

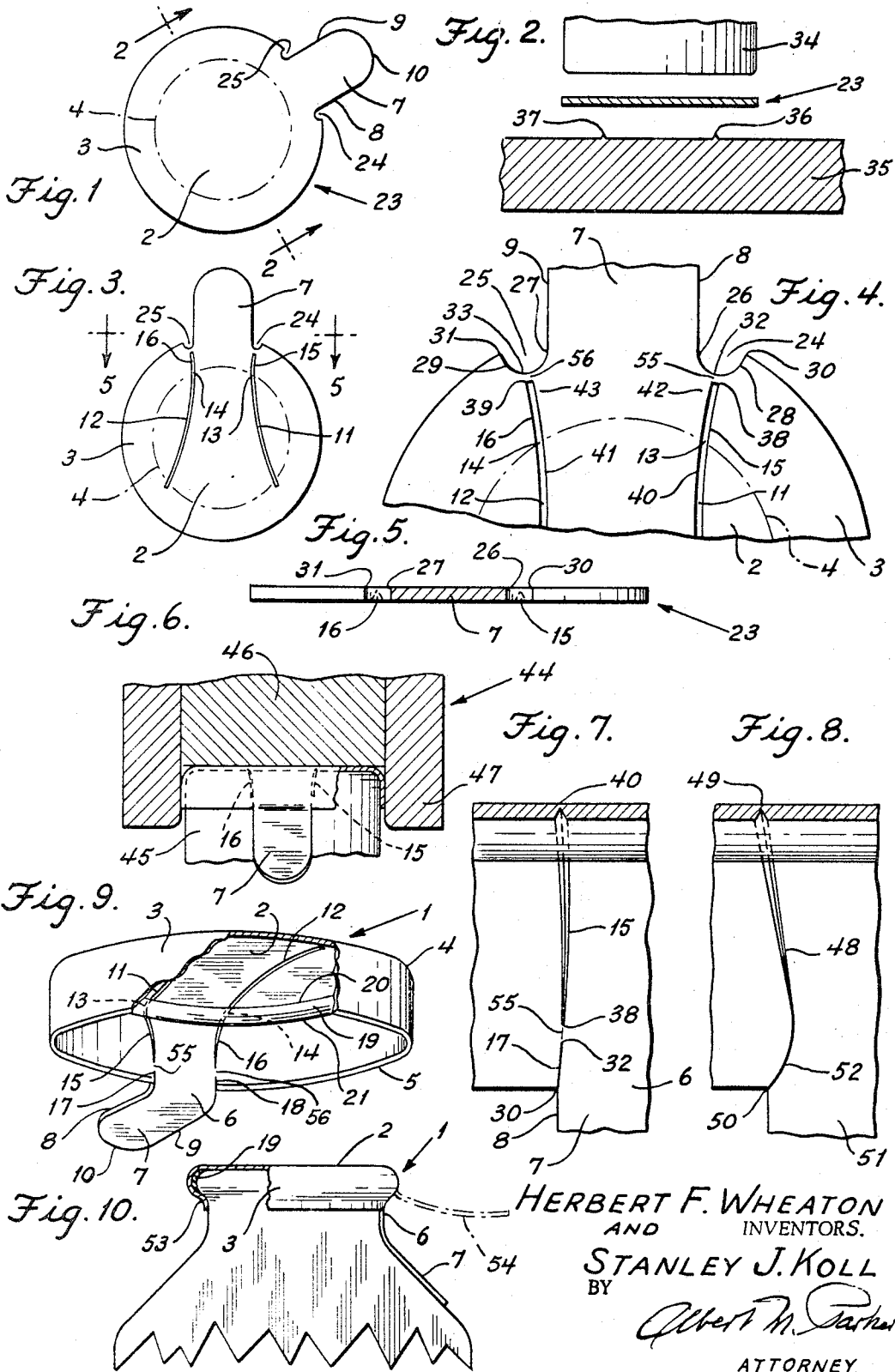
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METHOD OF FORMING CLOSURE CAPS

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METHOD OF FORMING CLOSURE CAPS

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5 Claims. (Cl. 113-121)

ABSTRACT OF THE DISCLOSURE

A method of forming lightweight metal closure caps provided with a tear strip portion to facilitate removal from a container. The forming of the cap and particularly the score lines which defines the tear strip, are carried out so as to improve upon the structural qualities of the finished cap.

This is a division of application Ser. No. 325,817, filed Nov. 25, 1963, now Patent No. 3,258,149.

This invention relates to closure caps for container openings and to methods for forming the same and is particularly concerned with such caps formed of lightweight metal which while effectively closing and sealing the openings of bottles, jars, cans and the like against pressure are nevertheless removable without the use of tools.

In the description to follow, the invention as shown in the accompanying drawings will be depicted from the standpoint of hand removable closure caps for beverage bottles. It is to be understood, however, that this is merely by way of illustration and not limitation since caps in accordance with the invention and those formed by the method of the invention may also be effectively employed for the closing and sealing of the openings of bottles of all sorts, jars of which baby food jars are a non-limiting illustration, cans when the same have openings with bottle-like finishes and any other containers similarly finished. When in the description the term "hand removable" is employed, it is to be understood that this refers to the means provided by the cap which may be grasped by the fingers of anyone, even a child, and actuated to destroy the cap and thus achieve its removal from the opening without the use of any kind of tool.

By and large practically all of the great volume of bottles carrying beverages under pressure have for some considerable time been closed by means of the well known crown cap which can only be properly removed by the use of a suitable tool. Likewise, throughout most of the shorter period that has existed wherein cans have been employed for the packaging of such commodities, tools have been needed for puncturing the end of the can to gain access to the contents. Recently means have been introduced to enable the consumer to effect an opening of desired size in the heads of such cans by the grasping of an upstanding ear and using the same for the tearing away of the section of the top. The same trend to provide greater convenience for the consumer has been recognized in the art of the capping of bottles, but until the advent of the instant invention, the efforts made to furnish such convenience in the bottle capping art have not met with any particular success.

In the first place, retention of pressure and ready removability are inconsistent functions which are difficult to reconcile in the structure such as a bottle cap. Accordingly certain efforts that have been made to provide prior art bottle caps with hand removable means have failed in sufficient proportion to practically eliminate their market-

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ability because the caps, if applied tightly enough to hold pressure, are too difficult, if not impossible, to remove by gripping of the hand removable means, or if applied in the manner to make the hand removable means effective, the percentage of failure to hold pressure is too high.

Efforts made to provide caps having scores to facilitate the removal of the cap by destruction of it by tearing out the section between the scores have likewise been tried and have shown some possibilities but have also been subject to substantial drawbacks. Such caps, though made of lightweight or thin metal such as aluminum, have been perfected so that they will hold substantial pressure, but the manner of scoring and forming them to make them hand removable, has introduced a number of drawbacks. The continuous deep scoring across the top of the cap and down the skirt thereof into intended alignment with the sides of the tearing ear has been done in such a way that various seriously damaging weaknesses have been introduced.

In some instances the commencement of the tearing has been provided for with such ease that even a light unintentional striking of the tearing ear has caused the seal to be broken and the pressure on the contents to be lost. The scoring has also affected the tear strip particularly where it extends down the skirt of the cap in such a manner that removal must be achieved by pulling in definite directions during different parts of the action lest the ear or the tear strip tears off before the bottle opening is reached and consequently before it is opened. This has made it necessary to apply a legend to the top of the cap and tell exactly how to pull on the ear to remove it. However, a sufficient portion of the users either do not read the legend or do not understand or follow what they have read so that an annoying large number of such caps have had their ears or tear strips torn off before the bottles have been opened.

The cap of the invention and method of forming the same are in the category of the lightweight metal caps with tear strips ending in tearing ears but in the method of forming them and in the structure resulting therefrom proper provision has been made to overcome the deficiencies of the prior art cap just described. Hence the cap of the invention when properly applied to a bottle or other suitable container first assures the provision of a tight seal against pressure even greater than that previously contained by the prior art caps. No instructions or directions are needed to enable the consumer to readily remove the cap. He merely needs to grasp the tearing ear and pull out or up as suits him to enable him to start and continue the tear of the strip along the score lines up the skirt and across the top to sufficient extent to cause the top to pop off. No reasonable action taken for removal of the cap will result in the consumer tearing off the ear before the cap is destroyed sufficiently that it will pop off. Furthermore, no accidental or unintentional striking upward or otherwise on the ear will cause the seal to be broken.

One feature by which the invention construction eliminates the prior art drawbacks is the novel and precise manner in which the scoring is imparted to the cap. The blank for the cap is made and the scoring is specially formed in it so that as the blank is cupped to form the cap the metal when moved into its changed position carries the scores with it so that they end up aligned with the sides of the tearing ear in its extension away from the cap skirt. This is achieved when scoring the flat blank by particular outward flaring of the scores with respect to the sides of the ear in their extension toward the periphery of the blank. The blank is also notched inward from its periphery at either side of the extended ear portion to provide a place for the metal of the blank portion forming the cap skirt to flow as its diameter is decreased

from that in the flat blank to that of the cylindrical skirt.

The scores in the cap blank extend to a position closely adjacent the base of the notches leaving a small section of material therebetween which, while the blank is in the flat, is neither notched nor scored. When the border of the flat blank is moved laterally to form the cap skirt the notches are closed up as are the scores. The scores, however, are closed in progressively starting from the position where the skirt of the cap departs from the top downwardly to their terminating ends where they are substantially completely closed. Meanwhile the small sections of metal remaining unscored between the notches and the ends of the formed scores are creased or pinched in a line which is an extension of the score to what, in each case, was the border of the notch. This creasing results from a puckering of the metal extending between the score and the notch which can be closed up as the skirt is formed while the small unscored portion between them has no such provision for reduction of its width.

When a cap so formed is applied over a bead or bottle finish convexly rounded in cross section and is formed in under the bead and against the neck at the bottom of that bead, there is, of course, a further closing of the score and of the notch due to a diminishing of the diameter of the skirt. Thus there is a further puckering of the unscored metal section and accentuation of the already formed crease line between the end of the score and the notch.

This relationship of precise direction and extension of the score lines through the skirt portion, the notches spaced from their ends and lying alongside the tearing ear and the mechanically unscored but creased dividing section between the ends of the scores and the bases of the notches serve to overcome the prior art drawbacks. By flaring the scores outward so that, in the flat, they terminate at positions spaced farther apart than the width of the tearing ear, the scores do not, when the cap is formed up out of the blank, come closer to each other than the width of the ear where the ear departs from the cap skirt. Thus as against prior art practices, the ear is left at its full strength and width at this position. Then the short creased portions devoid of any depth of scoring or notching at the ends of the scores serve several purposes. First, they prevent the end of the scores from cracking open during the formation of the cap and more particularly during the applying of the cap over the bead. Weakening of the holding power of the cap over the opening is thus guarded against. Then these creased portions provide just the right resistance against the starting of any tearing along the scores by accidental movement of the ear, so guard against unintended release of the pressure from the container.

Though it might appear that having merely creased rather than fully scored sections at this position would cause difficulty for the consumer in commencing the tearing away of the tear strip, the contrary is the case. The creases direct the tear in proper alignment with the scores and into them instead of having the tear running away from scores across the tear strip so that the ear comes off before the bottle can be opened as commonly happens with prior art constructions. The tear strips tear naturally from the short creased portions right into the positively scored portions and the tearing proceeds easily and along its proper path. Finally, the user can follow his own techniques of how to proceed with the tearing for it works well so long as the pulling is exerted in any reasonable opening direction.

It is accordingly a principal object of this invention to provide new and improved closure caps for containers.

Another object is to provide a novel method for manufacturing such caps.

Another object is to provide such closure caps, which though readily destructible and removable when intended, are stronger and more pressure-resistant than comparable closure caps heretofore employed.

Still another object is to provide such closure caps which though scored for destructibility and ease of removal withstand the action of securing them to container openings with a minimum of weakening.

5 Still another object is to provide such closure caps which, although capable of effectively sealing containers against internal pressures well in excess of accepted standards, are readily and easily hand removable.

10 A further object is to provide flat scored blanks for the formation of hand removable closure caps which blanks are so formed to retain their weakening strength where needed to resist in the drawing of the cap skirt portion away from the cap top portion.

15 A still further object is to provide hand removable closure caps which, though including a gripping ear to facilitate the intentional removal thereof are free from failure due to moderate accidental movement of such ear.

A more detailed object is to provide a method for forming scored closure caps having a top and a skirt extending therearound wherein the inherent deformation of the score portions in the skirt caused by the drawing of said skirt from a flattened to a laterally extending position with respect to that flat, enhances sealability while facilitating removability of such caps.

20 Further and more detailed objects will in part be obvious and in part pointed out as the description of the invention taken in conjunction with the accompanying drawing proceeds.

In that drawing:

30 FIG. 1 is a plan view of the cap blank for use in forming the closure cap of the invention.

FIG. 2 is a vertical section including the blank of FIG. 1, taken on line 2—2 thereof, of die elements for performing the scoring operation in the method of cap forming in accordance with the invention with those die elements in their initial position and with the blank therebetween ready for the commencement of the scoring.

35 FIG. 3 is a plan view of the cap blank of FIG. 1 after the scoring operation has been completed.

40 FIG. 4 is a greatly enlarged fragmentary plan showing of the portion of the scored blank of FIG. 3 adjacent the commencement of the tearing ear.

45 FIG. 5 is an enlarged vertical sectional view of the cap blank taken on line 5—5 of FIG. 3 and looking in the direction of the arrows.

50 FIG. 6 is a vertical sectional view of die elements for performing the drawing operation in the method of cap forming in accordance with the invention showing those die elements in their final forming position with a cap therebetween.

FIG. 7 is a greatly enlarged fragmentary section of the score portion in the cap skirt as viewed interiorly of the finish cap.

55 FIG. 8 is a view similar to FIG. 7 showing the prior art scoring.

FIG. 9 is a perspective view of a completed cap in accordance with the invention with a fragment of the non-scored portion of the skirt broken away to expose the interior thereof and,

60 FIG. 10 is a part elevational part sectional view of a cap applied to a container neck.

65 Considering first the general aspects of the closure cap of the invention as shown in FIGS. 9 and 10, the cap generally indicated at 1 comprises a flat disc-like top 2 surrounded by a depending skirt 3 with the numeral 4 indicating the juncture of the top and skirt. The skirt 3 terminates in a downwardly facing free edge 5, which edge forms a continuous circle except for the portion 6 which extends downwardly from the bottom of the skirt with a short distance forming the juncture of the skirt with a radially outwardly extending, integrally formed ear 7. As clearly illustrated in FIG. 9, the ear 7 is provided with two substantially parallel sides 8 and 9 and an end 10.

70 The interior surface of the cap 1 is provided with a pair of scores with portions 11 and 12 which extend across

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the cap top 2, portions 13 and 14 extending across the juncture 4 of the top and skirt and portions 15 and 16 which then continue for a distance down the skirt 3 in substantially parallel relationship. In the form of the cap here shown, the top score portions 11 and 12 are formed with an outwardly divergent sweep which aids in removing the cap from the bottle or other container opening to which it is applied. Although the configuration of the top score portions 11 and 12 may be varied somewhat without departing from the scope of the invention, it is important that the score portions 15 and 16 in the skirt 3 be in substantially parallel relationship with each line respectively positioned in alignment with the sides 8 and 9 of the ear 7.

The formed cap is provided with slits 17 and 18 extending upwardly from the free edge 5 up into the skirt 3 where the sides 8 and 9 of the ear depart from the skirt edge. These slits extend completely through the wall of the skirt forming very narrow severances or breaks in the lower portion of the skirt. These slits 17 and 18 extend in alignment with the score portions 15 and 16 but stop short of the ends of those score portions. There accordingly remain zones of metal which is neither scored nor slitted between the lower ends of the scores 15 and 16 and the upper ends of the slits 17 and 18.

To provide effective sealability of the cap of the invention, a gasket 19 is secured therewithin. In the form illustrated, the gasket 19 is preferably formed in situ and results from the applying of material in fluid form interiorly of the top and skirt juncture 4. Such material when suitably heat cured, sets up into the form of a resilient gasket permanently adhered to its seat within the cap. As shown, the gasket 19 extends part way inwardly beneath the top 2 of the cap at 20 and part way down the skirt 3 of the same to the portion 21. An important aspect of this gasketing resides in the fact that as the fluid material, out of which the gasket is made, is flowed into place on its seat a sufficient amount of the material flows into the scores, where the material crosses the scores, such as at the score portions 13 and 14, completely filling the scores and thus blocking them off against any possible leakage path along the scores behind the gasket. It should be noted, however, that gasket 19 and its method of application could be varied without departing from the invention. As an example, the gasket could be formed as a liner completely covering the interior of the cap top. Also, such gasket could be spun in or hot stamped and either heat cured or air dried. In either of these gasketing arrangements, the form of the cap and its sealing principle remain the same.

Reverting back to FIG. 1 for the forming of the cap 1, that operation begins with a flat blank generally indicated at 23. The size and thickness of the cap blank may vary over a wide range depending upon the final size of cap desired. One cap in accordance with the invention which has been found to be particularly suited for the capping of bottles containing beer, carbonated beverages and the like is formed from lightweight sheet aluminum approximating .010 inch in thickness.

For purposes of illustration, the zone where the juncture of the top and skirt of the finished cap will be located is indicated on the flat blank of FIGS. 1, 3, and 4 by the dot dash line 4. Similarly the portion of the flat blank representing the skirt portion of the finished cap is indicated at 3 and the cap top is at 2 on the blanks of FIGS. 1, 3 and 4. The cap ear 7 is also shown in the flat blank along with its side portions 8 and 9 and end portion 10. It is important to note, however, that the flat blank, instead of having the narrow slits 17 and 18 as shown in the finished cap of FIG. 9, is formed with a pair of open notches 24 and 25 located on either side of the ear 7. In the greatly enlarged showing of FIG. 1, the notches 24 and 25 extend in from the periphery of the blank in a U-shape whose inner sides 26 and 27 form continuations of the ear sides 8 and 9. Their outer sides 28 and 29 meet the blank periphery, which forms the skirt edge 5, at the

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points 30 and 31 respectively while the concavely curved bottom portions 32 and 33 complete the U-shape.

Considering next the scoring as applied to the blank, particular attention is directed to FIG. 2 wherein the cap blank 23 of FIG. 2 is shown in scoring position between an upper scoring die member 34 and a lower scoring die member 35. The lower scoring die member is provided with a pair of scoring knives 36 and 37 which, upon closing of the die, embed themselves to a predetermined depth into the material of the blank from the lower surface thereof. Due to the thinness of the metal and the pressure which the finished cap has to withstand this scoring must be accurately controlled to leave enough metal beneath the bottoms of the resultant grooves to hold that pressure while making the score deep enough to assure ease of tearing therealong.

FIGS. 3, 4, and 5 show the cap blank 23 after the scoring operation has been completed. Here the score portions shown in final location in FIG. 9 are indicated on the flat blank of FIG. 3 by the same reference characters. The score portions 11 and 12 extend across the central top portion 2, the portions 13 and 14 extend across the juncture 4, and the portions 15 and 16 partially cross the skirt portion 3. It is important to note however, that the score portions 15 and 16 in the skirt portion of the flat blank are not formed in parallelism but diverge outwardly terminating respectively at points 38 and 39. From the enlarged showing in FIG. 4, it can be seen that the distance between the score portions 11 and 12 at the positions 40 and 41 where they leave the juncture zone 4 between the top and skirt and start across the flat top 2 is the same as the distance between the inner sides 26 and 27 of the notches 24 and 25. It is also the same as the width of the ear 7 and at the positions 40 and 41 the score portions 11 and 12 are aligned with the sides 8 and 9 of that ear. As the score portions 11 and 12 cross the juncture zone 4 at 13 and 14 and continue outwardly across the skirt portion they curve away from each other to positions where their ends 38 and 39 lying just short of the central portion of the notch bases 32 and 33. In other words, the distance between the ends 38 and 39 of the score portions is substantially greater than the distance between the notch inner side walls 26 and 27, leaving areas of metal generally indicated at 42 and 43 respectively lying between the score portions 15 and 16 and lines forming projections of the sides 8 and 9 of the ear 7.

Turning now to the second step in the formation of the cap 1 wherein the cap skirt 3 is formed laterally away from the flat of the blank into cylindrical formation it is to be noted that, as a manufacturing expedient, the scoring can be effected before the cap is blanked out of a metal sheet or strip. Then as a second step, blanking and drawing can be carried out in one operation. However, the scoring and drawing are to the same effect for the purposes of the invention whether the scoring and drawing operations are performed on a cap blank as illustrated or the cap blank is first scored in the strip then blanked and drawn.

The drawing operation is performed with an upper die member generally indicated at 44 and a lower die member 45 which die members are shown in FIG. 6 in closed relationship about a formed cap 1. The upper die member 44 has an inner element 46, which holds the cap top portion of the flat blank against the lower die member 45, and an outer element 47 which draws the skirt portion of the blank laterally away from the top. As the skirt portion of the cap moves from its flattened position in the blank to the reduced circumference of the finished cap, there results a movement or slight upsetting of metal within the skirt wall causing a corresponding thickening and elongation of the same. Inasmuch as the scoring is the weakest portion of the skirt, such deformation and any detrimental effects thereof are concentrated in the score area. The showing in FIG. 8 illustrates what happens

when a cap blank with the prior art scoring is cupped in this manner.

When the initial scoring imparted to the flat blank has the form of straight parallel lines in alignment with the sides of the ear as has been the prior art practice, such lines are severely deformed inwardly towards each other upon the drawing of the skirt laterally away from the cap top. The prior art score portions 48 start to move inwardly from the position where they depart from the flat top at 49 and they become progressively deformed the further down the skirt they extend. As the lower ends 50 of the score portions 48 are approached, they tend to curve outwardly again due to the restraining effect imparted by the ear portion 51 which lies between the score sections and extends beyond the lower edge of the skirt. The lower portions 52 of the score sections 48 are deformed to such an extent that severe fracturing of the metal lying behind the score commonly occurs.

If the prior art score portions have not been damaged in the cupping of the blank to such an extent as to cause an uncontrolled tear in the skirt at this stage, they certainly will be when the skirt is subsequently subjected to the additional deformation imparted thereto by bending and working of the cap in the applying of it.

If severe fracturing or uncontrolled tearing of the skirt at the score sections due to the manufacture or application of the cap do not impair the effectiveness of the seal in prior art caps, there still remains the problem of removability, in order for this type of closure to be acceptable, it must, besides meeting high standards of sealability, be easily hand removable through the finger grip of a woman or child. If in the removing process a struggle ensues and in that struggle the tearing of the ear does not follow the score lines or the ear breaks off from the skirt altogether, a very unpleasant image is branded on the memory of the one attempting removal. Such frequently happens in the attempted removal of prior art closures characterized by the FIG. 8 showing. This difficulty has been due in large part to the fact that when one pulls on the ear 51 to start the tearing that tearing commences in the inwardly inclined portions 52 and, as it continues, instead of following around the curve to the score portion 48 it continues in straight lines directed towards each other from opposite sides of the tear strip. Thus the tear will go off at an undesired and ineffective angle, with the tear strip coming free before the cap is removed or the ear will tear off from the skirt.

Going back now to the invention and with particular reference to FIGS. 4, 6 and 7, for showings of how the invention eliminates the prior art deficiencies, the first step is by imparting an outward flaring to the scores 15 and 16 while in the flat skirt area. Hence when the skirt 3 is formed away from the flat top 2, those score portions move towards each other. Being properly positioned in their formation, the score portions 15 and 16 assume the relatively parallel relationship when the blank is cupped as shown in FIG. 6. The contrast between the invention and the prior art is immediately apparent from the side by side showings of FIGS. 7 and 8. As seen from FIG. 7, the movement of the peripheral portion of the skirt 3 from its flattened form to its laterally extending position has caused the notches 24 and 25 to become completely closed. The outer notch sides 28 and 29 have moved inwardly meeting the inner sides 26 and 27 respectively leaving only the slits 17 and 18 in the finished skirt. This arrangement provides a controlled slit replacing the severe deformation and varied fracturing of the scored portion adjacent the edge of the skirt as characterized by the prior art.

Besides the closing of the notches 24 and 25, the flared score portions 15 and 16 have also moved towards each other in the cupping of the blank. As seen in FIG. 7, the areas 42 and 43 have been completely absorbed in the intermediate skirt wall portion resulting in the scored

portions 15 and 16 being brought into parallelism and into alignment with the sides 8 and 9 respectively of the ear 7. What has been done here is to utilize the inherent movement of metal in the skirt 3 as it is drawn to a reduced circumference to convert outwardly flared lines into desired straight lines in contrast to the prior art practice of deforming straight lines into undesirable inwardly curved lines. In the improved score portion of FIG. 7, a substantially vertical line can be drawn from the point 40 where the scoring starts across the cap top down through the bottom end 38 of the score portion 15. That line also extends down through the slit 17 which was the notch 24. That line passes through the points 32 and 30 at the top and bottom of the slit and down along the side 8 of the ear. With this arrangement, very little pulling effort applied to the gripping ear 7 causes the tear strip to be torn along the scores and enables the cap to be torn off from the container. It is here to be noted that the scores 15 and 16 do not extend to the lower edge 5 of the skirt, where the disturbance of the metal is most severe.

Another important feature of the invention resides in the retention of unscored sections of metal, indicated at 55 and 56 in FIG. 4 bridging the spaces between the ends 38 and 39 of the scored sections 15 and 16 and the notch bases 32 and 33.

There is no removal of metal from the sections 55 and 56 in either the scoring of the blank or the cupping action to form the cap therefrom. However, the sections 55 and 56 are of such small extent in the line between the ends of the score portions at 38 and 39 and the bases of the grooves opposite the same at 32 and 33 that the metal in the unscored sections is necessarily deformed and weakened when the skirt of the cap is formed laterally from the peripheral portion of the flat blank. This lateral forming obviously diminishes the diameter of the skirt section to increasing extent as the periphery is approached. Thus the score portions 15 and 16 are progressively closed in a direction towards the unscored portions 55 and 56 while the notches 24 and 25 are closed all the way up to form slits. This permitted substantial movement of the metal at either side of sections 55 and 56 necessarily imposes a greater strain on those small sections than is imposed on portions of the skirt remote from those sections. Thus, though it may not always be readily discernable, lines of partial weakening are formed across the sections 55 and 56 by the cupping action.

The lines of weakening across the sections 55 and 56 connect the slits 17 and 18 with the score portions 15 and 16. Thus, this small unscored portion performs several important functions. First, it has the strength to prevent the cracking open of the scores when the caps are applied over the beads or other finishes on bottle necks. Next, it serves as a safeguard against accidental opening of the score and consequent loosening of the cap and loss of pressure which occurs in prior art closures on unintentional movement of the ear. Finally, and contrary to what one would think, the lines of weakening enhance the proper removal of the cap since they act as guides for the tear between the slits and the scores. As one grasps the ear and pulls on it he quickly jumps through the weakened but unscored portions whereupon the tearing naturally follows into the precisely formed aligned scores, rather than running out of and away from the scores as commonly happens in the prior art.

Careful selection of the extent of the unscored portions 55 and 56 must be made so as not to interfere with intentional tearing along the scored portions 15 and 16 while at the same time providing adequate protection against unintentional starting of the tear by some extraneous object engaging the ear. However, the type and thickness of metal enter into the determination of the extent of the unscored portion so no definite criterion can be established other than that it should space the end

of the score, and the end of the slit no further apart than is needed to provide the safeguards above indicated without interfering with the orderly removal of the cap.

The specially formed score portions 15 and 16 being bordered at their sides by metal which is relatively unstressed, and by being in the natural direct tearing path following along the sides of the ear 7 provide almost a guarantee that the tearing will go straight up them. They provide the only weakened path and there is nothing like the inward incline of the scores and consequent disturbance of the metal of the tear strip, as in the prior art, to cause the tearing to run off at an angle.

Many thousands of caps have been made in accordance with the teaching of the invention and on application of the same to the beads on bottle necks by rolling or crimping action the foregoing results claimed for the invention were found to be clearly present. In particular, the individuals removing the caps were able to do so without any previous instructions and by grasping the ears and pulling in such reasonable direction as appeared best for them. They also found that these caps "tear off" with uniform effectiveness. Surprisingly, in spite of the interruption in the scoring the tearing is more easily accomplished than was true with prior art caps.

Though, in the foregoing, a particular form of the closure and its method of manufacture have been shown and described, it is to be understood that the invention is not to be considered as being limited by the particulars of such showing. Numerous variations such as in the size and shape of the closure or in the configuration of the top scoring as would readily suggest themselves to those skilled in the art would not be considered a departure from the invention. Accordingly, it is, of course, to be understood that this showing and description are for illustrative and not for limiting purposes.

Having described our invention, what we claim as new and desire to obtain by Letters Patent is:

1. The method of manufacturing lightweight metal tear-off closure caps of the type adapted to be formed over a lip bordering the opening of a container neck, said cap having a top portion and a laterally depending skirt which comprises forming a substantially circular blank having a pair of spaced weakened lines extending at least partially thereacross, said weakened lines being so formed as to diverge outwardly away from each other as they approach the periphery of said blank, supporting a circular central portion of said blank, cupping said blank to form an annular peripheral portion laterally around said central portion and simultaneously with said cupping moving said outwardly divergent portions of said weakened lines into substantially parallel relationship on completion of the forming of said cap skirt.

2. The method of manufacturing lightweight metal tear-off closure caps of the type adapted to be formed over a lip bordering the opening of a container neck, said cap having a top portion and a laterally depending skirt which comprises forming a substantially circular blank and scoring said blank on lines extending at least partially thereacross, said score-lines being so formed as to have portions diverging outwardly away from each other as they approach the periphery of said blank, supporting a circular central portion of said blank, cupping said blank to form an annular peripheral portion laterally around said central portion and simultaneously with said cupping mov-

ing said outwardly divergent portions of said weakened lines into substantially parallel relationship on completion of the forming of said cap skirt.

3. The method of manufacturing lightweight metal tear-off closure caps of the type adapted to be formed over a lip bordering the opening of a container neck, said cap having a top portion and a laterally depending skirt which comprises forming a substantially circular blank having a pair of spaced notches formed in the periphery thereof and having a pair of spaced weakened lines extending at least partially thereacross, said weakened lines being so formed as to diverge outwardly away from each other as they approach said peripheral notches, supporting a circular central portion of said blank, cupping said blank to form an annular peripheral portion laterally around said central portion and simultaneously with said cupping closing up said notches into narrow slits and moving said outwardly divergent portions of said weakened lines into substantially parallel relationship on completion of the forming of said cap skirt.

4. The method of manufacturing lightweight metal tear-off closure caps of the type adapted to be formed over a lip bordering the opening of a container neck, said cap having a top portion and a laterally depending skirt which comprises providing a strip of metal for the forming of a closure cap therefrom, scoring said metal with a pair of opposed scored portions diverging outwardly away from each other at one end, blanking out a substantially circular flat blank surrounding said scores so that said divergent end of said scored portion extend across the peripheral portion of said blank, cupping said blank to form an annular peripheral portion laterally around said central portion and simultaneously with said cupping moving said outwardly divergent portions of said weakened lines into substantially parallel relationship on completion of the forming of said cap skirt.

5. The method of manufacturing lightweight metal tear-off closure caps of the type adapted to be formed over a lip bordering the opening of a container neck, said cap having a top portion and a laterally depending skirt which comprises providing a strip of metal for the forming of a closure cap therefrom, scoring said metal with a pair of opposed scored portions diverging outwardly away from each other at one end, blanking out a substantially circular flat blank having a pair of spaced notches formed in the periphery thereof and said blank surrounding said scores so that said divergent end of said scored portions extends across the peripheral portion of said blank, cupping said blank to form an annular peripheral portion laterally around said central portion and simultaneously with said cupping closing up said notches into narrow slits and moving said outwardly divergent portions of said weakened lines circumferentially toward each other during the forming of said cap skirt.

References Cited

UNITED STATES PATENTS

3,130,056 4/1964 Taylor et al. ----- 215-46
3,216,602 11/1965 Koll ----- 215-46

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