantially unworked and undrawn, as compared to the metal at the other end, and, therefore, suitable for the severe lip-forming operation. It is also non-increased in gauge or thickness as compared to the metal of the body at the bottom end, thus providing for the neck and cap finish formation a metal which is substantially more workable than the thickened metal at the open bottom-end of the container. This is desirable, since the final neck and lip finishing operations are relatively severe. Moreover, the metal of the entire body and top (Fig. 17) increases in gauge in the direction of the open bottom-end, thus providing a relatively strong rigid body while maintaining the metal at the neck and lip portion of the gauge more suitable for the finishing operations. The metal in the top 36 and at the upper end of the neck 12 (Fig. 17) has also the lowest Rockwell hardness of any of the metal in the container and hence, from the standpoint of ductility, it is the most suitable to withstand the working incident to the curl or bead-forming operation. Hence, it is not necessary to stop the operation in order to anneal and reduce the brittleness of the metal to be used in the cap-receiving finish which is adapted to withstand very high crowning pressures incident to the use of automatic crowning apparatus. Such apparatus may be employed without danger of distorting the sealing bead or the container to obtain a firm, tight seal between the cap and the sealing bead.

The body 10 at its lower end, as shown in Figure 1, is provided with an inwardly directed continuous projection 24' which, in one form of the invention, forms a seat against which the bottom 23 rests. The bottom is provided with a sealing flange 24 and the body is provided with a sealing flange 25, which flanges are folded together and rolled or folded inwardly as shown at 26 in such a manner that a strong joint is provided which is wholly within the vertical confines of the container. This joint, moreover, forms a support for the container when it stands in upright position. The customary sealing mediums may be used, if desired, at the seam between the bottom and body.

As will be appreciated, the container is not only useful for contents which are abnormally heavy, but will also be equally satisfactory with so-called pressure beverages, in that it will resist expansion strains without leakage or bulging or distortion of the container.

The container may be of various sizes and in one practical embodiment has an overall height of about $4^{15}/_{16}$'' to 5'' and the body diameter is about $2\frac{3}{4}$''. The distance from the bottom edge of the container to the projection 24' is about $\frac{3}{16}$'' and from the projection to the base of the conical top about $3\frac{1}{4}$'' and from the base of the top to the finish about $1\frac{1}{2}$''. The height of the cone is about $1\frac{1}{2}$'' to $1\frac{3}{8}$'' and the angularity of the apex angle is substantially 80°.

In Figure 8, there is shown a container having a bottom which is inwardly concave and united by another form of seam in which the seaming flanges are folded outwardly so that the seam extends beyond the confines of the vertical cylindrical wall of the body. With this seam, as with the seam shown in Figure 4, the usual sealing compositions may be employed if desired.

In Figure 2, the body 10' and bottom 23' are integral and formed from a single blank of metal. As shown, the bottom is pressed upwardly as shown at 27 adjacent the wall of the body and then downwardly as shown at 28, forming a very satisfactory and strong construction, and at the same time enabling the container to stand upright without difficulty.

The conical top 11' of the container shown in Figure 2 is formed as a separate part, but includes the integral neck 12' and locking lip 13', the whole being drawn from a single blank of metal. The open end of the body is provided with an integral conical rim 29 and the top and body are assembled by applying the conical top 11' over the rim 29, as shown in Figures 2 and 4 to form a frictional metal to metal contact joint along a single peripheral line which may be electrically welded or soldered to give a substantially integral structure. In some cases, the

rim 29 is provided with a hemmed portion 30 formed by hemming the free edge of the rim outwardly upon itself, and the top then has frictional contact with the rim and the overlapped hemmed area thereof.

Figure 7 shows a top which may be used instead of those shown in Figures 1 or 2. The top has an integral neck terminating in an inclined wall 15, from which the metal is turned outwardly to define a shoulder as at 31, and then inwardly as at 32 to form a hollow bead 33 or sealing lip disposed adjacent to and above the wall 15. As will be noted, the bead is of greater diameter than the wall 15 which is immediately therebelow. This bead forms a finish or cap-receiving means for a crown or crimped cap and the shoulder 31 has a curvature, as in the forms of Figures 1 and 2, adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap. The upper surface of the bead is flattened as at 34 to assure sealing engagement with the cushion liner 21 of the cap and the free edge may be turned inwardly into a hem 35 or outwardly into a similar hem.

If it is not desired to use a sealing composition in connection with the seams for securing the bottom of the container to the body, we sometimes so compress the overlapped and interfolded portions of the seaming flanges, as shown in Figures 1 and 6, as to produce in effect a compacted and densified metal joint. This joint is strong and thoroughly leakproof by reason of the densified overlapped metal layers and does not require the use of plastic sealing means.

It is to be understood that the container body and top shown in Figures 1 and 7 or the container body and bottom, and top shown in Figure 2, are each drawn from a suitable metal blank whereby the structure is not only free of seams, but has the required strength.

The container is formed of cold-rolled steel although hot-rolled steel may be employed. The gauge of the metal may vary, but it is quite thin and susceptible of the deep drawing operations employed for manufacturing the various forms of the invention.

Referring to Figures 9 to 22, the body 10, top 11 and neck 12 are drawn from a cup-shaped blank. That is to say, the entire axial and circumferential dimensions are drawn from a single blank. The drawing is continuous in immediately succeeding steps to increase the depth and decrease the diameter of the blank, as shown in Figures 9 to 13, inclusive, to provide a relatively deep cup (Figure 13), the body of which is cylindrical and curves at 11 into a closed end 36. This body is characterized by a gauge which increases from the curved portion 11*a* continuously to the open-end from a point just below the curved portion 11, the gauge increases from that of the initial metal of the cup-shaped blank of Figure 9 to the open end. This increase in gauge is due to the fact that as the cup is decreased in diameter, the excess metal is not all used to increase the length, but some is worked so as to increase the thickness of the wall progressively from near the top to the open end, thus providing a container body side wall which progressively increases in thickness. This not only facilitates manufacture, as hereinafter described, but also provides a container body of increased strength and rigidity. As shown in Figure 13, the body portion has been finally formed and subsequent operations (Figures 14 to 22) form the top, neck and lip. In forming the top and in partially forming the neck (Figures 14 to 17), the metal of the neck is not appreciably drawn as compared to the metal of the other end. Moreover, it is not appreciably increased in gauge as compared to the original stock. Hence, this metal at the mouth end which is to be severely worked in forming the lip is maintained relatively undrawn and close to the initial gauge which may be selected as the most suitable for forming the container. The metal which has been least increased in gauge and least reduced in ductility (Fig. 17) is used to form the cap-locking bead. It is, therefore, possible to proceed with the formation of that bead without discontinuing the operations to anneal the metal to be included in the bead before forming the bead. The metal adjacent the open end of the container (Fig. 17) is more brittle and heavier in gauge than the original sheet from which the body is drawn and than the less worked metal in the neck portion 12 and top 11. While the heavier metal of the body, because of its relative lack of ductility and brittleness would be comparatively unsuitable to receive a cap finish, particularly at the lower open end, nevertheless it has the strength to provide the required body-rigidity. While the metal at the wider open end indicated at 10*a* in Fig. 17 is the most increased in gauge and least ductile, it has sufficient ductility to permit, without previous annealing, formation of the bottom flange (Fig. 19) and of end seams (Figs. 1, 6 and 8).

This increasing of the gauge of the metal, which is accomplished during the drawing operation, has the further advantage of permitting the use of initial sheet stock of thinner gauge than would otherwise be suitable, at least for the body. In other words, while the initial stock may be of sufficient thickness for the lip, top and neck formation, but not of sufficient rigidity for the body, the latter may be given during the drawing operation, by increasing the metal gauge, the desired rigidity and strength suitable not only to prevent bending of the body, but also for receiving the seamed bottom. Moreover, a structure in which the gauge of the metal progressively increases from the lip to the bottom may be made more economically and at higher speed and more uniformly than drawn structures in which the gauge is uniform, or substantially so, throughout the height of the container.

The neck is drawn to final form and the closed end 36 is severed as shown in Figure 18. Referring to Figures 18 and 19, the metal at the marginal edge 37 of the neck is now given a slight or portion outward curl, as shown at 38 in Figures 19 and 20. As shown in these figures, this curl is carried sufficiently to cause the edge to hem in a subsequent operation. We prefer that in this partial curl, the free edge of the metal be carried outwardly and downwardly to insure a proper folding and hemming thereof during the second or final curl.

The foregoing drawing operations illustrated in Figures 9 to 19, inclusive, may be performed following the method and by means of apparatus of the character disclosed in our Patent No. 2,337,182, dated December 21, 1943. In such apparatus, the dies are formed so as to permit and cause the metal to flow during the drawing operation to progressively increase the gauge from the top and lip portion to the bottom of the container during the drawing operation. Although the gauge of the metal increases from the top to the bottom of the container, there is no decrease in the internal diameter as shown by the draw-

ings, this being due to the fact that the dies are of uniform diameter, as shown in the patent above mentioned. In other words, the variation in diameter corresponding to the gauge variation is entirely external. As described in said patent, the operations are immediately successive and uninterrupted, except for the time required to transfer the blanks from one operation to another, and the cup is progressively reduced in diameter and increased in length substantially evenly and uniformly around its circumference so that relatively little trimming of the edge is necessary after the drawing has been completed.

Thereafter, as a continuous operation, the metal above the inclined wall 15 is curled outwardly and inwardly to a partially curled bead, as shown at 39 in Figure 21. In this operation, the pre-curl 38 is formed into a hem 40 and aids in preventing splitting or cracking during the curling. The operation of forming the pre-curl 38 in the hem 40 is illustrated in Figure 23, wherein a curling die is diagrammatically illustrated. Figure 23 shows the successive steps in the hemmed-edge formation as the curling die bends the pre-curled edge outwardly in progressing toward the hem and second curl shown in Figure 21. Figure 23 illustrates the intermediate stages in the formation of the curl shown in Figure 21, and, as will be observed, the edge is completely hemmed before the second curl, illustrated in Figure 21, is well under way. This formation of the hem substantially before the completion of the curling, as shown in Figure 23, serves to prevent splitting of the edge during the severe working of the metal which occurs during the latter stages of the formation of the second curl illustrated in Figure 21. As explained above, the curling operation of Figure 23 continues until the edge is completely curled, the dotted lines (Figure 23) showing the progress of the hem and bead formation. It is not necessary, of course, to form the hem in the curling operation; that is the hem might be formed as an independent step prior to the curling.

Thereafter, the curl 39 is closed by axially pressing the same toward the inclined wall 15 and a hollow bead having a flat sealing surface 22' is formed as above described.

As will be observed, the sealing bead is curved to provide not only a sealing surface, but a locking shoulder as illustrated in Figures 1 to 5, inclusive. The curvature of this bead is of the character adapted to provide sufficient rigidity to resist the thrust applied during the application of a crown cap. This is likewise true of the curvature embodied in the form illustrated in Figure 7.

There is thus provided a container, the entire body, top and cap-receiving finish of which are drawn from a single blank in immediately succeeding drawing operations without the necessity for annealing any portions of the blank between these operations, or thereafter. The container is characterized by a wall structure in which the gauge of the wall metal increases from the top or cap-receiving lip to the bottom of the container at or adjacent which it has the maximum gauge. This increasing gauge provides a strong wall structure resistant to bending or denting and one adapted to receive a seamed bottom in a flanging or bending operation. The wall structure is further characterized by a substantially increased Rockwell hardness near the bottom as compared to the top of the container which receives the capping force. In the neck of the top, the hardness does not exceed the hardness of the metal in the wall near the bottom of the container, notwithstanding the working involved in forming the neck. This reducing hardness of the wall from the bottom toward the top is due to the use of the least increased in gauge metal to serve for the top and lip of the container, and thus affords for the severe working involved in forming the lip, metal which is more suitable in characteristics hereinbefore described, to withstand this working than the metal at the other end. The variation in gauge is illustrated, for example, in Figure 25, wherein the metal originally used was substantially .0132 and was deoxidized cold rolled black plate. While this particular metal was initially .0132, we have used successfully metal of a gauge of .0125.

While we have described the container as having a cap-receiving portion, particularly adapted to receive a crown type of cap, this may be varied to receive any of the usual commercially available closures.

In Figure 24 we have shown a modified form of top portion which may be utilized in any of the containers previously described. The novel distinguishing characteristics of the top shown in Fig. 24 include a series of grooves 41 spaced vertically along the conical top portion by intervening flat portions 42. It will be noted that these flat portions are all in the same conical surface or inclined plane, as viewed in cross-section (Fig. 24). By having intervening grooves, as distinguished from projections, a surface which is less likely to be marred in handling is provided, and the positioning of the flat surfaces constituting a major portion of the conical top in the same inclined plane, as distinguished from stepping these surfaces or arranging them in different planes, permits a construction requiring less drawing of the initial shell shown in Fig. 9 than would be required if stepped flat surfaces arranged in different planes are employed. In some instances, a grooved or irregular top, as distinguished from a flat-surfaced top, such as shown in Figs. 1 and 2, is found preferable. In this figure, we have shown an externally embossed ring or bead 45, which together with the projection formed by the bottom seam (Figs. 6 and 25) will serve to protect the decoration on the body of the container and also will strengthen the container at or adjacent the shoulder where the body merges into the top. This bead may be formed in any suitable manner, either during the drawing operation or subsequently. If desired, a similar bead adjacent the bottom may be used to advantage in the form shown in Figs. 1 and 2 where there is no external projecting bottom seam.

This application is a continuation-in-part of our applications Serial No. 58,746, filed January 11, 1936 for "Metal package and method of making same," and Serial No. 129,068, filed March 4, 1937, for "Container and method of making same."

We claim:

1. A metallic container for beer and similar beverages having a drawn body of substantially uniform diameter, a conical top integral with the body and smoothly joining the same, an upstanding neck of reduced diameter integral with the apex portion of said top whereby the body, top and neck are free of side and top seams, the body having a separate bottom secured thereto, the neck having its mouth portion projected

inwardly to provide a pouring lip and having an externally projecting shoulder of greater diameter than the immediately adjacent lower portion of the neck whereby to be adapted to lock thereon a crown cap, the shoulder having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap, the gauge of the metal of said container when drawn increasing in thickness substantially progressively from the neck to the bottom and the metal in the pouring lip being nearest the original thickness of the metal from which the container is drawn and being less drawn than the metal of the body of the container.

2. A metallic container for beer and similar beverages having a drawn body of substantially uniform diameter, a conical top integral with the body and smoothly joining the same, an upstanding neck of reduced diameter integral with the apex portion of said top whereby the body, top and neck are free of side and top seams, the wall of the container increasing in thickness substantially progressively from the neck to the bottom when drawn, the body having a separate bottom secured thereto, the neck having its mouth portion projected inwardly to provide a pouring lip and having an externally projecting shoulder formed by a substantially closed bead extending beyond the wall of the portion of the neck immediately therebelow and substantially contacting said wall whereby to be adapted to lock thereon a crown cap, said bead having its inner edge hemmed, the shoulder having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap.

3. A metallic container for beer and similar beverages having an integral body, conical top and neck of reduced diameter terminating in a finish adapted to receive a crown cap, the body, top and neck having their entire axial and circumferential dimensions drawn from a single cup-shaped blank, the bottom portion of which forms the top and neck, the wall of the container increasing in thickness substantially progressively from the neck to the bottom, the body being of substantially uniform diameter, the top being conical and smoothly joining the body, said neck being integral with and joining the apex portion of the top and upstanding therefrom, whereby the body, top and neck are free of side and top seams, the body having a separate bottom secured thereto, the neck having its mouth portion projected inwardly to provide a sealing lip and having an externally projecting shoulder of greater diameter than the immediately adjacent lower portion of the neck whereby to be adapted to lock thereon a crown cap, the shoulder having a curvature adapted to provide sufficient rigidity to resist thrust thereon during application of a crown cap.

4. A metal container for beer and other beverages having a cylindrical body and an integral frustro-conical top, said body and top being drawn from a single blank whereby the container body and top are devoid of side and top seams, the top having an upper portion above the cone thereof which has been least subjected to the drawing action and is of thinner gauge, lower "Rockwell" hardness and more ductile than the other metal of the container, and a cap receiving finish formed from said upper portion.

5. A metallic container having a drawn body of substantially uniform cross-section, a conical top integral therewith and a cylindrical neck of reduced diameter integral with the apex portion of said top and upstanding therefrom whereby the body, top and neck are free of side and top seams, the neck having an inwardly bent wall portion defining a mouth and the metal extending from the mouth being turned outwardly into a bead projecting over said inwardly bent wall portion and beyond the wall of the neck portion immediately therebelow whereby to be adapted to form a locking shoulder for the skirt of a crown cap, said bead having its wall overlying the outside surface of said inwardly bent wall portion substantially in contact with said portion and forming a substantially closed head, whereby the bead is supported to receive a crown cap.

6. A container having a drawn body, and a top and a neck integral therewith, the neck having a wall portion defining a mouth, and the metal extending from the mouth being turned outwardly into a bead projecting beyond the wall of the portion of the neck immediately therebelow whereby to be adapted to form a locking shoulder for the skirt of a crown cap, said bead having its wall disposed adjacent to and completely overlying and concealing the outside surface of said wall portion, whereby the bead is supported to receive a crown cap, and a crown cap crimped over said bead.

7. A container having a drawn integral body and conical top, the top having a mouth portion formed by a wall projected inwardly and upwardly and terminating in an externally projecting outwardly curved portion forming a substantially closed bead providing a shoulder of greater diameter than the top portion immediately therebelow whereby to be adapted to lock thereon a crown cap, the lower portion of the bead substantially resting upon the inwardly projecting wall and having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap.

8. A container having a drawn integral body and top, the top having a mouth portion formed by a wall projected inwardly and upwardly and terminating in an externally projecting outwardly curved portion forming a substantially closed bead having a hemmed inner edge and providing a shoulder of greater diameter than the top portion immediately therebelow whereby to be adapted to lock thereon a crown cap, the bead substantially resting upon the inwardly projecting wall and having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap.

9. A drawn metal top for containers having an inwardly and upwardly inclined wall portion defining a mouth, and the metal extending from the mouth being turned outwardly into a circumferentially seamless bead having a locking shoulder for the skirt of a crown cap, and having a portion of its wall adjacent to and overlying the outside surface of said inclined wall portion substantially parallel and in contact with the inclined wall, whereby the bead is supported to receive a crown cap, said bead having its outer wall of arcuate curvature to provide a bead the cross-sectional dimensions of which along lines axial to the container increase in a direction radially outward of the container whereby to provide a relatively flat top portion affording a substantial area of contact with the cushion liner of a cap.

10. A metal top for containers having a frustro-conical body portion terminating in an upstanding neck of reduced diameter extended to

have a wall portion defining a mouth, and the metal extending from the mouth being turned outwardly into a circumferentially seamless substantially closed bead of greater diameter than the neck portion immediately therebelow whereby to form a locking shoulder for the skirt of a crown cap, said bead having a portion of its wall disposed substantially in contact with and in position to be supported by the outside surface of said wall portion, whereby the bead is supported to receive a crown cap.

11. A drawn metal top for containers having an inwardly and upwardly inclined wall portion defining a mouth and the metal extending from the mouth being turned outwardly into a closed circumferentially seamless bead having its inner edge parallel with and overlying the outside surface of the inclined wall portion and substantially in contact with said portion so as to be supported thereby and being of greater diameter than the portion of the top immediately therebelow whereby to form a locking shoulder for the skirt of a cap.

12. A drawn metal top for containers having an inwardly extending wall portion defining a mouth, the metal extending from the mouth being turned outwardly into a circumferentially seamless substantially closed bead of greater diameter than the wall portion immediately therebelow whereby to form a locking shoulder for the skirt of a crown cap, said bead having a hemmed edge disposed substantially in contact with and overlying the outside surface of said inwardly extending wall portion, whereby the bead is supported by the said wall portion to receive a crown cap.

13. A container having a drawn body whereby the same is devoid of side seams and an integral top, the top having an inwardly and upwardly inclined wall portion defining the container mouth and the metal extending from the mouth being turned outwardly into a closed bead having a hemmed inner edge portion overlying and completely concealing the outside surface of the inclined surface, the bead being of greater diameter than the surface of the top immediately therebelow and thereby forming a locking shoulder for the skirt of a cap, and a crown cap crimped over said bead.

14. A container having a drawn body and an integral top whereby the same is devoid of top and side seams, the top having an inwardly and upwardly inclined wall portion defining a mouth and the metal extending from the mouth being turned outwardly into a substantially closed bead having a hemmed inner edge portion disposed adjacent to and overlying and substantially contacting the outside surface of the inclined wall portion and forming a locking shoulder for a skirt of a cap extending outwardly beyond the wall of the top immediately therebelow.

15. A container having a drawn body, a conical top integral therewith and an upstanding neck of reduced diameter integral with the apex of said top whereby the body, top and neck are free of side and top seams, the neck having an inwardly and upwardly inclined wall portion defining the mouth of the container and the metal extending from the mouth being turned outwardly into a closed bead having a hemmed inner edge, the wall of the bead contacting surface to surface the outside surface of the mouth and forming a locking shoulder for a skirt of a cap extending outwardly beyond the wall of the neck immediately therebelow.

16. A container having a body and a top, the top having an inwardly and upwardly inclined wall portion defining the container mouth and the metal extending from the wall portion being turned outwardly into a closed circumferentially seamless bead overlying the inclined wall portion in position to be supported thereby and having a hemmed inner edge adjacent said wall portion, said bead extending outwardly beyond the top immediately therebelow.

17. A container having a body and a top, the top having an inwardly and upwardly inclined wall defining the container mouth and the metal extending from the mouth being turned outwardly into a closed circumferentially seamless bead having a hemmed inner edge resting on the outside surface of said wall and forming a locking shoulder for the skirt of a cap extending outwardly beyond the wall of the top immediately therebelow.

18. A container having a body, a top and a neck projecting upwardly from the top, the neck at its upper end having an inwardly and upwardly inclined wall portion defining the container mouth and the metal extending from the mouth being turned outwardly into a closed circumferentially seamless bead resting upon the outside surface of the inclined wall portion of the neck and projecting radially beyond the wall of the neck below the inclined wall portion to form a locking shoulder for the skirt of a cap.

19. A container having a body and a top provided with a pouring mouth, said mouth being formed from the metal of the top by a wall extending from the top at an inward and upward inclination, the metal at the upper end of the inclined wall being turned outwardly into a closed circumferentially seamless bead overlying and substantially in engagement with the outside surface of said inclined wall, the bead being of greater diameter than the portion of the top immediately therebelow whereby to form a locking shoulder for the skirt of a crown cap, the inner edge of said bead being folded inwardly upon itself to provide a substantially hemmed edge portion.

20. A container having a drawn body providing side walls devoid of seams and a top provided with a pouring mouth, said mouth being formed from the metal of the top by a wall extending from the top at an inward and upward inclination, the metal at the upper end of the inclined wall being turned outwardly into a substantially closed circumferentially seamless bead overlying and substantially concealing the outside surface of said inclined wall and substantially resting upon said wall, the bead being of greater diameter than the portion of the top immediately therebelow whereby to form a locking shoulder for the skirt of a crown cap and a crown cap crimped over and interlocking with said head.

21. A container having a body of substantially cylindrical shape formed from a single piece of metal devoid of seams and a top having its body portion of substantially conical shape and formed from a single piece of metal devoid of seams, said top including a neck of reduced diameter integral at one end with the apex of said conical body portion and terminating at its other end in an inwardly and upwardly inclined wall from which the metal is curled outwardly into a hollow bead forming a sealing lip and a locking shoulder for a crown cap, said bead having its inner edge hemmed and overlying said inclined wall to be supported thereby and the bead extending outwardly beyond the wall of the neck immediately therebelow.

22. A metallic container drawn from a single sheet of metal to form a body side wall, top and cap-receiving finish on the top having an external locking shoulder for a cap of the "crown" or crimped type, the metal of the wall progressively increasing in gauge from the cap receiving finish substantially to the bottom of the side wall, and the metal of the top being in gauge nearest that of the original sheet from which the container is drawn while the metal of the body is of a gauge in excess of that of the original sheet and progressively increases in the direction of the bottom.

23. As an intermediate product in the formation of a container, a blank having a cylindrical body and a conical top formed with a neck, said blank having its neck substantially less worked and drawn than the other end of the blank and the wall of the blank increasing in gauge from the neck to the other end of the blank, the neck having its mouth portion projected inwardly to provide a sealing lip and having an externally projecting shoulder of greater diameter than the immediately adjacent lower portion of the neck.

24. A method of forming a metallic container which consists in drawing a cup-shaped blank to form a cylindrical body, a conical top and a neck at the closed end of the cup adapted to be formed into a sealing lip when the closed end of the neck is removed, and controlling the flow of the metal in the drawing operation to cause the gauge of the metal to progressively increase from substantially the neck to the other open end of the cup and forming the end of the neck having the thinnest gauge and least worked metal and having a gauge nearest the gauge of the sheet from which the container is formed, with a mouth portion having a cap receiving sealing lip projecting inwardly and having projecting outwardly a shoulder of greater diameter than the immediately adjacent lower portion of the neck.

25. A metallic container for beer and similar beverages having a drawn body of substantially uniform diameter, a conical top integral with the body and smoothly joining the same, a neck integral with the apex portion of said top whereby the body, top and neck are free of side and top seams, the body having a separate bottom secured thereto, the neck having its mouth portion projected inwardly to provide a pouring lip and curled outwardly into a substantially closed bead having a hemmed inner edge, said bead forming an externally projecting shoulder of greater diameter than the immediately adjacent lower portion of the neck whereby to be adapted to lock thereon a crown cap, the mouth portion and pouring lip including the externally projecting shoulder when drawn being formed of metal which is more ductile, and has a lower Rockwell hardness and thinner gauge than other metal of the wall of the container, the shoulder having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap.

26. A metallic container for beer and similar beverages having a drawn body of substantially uniform diameter, a conical top integral with the body and smoothly joining the same, a neck integral with the apex portion of said top whereby the body, top and neck are free of side and top seams, the wall of the container increasing in thickness substantially progressively from the neck to the bottom when drawn, the body having a separate bottom secured thereto, the neck having its mouth portion projected inwardly to provide a pouring lip and projected outwardly to provide an externally projecting shoulder extending beyond the wall of the portion of the neck immediately therebelow whereby to be adapted to lock thereon a crown cap, the mouth portion and pouring lip including the externally projecting shoulder being formed of metal of thinner gauge and nearest that of the original sheet from which the container is drawn, said lip portion being of lower Rockwell hardness, and more ductility than other metal of the wall of the container, the shoulder having a curvature adapted to provide sufficient rigidity to resist the thrust applied during application of a crown cap.

27. A drawn metal top for containers having an inwardly and upwardly inclined wall portion defining a mouth, and the metal extending from the mouth being turned outwardly into a circumferentially seamless bead having a hemmed inner edge and having a locking shoulder for the skirt of a crown cap, said bead having a portion of its wall including the hemmed edge adjacent to and overlying the outside surface of said inclined wall portion substantially parallel and in contact with the inclined wall, whereby the bead is supported to receive a crown cap, said bead having its outer wall of arcuate curvature to provide a bead the cross-sectional dimensions of which along lines axial to the container increase in a direction radially outward of the container whereby to provide a relatively flat top portion affording a substantial area of contact with the cushion liner of a cap.

28. A metallic container for beer and similar beverages having a drawn body of substantially uniform diameter, a conical top integral with the body and smoothly joining the same, a neck integral with the apex portion of said top whereby the body, top and neck are free of side and top seams, the body having a separate bottom secured thereto, the neck having an inwardly and upwardly inclined wall portion defining a mouth, and the metal extending from the mouth being turned outwardly into a circumferentially seamless bead having a locking shoulder for the skirt of a crown cap, and having a portion of its wall adjacent to and overlying the outside surface of said inclined wall portion substantially parallel and in contact with the inclined wall, whereby the bead is supported to receive a crown cap, said bead having its outer wall of arcuate curvature to provide a bead the cross-sectional dimensions of which along lines axial to the container increase in a direction radially outward of the container whereby to provide a relatively flat top portion affording a substantial area of contact with the cushion liner of a cap.

29. The method of making a crown finish on the end portion of a sheet metal reecptacle which comprises providing a blank having a neck terminating at its upper end in an inwardly tapering frusto-conical portion and an upwardly projecting cylindrical portion of reduced diameter, curling the cylindrical portion outwardly and downwardly along a toroidal path to provide an outwardly curled bead of greater diameter than the base of said frusto-conical portion, and then axially pressing said bead to partially flatten the bead and to cause the lower curled end thereof to contact the outer surface of said frusto-conical portion along a line adjacent the base thereof.

30. The method of forming a top portion for a metal container having an integral neck and cap receiving portion which comprises drawing from a metal blank a seamless substantially uni-

formly circular neck having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion outwardly into an initial open curl, curling the neck portion including said initial curl outwardly into a hollow bead of sufficiently larger diameter than the neck opening and the initial curl so that during the curling said initial curl is flattened to form a hemmed edge in the formation of the hollow bead and pressing said bead upon the outer surface of said shoulder with the bead substantially resting thereon.

31. The method of forming a top portion for a metal container having an integral neck and cap receiving portion which comprises drawing from a metal blank a seamless substantially uniformly circular neck having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion above said shoulder outwardly and downwardly to provide a hem, curling the said neck portion including said bent edge outwardly and downwardly into a hollow bead of larger diameter than the first outward and downward bend and said neck and pressing said bead into engagement with the shoulder and positioning the bead over said shoulder with a portion of the bead projecting beyond the wall of the neck to form a cap locking shoulder and with the bead substantially resting on said neck shoulder.

32. The method of forming a top portion for a metal container having an integral neck and cap receiving portion which comprises drawing from a metal blank a seamless substantitally frustoconical top terminating at its smaller end in an upstanding seamless substantially uniformly circular neck having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion outwardly into an initial open curl, curling the neck portion including said initial curl outwardly into a hollow bead of sufficiently larger diameter than the neck opening and the initial curl so that during the curling said initial curl is flattened to form a hemmed edge in the formation of the hollow bead and pressing said bead upon the outer surface of said shoulder with the bead substantially resting thereon.

33. The method of forming a top portion for a metal container having an integral neck and cap receiving portion which comprises drawing from a metal blank a seamless substantially frustoconical top terminating at its smaller end in an upstanding seamless substantially uniformly circular neck having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion above said shoulder outwardly and downwardly to provide a hem, curling the said neck portion including said bent edge outwardly and downwardly into a hollow bead of larger diameter than the first outward and downward bend and said neck and pressing said bead into engagement with the shoulder and positioning the bead over said shoulder with a portion of the bead projecting beyond the wall of the neck to form a cap locking shoulder and with the bead substantially resting on said neck shoulder.

34. The method of making container body blanks of the can type devoid of seams and having a body, top, and cap finish comprising drawing a cup-shaped blank of sheet metal and increasing its length and decreasing its diameter so as to form a cylindrical body having a closed end, drawing said body and forming a frusto-conical top portion integral with and extending from the cylindrical body and a cylindrical neck portion at the top of the frusto-conical portion and integral therewith having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion outwardly into an initial open curl, curling the neck portion including said initial curl outwardly into a hollow bead of sufficiently larger diameter than the neck opening and the initial curl so that during the curling said initial curl is flattened to form a hemmed edge in the formation of the hollow bead and pressing said bead upon the outer surface of said shoulder with the bead substantially resting thereon.

35. The method of making container body blanks of the can type devoid of seams and having a body, top, and cap finish comprising drawing a cup-shaped blank of sheet metal and increasing its length and decreasing its diameter so as to form a cylindrical body having a closed end, drawing said body and forming a frusto-conical top portion integral with and extending from the cylindrical body and a cylindrical neck portion at the top of the frusto-conical portion and integral therewith having an inwardly and upwardly directed shoulder and a neck portion of reduced diameter above said shoulder, bending the free edge of the neck portion above said shoulder outwardly and downwardly to provide a hem, curling the said neck portion including said bent edge outwardly and downwardly into a hollow bead of larger diameter than the first outward and downward bend and said neck and pressing said bead into engagement with the shoulder and positioning the bead over said shoulder with a portion of the bead projecting beyond the wall of the neck to form a cap locking shoulder and with the bead substantially resting on said neck shoulder.

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