

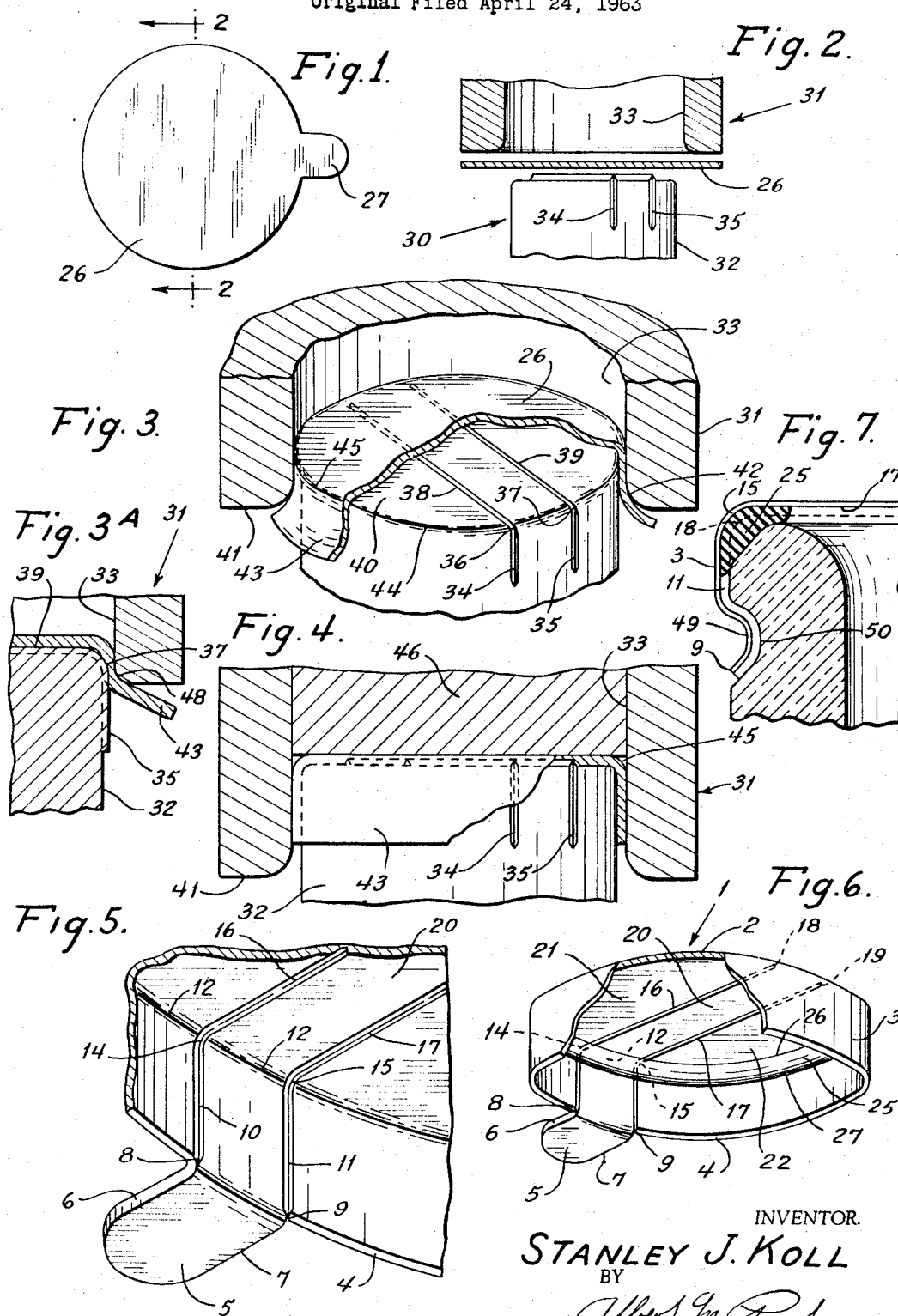
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METHOD FOR FORMING CLOSURE CAPS

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METHOD FOR FORMING CLOSURE CAPS

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This invention relates to lightweight metal closure caps for container openings and to methods for forming the same and is particularly concerned with such caps and the forming of the same to provide pressure-resistant but readily destructible closing and sealing for the openings of bottles, cans and like containers.

This invention is particularly concerned with improved lightweight closure caps usable for the closing and sealing of openings in bottle necks and of other containers having comparable openings where resistance to substantial pressure within the container during shipment and storage thereof is a requisite while at the same time destructibility and removal of the cap by hand action without the use of any tools can be readily achieved. Additionally the invention is particularly concerned with methods for forming such caps and particularly for providing destructibility of the same when desired by the user without that provision for destructibility introducing the likelihood of fracture or failure under pressure into such caps as they are sealingly secured about the container opening.

Heretofore little thought has been given to the provision of readily destructible caps of substantial size for the closing and sealing of container openings large enough for one to drink out of which caps would nevertheless make tight closures and resist strong internal pressure prior to their intended destruction. The sort of commodities which exert such pressure are, for instance, beer and charged water or carbonated soft drinks. Crimped or spun-on caps with tearing ears as heretofore employed had been generally limited in use to the closing of relatively small openings where the retaining of pressure within the container was not particularly a factor. Thus the forming and scoring of such caps did not have to be done with an eye to a pressure resistant construction. Accordingly prior art caps of lightweight metal could be internally scored while the metal was laid out in the flat and then could be formed into cup or cap shape after they were scored. The fact that this forming imposed strains on the metal due to such things as the gathering and tendency of the cap skirt to pucker as it was brought from the flat blank into the lateral formation desired and concentrated those strains upon the thin metal at the base of the scoring, was of no particular consequence in the prior art use of such caps. When, however, the caps needed to be enlarged to close larger openings while still being of thin enough metal to be destroyed by hand by the consumer, the established scoring practices ceased to provide a satisfactory answer. The absence of such answer had not been properly recognized until the advent of the instant invention.

In the prior art practices, the weakening, if not real fracturing, of the metal of the caps remaining in back of the scores after scoring, developed in two stages. The first of these stages was in the forming of the caps and the second was in the applying of them to the containers. In the first stage caps internally scored, when in the initial form of a flat sheet or blank, had their skirts subsequently bent laterally from the flat position so as to depend from and about the cap top. If this bending took place

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about too sharp a radius, strain in various directions would be imposed on the metal at the bend. Further, the skirt in its extent from the bend to the lateral free edge thereof would be subjected to increasing destructive forces due to the moving of the same strip of metal into a position where it occupied less space than it did while laid out in the flat. This imposed a compressive action upon the metal which could be relieved if the cap skirts were permitted to pucker, thus extending their area. Puckering, however, is unsightly and undesirable so is to be avoided. With caps having their skirts thus scored in the flat, there is nothing to prevent this puckering action from manifesting itself instead in the reducing of the width of the score and while doing so, exerting a weakening, bending action on the thin wall of metal in back of the score. Even if such prescored skirts are allowed to elongate while being bent laterally, the problem is not overcome because the elongating also sets up a drawing action on the metal in back of the score. Thus in the prior art forming of the caps substantial weakening of their structure was affected due to the focusing of the destructive forces upon the thin sections of metal in back of the score.

The second stage of weakening evidenced in the prior art often finished the job. In this stage the cap, after it had been internally gasketed around the periphery of its top, would be secured over whatever neck formation the container opening had for retaining the cap tightly in place. This formation would normally be a recess below an enlargement that just received the cap or it might be a combination of receiving and enlargement to a certain extent. In any event if the cap was to withstand any amount of pressure, its skirt would have to be deformed to substantial extent to provide the mechanical holding action needed to keep the cap tightly and sealably in place.

The securing of the caps could be achieved in a number of ways, for example, by a spinning tool having inwardly urged rotating elements to move the metal of the cap inwardly or by means of a multi-jawed crimping tool crimping the cap inwardly without leaving any space for the puckering of it. In any event, the forces applied to effect this sealing are quite substantial and they were applied to prior art cap skirts already weakened by the action of forming them out of the flat after scoring. Again the destructive forces would be focused on the thinnest part of the metal. In many instances the caps would be weakened beyond the critical point at which they no longer resist the pressures in the containers which they were intended to seal.

Caps made in accordance with the invention are free of the first and most acute of these two destructive factors inasmuch as no weakening of the metal beyond the thinning of it is effected in the cap manufacture. Accordingly little appreciable weakening is effected in the second step, the applying of the caps such as by spinning or crimping as just described. The caps of the invention are formed by means of a method wherein flat blanks are scored at the same instant they are being formed in the desired cup or cap shape. Preferably the skirts are scored first, such scoring commencing at the periphery of the cap top or where the skirts are bent out of the flat and then continuing down to the free edge of the skirt. This precludes hardening or straining of the metal and allows free flow towards the free edge. When the scores around the bend and down the skirt have been completed, the mating scores across the top where no bending or straining takes place are effected. The result is a cap with a uniform continuous score backed up by strain-free metal. It accordingly withstands the subsequent crimping or rolling on to an opening lip formation without the serious weakening effects of the prior art caps.

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The method of the invention, as here illustrated, is simple, straightforward and is capable of being carried out in high speed production. By means of it, cap blanks may be sheared from the strip, or be provided already sheared and then be formed into the general cup-shape of a cap while being scored as well all in the single stroke of a press.

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.

Still another object is to provide such closure caps, which though readily destructible and removable when intended, are stronger and more pressure-resistant than closure caps of comparable size and material heretofore made.

Still another object is to provide such closure caps which though scored for destructibility and ready removal are weakened to a minimum extent in the securing of them to container openings.

A further object is to provide a method for forming such caps which, in spite of substantial scoring of the same, retains the strength of the cap to the fullest extent possible.

Still another object is to provide such method which is productive of scores in the finished cap which are substantially uniform throughout in cross-section.

A still further object is to provide such a method which avoids deformation or straining of the metal remaining in back of the scores.

A still further object is to provide apparatus for carrying out the method of the invention.

A more detailed object is to provide a method for forming internally scored closure caps having a top and a skirt extending therearound wherein scoring formed in the skirt is unaffected by the forming of the skirt from the flattened to a laterally extending position with respect to that flat.

Another detailed object is to provide a method for simultaneously forming the skirt of a closure cap laterally from a flat blank while scoring the same internally.

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

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 method of cap forming in accordance with the invention showing those die elements in their initial position with the blank therebetween ready for the commencement of the forming.

FIG. 3 is a fragmentary perspective view partially broken away of the die elements and blank at an intermediate stage in the method of forming the cap.

FIG. 3A is a greatly enlarged fragmentary vertical section taken through the score knife of the cap and die elements in the position of FIG. 3.

FIG. 4 is a vertical sectional view with a part of the cap skirt broken away showing the final forming stage.

FIG. 5 is a greatly enlarged fragmentary perspective view of the scored portion of the cap formed in accordance with the invention as viewed from the inside thereof.

FIG. 6 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.

FIG. 7 is a greatly enlarged fragmentary vertical section of a cap applied to a container neck.

The closure cap of the invention is shown per se in FIG. 6 where it is generally indicated at 1. It has a disc-like top 2, surrounded by a downwardly extending skirt 3 from the free edge 4 of which a tearing ear 5 extends laterally outwardly. Where the parallel sides 6 and 7 meet

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the edge 4 at the positions 8 and 9, the internal scores in accordance with the invention commence. These scores have parallel portions 10 and 11 shown in detail in FIG. 5 which extend across the skirt 3 of the cap to the rounded corner portion 12 where the skirt joins with the top 2. The scores continue in portions 14 and 15 around the inside of the rounded portion 12 and then extend substantially across the top 2 of the cap in continuing parallel portions 16 and 17. These portions 16 and 17 as here shown terminate at the positions 18 and 19 adjacent a portion of the cap diametrically opposite from the rounded portion 14 and 15 of the scores. Considering the light weight of the material used for these caps, the scoring is adequate if it terminates at the positions 18 and 19 for when the tearing of the tear strip 20 between the scores has continued that far, the separated portions 21 and 22 of the cap will have been sufficiently freed from each other that at the end of the tearing action, the cap will come right off the container neck to which it is applied.

The important thing to note with regard to the construction of the cap and here reference is made particularly to the enlarged showing in FIG. 5 is the uniformity of the score portions 10, 11, 14, 15 and 16, 17. The portions 10 and 11 have the same width and depth from their commencement at 8 and 9 to the rounded portions 14 and 15. That same uniform width and depth also continues around the rounded portions at 14 and 15 and, likewise continues across the top of the cap in the portions 16 and 17. This uniform scoring throughout having been effected by a method of manufacture about to be described makes it quite clear that the material remaining in back of the scores remains of the same thickness and has the same undistorted condition from the commencement of the scores 8 and 9 throughout the full extent of the portions 10 and 11, 14 and 15, and 16 and 17.

Reverting back to FIG. 6, it will be seen that interiorly of its rounded edge portion 12 where the skirt and top come together, the cap has a gasket 25 secured therein. This gasket is preferably formed in situ within the cap and results from the applying of material in fluid form which, when suitably heated, sets up into the form of a resilient gasket and is adhered to its seat within the cap. As seen, the gasket extends part way in beneath the top of the cap at 26 and part way down the skirt of the same to the position 27. An important aspect of this gasketing resides in the fact that as the fluid material out of which the gasket is made is flowed across the rounded portions 14 and 15 of the internal scores, a certain amount of it flows into those scores, as shown at 18 in FIG. 7, completely fills them and thus blocks them off against any possible leakage path along the scores behind the gasket. The uniformity of the scores at the positions 14 and 15 as well as the score portions joining up with portions 14 and 15 is also instrumental in causing a uniform flowing of the gasket material into the scores to block the same. Were the scores closed up to any extent in any one of such portions, the possibility would always exist of the gasketing material failing to fully enter and fully conform itself to the scores. Accordingly, the cap of the invention possesses the greatest strength and greatest resistance to leakage of any scored cap heretofore devised in lightweight material.

The method by which the cap blank is given the uniform scoring in accordance with the invention, is illustrated in FIGS. 1 through 4. The initial form is a flat blank 26 as shown in FIG. 1. This may be stamped out of a flat sheet as an integral part of the forming operation or may be brought to the forming stage in a blank as seen in FIG. 1. What is significant to note, however, is that the blank is in no way scored while in the flat leaving all of the scoring to be effected along with the forming of the blank into the cap. Turning then to FIG. 2, the blank 26 of FIG. 1 with its outwardly protruding portion 27 is positioned between a pair of forming members in aligned operative relationship, the lower of which forming mem-

bers, referred to hereinafter as the forming anvil, is indicated generally at 30 while the upper annular forming member, referred to hereinafter as the drawing die and indicated generally at 31, is positioned above the blank 26 ready to move the same downwardly over the forming anvil 30. For this purpose the forming anvil 30 has an outer cylindrical surface 32 of the size desired for the interior of the cap while the drawing die 31 has an inner cylindrical surface 33 whose diameter is equal to the diameter of the wall 32 of the forming anvil plus twice the thickness of the blank 26 and leaving enough additional clearance to enable the drawing die to move down over the forming anvil with a blank therebetween and to be thereafter retracted therefrom.

Before turning from FIG. 2, it is to be noted that the forming anvil 30 is provided with a pair of scoring knives 34 and 35 extending outwardly from the cylindrical surface 32 thereof to the extent needed to effect the desired scoring in the cap. The knife portions 34 and 35, clearly shown in FIG. 3, continue at their upper ends in rounded portions 36 and 37 which are accurately aligned with and continue into parallel knife portions 38 and 39. The portions 38 and 39 extend across and project up from the otherwise flat top 40 of the forming anvil 30. These knife portions have uniform cross-sectional shape throughout, are accurately aligned and are continuous for each knife. They may be provided in various manners as would readily suggest themselves to one skilled in the art, but for the present and for the consideration of the method involved, it is only necessary to appreciate that they are formed on the forming anvil and project outwardly therefrom.

Referring in greater detail to FIGS. 3 and 3A, it will be seen that the drawing die 31 has moved down to an intermediate position where first its bottom flat face 41 and then its rounded entrance surface 42 extending from the face 41 to the inner surface 33 has engaged the upper surface of the blank 26 and has turned the peripheral portion 43 of that blank around the rounded edge 44 where the side wall 32 of the forming anvil turns into the top 40 thereof. Thus the peripheral portion 43 of the blank has been moved down towards a vertical position with the intermediate portion 45 between the top and the portion 43 of the blank being turned down around the rounded surface 44 of the forming anvil. This takes place uniformly around the blank but at the position where the blank is drawn down over the rounded portions 36 and 37 of the scoring members and down along the skirt portions 34 and 35 thereof, it will be seen that as the skirt is moved downwardly it is at the same time slid down over the scoring knives and forced inwardly in the course of that downward sliding. This then causes a scoring of the interior of the skirt 43 at the same time as the skirt 43 is formed out of the flat blank. Thus, the scoring will take the exact conformation of the scoring knives and as the formation of it proceeds, it will maintain the uniformity of the scoring knives.

This action will continue as the downward drawing of the peripheral portion 43 continues until that is completed. Then, as the final stage, the scoring across the top of the cap only merely commenced up to this stage, will be effected as the center portion 46 of the drawing die 31 contacts the upper surface of the blank 26. The formation of the score portions 16 and 17 may be effected just prior to, during, or just after the forming and scoring of the skirt depending on the particular die design employed. Of primary importance is the fact that once the simultaneous forming and scoring of the skirt occurs at any given point such as shown in FIG. 3A, there is no subsequent movement or flexing of that portion of the thin layer of metal 48 lying behind the score. In addition the wiping action imparted to the metal lying in back of the score during the formation thereof does not have the hardening effect which results when the prior art blank is scored in the flat. It can readily be appreciated

that any brittleness in the scored area such as results from hardening in prior art methods is a detriment.

In the particular securing of the cap after the gasket has been applied as seen in FIG. 7, the only real deformation imparted to its skirt is that which takes place where the lower portion is deformed at 49 so as to make it lie tightly within the neck recess 50. This may well have the effect of deforming the metal in the back of the score at the position where the scored skirt portion is forced inwardly. However, as against the prior art practices, this metal in back of the scored portion has not been previously deformed so it readily withstands the deformation involved in the securing. In the prior art constructions on the contrary, this is the portion of the cap score which has had the metal of the score in back of the actual scored channel deformed the most. Accordingly the further deformation needed to secure the cap seal in place by an inward beading as at 49 could well under the prior art practices cause fracture of the skirt at the score. Such fracture or incipient fracture due to weakened condition obviously materially detracts from the holding power of the cap and from its ability to stay in place when the cap is subjected to strong internal pressures. The cap of the invention however retains adequate strength in the inwardly beaded portion 49 and since little or none of the rest of the score is deformed at all—not having been deformed in manufacture—the cap is a strong fully effective one.

It can be readily seen that besides providing a greatly improved closure cap, the instant invention discloses a method for making closures from which flow advantages in terms of economy and manufacturing efficiency of substantial importance. The closure cap so formed is characterized by the complete absence of fracturing or weakening of the thin layer of metal in the skirt lying behind the score line. It has been found that even though the skirt of the cap is severely deformed in the application of the cap to a container neck, the cap will remain fully effective due to this structural improvement. Furthermore the ease with which the closure cap of the invention can be torn off of a container neck is greatly enhanced since a relatively deep score can now be made in the metal without fear of detrimental weakening at this point. Such features make this closure particularly well-suited for the capping of beer or soft drink bottles where substantial internal pressures are present and ease of opening is an essential requirement.

From the foregoing description, it will be apparent that although a single embodiment has been shown and described the invention is not necessarily limited thereby but encompasses also such other embodiments as might suggest themselves to one skilled in the art. It is accordingly to be understood that the foregoing description of the invention, taken in conjunction with the accompanying drawing, is to be construed in an illustrative and not a limiting sense.

Having described my invention what I claim is new and seek to obtain Letters Patent for is:

1. The method of manufacturing lightweight metal 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 blank having a substantially circular periphery but with an ear extending outwardly from said periphery for a portion of the same, supporting a circular central portion of said blank, forming an annular peripheral portion surrounding said central portion laterally with respect to said supported center portion, and simultaneously with said forming, scoring said lateral portion with a continuous score extending from the free end edge of said lateral portion throughout the extent of the same.

2. The method as in claim 1 and including engaging said laterally extending peripheral portion on its outer surface forming the same downwardly from the flat into

a direct lateral extension commencing the scoring of said lateral portion at the position where the same departs from said supported center portion and progressively scoring said lateral portion down from said commencement thereof to the free end edge thereof as said lateral portion is formed out of said annular peripheral portion.

3. The method as in claim 2 and including scoring said circular central portion with a continuous score extending across said central portion from the position where said lateral scoring terminates at the juncture of said central portion and said annular peripheral portion.

4. The method of manufacturing lightweight metal 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 the steps of forming a blank having a substantially circular periphery but with an ear extending outwardly from said periphery for a portion of the same, drawing an annular peripheral portion of said blank laterally from the plane of said blank while supporting the center circular portion of said blank, and simultaneously with said forming, scoring said lateral portion with

a continuous score extending from the free edge of said lateral portion throughout the extent of the same.

5. The method of forming a cylindrical member out of lightweight sheet metal, said cylindrical member having a closed integral end portion and an internal score mark extending the length of and parallel to the cylindrical axis of said member which comprises providing a blank of sheet metal, supporting a central portion of said blank, moving an outer portion of said blank to a position extending laterally away from said central portion and simultaneously with said movement progressively imparting a score mark to said outer portion as said outer portion moves from the plane of said central portion to its lateral position.

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