United States Patent [19]

Kagami

[11] **3,738,528**

[45] **June 12, 1973**

[54] **CONTAINER AND A METHOD FOR PRODUCING SAME**

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[22] Filed: **July 29, 1971**

[21] Appl. No.: **167,250**

[30] **Foreign Application Priority Data**

Apr. 3, 1971 Japan 46/20072

[52] **U.S. Cl.** ..... **220/72**, 220/DIG. 22, 113/120 H

[51] **Int. Cl.** **B65d 7/42**

[58] **Field of Search** ..... 72/347, 348, 349, 72/47; 113/120 H, 120 R; 220/DIG. 22, 72, 74, 83

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[57] **ABSTRACT**

A method for producing a tinplate cylindrical container with a bottom end having a thick walled upper portion by drawing and ironing in which the wall of the main part of the container body near the bottom end is made thick while the wall thereof near the upper portion is made thin, and in which the gradient angle or taper representing the variation of the wall thickness of the container main body part is made smaller than that of the punch core of the ironing means so as to make it possible to readily strip said container from said punch core. There is also provided a container of that kind in which the upper portion of said container is not subjected to the final ironing so that the hardness thereof is lower than that of the middle part of the body of the container to prevent the cracking of the flange which would otherwise be encountered.

1 Claim, 2 Drawing Figures

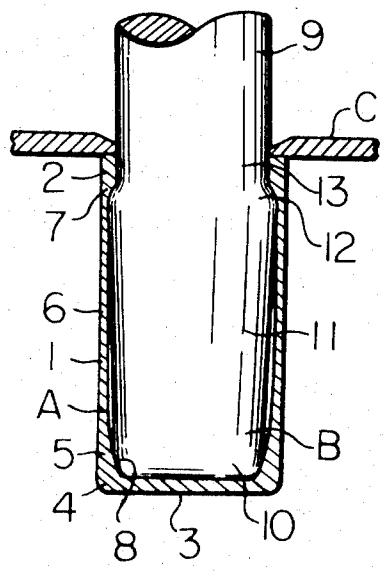


Fig. 1

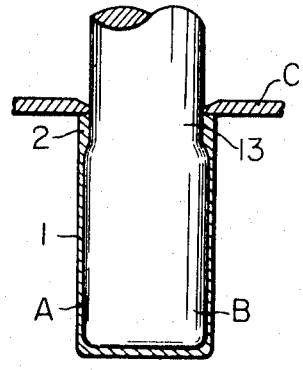
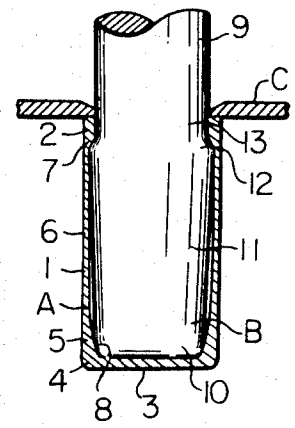


Fig. 2



CONTAINER AND A METHOD FOR PRODUCING SAME

BACKGROUND OF THE INVENTION

It is known that a metallic disc having high elongation can be drawn to form a cup, the body wall of which is then subjected to ironing to produce a tubular or cylindrical container with a bottom end. The section of the body wall thus obtained along the container axis may be classified such that:

1. the thickness of wall is progressively increased from the bottom side to the open side, being maximum at the upper portion;

2. the thickness of the wall is substantially equal over the entire body of the container; or

3. the thickness of the wall is substantially equal over the body except for the upper portion thereof, being thicker in said upper portion.

Among the above three configurations, it is the configuration shown in the item (3) which meets the requirements that the upper edge of the container will not be bent even when it is caused to butt against the stripper fingers at high speed; that the amount of material used is minimum or the cost thereof is cheapest; that when the upper edge of the body wall is subjected to flanging followed by double seaming with an upper end or cover, said edge will not be cracked; that the container can be made by mass production and is capable of competing with the other containers of this kind. If in the above three configurations (1) to (3) the upper edges have the same thickness, it is easily presumed in view of easiness of stripping the container from the punch core that when the stripper fingers are caused to butt against the upper edge the upper edge tends to be bent in the order of (1), (3) and (2). The amount of material to be used is increased in the order of (3), (1) and (2), and the probability of occurrence of cracking in flanging and double seaming is substantially identical in these configurations (1), (2) and (3). It is thus obvious that the configuration (3) is optimum so long as the container can be easily stripped from the punch core without bending the upper edge. In fact, it is possible in case of the material of highly malleable metal in the configuration (3) to strip the container from the punch core without troubles even at the high speed of 200 cans/min.

However, when the tin plate or black plate is used as the material, it is impossible to strip the container from the punch core having the configuration (3) of the body wall which results in that the upper edge of the container is bent and, at the worst conditions, cut off by the action of the stripper fingers.

It is known that when matte tinplate is used as the material which is not an ordinary tinplate but a tinplate to which the first processing of electroplating of tin on the steel plate has been applied but the second processing of reflow has not been applied, the lubricant is well kept on the surface of the tinplate since it is rough so that the defect of breaking the part of the body wall nearest the bottom end is prevented, which defect is encountered in the ordinary tinplate since the resistance of the tinplate to the plastic deformation is large enough to produce the maximum tensile strain at the part of the body wall nearest the bottom end. However, the advantage of the matte tinplate is actually displayed when the body wall of the container is elongated and has no concern with the case when the container is

stripped from the punch core. Thus even when the matte tinplate is used as the material, it often happens that the container having the configuration (3) cannot be stripped from the punch core as with the case of tinplate or blackplate.

The problem arising in case of producing a container by subjecting the tinplate to drawing and ironing to make a body with an integral bottom end and then double seaming the same with a cover is that the hardness of tinplate is increased by ironing work whereby the upper part of the container to be flanged and double seamed tends to crack, although it is not necessary to take the problem into account in case of the aluminium material. The upper part of the body wall is hardened by drawing to a greater extent than the lower part, which is further hardened by ironing such that it may be easily cracked by flanging. Under the circumstances, it cannot be said by any means that the container can be manufactured by subjecting the tinplate to drawing and ironing, so long as there is no means found to prevent the flange cracking. Since the thickness of the body wall is rendered extremely thin by ironing but the hardness of the body wall is caused to increase by that processing, the increase of the hardness will compensate for the susceptibility of the container to deformation due to the thin thickness of the wall in case of tinplate. However, the flange cracking tends to occur because of the increased hardness of the tinplate, which will injure the sealability of the container as well as incur the putrefaction or leakage of the contents in the container. This is one of the reasons why a tinplate container subjected to drawing and ironing does not appear in the market despite of the latter advantage.

It is therefore an object of the invention to overcome the aforesaid defect. It is another object of the invention to provide a method of producing a cylindrical container with an integral bottom end by drawing and ironing the tinplate, which container meets the requirements that the amount of material to be used is small; that there is no occurrence of flange cracking and that the container can be stripped from the punch core even at high speed production. It is still another object of the invention to provide a container produced by the same method. It is a further object of the invention to provide members to be used by the same method.

SUMMARY OF THE INVENTION

In one aspect of the invention it relates to production of a cylindrical container with a bottom end by subjecting a tinplate material to drawing and ironing, in which a punch core is used having a part adapted for forming the main body portion of said container which is made slightly thinner upwardly; the thickness of the wall of said main body portion is made such that its gradient angle is smaller than that of said part of said punch core for ease of stripping of the container from the punch core, i.e., the inner surface of the container is of inverted truncated conical shape. In another aspect of the invention, it relates to a container produced by the use of above means with a punch core having the structure such that it does not give the final ironing to the upper portion of the container so as to suppress the increase of the work hardening thereof and make it possible to conduct flanging and double seaming with a cover on said upper portion.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematical sectional view of a container with a bottom end being produced by a punch core such that the thickness of the body wall thereof is substantially equal except for its upper portion.

FIG. 2 is a schematic sectional view of a container illustrating a preferred embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

This invention is directed to a container made of a tinplate material which can easily be stripped from the punch core after drawing & ironing, said container not being cracked by flanging, double seaming and adapted for mass production on a commercial scale by means of drawing and ironing of the tinplate material.

One of the preferred embodiments of the invention is described below with reference to the attached drawing. It is to be noted that in this case the material used is a tinplate and that the sectional configuration of the product container taken along a plane including the axis of the container is such taht the thickness of the upper portion of the body wall is thicker than that of the other portion, being about 1.0 to 0.18 mm or so.

In FIG. 1 is shown a container A having the aforementioned configuration (3) which, after ironing, is about to be stripped from the punch core B by means of the stripper fingers C butting against the upper portion **2.** As apparent from this Figure, the punch core B has the circumferential surface having a substantially equal diameter portion which continues from the bottom part through the arc portion. The circumferential side surface has an upper part **13** having a smaller diameter which continues from said side surface through a part having a progressively diminishing diameter.

This upper part is in turn connected to the driving means not shown for the punch core. The container A as formed by means of this punch core B has a bottom end having about the same thickness as that of the material and a main body portion **1** having a substantially uniform thickness with an arc portion therebetween and an upper portion **2** having a thick wall, a portion which has a progressively increasing thickness intervening between the upper portion **2** and the main body portion **1.** In case that the material is aluminium, it is possible to make the container A by the use of this punch core B, but if the material is tinplate, it is impossible to strip the container A from the punch core B. The reason is not well known but it is presumed that when the tinplate is used the frictional engagement between the punch core and the container wall surface is stronger than that when the aluminium is used owing to the difference in the plasticity and thermal deformation between the both metals, and therefore, even if the upper part of the container A is in the order of 0.10 to 0.18 mm it is bent enough to prevent the stripping of the container.

A preferable embodiment of the present invention is shown in FIG. **2,** in which the reference numeral B is the punch core to be used to form the container the invention. It is composed of a bottom part **10,** a main body part **11** and a small diameter part **13.** It also contains a part **8** which is to be engaged with the lower part **5** of the container and which increases its diameter comparatively sharply. This part **8** is connected to the bottom part **10** via an arc part therebetween. The main body part **11** extends upwards from the part **8** constituting a side surface which increase its diameter very gradually or is very slightly inclined from the exis of the punch core. The small diameter part **13** is connected to the main body part **11** via a part **12** which decreases its diameter gradually. Said part **13** has a circumferential side surface which is parallel to the axis of the punch core. Said part **13** is provided a neck part **9** which is connected to a punch core driving means (not shown) by means of suitable device so that the punch core will be reciprocated through a die ring (not shown).

In FIG. **2,** a gap is shown to exist between the outer surface of the punch core B and the inner surface of the container A by way of simplicity of explanation. Thus the gap appears in some cases but not in other cases. It only shows that the difference in the wall thickness between the upper main body portion **6** and the lower main body portion **6** should be smaller in case of tinplate material than that of the aluminium material. Accordingly, the container A made of tinplate as produced through ironing by the punch core B of FIG. **2** is composed of the bottom portion **3** having substantially the same thickness as that of the material blank, the arc portion **4** successive to said bottom portion **3,** the short portion **5** successive to said arc portion **4** in which the wall thickness **1** is sharply decreased, the main body portion **6** successive to said short portion **5** in which the wall thickness **1** is gradually decreased, the portion **7** successive to said main body portion **6** in which the wall thickness is considerably sharply increased and the thick upper portion **2.** Based upon the outer surface of the main body portion **6,** the gradient angle of the interior surface thereof should preferably be not more than four-fifths of the gradient angle of the circumferential surface **11** of the punch core B to the axis thereof. In other words, the outer surface of the main body portion **6** of the container subjected to ironing should preferably be in a form of an inverted truncated cone and not in a cylindrical form. Good results are obtained when said gradient angle of the core punch is 0.0001 to 0.0003 radian, and the container made of tinplate can be stripped from the punch core when the ironing is effected such that the above relation is obtained between the wall thickness of the container and the gradient angle, although the reason therefor is not known. The ironing work by which the above relation can be obtained may be predetermined by the property of the tinplate material, the gradient angle of the punch core and the ironing velocity of the punch core. In case that the difference in the thickness between the upper portion **2** of the container and the upper thinnest part of the main body portion **6** of the container is too much great, the container made of tinplate can not be stripped from the core punch. In addition, if the thinnest part of the main body portion **6** has the thickness of 0.05 mm or less, the container can not stand the axial stress given when the double seaming with a cover is effected, and the portion **6** is thereby collapsed. Therefore, the thickness of the upper portion **2** of the container should be 0.10 mm to 0.18 mm and preferably, 0.15 mm to 0.17 mm in order to obtain a satisfactory result when it is desired to strip the container from the punch core.

As set forth above, it is thus possible to form a container made of tinplate by drawing and ironing and strip the container from the punch core. However, it is further necessary to prevent the flange cracking of the

container so as to render its use possible as the tinplate container. When aluminium is used as the starting material, the flange cracking will not occur on the upper portion of the container due to less work hardening by ironing work. When tinplate is used as the material, considerable increase of hardening will occur. For instance, when the tinplate material having the wall thickness of 0.35mm and the Rockwell hardness of (30T) **55** is drawn to form a cup having a bottom diameter of 6 cm and a height of 65 cm, the hardness of the upper body portion is greater by about three than that of the middle main body portion. When the first and the second ironing are subjected to this main body wall of the semiproduct or cup, the above difference in the hardness still remains and the entire hardness is increased in the product container, and it sometimes happens that the flange cracking occurs when the thus obtained container is subjected to flanging work.

In the present invention, it is possible that the final ironing is not given to the upper portion **2** of the container, and in this case, the hardness of the upper portion **2** becomes lower by 1 to 22 than that of the middle portion.

When this container is subjected to flanging and double seaming, the flange cracking does not occur.

I claim:

1. A tinplate container comprising a relatively deep drawn cup-shaped body having a bottom of substantially uniform thickness and an integral encircling wall upstanding therefrom, said upstanding wall having a cylindrical outer surface of substantially uniform diameter and an inner surface in the form of an inverted truncated cone, said upstanding wall further being characterized by having a short portion adjacent said bottom and which extends upwardly therefrom from an initial thickness substantially greater than said bottom in a course of decreasing thickness to joinder with a wall main body portion, said upstanding wall further having an upper portion joined to said main body portion, the thickness of said main body portion gradually decreasing in a direction away from said short portion to a point of minimum thickness at its joinder with said upper portion, said upper portion having a substantially uniform thickness which is greater than that of said main body portion for providing material for a container flange, the upper portion of said wall having a Rockwell hardness which is lower than that of said wall main body portion.

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