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(54) **BOTTLE CLOSURES AND CONTAINMENT SYSTEMS**

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USPC ..... **215/246; 215/316**

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(57) **ABSTRACT**

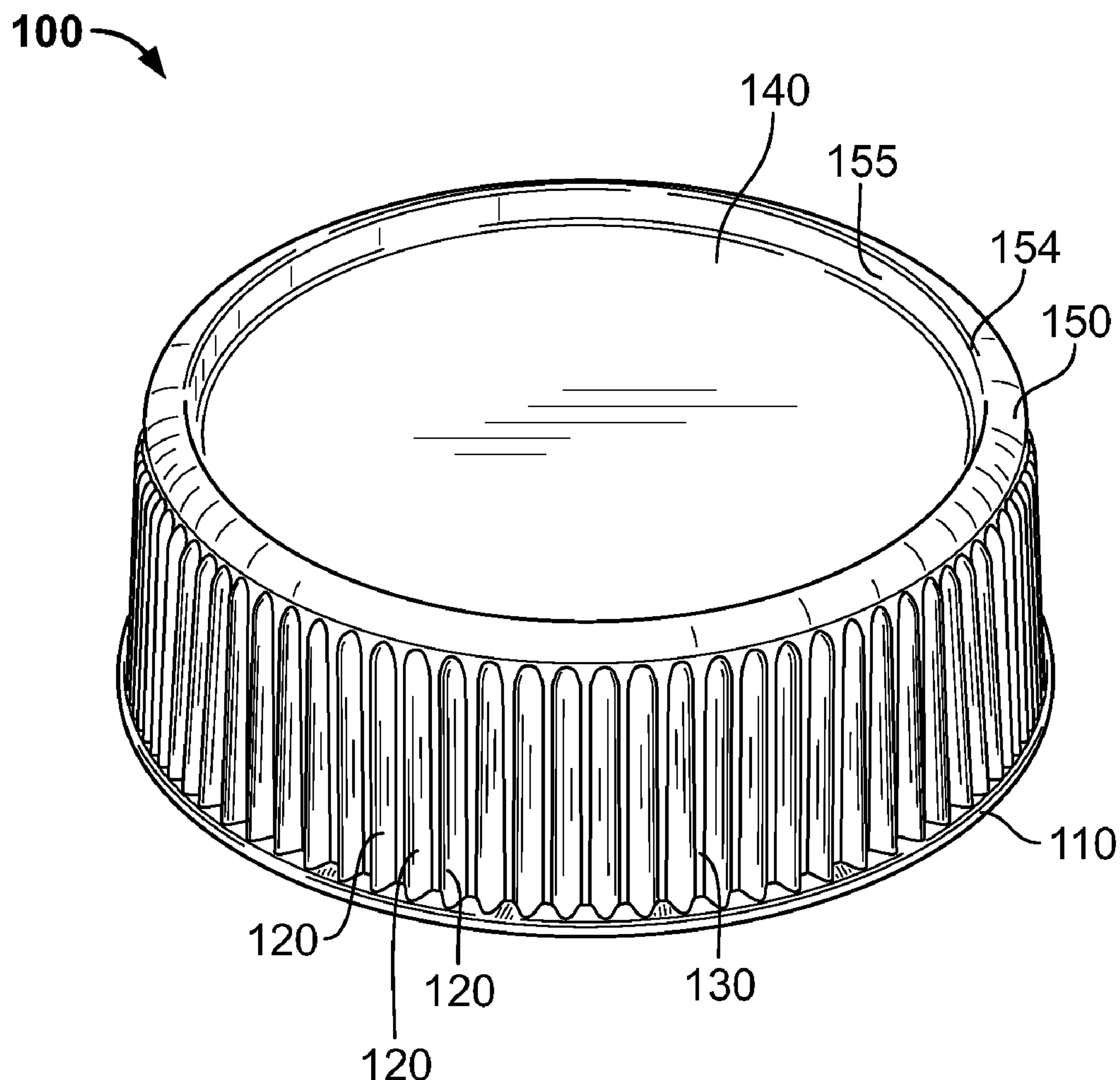
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**B65D 41/24** (2006.01)

According to techniques of the application, a closure includes a sidewall, a plurality of knurls, a top surface, and a rim. The sidewall has an outer surface, about which the knurls are distributed. The top surface is bounded by the sidewall. The rim includes a portion of the sidewall extending above the top surface, a top edge, and an inner surface. The rim has a first curvature having a first curvature radius. The first curvature is convex and extends from the top edge of the rim towards the outer surface of the sidewall. The rim has a second curvature having a second curvature radius. The first curvature radius is larger than second curvature radius.



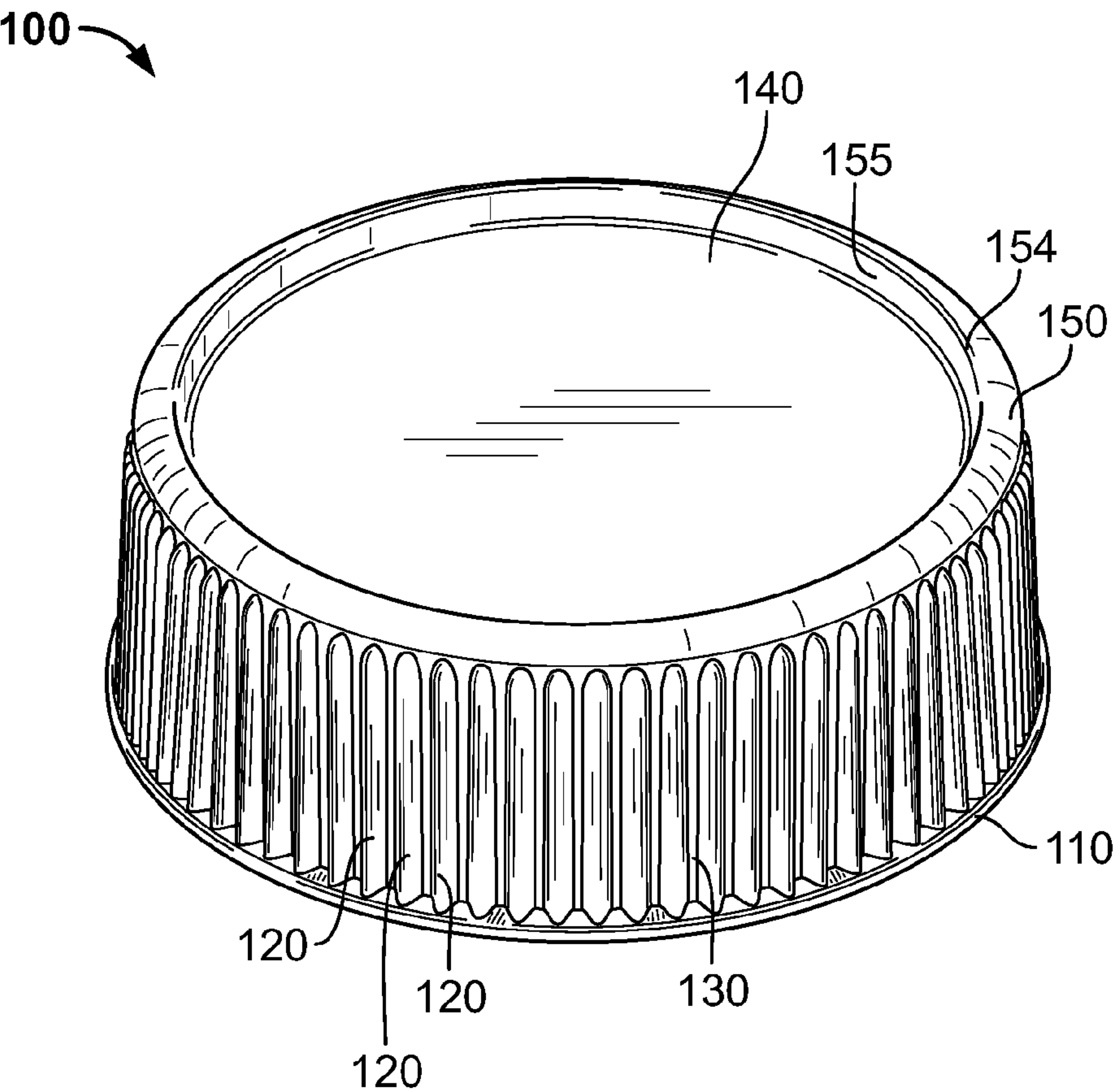


FIG. 1A

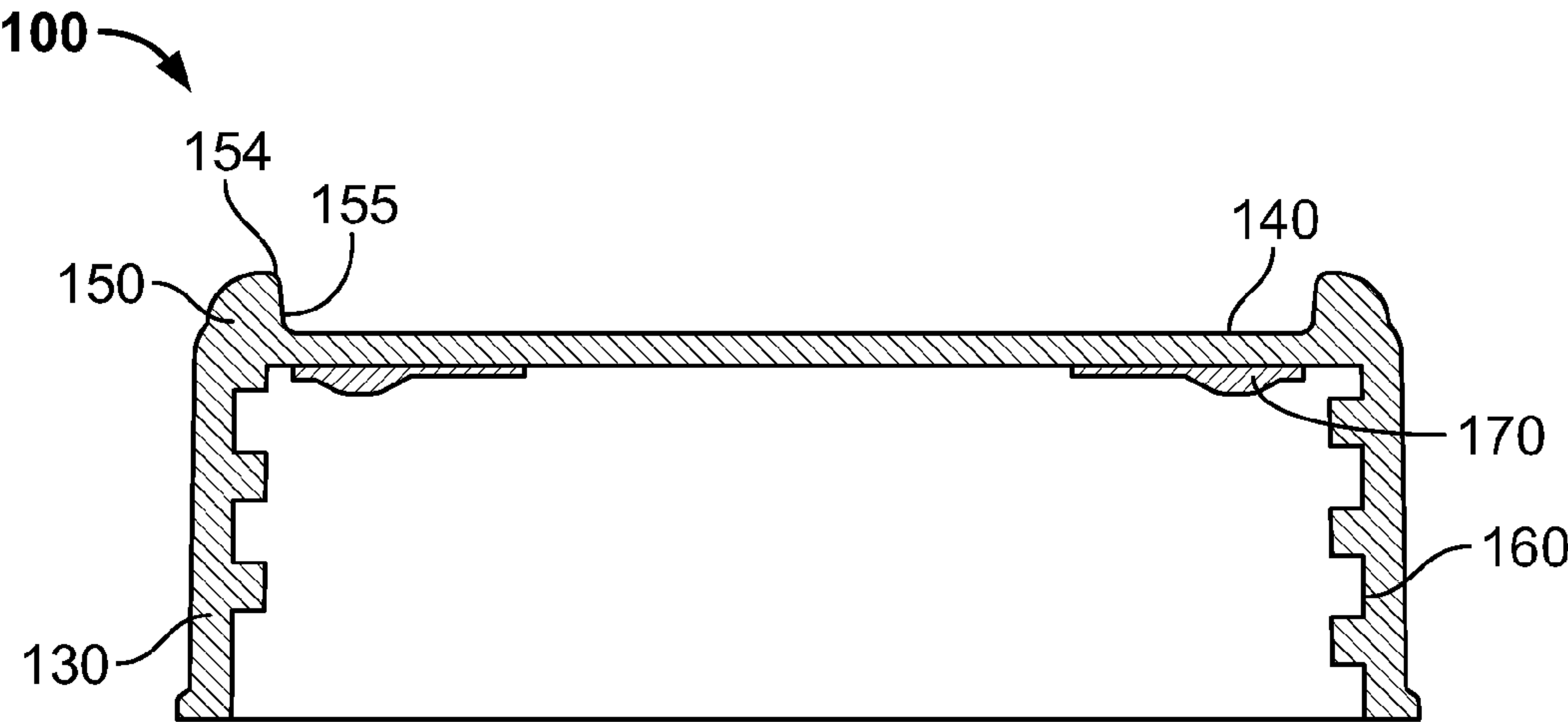


FIG. 1B

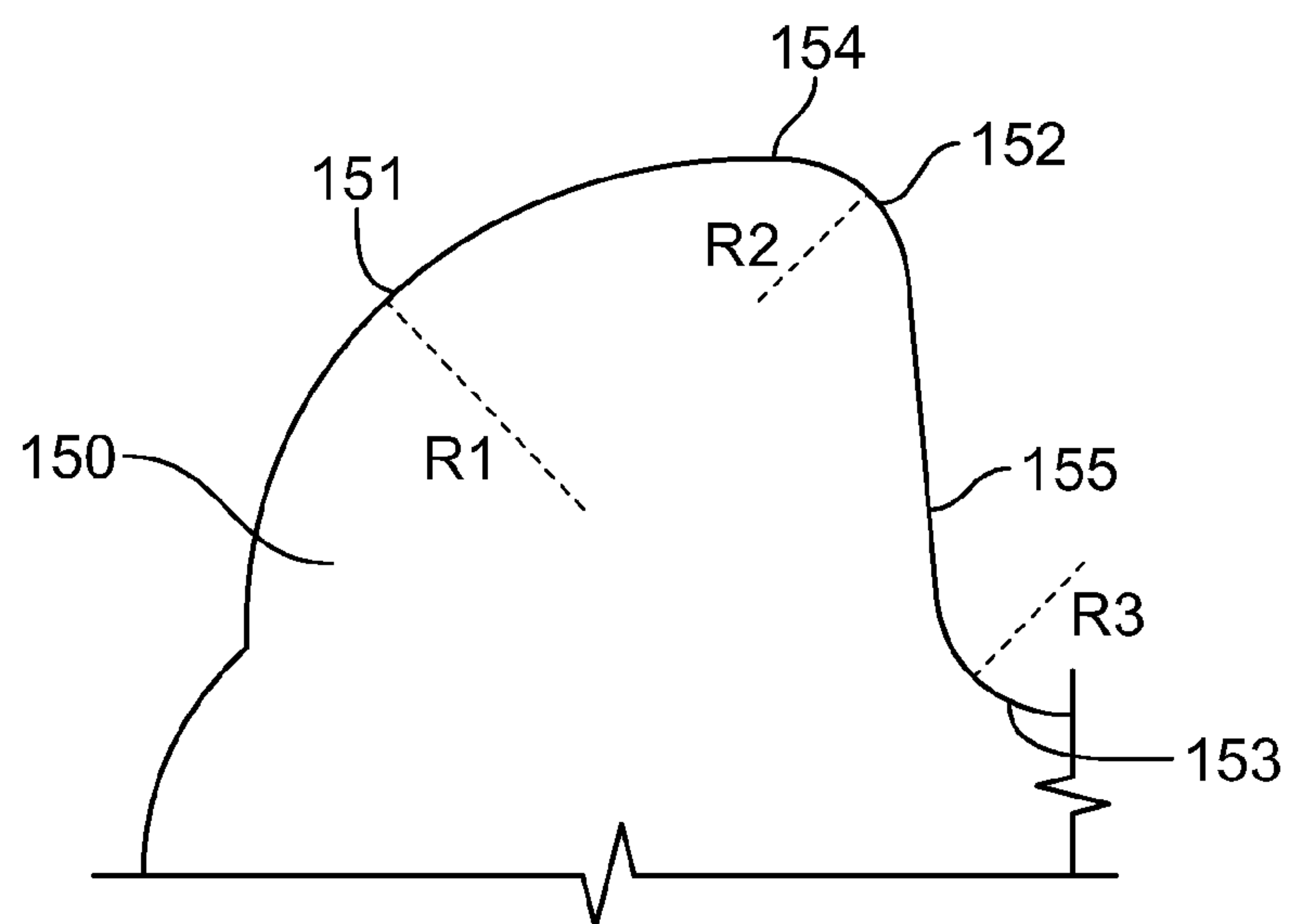


FIG. 1C

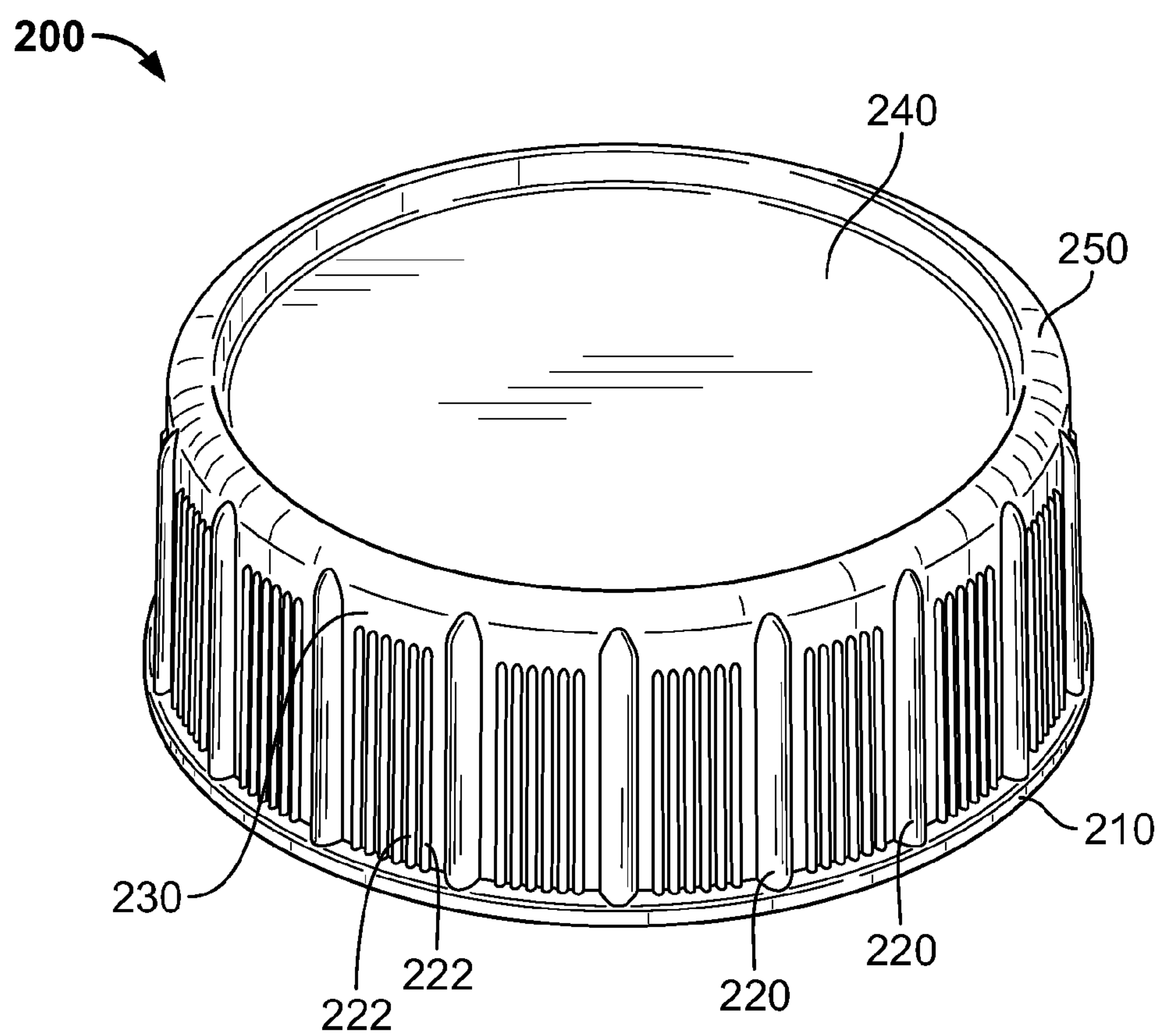


FIG. 2A

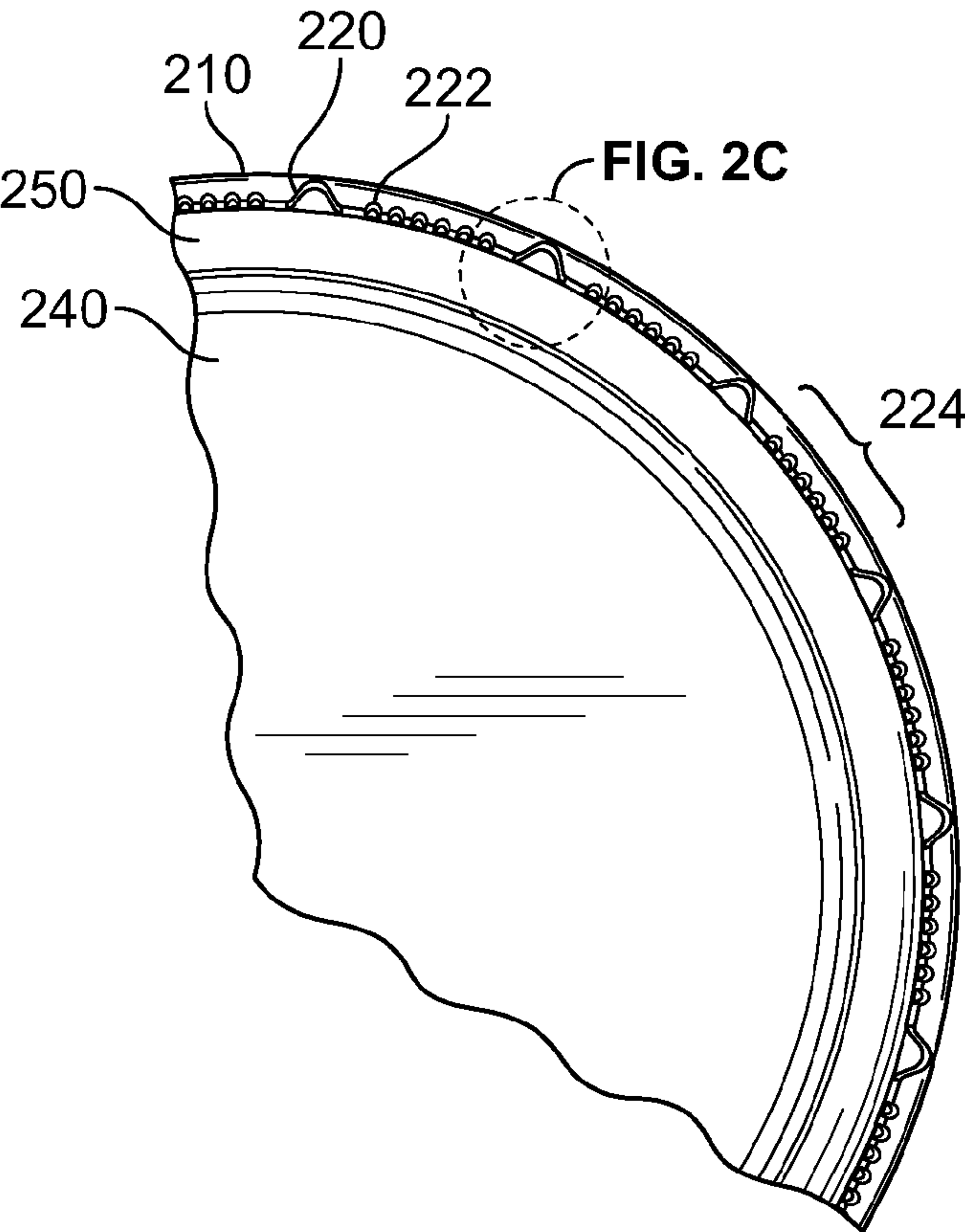


FIG. 2B

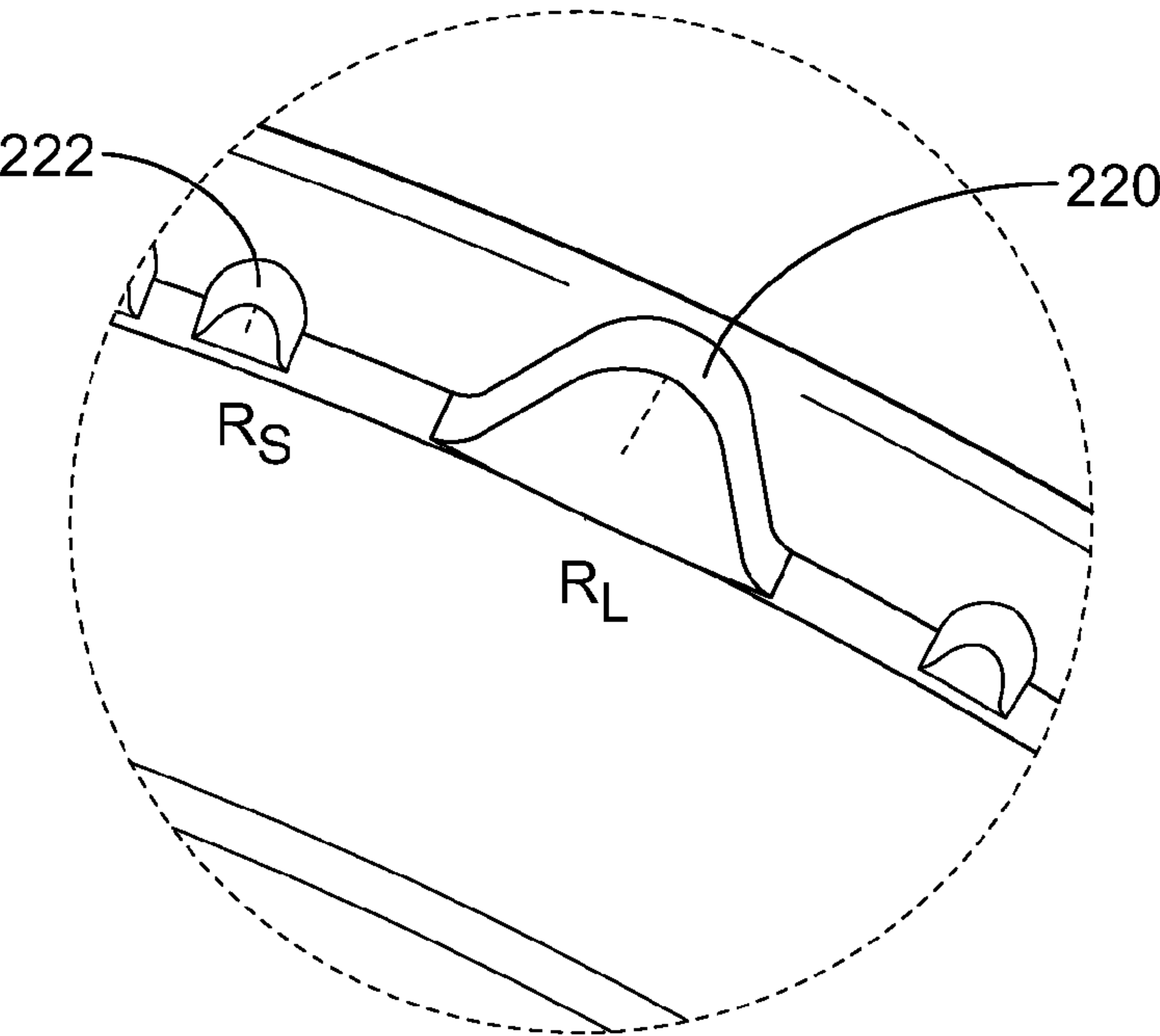


FIG. 2C

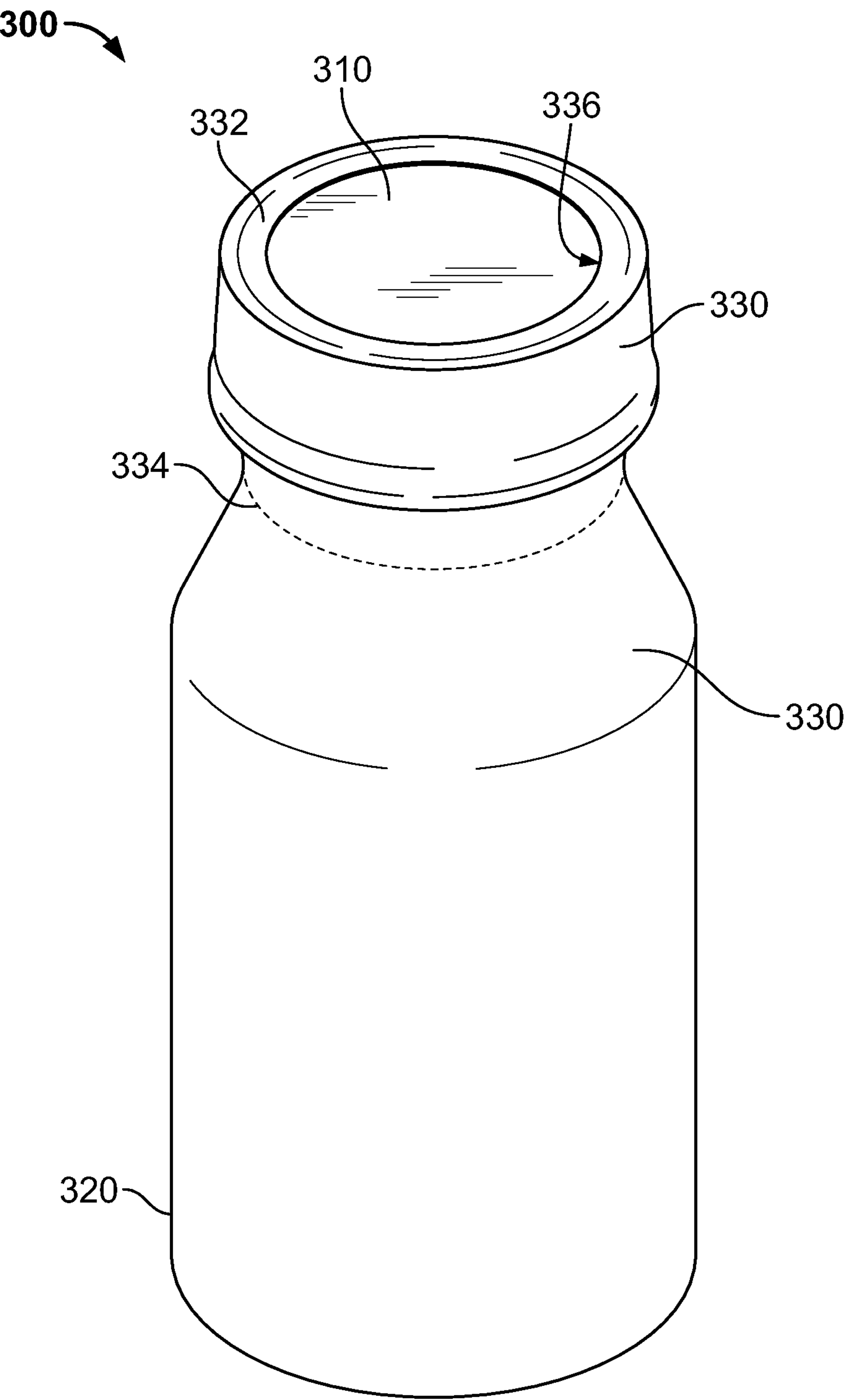


FIG. 3



## BOTTLE CLOSURES AND CONTAINMENT SYSTEMS

### CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

### BACKGROUND OF THE APPLICATION

[0002] Generally, this application relates to closures and containment systems. Existing closures and containment systems may be used to contain products for end users. Often, users prefer to have evidence of whether or not a product has been tampered with. Tamper resistant-films may provide such evidence. Often, these films are applied over a closure and/or bottle by a heat shrinking process.

[0003] It has been observed that some users prefer to first remove the film and then open the closure. Other users prefer to grab the closure and remove it while the tamper-resistant film is still intact. Among the latter group of users, some may prefer to “palm” the top of the closure to open it by placing the palm substantially on top or on part of the top of the closure (as opposed to substantially around the side of the closure).

[0004] There is a need for closures and containment systems that accommodate these and other varying user behaviors and preferences.

### BRIEF SUMMARY OF THE APPLICATION

[0005] Closures and containment systems are provided for accommodating various user behaviors and preferences for opening a product, substantially as illustrated and described in connection with at least one of the figures, as set forth more completely in the claims.

### BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0006] FIG. 1A illustrates a perspective view of a closure, according to techniques of the present application.

[0007] FIG. 1B illustrates a cross-sectional view of a closure, according to techniques of the present application.

[0008] FIG. 1C illustrates a cross-sectional view of a portion of a closure including a rim, according to techniques of the present application.

[0009] FIG. 2A illustrates a perspective view of a closure, according to techniques of the present application.

[0010] FIG. 2B illustrates a top view of a portion of a closure, according to techniques of the present application.

[0011] FIG. 2C illustrates a top view of a portion of a closure, according to techniques of the present application.

[0012] FIG. 3 illustrates a containment system including a closure, a bottle, and a shrink film, according to techniques of the present application.

[0013] The foregoing summary, as well as the following detailed description of certain techniques of the present application, will be better understood when read in conjunction with the appended drawings. For the purposes of illustration, certain techniques are shown in the drawings. It should be understood, however, that the claims are not limited to the arrangements and instrumentality shown in the attached drawings. Furthermore, the appearance shown in the drawings is one of many ornamental appearances that can be employed for the closures and containment systems discussed herein.

## DETAILED DESCRIPTION OF THE APPLICATION

[0014] FIGS. 1A and 1B respectively illustrate a perspective view and a cross-sectional side view of a closure 100, according to techniques of the present application. The closure 100 may include a base 110 and a plurality of knurls 120 distributed around an outer surface of a sidewall 130 of the closure 100. The knurls 120 may be rounded to provide a comfortable and efficient contour for a user to grab or hold to effectively turn the closure 100. The closure 100 may also include a top surface 140 bounded by the sidewall 130. The closure may also include a rim 150. The rim 150 may include a portion of the sidewall 130 that extends above the top surface 140. The rim may also include a top edge 154 and an inner surface 155. A ratio of the height of the sidewall 130 to a height of inner surface 155 of the rim 150 may be between approximately 6:1 and 7:1.

[0015] On its inside, the closure 100 may have female threads 160 and a gasket 170. The female threads may be configured to accept corresponding male threads from, for example, a neck of a bottle. The inside of the closure 100 may also include a gasket 170. The gasket 170 may be applied after the rest of the closure 100 is formed (for example, formed through injection molding). The gasket 170 may be helpful in providing a seal, for example, if the closure 100 and a corresponding mating portion include materials such as high-density polyethylene or polypropylene. The gasket 170 may also be used in conjunction with other types of resins, such as PET.

[0016] FIG. 1C illustrates a cross-sectional view of a portion of the closure 100 including the rim 150, according to techniques of the present application. The rim 150 includes a first curvature 151, a second curvature 152, and a third curvature 153. The curvatures 151-153 may extend circumferentially around the rim 150.

[0017] The first curvature 151 may be convex and have a first curvature radius R1. The first curvature 151 may extend from the top edge 154 of the rim 150 towards the outer surface of the sidewall 130. The radius R1 may be relatively large. This may provide a more comfortable surface on the rim. For example, some users are known to open or close a closure by “palming” the closure. By making R1 relatively large, a more comfortable and efficient rim 150 may be formed, for example, for users who palm the closure 100.

[0018] The second curvature 152 may be convex and have a second curvature radius R2. The second curvature 152 may extend from the top edge 154 of the rim 150 towards the inner surface 155 of the rim 150. The radius R2 may be relatively small as compared to radius R1. For example, the ratio of R1 to R2 may be between 3:1 and 4:1 (for example, 3.5:1). As another example, R1 may be approximately 0.075 inches and R2 may be approximately 0.02 inches.

[0019] As will be further discussed below in conjunction with FIG. 3, a shrink film may be applied to the closure 100. A portion of the shrink film may extend substantially horizontally over the top edge 154 of the rim 150 and towards a center axis of the closure 100 (which is perpendicular to the top surface 140). By making radius R2 relatively small, it may be possible promote a substantially horizontal orientation of the portion of the shrink film that extends over the top edge 154 of the rim 150.

[0020] The third curvature 153 may be concave and have a third curvature radius R3. The third curvature 153 may extend from the inner surface 155 of the rim 150 towards the top surface 140. The radius R3 may be relatively small as com-



pared to radius R1. For example, the ratio of R1 to R3 may be between 3:1 and 4:1 (for example, 3.5:1). As another example, R1 may be approximately 0.075 inches and R3 may be approximately 0.02 inches. The ratio of R2 to R3 may be approximately 1:1. The end portions of the third curvature 153 may align with the inner surface 155 of the rim 150 and the top surface 140. The angle formed between the end portions of the third curvature 153 may be an obtuse angle. This may promote effective removal of the closure 100 from a mold after being formed.

[0021] FIG. 2A illustrates a perspective view of a closure 200, according to techniques of the present application. The closure 200 may be, in certain respects, similar to closure 100. The closure 200 may include a base 210 and a sidewall 230. The closure 200 may also include a top surface 240 bounded by the sidewall 230.

[0022] The closure 200 may also include a top surface 240 bounded by the sidewall 230. The closure may also include a rim 250. The rim 250 may include a portion of the sidewall 230 that extends above the top surface 240. The rim 250 may include similar curvatures, dimensions, and proportions as those disclosed above in conjunction with closure 100.

[0023] The closure may include a first type of knurls 220 and a second type of knurls 222 distributed on the outer surface of the sidewall 230. The knurls 220 or 222 may be rounded. Rounded knurls (for example knurls 220) may provide comfort and efficiency for a user when opening or closing the closure 200. The second type of knurls 222 may be distributed in groups (for example, five knurls 222 per group).

[0024] FIG. 2B illustrates a top view of a portion of the closure 200, according to techniques of the present application. Between each of the first type of knurl 220, there may be a convex region 224 of the outer surface of the sidewall 230. A group of the second type of knurls 222 may be located in the convex region 224. For example, the number of the first type of knurls 220 may be equal to the number of convex regions 224. As another example, the number of the first type of knurls may be equal to the number of groups of the second type of knurls 222.

[0025] FIG. 2C illustrates a top view of a portion of the closure 200, according to techniques of the present application. The first type of knurl 220 may have a convex curvature having a radius  $R_L$ . The second type of knurl 222 may have a convex curvature having a radius  $R_S$ . The ratio of  $R_L$  to  $R_S$  may be approximately between 3:1 and 4:1 (for example, 3.7:1). As an example,  $R_L$  may be approximately 0.022 inches and  $R_S$  may be approximately 0.006 inches.

[0026] FIG. 3 illustrates a containment system 300 including a closure 310, a bottle 320 (including a base and a neck), and a shrink film 330, according to techniques of the present application. The closure 310 may releasably engage (for example, twist or screw to open or close) with the neck of the bottle 320. The closure 310 may be similar to closure 100 or closure 200 discussed above.

[0027] The shrink film 330 may encompass at least a portion of the base of the bottle 320. The shrink film 330 may encompass portions of the bottle and the outer surface of the sidewall of the closure 310. A perforation 334 may separate an upper portion of the shrink film 330 from a lower portion of the shrink film.

[0028] The shrink film 330 may include a flap 332 that extends horizontally over the top edge of the rim and towards a center axis of the closure 310 (which is perpendicular to the top surface of the closure 310). The flap 332, the inner surface

of the rim of the closure 310, and the top surface of the closure 310 may form a cavity 336. The cavity 336 may be sized to accommodate a user's fingertip or fingernail. This may facilitate the user's attempt to remove the portion of the shrink film 330 that encompasses the closure 310 (for example, the portion of the shrink film 330 that is above the perforation 334). Additional perforations (not shown) may further facilitate the user's effort to remove the upper portion of the shrink film 330. For example, vertical or diagonal perforations may extend from the flap 332 down to the perforation 334. The shrink film may also include a pull tab on or around the flap 332 to facilitate removal of the shrink film 330.

[0029] Different users may attempt to open the containment system 300 in different ways. For example, some users may first peel away the upper region of the perforation and then unscrew the closure. Other users may grab the shrink film 330 around the closure 310 and twist so that the closure 310 opens and the shrink film 330 is removed during one process. Some users may palm the top of the closure 300, either before or after the shrink film 330 has been removed.

[0030] The shrink film 330 may relatively snugly fit to the contours formed by the knurls (for example, knurls shown in closure 100 or closure 200) on the outer surface of the closure 300. The shrink film 330 may also relatively snugly fit over the first curvature of the rim of the closure 300. The combination of knurl shape, rim curvatures, and the flap 332 of the shrink film 330 may provide a user with numerous options for opening and closing the containment system 300, either before or after the shrink film 330 has been removed from the closure.

[0031] It will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the novel techniques disclosed in this application. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the novel techniques without departing from its scope. Therefore, it is intended that the novel techniques not be limited to the particular techniques disclosed, but that they will include all techniques falling within the scope of the appended claims.

1. A closure comprising:

a sidewall including an outer surface;

a plurality of knurls distributed around the outer surface of the sidewall;

a top surface bounded by the sidewall; and

a rim including:

a portion of the sidewall extending above the top surface, a top edge,

an inner surface,

a first curvature comprising a first curvature radius, wherein the first curvature is convex and extends from the top edge of the rim towards the outer surface of the sidewall,

a second curvature including a second curvature radius, wherein the second curvature is convex and extends from the top edge of the rim towards the inner surface of the rim

wherein the first curvature and the second curvature each extend circumferentially around the rim, and

wherein the first curvature radius is larger than the second curvature radius.

2. The closure of claim 1, wherein a ratio of the first curvature radius to the second curvature radius is approximately between 3:1 and 4:1.



3. The closure of claim 2, wherein the ratio of the first curvature radius to the second curvature radius is approximately 3.5:1.

4. The closure of claim 1, wherein the rim further includes a third curvature including a third curvature radius, wherein the third curvature is concave and extends from the inner surface of the rim towards the top surface, and wherein the first curvature radius is larger than the third curvature radius.

5. The closure of claim 4, wherein a ratio of the first curvature radius to the third curvature radius is approximately between 3:1 and 4:1.

6. The closure of claim 5, wherein the ratio of the first curvature radius to the third curvature radius is approximately 3.5:1.

7. The closure of claim 4, wherein a ratio of the second curvature radius to the third curvature radius is approximately 1:1.

8. The closure of claim 1, wherein a ratio of a height of the sidewall to a height of inner surface of the rim is between approximately 6:1 and 7:1.

9. A closure comprising:

a sidewall including an outer surface and a number of convex regions on the outer surface;

a top surface bounded by the sidewall; and

a rim including:

a portion of the sidewall extending above the top surface,

a top edge, and

an inner surface;

a number of a first type of knurls distributed on the outer surface of the sidewall;

a number of groups of a second type of knurls;

wherein:

the first type of knurls are rounded,

each of the convex regions is between two of the first type of knurls, and

each of the groups of the second type of knurls is located within a different one of the convex regions.

10. The closure of claim 9, wherein the number of the first type of knurls is equal to the number of the convex regions.

11. The closure of claim 9, wherein the number of the first type of knurls is equal to the number of the groups of the second type of knurls.

12. The closure of claim 9, wherein:

a plurality of the first type of knurls each comprise a convex curvature including a first type of knurl radius;

a plurality of the second type of knurls each comprise a convex curvature including a second type of knurl radius; and

wherein a ratio of the first type of knurl radius to the second type of knurl radius is approximately between 3:1 and 4:1.

13. The closure of claim 12, wherein the ratio of the first type of knurl radius to the second type of knurl radius is approximately 3.7:1.

14. The closure of claim 9, wherein the rim further includes:

a first curvature comprising a first curvature radius, wherein the first curvature is convex and extends from the top edge of the rim towards the outer surface of the sidewall,

a second curvature including a second curvature radius, wherein the second curvature is convex and extends from the top edge of the rim towards the inner surface of the rim,

wherein the first curvature and the second curvature each extend circumferentially around the rim, and wherein the first curvature radius is larger than the second curvature radius.

15. The closure of claim 14, wherein a ratio of the first curvature radius to the second curvature radius is approximately between 3:1 and 4:1.

16. The closure of claim 15, wherein the ratio of the first curvature radius to the second curvature radius is approximately 3.5:1.

17. The closure of claim 14, wherein the rim further includes a third curvature including a third curvature radius, wherein the third curvature is concave and extends from the inner surface of the rim towards the top surface, and wherein the first curvature radius is larger than the third curvature radius.

18. The closure of claim 17, wherein a ratio of the first curvature radius to the third curvature radius is approximately between 3:1 and 4:1.

19. The closure of claim 18, wherein the ratio of the first curvature radius to the third curvature radius is approximately 3.5:1.

20. The closure of claim 17, wherein a ratio of the second curvature radius to the third curvature radius is approximately 1:1.

21. A containment system comprising:

a bottle including a base and a neck;

a closure configured to releasably engage with the neck of the bottle, wherein the closure includes:

a sidewall including an outer surface;

a plurality of knurls distributed around the outer surface of the sidewall;

a top surface bounded by the sidewall;

a rim including a portion of the sidewall extending above the top surface, a top edge, and an inner surface;

a shrink film encompassing at least a portion of the base of the bottle and the outer surface of the sidewall of the closure; and

wherein:

the shrink film includes a flap extending horizontally from the top edge of the rim towards a center axis perpendicular to the top surface of the closure, and

the flap, the top surface, and the inner surface of the rim form a cavity.

22. The containment system of claim 21, wherein the rim further comprises:

a first curvature comprising a first curvature radius, wherein the first curvature is convex and extends from the top edge of the rim towards the outer surface of the sidewall;

a second curvature including a second curvature radius, wherein the second curvature is convex and extends from the top edge of the rim towards the inner surface of the rim;

wherein the first curvature and the second curvature each extend circumferentially around the rim; and

wherein the first curvature radius is larger than the second curvature radius.

23. The containment system of claim 22, wherein a ratio of the first curvature radius to the second curvature radius is approximately between 3:1 and 4:1.

24. The containment system of claim 23, wherein the ratio of the first curvature radius to the second curvature radius is approximately 3.5:1.



- 25.** The containment system of claim **21**, wherein:  
the sidewall further comprises a number of convex regions  
on the outer surface;  
the plurality of knurls further comprises:  
a number of a first type of knurls distributed on the outer  
surface of the sidewall,  
a number of groups of a second type of knurls; and  
wherein:  
the first type of knurls are rounded,  
each of the convex regions is between two of the first  
type of knurls, and  
each of the groups of the second type of knurls is located  
within a different one of the convex regions.
- 26.** The closure of claim **25**, wherein the number of the first  
type of knurls is equal to the number of the convex regions.
- 27.** The closure of claim **25**, wherein the number of the first  
type of knurls is equal to the number of the groups of the  
second type of knurls.

\* \* \* \* \*