

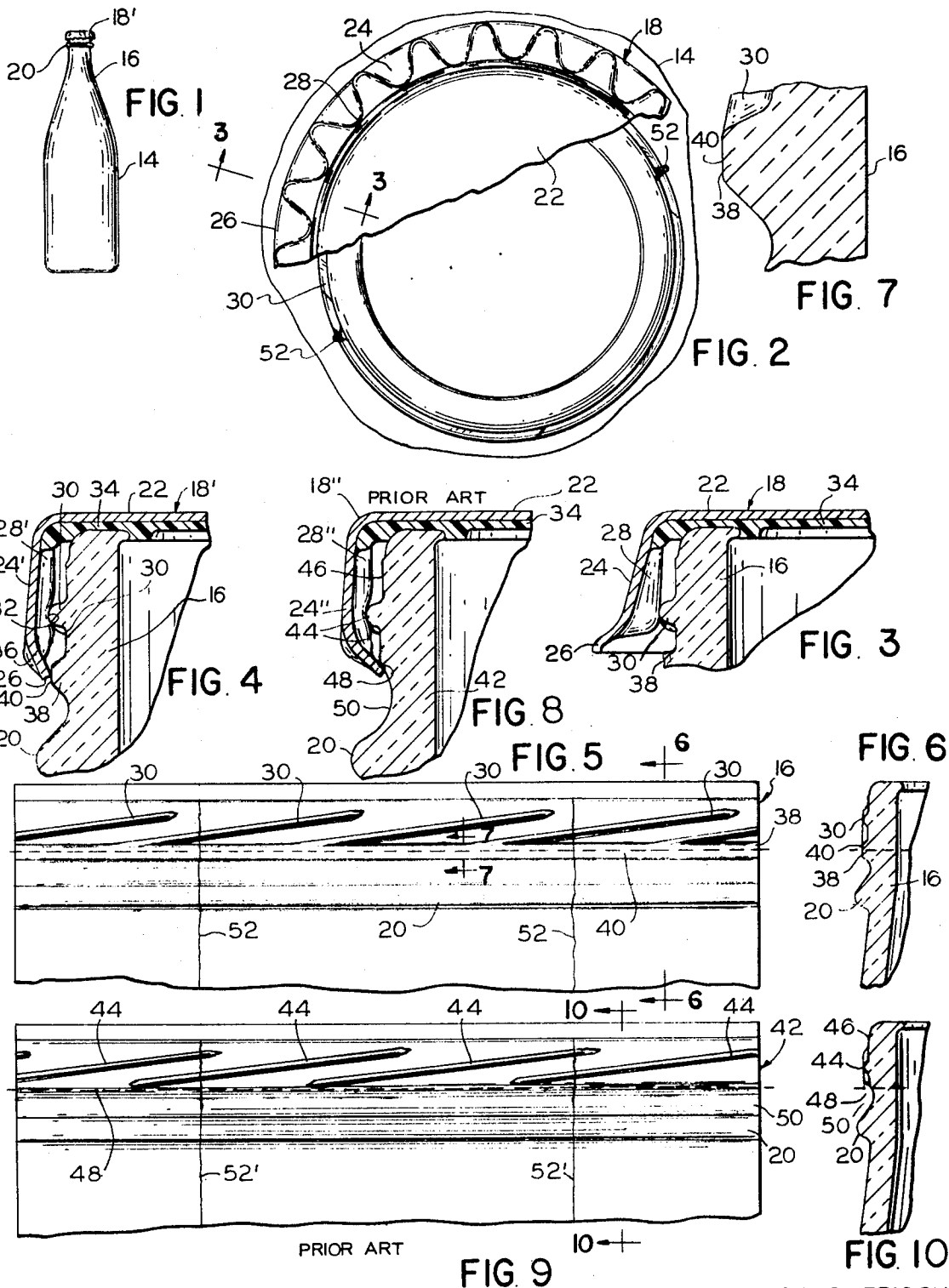
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BOTTLE STRUCTURE FOR CRIMP ON-TWIST OFF CAPS

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5 Claims

ABSTRACT OF THE DISCLOSURE

A bottle has its neck portion provided with a multiple thread structure which will receive and hold a pressure applied crown or crimp on type metal cap and which will enable the cap to be more easily twisted off than prior constructions. The lower part of the thread structure terminates in an outwardly projecting circumferential ring having an outer cylindrical surface substantially parallel to the axis of the neck of the bottle. The outer diameter of this ring is substantially equal to the outer diameter of the threads and is positioned on the neck so that the lower edge of the cap contacts the mid portion of this surface. Also the ridges of the mold parting lines on the bottle neck are positioned so that each crosses one thread only near the lower end of the thread.

BACKGROUND OF INVENTION

Glass bottles provided with metal crimp on and twist off caps are in widespread commercial use, particularly for bottled beer. The caps are of the pressure applied crown type having a top portion which fits and forms a closure and seal for the open end of the neck of the bottle and a downwardly extending flange or rim portion which is crimped around the upper portion of the neck by applying pressure through an annular crimping die moved axially downwardly around an uncrimped cap on the top of the neck of the bottle. Such caps differ materially in construction and operation from the more easily deformed spin on caps previously employed on threaded bottle necks and present different problems.

The prior art bottles for crimp on and twist off caps are provided with a multiple thread structure molded on the exterior surface of the upper portion of the neck of the bottle. This thread structure usually includes four threads projecting radially outward from the surface of the neck so that this surface defines the root diameter of the threads. The threads are spaced from each other and each thread extends helically part way around the neck in overlapping relationship with the two adjacent threads.

The flanges or rims of the bottle caps have a plurality of circumferentially spaced inwardly displaced deformable portions positioned to engage the threads on the bottle neck when the rims of the caps are crimped. Short groove sections corresponding to and fitting the threads are formed in these deformable portions during the rim crimping operation. The groove sections are helically aligned along the threads and enable the caps to be removed by twisting them relatively to the bottle neck.

It has been considered desirable in prior art constructions to provide a thread structure on the bottle neck which results in the lower edge of the rim of the cap being crimped radially inwardly below the lower end of the threads to an extent that the resulting internal diameter of the edge of the rim is at least as small as the root diameter of the threads. This internal diameter of the edge of the rim is thus substantially smaller than the outer diameter of the threads.

The necks of the bottles have also been provided with an annular groove providing a surface tapering down-

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wardly and inwardly from the cylindrical surface of the neck upon which the threads are molded. The upper edge of this tapered surface has been positioned just below the lower ends of the threads so as to form at the lower ends of the threads a continuation of the lower side surfaces of the threads. This tapered surface insures that the lower edge of the rim of a cap can be crimped under the lower ends of the threads.

The structure just described is intended to provide an initial positive locking action which can be readily overcome when the cap is twisted off, but prevents accidental untwisting of the cap during handling and shipment of the filled and capped bottles. It has, however, been found impossible to maintain the close tolerances required during both the manufacture of the bottles and the manufacture of the caps to consistently produce this result. The actual result is that a substantial percentage of the applied caps are very difficult to remove by a twisting action. This is primarily because the lower edge of these caps are effectively clinched under the upper edge of the tapered surface referred to above.

Even if the lower edge of the rim of the cap is not clinched under the upper edge of the tapered surface referred to above, the crimping of the lower edge of the rim to a lesser diameter than the external diameter of the threads, requires that portions of this rim must be bent outwardly to clear the threads at the beginning of the untwisting operation. This requires the application of substantial torsional force in addition to that required for breaking the static friction bond between the threads on the bottle and the deformable portions of the cap. The resilience of these outwardly bent portions of the rim also causes them to grip and drag along the outer surfaces of the threads to resist turning of the cap relative to the neck of the bottle after the initial starting of the untwisting of the cap.

In addition bottle molding procedures always produce ridges referred to as mold parting lines which project radially outwardly from and extending along diametrical opposed portions of the bottle including the neck. These mold parting lines extend across and project outwardly from the outer surfaces of the threads of the thread structure and terminate just short of the upper end of the neck. Prior bottles have been molded with these mold parting lines extending across all of the threads on a bottle. Thus each mold parting line crossed a thread near the lower end of one thread and crossed an adjacent overlapping thread near the upper end of that thread. The mold parting lines have not been positioned near the centers of the threads in order to avoid any possibility of forcing a projecting ridge of a mold line into one of the deformable portions of the rim of the cap during the crimping operation and thus further locking the cap on the neck of the bottle. These mold parting lines near the upper ends of the threads, however, also resist untwisting of the cap.

The thread fitting grooves formed in the deformable portions of the cap during crimping of the rim of the cap are circumferentially discontinuous. As the grooved deformable portions of the cap are successively dragged over a mold parting line across the upper end of a thread during a cap removing operation, they are successively forcibly cammed outwardly or deformed to further discontinuously impede twisting of the cap. These ridges across the threads are of variable size and shape on different bottles and the result of all of the factors discussed above, is that the twist off characteristic of crimped on and twist off caps have been extremely erratic. Some of them from even the same capping machine have been relatively easy to twist off and others extremely difficult to even start.

3 SUMMARY

In accordance with the present invention it has been found unnecessary to clinch the lower edge of the rims of crimp on and twist off bottle caps below the lower ends of the threads on the bottle neck in order to prevent accidental untwisting of the caps during handling and shipping of the filled bottles. In order to prevent such clinching the neck of the bottle is provided with a circumferential ring extending around the neck of the bottle at the lower end of the threads on the bottle neck.

The circumferential ring has an external diameter substantially equal to the outer diameter of the threads and has an outer substantially cylindrical surface of substantial width. It is positioned on the neck of the bottle so that the lower edge of the crimped rim of the cap engages this surface and is thus prevented from being crimped to an internal diameter substantially less than that of the outer diameter of the threads. No spreading of any portions of the crimped rim of the cap to a larger diameter is necessary during the initial movement of the cap.

Initiation of the twisting off of the cap is therefor much easier than with prior bottles and the edge of the rim does not produce any significant amount of frictional resistance to twisting of the cap after rotation of the cap on the neck of the bottle has once been started.

The threads preferably have their lower ends merged into the circumferential ring to provide smooth continuous surfaces over which the rim of the cap moves during the removal of the caps and to prevent any possible crimping of any portion of the cap below the lower end of a thread.

The mold parting lines are positioned on the bottle so that they cross one thread only and this crossing is sufficiently near the lower end of the thread that it is below any possible area of contact between a thread and one of the inwardly displaced deformable portion of the rim in which the threads form grooves during crimping of the rim.

With the structure of the present invention, none of the thread engaging displaced portions of the rim ever have to pass over a ridge formed on the top of a thread by a mold parting line. The edge of the rim does have to pass over one of these ridges on the lower ends of each of two of the threads of the bottle of the present invention, but this happens immediately after the initial breaking of the frictional bond between the cap and bottle due to the crimping of the cap on the neck of the bottle and produces no effect which is felt by the person removing the cap. That is to say, a torsional force is resiliently exerted on the cap by the hand of the person removing the cap until the cap snaps loose to not only break the friction bond but to carry the rim over the ridges of the mold parting lines. The cap can then be easily and smoothly unscrewed from the bottle neck with a minimum of effort in contrast to the prior bottle constructions in which the rim of the cap resiliently grips the tops of the threads during the remainder of the cap removal operation, and this smaller diameter rim as well as the grooved thread engaging portions of the cap must be forced over mold parting line ridges on the upper ends of the threads.

The static frictional bonding force between the crimped rim of the cap and the bottle neck has been found entirely adequate to retain the cap on the filled bottles even though the force to break this bond is much less than that required to expand portions of the rim of the cap to a larger diameter as well as break the similar bond in prior constructions. Also the ease and smoothness of the remainder of the cap twisting off operation is in marked contrast with the prior construction discussed above.

It is therefore an object of the present invention to provide an improved thread structure for crimp on and twist off bottle caps which enables the caps to be applied in a known manner so as to remain securely in position, and

also enables the caps to be more easily and smoothly removed by a twisting operation.

4 BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side elevation of a bottle with a metal crimp on and twist off cap crimped on the neck of the bottle;

FIG. 2 is a much enlarged plan view of a bottle cap in position to be crimped on the bottle neck and partly broken away to show the thread structure of the bottle neck;

FIG. 3 is a fragmentary vertical elevation of the cap and bottle neck taken on the line 3—3 of FIG. 2;

FIG. 4 is a view similar to FIG. 3 showing a portion of the cap and bottle neck after crimping of the cap on the bottle neck;

FIG. 5 is a developed elevational view of the upper portion of the bottle neck of FIGS. 3 and 4 on a reduced scale, showing the thread structure of the present invention;

FIG. 6 is a fragmentary vertical section taken on the line 6—6 of FIG. 5;

FIG. 7 is a fragmentary vertical section on a further enlarged scale taken on the line 7—7 of FIG. 5, showing the form of the circumferential ring of FIGS. 3, 4, 5 and 6 in greater detail;

FIG. 8 is a view similar to FIG. 4 showing a prior art structure;

FIG. 9 is a view similar to FIG. 5 showing a developed elevation of the prior art thread structure of FIG. 8; and

FIG. 10 is a vertical section taken on the line 10—10 of FIG. 9.

DESCRIPTION OF PREFERRED EMBODIMENT

A bottle 14 in accordance with the present invention is shown in FIG. 1 having a neck portion 16 and a crimped on and twist off cap 18' crimped on the upper portion of the neck 16 above the usual reinforcing ring 20 molded on the outer surface of the neck of the bottle. The cap 18' prior to crimping on the neck of the bottle is shown at 18 in FIGS. 2 and 3, and is of conventional form employed in prior art structures having crimped on and twist off caps.

The cap 18 of FIGS. 2 and 3 is made of thin deformable sheet metal and has a central circular portion 22 of flat disc form surrounded by a rim portion 24 in the form of a downwardly extending flange. The rim 24 is flared outwardly as well as extending downwardly and terminates in a further outwardly flared and downwardly extending peripheral edge portion 26. The intermediate portion of the rim 24 has a plurality of inwardly displaced deformable portions 28 which are positioned to engage threads 30 molded on the upper portion of the neck of the bottle as shown in FIG. 3. The deformable portions 28 of FIG. 3 are deformed by the threads 30 during the cap applying or rim crimping operation into grooved portions 28' shown in FIG. 4. Thus the deformation takes the form of impressing a groove increment 32 extending helically across the inner face of each of the deformable portions 28 which is engaged by a thread 30 to provide a helically aligned series of thread receiving groove increments for each thread, enabling the crimped on cap to be twisted off the end of the bottle.

The interior of the cap 18 of FIGS. 2 and 3 conventionally contains a sealing element 34 extending over the interior surface of the top portion 22 and engaging the top edge of the neck of the bottle. During the crimping operation, the top of the cap including the sealing element is pressed against the upper edge of the neck of the bottle. The neck has a smooth upper surface free of mold parting line ridges discussed below so that the neck of the bottle is securely sealed. In addition to forcing the threads 30 of the bottle neck into the deformable portions 28 to produce the groove increments 32, the crimping die also deforms the lower edge portion 26 of the cap by displacing spaced portions of the lower rim portion 26 inwardly to

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form notches 36 shown in FIG. 4 to thus shorten the diameter of the rim portion of the cap to cause it to tightly engage the neck of the bottle.

As shown in FIGS. 3 to 7 inclusive, the neck of the bottle of the present invention is provided with circumferential ring 38 of the form shown most clearly in FIG. 7. Thus this ring has a cylindrical outer surface 40 with substantially the same outer diameter as the outer diameter of the threads 30. The circumferential ring 38 is positioned a distance from the upper edge of the neck of the bottle substantially equal to the length of the flange of the rim 24 so that the edge of the lower edge portion 26 of the crimped cap 18' engages the surface 40. This prevents the lower edge of the flange 24 of the cap 18' from having a smaller diameter than the outer diameter of the threads 30. As shown most clearly in FIG. 5, the threads 30 merge into the ring 38 so that, in conjunction with the outer surface 40 of this ring, they provide a smooth surface for the lower edge of the flange 24 during the twisting of the cap as it is being removed from the bottle neck. The static friction bond produced by engagements of the deformed portions 28' of the rim of the cap 18' securely holds the cap in position on the neck of the bottle but this bond is relatively easily broken and the cap can be rapidly and smoothly unscrewed from the rest of the neck of the bottle.

The above described structure is to be contrasted with the prior art structure shown in FIGS. 8, 9 and 10, in which a cap of the type 18 shown in FIGS. 2 and 4, is crimped into the cap 18'' on a bottle having a prior art type of neck 42. The neck 42 has a thread structure with threads 44 which differs from the threads 30 of FIGS. 3, 4 and 5, as will be described more at length below, and is not provided with a circumferential ring 38. Instead the surface 46 on the bottle neck defining the root diameter of the threads 44 merely terminates adjacent the lower ends of the threads 44 at the edge of a downwardly and inwardly inclined surface 48 forming part of a groove 50 between the surface 46 and the reinforcing ring 20.

As shown in FIG. 8 the lower edge of the rim or flange portion 24'' of the crimped cap 18'' is crimped inwardly over the lower ends of the threads 44 so that the lower edge of the flange has an interior diameter substantially equal to that of the root diameter of the threads 44. In fact the usual failure to retain tolerances in molding the neck 42 of the bottle and in manufacturing and pressing the cap upon the bottle neck 42, cause the lower edge of the rim 24'' of some of the crimped caps to extend over the lower edge of the surface 46 and be clinched radially inwardly against the inclined surface 48 of the groove 50 referred to above. This makes it very difficult to initiate the untwisting of the cap 18'', since to do so that internal diameter of the lower edge portion of the cap must be enlarged by bending of this lower portion of the flange outwardly. Even if the lower edge of the flange does not extend into the groove 50 so as to be clinched against the inclined surface 48, portions of the lower edge portion of the flange must be initially bent outwardly to a diameter large enough to pass over the threads 44, i.e. to a diameter at least as large as the outer diameter of the threads 44. This requires considerably more force than it does to start the cap 18' of FIG. 4.

Even after enough initial force has been applied to the cap 18'' of FIGS. 8, 9 and 10, to not only expand the lower end of the flange 24', but also to break the friction bond between the threads 44 and the deformed portion 28'', the lower edge of the rim 24'' resiliently engages the outer surfaces of the threads 44 and considerably more force must be continuously applied to complete the removal of the cap from the neck of the bottle than is required for the cap 18' of the present invention shown in FIG. 4.

There is a further factor which results in easier removal of the cap 18' of FIG. 4. Glass bottles, in general, have a pair of radially outwardly projecting ridges extend-

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ing longitudinally along diametrically opposite portions of the circumferential surface of the bottle. These ridges on the bottle of the present invention are shown at 52 in FIGS. 2 and 5. As shown in FIG. 5, the ridges 52 cross one of the threads 30 only and that this crossing is adjacent the lower end of such threads. These ridges result from the necessity of using a multiple part mold for the bottle mold. The structure of FIG. 5 in which the mold parting line ridges cross one thread only is contrasted with the prior structure of FIG. 9 in which the mold parting line ridges 52' each cross two of the threads 44. These mold parting line ridges 52 in the structure of FIG. 5 are positioned to miss the upper ends of the threads 30 while still crossing the lower ends of the adjacent threads sufficiently close to the lower edge of the rim 24' of the cap 18' of FIG. 4 that none of the deformed portions 28' of FIG. 4 are in contact with the thread 30 below or at the point of crossing of the ridge 52. The result is that none of the deformed portions 28' containing the grooves 42 have to be moved over one of the ridges 42, which ridges frequently project substantial distance from the top of the threads 30.

The lower edge of the flange 24' must, however, be moved over the ridges 52 where they cross the lower end of two of the threads 30. The portion of the thread 30 crossed by the ridges 52 are, however, sufficiently close to the lower ends of the threads and of the lower edge of the rim 24' of the crimped cap, that the breaking loose of the cap in the initial portion of the untwisting operation causes the resilient reaction of the hands of the user to carry the rim of the cap past the ridges 52. These two forces required to produce these two actions are not applied simultaneously and therefore are not additive, although the movement of the rim over the mold parting line ridges appears to the person removing the cap to be part of the original breaking of the friction bond between the deformed portions 28' of the cap and the threads 30. The cap can thereafter be smoothly and easily further unscrewed from the neck of the bottle without any catching or irregularities in the movement of the cap. This is contrasted with the structure of FIG. 9 of the prior art in which a plurality of the grooved portions 28'' of FIG. 8 must be moved across the mold parting line ridges 52' where they cross the upper portions of the threads 44.

As a result of the structure of the present invention, the ease with which a cap which securely seals the bottle can be removed from the bottle of the present invention in marked contrast to that of the prior art structures.

We claim:

1. In a closure structure for the opening in the top of the neck of a bottle;

a crimp on and twist off cap formed of sheet metal having a top closure portion and a downwardly extending flange portion for crimping around the upper portion of said neck in combination with a bottle having a thread structure molded on the outer surface of said neck and including means for preventing clinching of the lower edge portion of said flange portion below said thread structure;

said flange portion being provided with a plurality of similar deformable portions displaced inwardly from the sheet metal of said flange portion and spaced from each other around said flange portion and extending downwardly of and stiffening said flange portion between said top portion and said edge portion;

said thread structure including a plurality of helically extending threads projecting radially outwardly from said neck adjacent the top of said neck and being spaced from each other axially of said neck and extending part way around said neck in overlapping relationship;

said threads being positioned to have their mid portions engaged by said deformable portions to produce

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grooves in said deformable portions in alignment with said threads when said flange is crimped around the upper portion of said neck;

said means for preventing clinching of said lower edge portion of said flange comprising a circumferential ring molded on the outer surface of said neck below said threads with an outer cylindrical surface of substantially the same diameter as the outer diameter of said threads extending axially of said neck and having the lower ends of said threads merging with said surface;

said ring being positioned at a distance from said top of said neck causing the lower edge portion of said flange to be in contact with said surface when said flange is crimped around said neck.

2. The bottle of claim 1 in which mold parting lines in the form of ridges extend axially along diametrically opposed portions of said neck and project radially outwardly from said neck and said threads, each of said mold parting lines crossing one thread only of said plurality of threads at a position adjacent the lowermost end of said one thread.

3. A bottle in accordance with claim 2 in which said thread structure contains four overlapping threads and said mold parting lines are positioned adjacent the upper ends of alternate threads and are spaced from said alternate threads.

4. A bottle having a neck structure for receiving a crimp on and twist off cap with a top closure portion and a downwardly extending rim portion provided with a plurality of circumferentially spaced inwardly displaced deformable portions for crimping around the upper portion of the neck of said bottle; said neck structure comprising:

a multiple thread structure molded on said upper portion of said neck including a plurality of threads spaced from each other and each extending helically part way around said neck and projecting radially outwardly from said neck for producing thread engaging grooves in said deformable portions of said

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rim when said rim is crimped around said upper portion of said neck;

there being mold parting lines in the form of ridges extending axially along diametrically opposed portions of said neck and projecting radially outwardly from said neck and said threads, each of said mold parting lines crossing one thread only of said plurality of threads adjacent the lowermost end of said one thread.

5. The bottle of claim 4 in which said thread structure terminates at its lower end in a circumferential ring extending around and projecting radially outwardly from said neck;

said circumferential ring having an outer cylindrical surface extending axially of said neck and having an outer diameter substantially the same as the outer diameter of said threads;

said circumferential ring being positioned a distance from the top of said neck causing the lower edge of said rim to be in contact with said surface when said rim is crimped around the upper portion of said neck;

the lower ends of said threads merging into said circumferential ring,

said thread structure containing four overlapping threads and said mold parting lines being positioned in spaced relation with respect to the upper ends of alternate threads, but adjacent said upper ends.

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