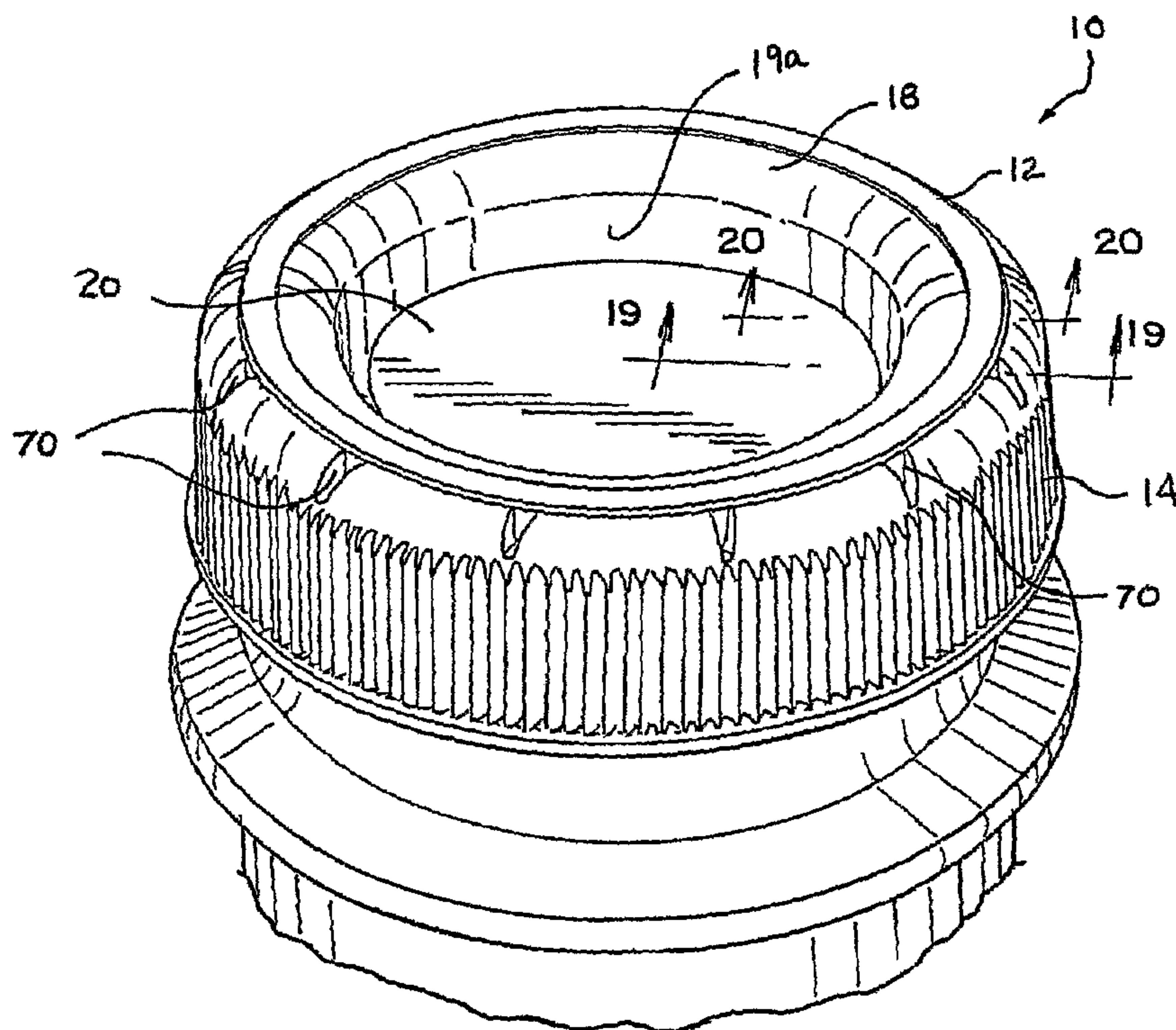




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(54) Title: COMPOSITE CLOSURE WITH BARRIER END PANEL



(57) Abrégé/Abstract:

Composite closures for plastic containers are disclosed. The composite closures include an end panel (20) with oxygen barrier properties. The liner includes a sealing liner (38) or gasket for sealing engagement with a container finish.

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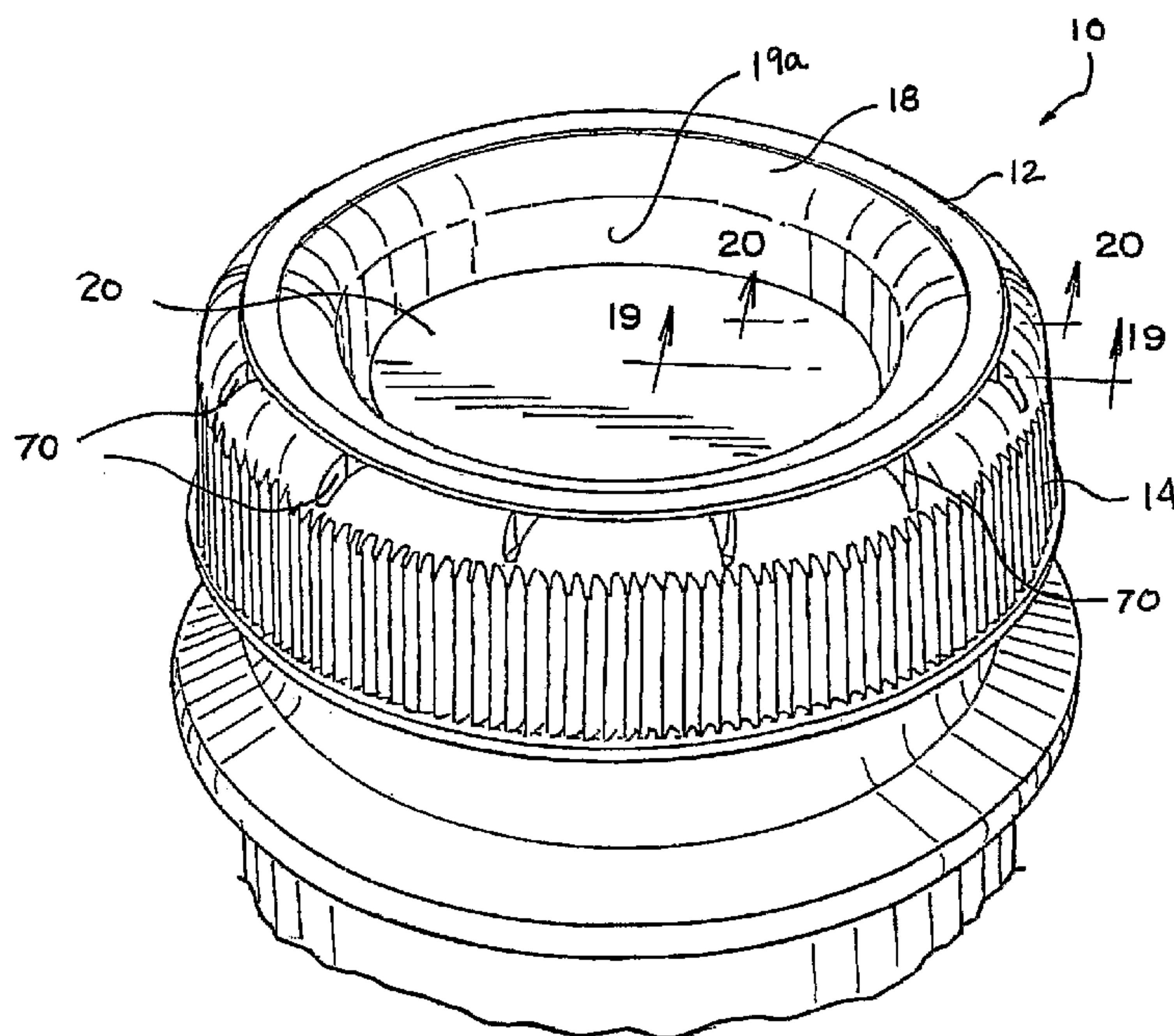
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(54) Title: COMPOSITE CLOSURE WITH BARRIER END PANEL



(57) Abstract: Composite closures for plastic containers are disclosed. The composite closures include an end panel (20) with oxygen barrier properties. The liner includes a sealing liner (38) or gasket for sealing engagement with a container finish.

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COMPOSITE CLOSURE WITH BARRIER END PANEL

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 60/580,946, filed June 18, 2004.

[0002] The present invention is directed to a composite closure cap for containers such as, but not limited to, plastic bottles and jars. The closure cap includes a disc-shaped end panel that has excellent oxygen barrier properties. Application of the closure cap results in a hermetic seal between the container and the cap. More particularly, the present invention is directed to a composite closure cap with an end panel made substantially of plastic, having oxygen barrier properties and providing a hermetic seal between the container and the cap in a variety of sealing and sterilization environments.

BACKGROUND OF THE INVENTION

[0001] Composite closures are well known in the art. Composite closures typically include two parts (thus, the word "composite"), an annular shell or ring with a central opening and a separate end panel covering the central opening. Composite closures are often used in products that are either hot filled or are thermally pasteurized or sterilized after filling, including products where the entire package (filled container with sealed closure) is subjected to "retorting" (i.e., heating the package to a temperature greater than 220°F).

[0002] Most currently available composite closures include a metal end panel and an annular gasket or ringed liner that provides a hermetic seal between the closure and the container finish. The metal end panel of the metal/plastic composite closure provides a good barrier to oxygen which, if allowed to freely permeate the package, can result in spoilage of the food product. More recently, composite closures where the end panel is made substantially of a non-metal material, such as plastic, have been introduced. Such "all-plastic" composite closures have the advantage of the end panel being less susceptible to

corrosion and are less costly to manufacture.

[0003] Although, many of the known composite closures have worked satisfactorily, there is a continuing need for composite closures that (1) effectively limit the ingress of oxygen through the closure, (2) seal the package to further limit oxygen ingress at the interface of the container finish and closure cap, (3) provide evidence of tampering, and (4) reduce the cost of manufacture.

[0004] Whether the composite closure includes a metal or plastic end panel, but particularly where the end panel is made substantially of plastic, maintaining the integrity of the seal can be particularly problematic in food products packaged in plastic containers that are subjected to retorting. Plastic containers and, more particularly, the plastic container finishes that are subjected to retort often undergo expansion and subsequent contraction. The expansion and contraction of the container finish affects the seal interface between the container and the closure, thus making it more possible that the product can spoil. Thus, there is a need for a closure with the properties previously described that can also be subjected to retort while maintaining the integrity of the seal. The closure of the present invention addresses the above-stated needs.

BRIEF DESCRIPTION OF THE FIGURES

[0005] Fig. 1 is a perspective view of one embodiment of the composite closure fitted onto a container finish;

[0006] Fig. 2 is a perspective view of the composite closure of Fig. 1 with a section broken away to show the end panel disc lined with a ring (gasket) of sealant;

[0007] Fig. 3 is a top view of a package with the closure embodying the present invention;

[0008] Fig. 4 is a partial cross-sectional side view of the composite closure of Fig. 3 taken along line 4-4;

[0009] Fig. 5 is a partial, cross-sectional side view of the closure cap of Fig. 1 taken through a vent, with the closure fitted onto a container finish;

[00010] Fig. 6 is a bottom view of the closure cap shell

without the end panel disc;

[00011] Fig. 7 is a plan view of the closure cap of Fig. 1 fitted onto a container finish showing the internal threads and bead on the closure inner surface and the threads on the outer surface of the container neck (in broken lines);

[00012] Fig. 8 is a perspective view of an alternative embodiment of the closure cap with a section broken away, with the closure fitted onto a container finish;

[00013] Fig. 9 partial, cross-sectional side view taken along 9-9 of Fig. 8;

[00014] Fig. 10 is a partial, cross-sectional side view taken along 10-10 of Fig. 8;

[00015] Fig. 11 is a cross-sectional view of the closure of Fig. 1 after insertion of the end panel into the shell, but prior to placement on a container finish; and

[00016] Fig. 12 is an enlarged cross-sectional view of the closure cap of Fig. 1 fitted onto a container finish.

[00017] Fig. 13 is a perspective view of another embodiment of the closure cap fitted onto a container finish, the closure cap including an end panel with a mechanically shaped vacuum activated button (in the up position);

[00018] Fig. 14 is a perspective view of the closure cap of Fig. 13 with the vacuum activated button (in the down position);

[00019] Fig. 15 is a top view of the closure of Fig. 13;

[00020] Fig. 16. is a cross-sectional side view of the closure of Fig. 13 taken along 15-15 of Fig. 15;

[00021] Fig. 17 is a cross-sectional side view of the closure of Fig. 14 taken along line 16-16 of Fig. 15.

[00022] Fig. 18 is a partial perspective view of another alternative embodiment of the composite closure.

[00023] Fig. 19 is a partial cross-sectional side view of the closure cap of Fig. 18 taken along line 19-19, fitted onto a container finish;

[00024] Fig. 20 is a partial cross-sectional side view of the closure cap of Fig. 18 taken along line 20-20, fitted onto a container finish;

[00025] Fig. 21 is a perspective view of still another alternative embodiment of the shell 9 of a composite closure;

[00026] Fig. 22 is a partial cross-sectional side view of the closure cap of Fig. 21 taken along line 22-22, fitted onto a container;

[00027] Fig. 23 is a partial cross-sectional side view of the closure cap of Fig. 21 taken along line 23-23, fitted onto a container;

[00028] Fig. 24 is a perspective view of still another alternative embodiment of the closure cap with a portion broken away;

[00029] Fig. 25 is a side view of the closure cap of Fig. 24 with a portion broken away;

[00030] Fig. 26 is a different (bottom) perspective view of the closure cap of Fig. 24.

[00031] Fig. 27A is a cross-sectional side view of the closure cap prior to insertion of the end panel into the shell;

[00032] Fig. 27B is a cross-sectional side view of the closure cap with end panel inserted into the shell but prior to application of the closure onto the finish of a container;

[00033] Fig. 27C is a cross-sectional side view of the closure cap as it is being applied onto the finish of a container;

[00034] Fig. 27D is a cross-sectional side view of the closure cap at a later stage during the application of the closure cap onto the finish of a container;

[00035] Fig. 27E is a cross-sectional side view of the closure cap at a still later stage during the application of the closure cap onto the finish of a container as the finish fully engages the closure.

[00036] Fig. 27F is a cross-sectional side view of the closure cap at the final fully sealed position relative to the closure finish;

[00037] Fig. 28 is a perspective view of the end panel with the gasket applied to the lower panel surface;

[00038] Fig. 29 is a cross-sectional side view of a pre-formed end panel with the gasket applied to the peripheral portion of

the lower panel surface;

[00039] Fig. 30 is a cross-sectional side view of a flat end panel with the gasket applied to the peripheral portion of the lower panel surface;

[00040] Fig. 31 is a cross-sectional side view of the preformed disk of Fig. 29 being applied to the shell of the closure; and

[00041] Fig. 32 is a cross-sectional side view of the closure of Fig. 31 applied to the finish of a container.

DESCRIPTION OF THE EMBODIMENTS

[00042] With reference to the Figures, closure cap 10 includes a generally cylindrical shell 12 having a central opening covered by an end panel 20 held within shell 12. Shell 12 is preferably molded from a plastic material such as, but not limited to, polypropylene.

[00043] As shown in the Figures and, in particular, Fig. 2, shell 12 includes a downwardly extending skirt 14 integrally formed with an upper radially and inwardly extending flange 18. Flange includes a top surface 19 and a bottom surface 21. As best seen in Figs. 4 and 5, top surface 19 of flange 18 is slightly downwardly sloped in the direction of the closure center.

[00044] As shown in Figs. 2, 8, 11 and 12, the inner circumferential surface of skirt 14 is provided with one or more preformed threads 22. Thread 22 is intended for cooperative mating engagement with corresponding thread(s) 23 on the container finish 27, as generally depicted in Fig. 7 and elsewhere. In a preferred embodiment, thread 22 is a single lead thread that extends more than 360° on the inner surface of ring 12. Alternatively, thread 22 may also be a multi-lead thread.

[00045] The inner circumferential surface of skirt 14 includes, preferably, lifting bead 24, which is located above thread 22 and, more specifically, above the upper terminal end of thread 22. Lifting bead 24 lifts end panel 20 and releases it from its sealing contact with the container during the

opening sequence. In a preferred embodiment, lifting bead 24 is substantially horizontal (i.e., does not slope). In one embodiment, bead 24 may extend around the entire circumference of shell 12 (i.e., 360°). More preferably, bead 24 may extend less than 360° around shell 12. In one embodiment, lifting bead 24 extends approximately 240° or less around ring 12 and is continuous (i.e., uninterrupted). However, as shown in Fig. 26, discussed below, lifting bead may also be non-continuous and be made up of a series of annular bead segments 24a, 24b, etc.

[00046] Alternatively, shell 12 may be provided without lifting bead 24. Where bead 24 is absent, release of disc 20 from the container may be achieved by the lifting action of one of the threads 22. This provides for more distance between disc 20 and the lifting means (i.e., thread 22), thereby maximizing the travel distance of disc 20 before the primary seal of the package is broken. This may be advantageous where more sequential opening is desired.

[00047] Attached to the terminal end of skirt 14 is a tamper evident band 26. In a preferred embodiment, band 26 may be an extension of skirt 14 and be attached to skirt 14 by a plurality of bridges, at a location below a container retaining bead 60. A continuous or semi-continuous slit 28 or line of weakening between skirt 14 and band 26 is also provided to allow for separation of the cap from band 26 during opening. Band 26 further includes an upwardly and annular inwardly extending retaining member 29 for engagement of bead 60 on the container finish 27. An example of this type of tamper evident band is disclosed in U.S. Patent No. 5,685,443, incorporated herein by reference. Alternatively, band 26 may include a series of annular ratchets or ratchet segments (not shown) that engage corresponding ratchets 37 (see Figs. 19-20, 22-23) on the finish 27 of the container. Such ratchet engagement is well known and will be understood by those of skill in the art.

[00048] In the embodiment of Fig. 11, end panel 20 has an outside diameter that is less than the inside diameter of ring 12 at the inner surface of skirt 14 between lifting bead 24 and

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the transition portion 43 between skirt 14 and flange 18. In the embodiment of Fig. 1, as best seen in Fig. 11, the outside diameter of end panel 20 is slightly greater than the diameter of lifting bead 24 which allows end panel 20 to rest flat on the lifting bead 24 when closure 10 is in the assembled state but prior to placement of the assembled closure on a container finish. Thus, end panel 20 is free-floating between lifting bead 24 and the bottom surface of flange 18.

[00049] End panel disc 20 may be made of any suitable plastic composition and may be provided as a single sheet or layer or, as described below, a plurality of sheets. In one embodiment, end panel 20 may be made of one or more layers of polypropylene. Preferably, however, the disc is made of a material(s) that has good oxygen barrier properties. One example is a material that includes a metal component, such as a metal film. Alternatively, non-metallic, (e.g., plastic) substantially oxygen impermeant compositions may also be used. In one embodiment, where oxygen barrier properties are desired, end panel disc 20 is made of a single layer of one or more plastic materials, wherein at least one of the materials is an oxygen barrier.

[00050] In another embodiment, end panel disc 20 may be a multi-layered disc 20. A multi-layered disc, as shown, for example, in Figs. 5 and elsewhere, can be made by a variety of methods. In one embodiment, disc 20 can be made from co-extruded sheets of multiple sheet layers. In still another embodiment, disc 20 can be made by molding, such as by injection molding.

[00051] As shown in Fig. 5, for example, the multi-layered disc may include top 32, middle 34 and bottom 36 sheets of a plastic material, wherein at least one layer includes oxygen barrier properties. In one embodiment, top layer 32 may be made of a plastic material such as, but not limited to, a polypropylene and/or polypropylene co-polymer. Middle layer 34 may be a compound with good oxygen barrier properties. For example, middle layer 34 may be an ethylene vinyl compound such

as, but not limited to, EVOH. Bottom layer 36 may be a polypropylene or a polypropylene co-polymer. Additionally, where disc 20 is a multi-layer disc 20, it may include adhesive between the top and middle layers and between the bottom and middle layers.

[00052] Alternatively, the material having the oxygen barrier property (e.g., EVOH) may comprise top layer 32. Thus, in this alternative embodiment, top layer 32 may be an oxygen barrier, middle layer 24 may be a bonding layer and bottom layer 36 may be polypropylene, a copolymer thereof or other polymeric material with insubstantial oxygen barrier properties. Examples of commercially available films that may be useful in the manufacture of end panel 20 include Besela® films available from Kureha Chemicals.

[00053] In addition to or as a further alternative to the above, disc 20 may include an oxygen scavenger. Preferably, the scavenger will be combined, blended or otherwise incorporated into a single-layer disc. Where disc 20 is made of multiple layers, bottom layer 36 may include an oxygen scavenger so as to reduce head space oxygen levels after sealing of the container. Examples of suitable scavengers include fine sodium ascorbate particulate or powder. Other examples of oxygen scavengers include iron-based compounds, such as ferrous oxide. Using an oxygen scavenger with one or more layers of an oxygen barrier provides an active and passive barrier system.

[00054] Although the thickness of panel will depend, in part, on the size of closure 10, in most of the embodiments described herein a panel thickness of approximately 0.020 inch is preferred. An end panel of reduced thickness may be preferred for purposes of cost reduction and effective heat transfer, particularly during a retort process. In the embodiment, where the top and bottom layers are polypropylene or copolymers thereof with a middle layer of, for example, EVOH in between, the thickness of the middle layer will preferably be approximately 1.2 mils.

[00055] Closure cap 10 may also include an annular gasket or

liner 38 which is sealingly engageable with the end and preferably inner surfaces of the container finish. Liner 38 may be a full pad liner that substantially covers the entire bottom surface of disc 20. Liner or gasket 38 may be applied to the bottom of end panel disc 20. In a preferred embodiment, sealant is provided as a ring or gasket 38 around the outer periphery of disc 20, as best seen in Figs. 2, 4 and 5. An example of a gasket and its method of manufacture and application is provided in U.S. Patent Application Serial No. 09/634,182, filed August 9, 2000, and U.S. Patent Application Publication No. 2003/0098287 A1, filed January 9, 2003, both of which are incorporated herein by reference. Gasket 38 provides an effective seal between end panel disc 20 and container finish 27. Gasket 38 is preferably injection molded onto end panel disc 20. Suitable compositions for use in the gasket 38 or liner 38 are any compositions that can provide a hermetic seal with container finish 27. In one embodiment, the sealant may be made of polypropylene or copolymer thereof. Other known sealant compositions that may be used include a SEBS block copolymer. Thermoplastic elastomers or other compositions which have oxygen barrier properties to varying degrees may also be used. Such thermoplastic elastomers are disclosed in U. S. Patent No. 6,677,397 and U.S. Patent Application Serial No. 10/400,304, filed March 27, 2003, both of which are incorporated herein by reference. Although any suitable TPE or TPE-based composition may be used for gasket 38, the preferred plastic compositions disclosed in Serial No. 10/400,304 are particularly useful in the closures described herein.

[00056] Composite closures of the present invention provide further improvement in oxygen barrier properties over more traditional metal/plastic composite closures (i.e., plastic fitment ring with metal end panel). In one study, the oxygen barrier properties of (A) a composite closure including a polypropylene/EVOH/polypropylene end panel 20, lined with a gasket made of the preferred sealant composition described in U.S. Serial No.10/400,304 was compared to (B) a metal/plastic

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composite closure lined with a plastisol composition.

[00057] Using an oxygen permeability measuring apparatus, Model Ox-Tran2/61, available from MOCON® of Minneapolis, Minnesota, closures of the present invention (as described above) exhibited an oxygen ingress rate of typically less than approximately 0.003 cc/package/day/atm, measured at 65% relative humidity (and based on a 40 mm closure), and approximately 0.0025 cc/package/day/atm. Plastic/metal composite closures, lined with plastisol exhibited an oxygen ingress rate of approximately 0.0041 cc/package/day/atm. (Briefly, equipment of the type described above measures oxygen ingress by introducing nitrogen gas into a vessel sealed with a lined closure. The nitrogen gas flushes any oxygen that may be present, due to ingress through the closure, within the sealed vessel. The nitrogen gas exits the vessel through an outlet and the level of captured oxygen is recorded as an electronic signal and reported as cubic centimeters (cc) of oxygen permeating into a package (closure with liner) in a day. The reading is then adjusted to take into account barrier properties of the container or vessel to give a more accurate reading.

[00058] As shown in Figs. 1-2, closure cap 10 includes a plurality of annularly spaced vents 40 along the bottom surface 21 of flange 18. Vents 40 provide flow channels for draining liquid (water) used to cool or rinse the package. Vents 40 may be regularly spaced from each other and separated by portions of flange 18 identified by reference numeral 42. When the container is sealed by closure cap 10, portions 42 are in contact with disc 20, as shown, for example, in Fig. 4.

[00059] The closure 10 of the present invention is particularly well-suited for use in hot-fill or retort environments, provided that the container is likewise suitable for use in retort operations. Further alternative embodiments of a "retortable" closure for use with more traditional container materials are also described below.

[00060] Figs. 8-10 depict an alternative version of a closure cap embodying the present invention. As in the above-described

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preferred embodiment, closure cap 10 includes a fitment ring 12 and an end panel disc 20 within ring 12. Whereas in the previous embodiment (of Figs. 1-7) flange 18 of shell 12 defines a central opening, in the embodiment of Figs. 8-10, ring 12 include a further central panel 50 overlying end panel disc 20.

[00061] Preferably, central panel 50 is integral with ring 12 and is made of the same (plastic) material as ring 12 during the molding process. As shown n Fig. 8, central panel 50 is attached to flange 18 by the areas 52 of connecting arms 52 radiating from central panel 50. The sides of connecting arms 52, the end wall 54 of central panel 50 and the end wall 43 of flange define windows 56 through which disc 20 is exposed to the outside environment. Preferably connecting arms 52 of the web have a thickness that is about (1/2) of the thickness of flange 18. As in the previously described embodiment, ring 12 includes a plurality of annularly spaced vents 40 along the bottom surface of flange 18 separated by portions 42 of flange 18. Vents 40 may be interrupted by connecting arms 52 of ring 12, as best seen in Fig. 8.

[00062] In all other respects, closure cap 10, shown in Figs. 8-10, is substantially identical to the previously described embodiments. Ring 12, such as the one shown in Figs. 8-10 and described above may be used where a more robust ring 12 is desired, (as the central end panel 50 reinforces ring 12.) Panel 50 also provides a surface that can be used for printing, embossing or otherwise applying product information thereon.

[00063] Figures 13-17 depict another alternative embodiment or feature of closure 10 and more specifically, end panel disc 20. In the embodiments of Figs. 13-17, end panel disc 20 includes a vacuum activated button. Composite closures with mechanically formed buttons in the end panel are disclosed in U.S. Patent No. 4,989,740, which is incorporated herein by reference. In the embodiment of Figs. 13-17, the at least substantially plastic end panel disc 20 may be mechanically pre-formed to include a vacuum-activated button. The presence of vacuum in a sealed container is an indication that the container is sealed. A

button in a down state can be detected in a filling line at high speed rates using optical measurement sensors.

[00064] Figs. 18-32 depict additional embodiments of closure cap 10 of the present invention. In many respects, the closure cap 10 is similar or identical in structure and materials to closure cap 10 previously described. Where such similar or identical features are included in the embodiments of Figs. 18-32, they will not be described in great detail and, instead, it will be understood that the previous description of the similar or identical feature is incorporated by reference. Thus, for example, while the embodiments of Figs. 18-32 do not show tamper evident bands attached to the terminal end of skirt 14, as shown, for example, in Figs. 1-17, it will be understood that closures shown in Figs. 18-32 will include some tamper indicating means. The tamper indicating band 26 may include a retaining member 29, as shown in Figs. 1-17, and previously described, or may include annular ratchets for engagement with the neck of container 33.

[00065] Not only do the closure caps 10 of Figs. 18-32 provide the good barrier to oxygen and evidence of product tampering, also provided by the previously described embodiment, but they are also particularly well suited for retorting operations and effectively maintain the hermetic seal even after temperature changes and the bottle expansion and contraction that is encountered during retort.

One such example of a retortable closure is shown in Figs. 18-21. As shown in Fig. 18, composite closure 10 includes shell 12 with end panel 20, as previously described. Shell 12 may typically be made of polypropylene or other suitable plastic materials. Shell 12 includes a downwardly extending skirt 14 that, as in the previously described embodiments, is integrally formed with flange 18. Also, as described above, inner surface of skirt 14 includes one or more threads for cooperative engagement with the threads of the container 23, as seen in the cross-sectional view of Fig. 19. Inner surface of skirt 14 of the embodiments shown in Figs. 18-32 also includes bead 24, as

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generally described above. Bead 24 is located above the upper terminal end of thread 22 on the inner surface of skirt 14, and lifts end panel 20 during the opening sequence.

[00066] In one embodiment, shown in Fig. 26, bead 24 extends 360° around the inner surface of skirt 14 and is non-continuous. For example, bead 26 may be provided as a series of annular bead segments that extend 360° or less than 360° around the inner surface of skirt 14 and are separated from one another. Alternatively, bead 24 may be a continuous bead that extends less than 360° and, preferably, 240° around the inner surface of skirt 14, as previously described.

[00067] As in the previous embodiments, shell 12 of the closure shown in Fig. 18 includes top flange 18 integrally formed with skirt 14. Flange 18 includes a top surface 19, and a bottom surface 21. Flange 18 of the closure shown in Fig. 18 differs, however, from the previously described embodiments in that it has a generally C-shaped cross-section and/or profile, as best seen in Fig. 19. More specifically, as shown in Figs. 19 and 20, both flange top surface 19 and bottom surface 21 have a generally C-shaped profile where the top surface 19 and bottom surface 21 parallel to one another. As shown in Fig. 19, bottom surface 21 includes a radially inner, downwardly extending portion 21a, a downwardly extending portion 21c, and a central curved portion 21b. Similarly, flange top surface 19 may include a radially inner downwardly extending portion 19a, a radially outer, downwardly extending portion 19c, and a central curved portion 19b, as shown variously in Figs. 18-26. In one embodiment, only the bottom surface may have a generally C-shaped profile, while flange top surface 19 may include a different profile. For example, flange top surface 19 may include a generally C-shaped profile and provide a relatively and continuously smooth surface (as shown, for example, in Figs. 24-26). Alternatively, flange top surface 19 may have something other than a generally C-shaped profile and include, for example, notch 29 between the top curved and radially outer portions of flange top surface 19.

[00068] Shell 12 of composite closure 10, shown in Figs. 18-32, may also include a plurality of vents 70. Typically, vents 70 are annularly spaced from one another along the entire circumference of shell 12. As shown in Figs. 18, 21, and 24, for example, vents 70 open to the outside in flange 18 between central curved portion 19b and downwardly extending radially outer portion 19c of flange top surface 19. As shown in Fig. 19, vents 70 provide a flow path 72 between skirt 14 and the finish 17 of the container 23.

[00069] As shown in Figs. 18-32, composite closure 10 also includes end panel 20. End panel 20 of the embodiments shown in Figs. 18-32 is substantially identical to end panel 20 previously described, particularly in terms of its material composition. That is, in one embodiment, end panel 20, preferably has oxygen barrier properties. Furthermore, as previously described, end panel 20 may be made of a single layer or sheet of one or more plastic materials or, is preferably made of a plurality of sheets where one or more of the sheets include(s) an oxygen barrier and/or an oxygen scavenger. As previously described, in a preferred embodiment, end panel may be made of three (3) layers or sheets, where the middle sheet includes an oxygen barrier, such as EVOH, while top and bottom sheets include polypropylene or other suitable plastic material. Adhesives may be used as necessary, and as previously described. Of course, where a multi-layer end panel is desired, such end panel can be made by molding or extrusion, as previously described.

[00070] As shown in the Figures, end panel 20 includes a top surface 20a and a lower surface 20b. End panel 20 further includes a central portion 60 and outer peripheral portion 62. In a preferred embodiment, end panel 20 may be provided with a liner (e.g., full pad) or gasket 38 of sealant, as previously described and shown more particularly in Figs. 28-30. Preferably, gasket 38 is applied as a ring on the lower surface 20b at least the peripheral portion of end panel 20, as shown in Fig. 28. The method of manufacture and application of gasket 38

to end panel 20 is beyond the scope of the present application. However, methods of manufacture and application of gaskets are described in U.S. Patent Publication No. 2003/0098287 A1, filed January 9, 2003, and U.S. Patent Application Serial No. 09/634,182, filed August 9, 2000, both of which have been previously incorporated by reference.

[00071] End panel 20 may be provided as a flat disc, as shown in Fig. 30. During application of closure 10 to container finish 27, disc 20 is substantially conformed to the flange bottom surface 21. Alternatively, end panel 20 may be provided as a contoured disc, as shown in Fig. 29, that is preformed to substantially conform to the profile of flange bottom surface 21. When provided as a flat disc, the overall diameter of disc 20 may be greater than the diameter of the skirt inner surface.

[00072] Figs. 27A-27F show the steps in the assembly of the composite closure 10 and in the application of the assembled closure 10 to a container finish 27. During assembly, end panel 20 is introduced through the mouth of shell 12. The end panel 20 is pushed through shell 12 to a point beyond bead 24 in proximity to flange 18. Because of its greater diameter, end panel 20 may bend slightly at outer peripheral portion 62 and adopt a shape generally shown in Fig. 27b.

[00073] Fig. 27c shows the first step in the application of closure 10 to container finish 27. As shown in Fig. 27c, the end of the container finish first contacts outer peripheral portion 62 of disc 20 and gasket 38 at the radially inner most point thereof. Stated differently, contact by the container finish 17 to the gasket 38 proceeds from radially inner part of gasket 38 to radially outer part of gasket 38 or, as depicted in Fig. 27, from the bottom up.

[00074] As contact between container finish 27 and end panel 20 continues during the application process, outer peripheral portion 62 conforms to the shape of the flange bottom surface 21, as shown in Fig. 27d. In that regard, it is preferable that disc 20 be provided with a point of weakening between central portion 60 and outer peripheral portion 62. The point of

weakening allows the plastic disc to bend at a point between central portion 60 and outer peripheral portion 62, thereby allowing end panel to bend and conform in the manner described above and shown in Figs. 27a-27d. The point of weakening can be provided as an area where the thickness of end panel disc has been reduced during, for example, coining or cold-forming end panel 20 to provide a notch 64 in disc 20.

[00075] Fig. 27e shows the outer peripheral portion of disc 20 conformed to the inner radial and central portions 21a and 21b of flange bottom surface 21. As closure 10 is further advanced onto the finish 27 of container 23, gasket 38 is compressed over the inner and top surfaces of finish 27, thereby providing a tight seal, as shown in Fig. 27f. The seal may become even tighter after the expansion and, more importantly, contraction of container finish 17 that typically occurs during retort operations.

[00076] Fig. 29 shows an alternative embodiment of end panel 20. In Fig. 29, end panel 20 is not presented as a flat disc. Instead, end panel 20 is initially flat, but then shaped prior to its introduction and association with shell 12. End panel 20 is contoured to more closely follow the shape of flange bottom surface 21 at the inner radial and central portions 21a, 21b thereof. Thus, end panel 20 may be shaped by, for example, bending and contouring end panel in the presence of heat, i.e., thermo-forming. Alternatively, shaped end panel may be provided by injection or compression molding. As shown in Fig. 29, a shaped, preformed end panel includes a generally planar central portion 60. Near the outer peripheral portion 62 of end panel 20, disc slopes slightly downwardly (in the radially outward direction) before becoming substantially planar again. In the outer peripheral portion 62, disc 20 slopes upwardly (in the radially outward direction), as shown in Fig. 29.

[00077] Whether end panel 20 is applied as a flat disc, as shown in Figs. 27a through 27f, or applied as a preformed and end panel, as shown in Figs. 31 and 32, composite closure 10 of the present invention provides suitable sealing to the container

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finish 17. Unlike other retortable composite closures which often require both radially inner and radially outer sealing of the container finish, composite closure 10 of the present invention, as shown in Figs. 18-32, primarily provides an inner and top seal. An effective seal is maintained to the container, even after subjecting the package to the elevated temperatures of retort.

[00078] As shown in Fig. 21, the composite closure may also be provided with an additional central panel 50, as previously described. Central panel 50 may be integrally formed with shell 12 during the molding process. Central panel 50 includes a web of connecting members 52 annularly spaced from one another, thereby exposing at least a portion of the end panel 20 to the outside environment.

[00079] Figs. 22 and 23 are cross-sectional views of the embodiment of Fig. 21 taken through a vent portion and a solid portion of the shell 12, respectively. As seen in Figs. 22 and 23, central panel 50 may be spaced from end panel 20. Alternatively, central panel 50 may contact top surface 20a of end panel 20. As described above, central panel 50 provides additional strength to shell 12. It also provides a surface that may be embossed with a product name or include a stenciled product name on the central portion of the central panel 50, thereby further exposing the end panel 20 to the outside environment. In all other respects, the contour of the flange top and bottom surfaces is identical to the corresponding surfaces described in relation to the embodiments of Figs. 18 and 24.

[00080] While the present invention has been described in connection with various embodiments, it will be apparent to those skilled in this art that modifications and variations may be made therefrom without departing from the spirit and scope of this invention. Accordingly, this invention is to be construed and limited only by the scope of the appended claims.

THAT WHICH IS CLAIMED:

1. A composite closure cap for a container comprising:
an end panel disk made substantially of one or more plastic materials and having oxygen barrier properties, said disk including upper and lower surfaces, and a central portion and an outer peripheral portion terminating in an outer edge;
a shell including a cylindrical, downwardly extending skirt and an annular top flange overlying and in contact with the upper surface of said outer peripheral portion of said disk;
a sealing liner on at least the outer peripheral portion of said lower surface of said disk.
2. The composite closure of Claim 1 wherein said disk comprises a plurality of sheets wherein at least one of said sheets is made at least in part from a material that is a substantial barrier to oxygen.
3. The composite closure of Claim 2 wherein said disk includes top, middle and bottom sheets, wherein at least one of said top or middle sheets is made at least in part from a material that is a barrier to oxygen.
4. The composite closure of Claim 3 wherein said disk comprises a top layer made at least in part of polypropylene or copolymer thereof, a middle sheet made at least in part of EVOH, and a bottom sheet made at least in part of polypropylene or copolymer thereof.
5. The composite closure of Claim 3 wherein said disk comprises a top sheet made at least in part of a material that is a barrier to oxygen, said bottom sheet is made at least in part of polypropylene or copolymer thereof, and said middle sheet is made of a material selected to adhere to said top and bottom sheets.
6. The composite closure of Claim 3 wherein at least one of said sheets includes an oxygen scavenger.
7. The composite closure of Claim 1 wherein said flange defines a central opening in said shell.
8. The composite closure of Claim 1 further including a panel overlying and being spaced from said inner portion of said

central portion of said end panel disk.

9. The composite closure of Claim 8 wherein said overlying panel is integrally formed with said shell.

10. The composite closure of Claim 9 wherein said overlying panel is joined to said flange by a plurality of annularly spaced connecting arms.

11. The composite closure of Claim 1 wherein said skirt includes at least one preformed thread on the inner circumferential surface of said skirt.

12. The composite closure of Claim 1 including at least one preformed thread and a preformed bead on the inner circumferential surface of said skirt, wherein said bead is spaced above the upper terminal end of said thread.

13. The composite closure of Claim 12 wherein said bead is continuous.

14. The composite closure of Claim 12 wherein said bead extends for less than 360°.

15. The composite closure of Claim 12 wherein said preformed bead is non-continuous.

16. The composite closure of Claim 12 wherein said the outside diameter of said end panel disk is greater than the diameter of said preformed bead.

17. The composite closure of Claim 1 including a plurality of annularly spaced vents in said flange.

18. A composite closure cap for a container comprising:

an end panel disk made substantially of one or more plastic materials and having oxygen barrier properties, said disk including a upper and lower surfaces, and a central portion and an outer peripheral portion terminating in an outer edge;

a shell including a cylindrical, downwardly extending skirt including an annular top flange including a top surface a bottom surface and a radially inner surface between said top and bottom surfaces, said flange overlying at least the outer peripheral portion of said disk such that said bottom surface of said flange is in contact with the upper surface of said outer peripheral portion of said disk;

wherein at least part of said disk upper surface is exposed to the outside environment; and

a sealing liner on at least the outer peripheral portion of said lower surface of said disk.

19. The composite closure of Claim 18 including a panel overlying said inner portion of said central portion of said end panel disk.

20. The composite closure of Claim 19 wherein said overlying panel is integrally formed with said shell.

21. The composite closure of Claim 19 wherein said overlying panel is joined to said flange by a plurality of annularly spaced connecting arms.

22. The composite closure of Claim 18 including a plurality of annularly spaced vents in said flange.

23. The composite closure of Claim 22 wherein said vents are located on said radially innermost surface of said flange.

24. The composite closure of Claim 22 wherein said vents are located in said top surface of said flange.

25. A composite closure cap for a container comprising:

a shell including a downwardly extending skirt portion and an annular top flange, said flange including a top surface and a bottom surface wherein at least said bottom surface of said flange has a generally C-shaped profile whereby said flange bottom surface includes a radially inner downwardly extending inner portion, a radially outer downwardly extending portion and a curved portion between said radially inner and outer portions;

said end panel disk made substantially of one or more plastic materials and having oxygen barrier properties, said disk including upper and lower surfaces, and a central portion and an outer peripheral portion terminating in a free edge, wherein said outer peripheral portion of said disk is substantially conformed to and in contact with at least said downwardly extending and curved top portions of said flange bottom surface; and

a sealing liner on at least the outer peripheral portion of said lower surface of said disk where said disk is substantially

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conformed to said radially downwardly extending and curved top portions of said flange bottom surface.

26. The composite closure of Claim 25 wherein said disk comprises a plurality of layers and wherein at least one of said layers is made at least in part from a material that is a barrier to oxygen.

27. The composite closure of Claim 25 wherein said disk includes a top, middle and bottom layers wherein at least one of said top or middle layers is made at least in part from a material that is a substantial barrier to oxygen.

28. The composite closure of Claim 27 wherein said disk comprises a top layer made at least in part of a polypropylene or copolymer thereof, a middle sheet made at least in part of EVOH, and a bottom sheet made at least in part of a polypropylene or copolymer thereof.

29. The composite closure of Claim 25 wherein said flange top surface has a generally C-shaped profile, whereby said top surface includes a radially inner downwardly extending inner portion, a radially outer downwardly extending portion and a curved portion between said radially inner and outer portions.

30. The composite closure of Claim 29 including a plurality of annularly spaced vents in said flange.

31. The composite closure of Claim 30 wherein said vents comprise openings in between said bottom and top surfaces of said flange.

32. The composite closure of Claim 31 wherein said vents are located between said curved and radially outer portions of said flange top and bottom surfaces.

33. The composite closure of Claim 25 wherein said gasket is made of a material selected to sealingly engage a container finish made of a material that is susceptible to shrinkage during cooling following exposure to temperatures in excess of 220°F.

34. The composite closure of Claim 25 wherein said gasket is made of a material selected to adhere to a container finish made of a polyethylene terephthalate.

35. A method of making a composite closure cap comprising:

molding an outer plastic shell including a cylindrical skirt and an annular top flange, said skirt defining a central mouth and said flange having a top surface, a bottom surface and a generally C-shaped cross-section profile whereby said bottom surface includes a radially downwardly extending inner portion, a radially downwardly outer portion, a curved portion between said radially inner and outer portions;

providing a circular disk having a top surface and a bottom surface, said disk including a central portion and a outer peripheral portion;

applying a sealant material to at least the outer peripheral portion of said disk bottom surface;

introducing said disk into said shell through said central mouth.

36. The method of Claim 35 comprising providing a generally flat, flexible circular disk.

37. The method of Claim 35 further comprising providing an area of weakening in said disk between said disk central portion and said outer peripheral portion.

38. The method of Claim 37 comprising providing said area of weakening in said disk by forming a notch in said disk between said central portion and said outer peripheral portion.

39. The method of Claim 37 comprising pressing said outer peripheral portion of said disk against said flange to substantially conform said outer peripheral portion to the shape of said inner radial and top portions of said flange bottom surface.

40. The method of Claim 35 comprising providing a disk having a central portion and outer peripheral portion, said outer peripheral portion having a generally C-shaped cross-section and including a radially inner, downwardly extending surface and a radially outer curved surface.

41. The method of Claim 40 comprising thermoforming said disk to provide disk having an outer peripheral portion with a generally C-shaped cross-section, including a radially inner,

-23-

downwardly extending surface and a curved surface.

42. The method of Claim 41 comprising applying said sealant prior to said thermoforming.

43. A composite closure cap for a container comprising:

an end panel disc substantially made of one or more plastic materials and having oxygen barrier properties;

a plastic ring including a downwardly extending skirt and upper radially inwardly extending flange, said flange overlying the outer periphery of said disc;

a sealant applied to the bottom surface of said disc.

44. The composite closure of Claim 43 wherein said sealant is applied to the outer peripheral portion of said disc bottom surface as a gasket.

45. The composite closure of Claim 43 wherein said end panel comprises a single sheet of one or more plastic materials.

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FIG. 1

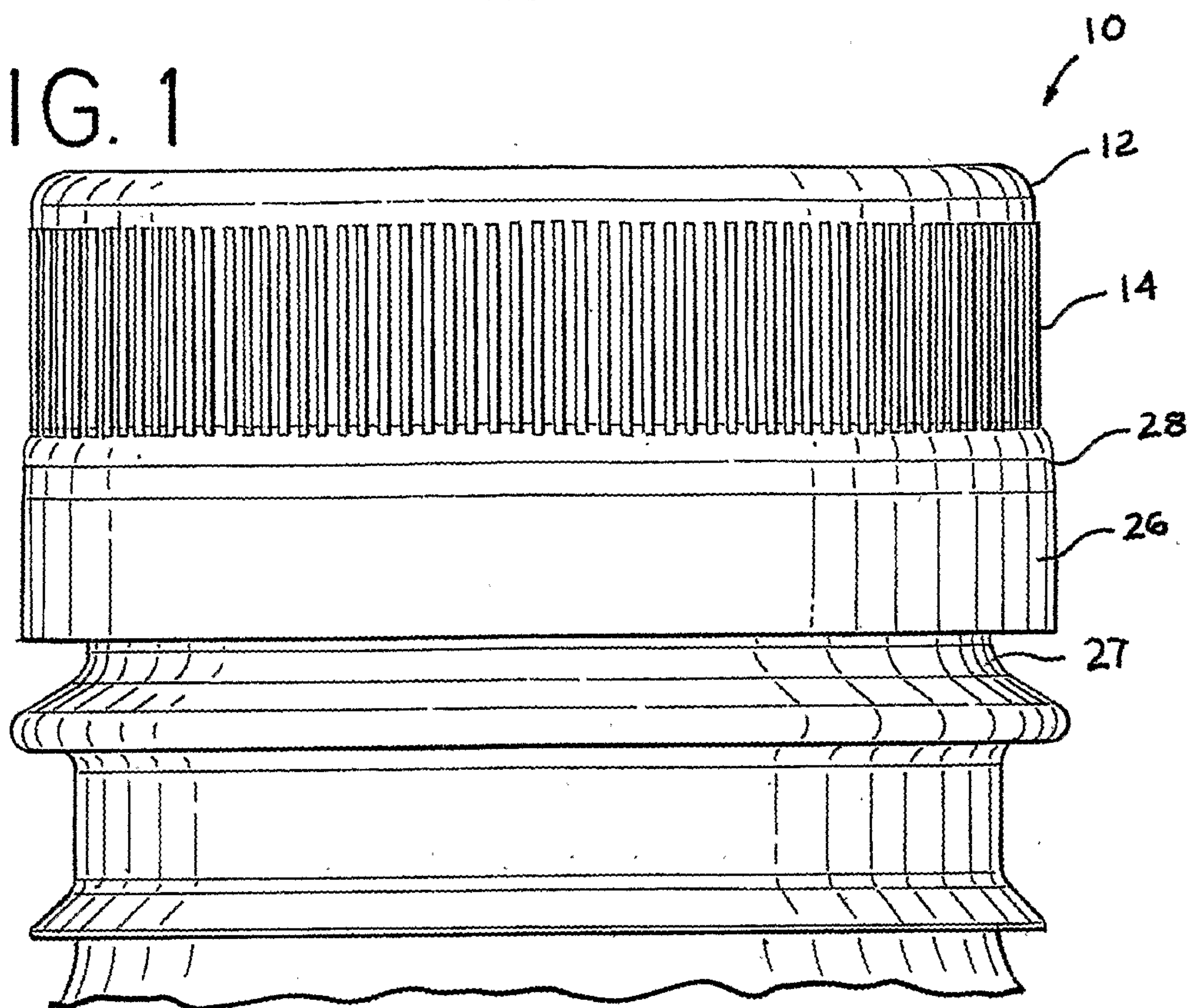
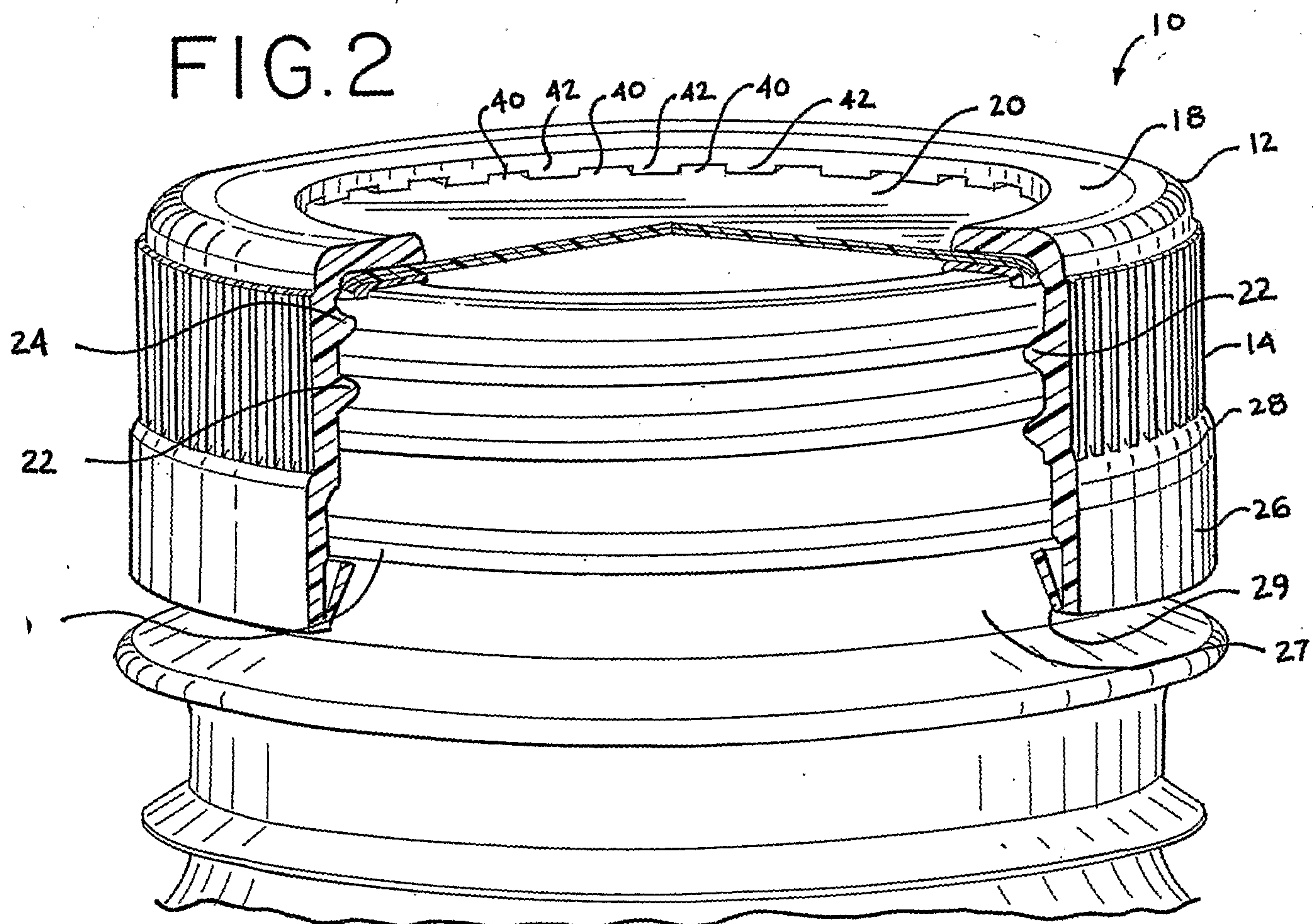


FIG. 2



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FIG. 3

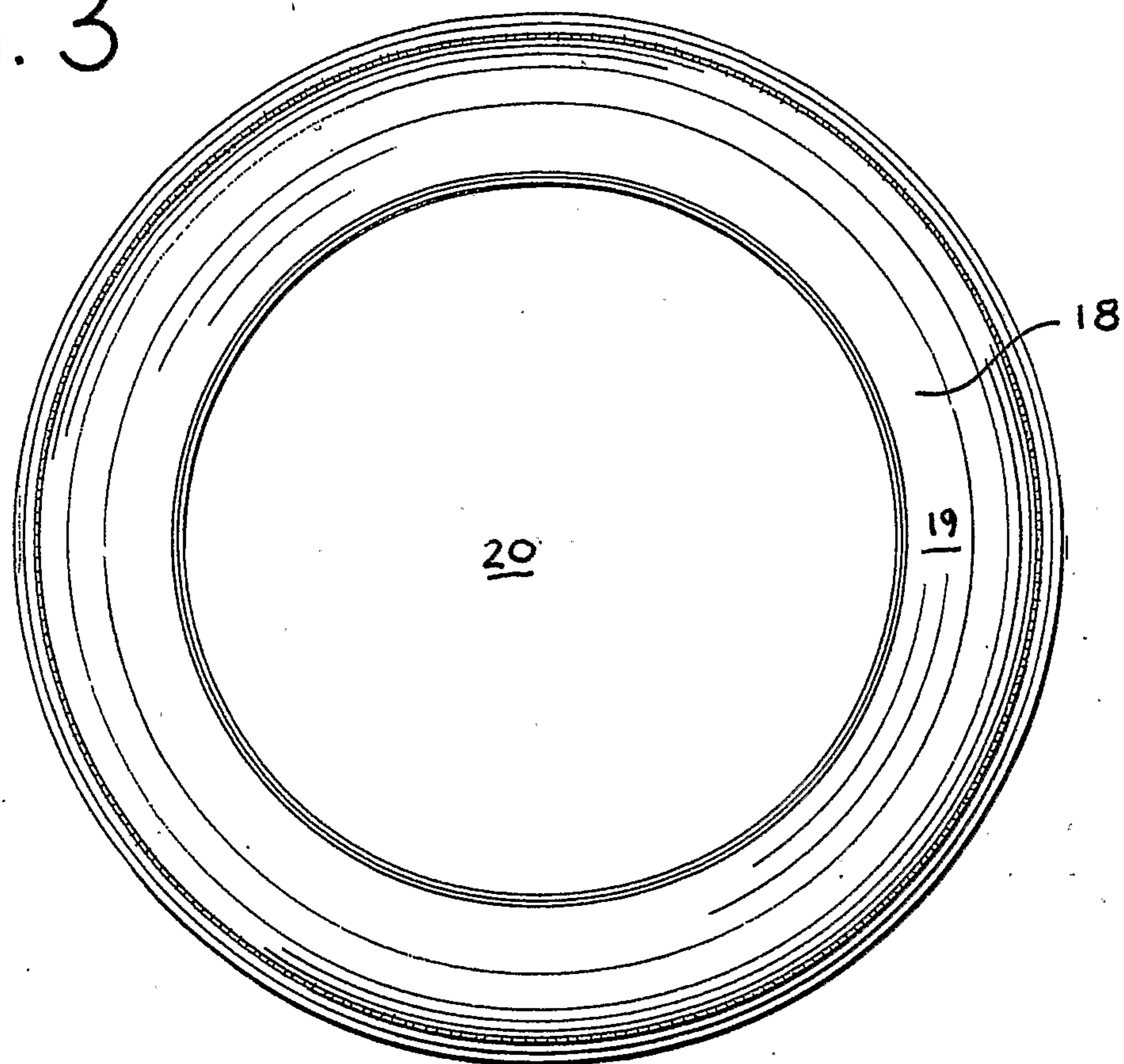
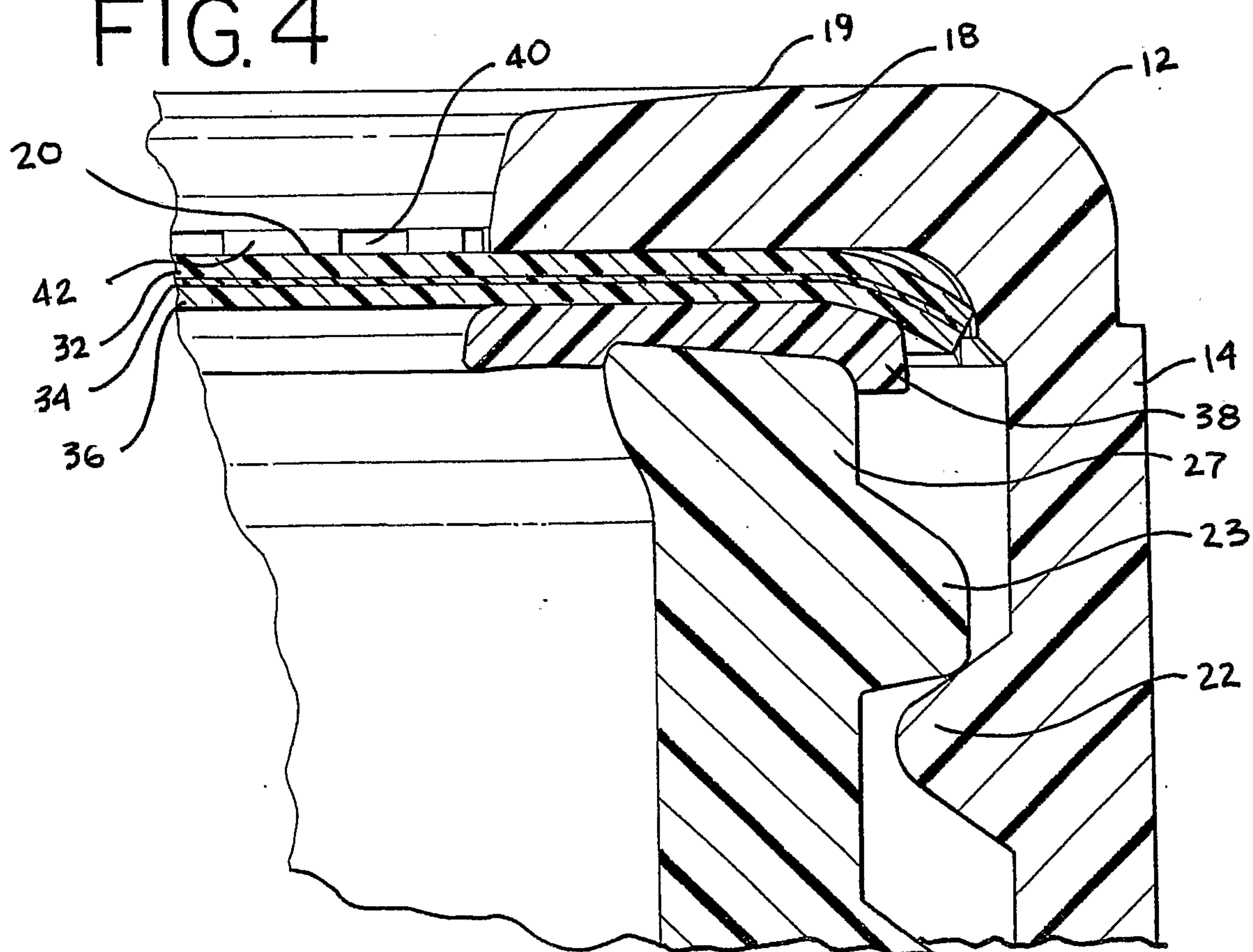


FIG. 4



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FIG. 5

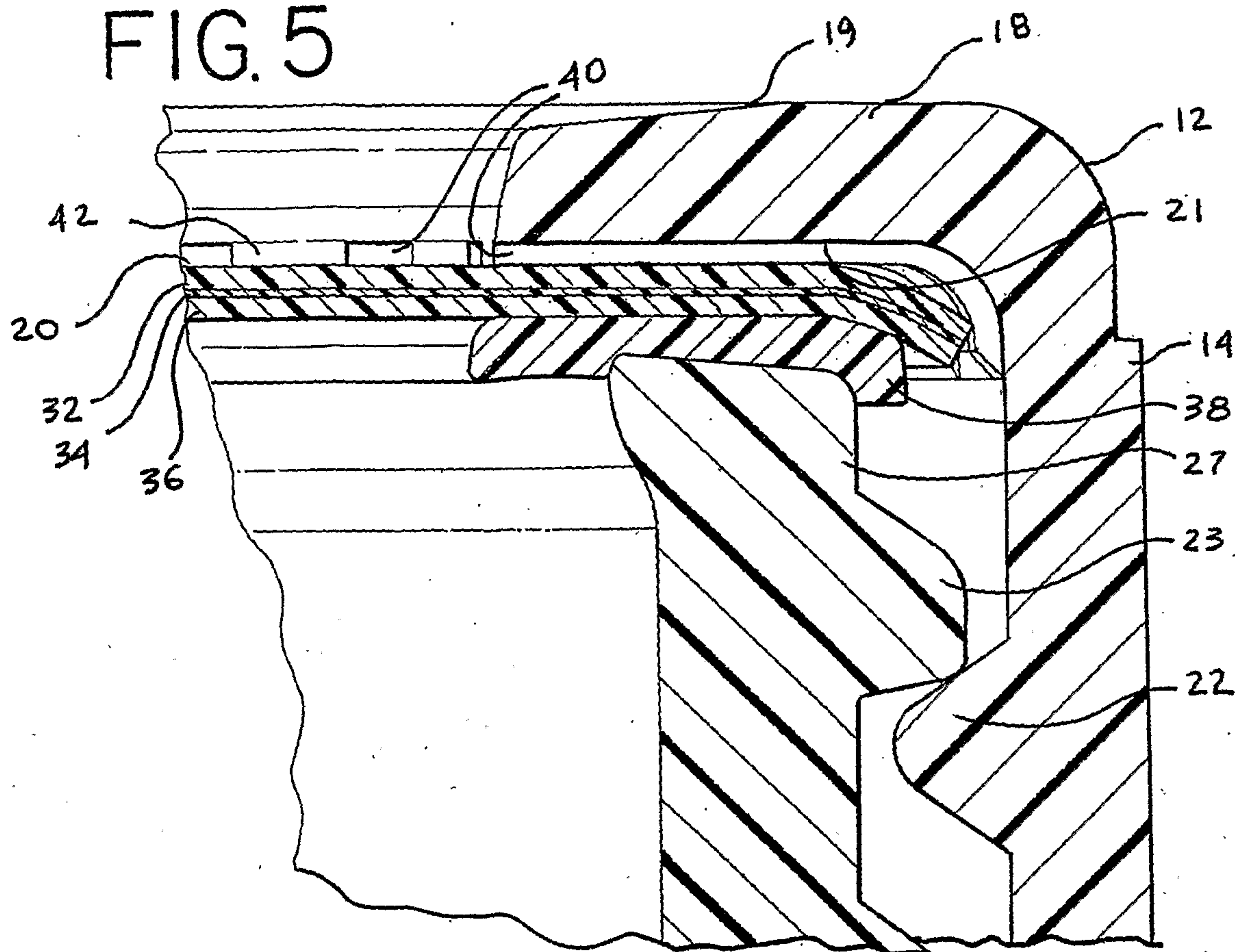
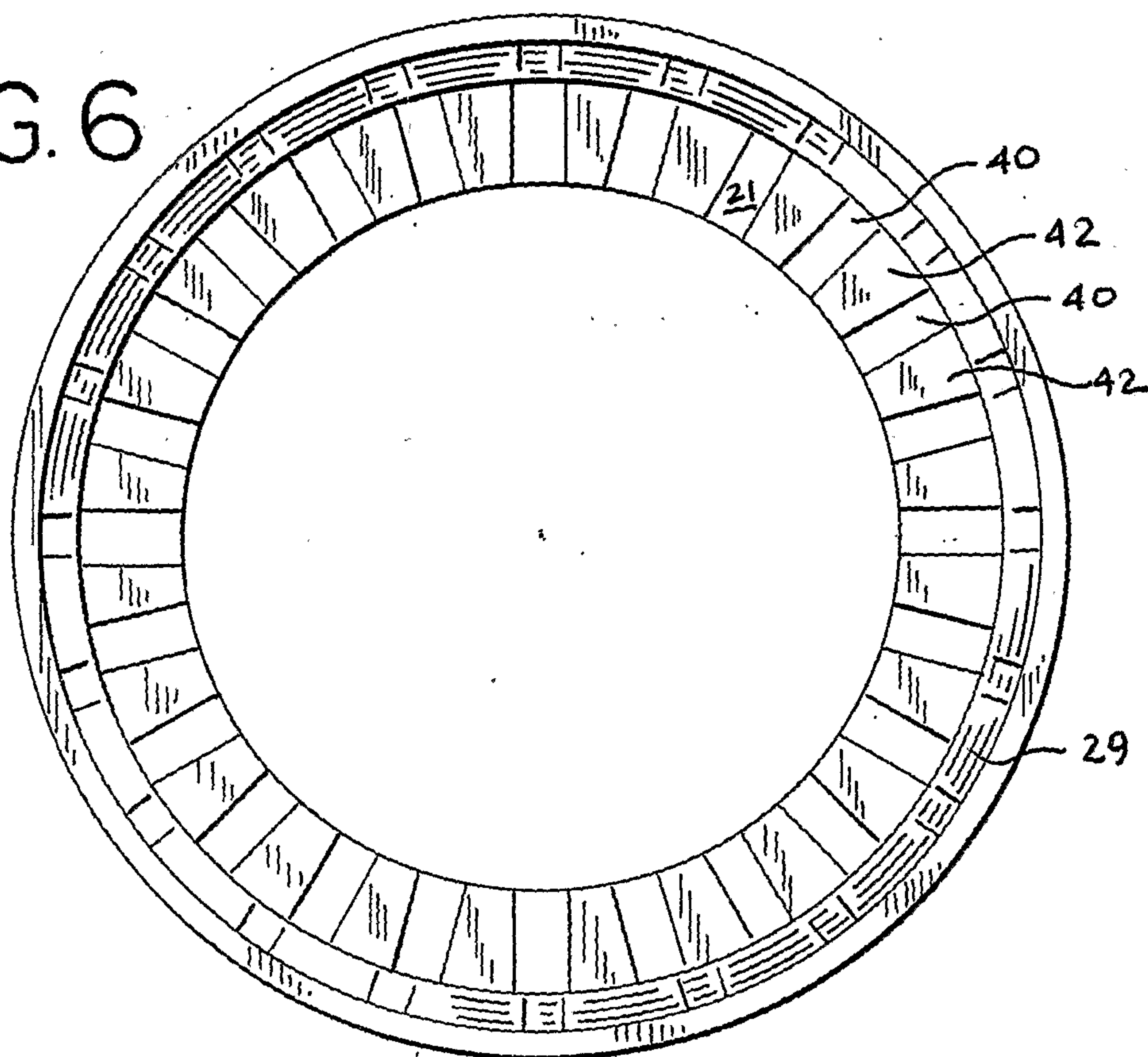


FIG. 6



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FIG. 7

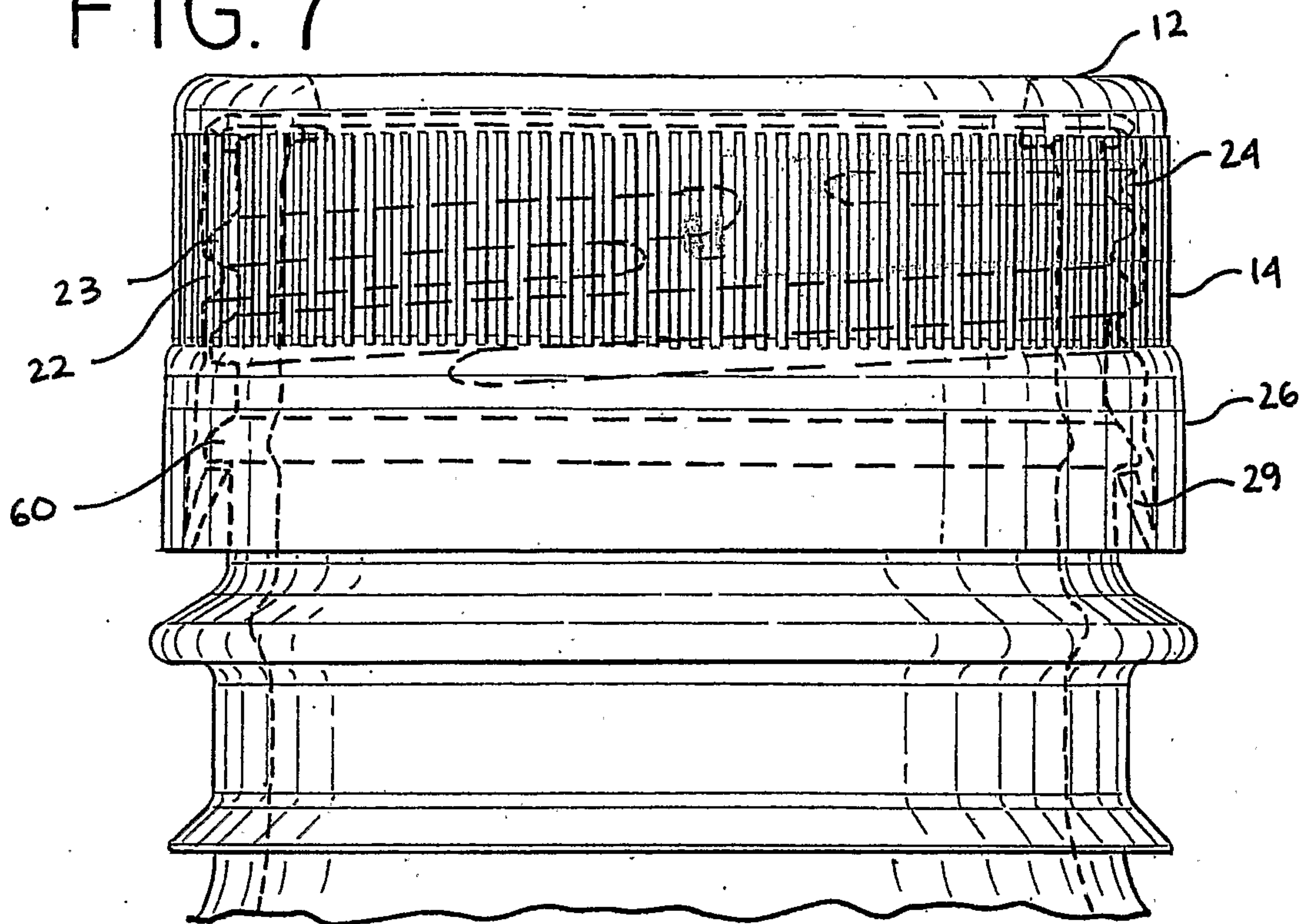
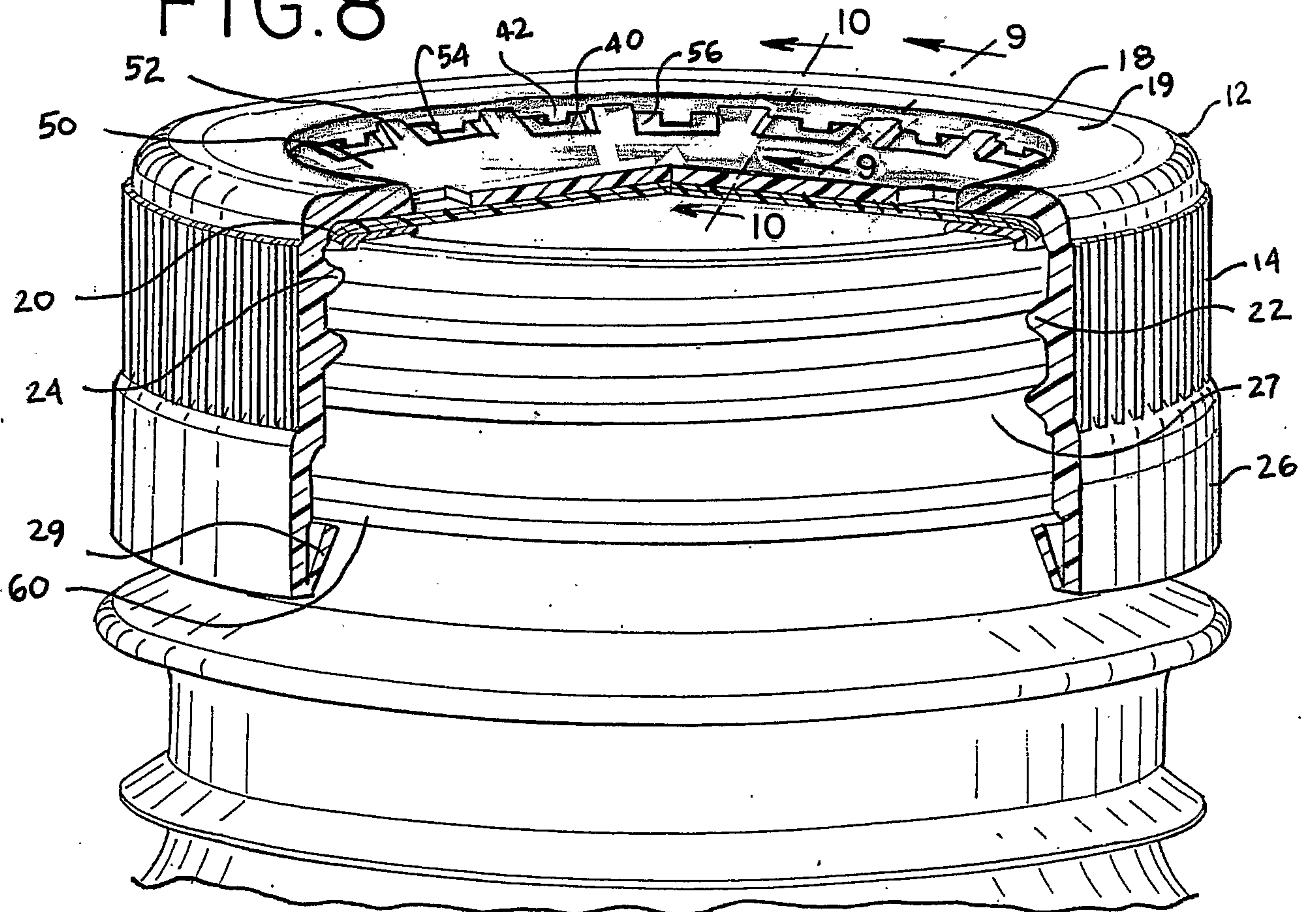


FIG. 8



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FIG. 9

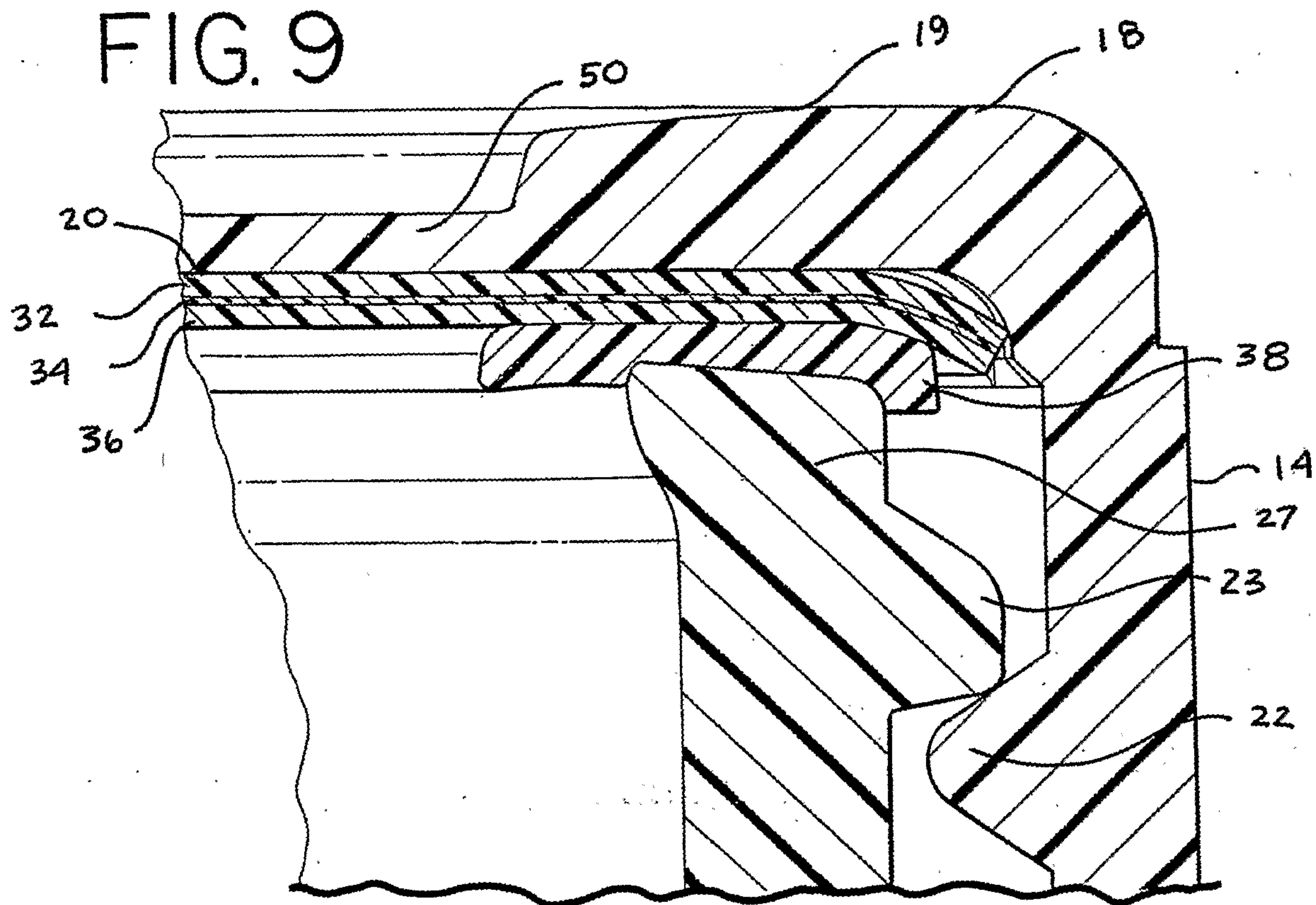
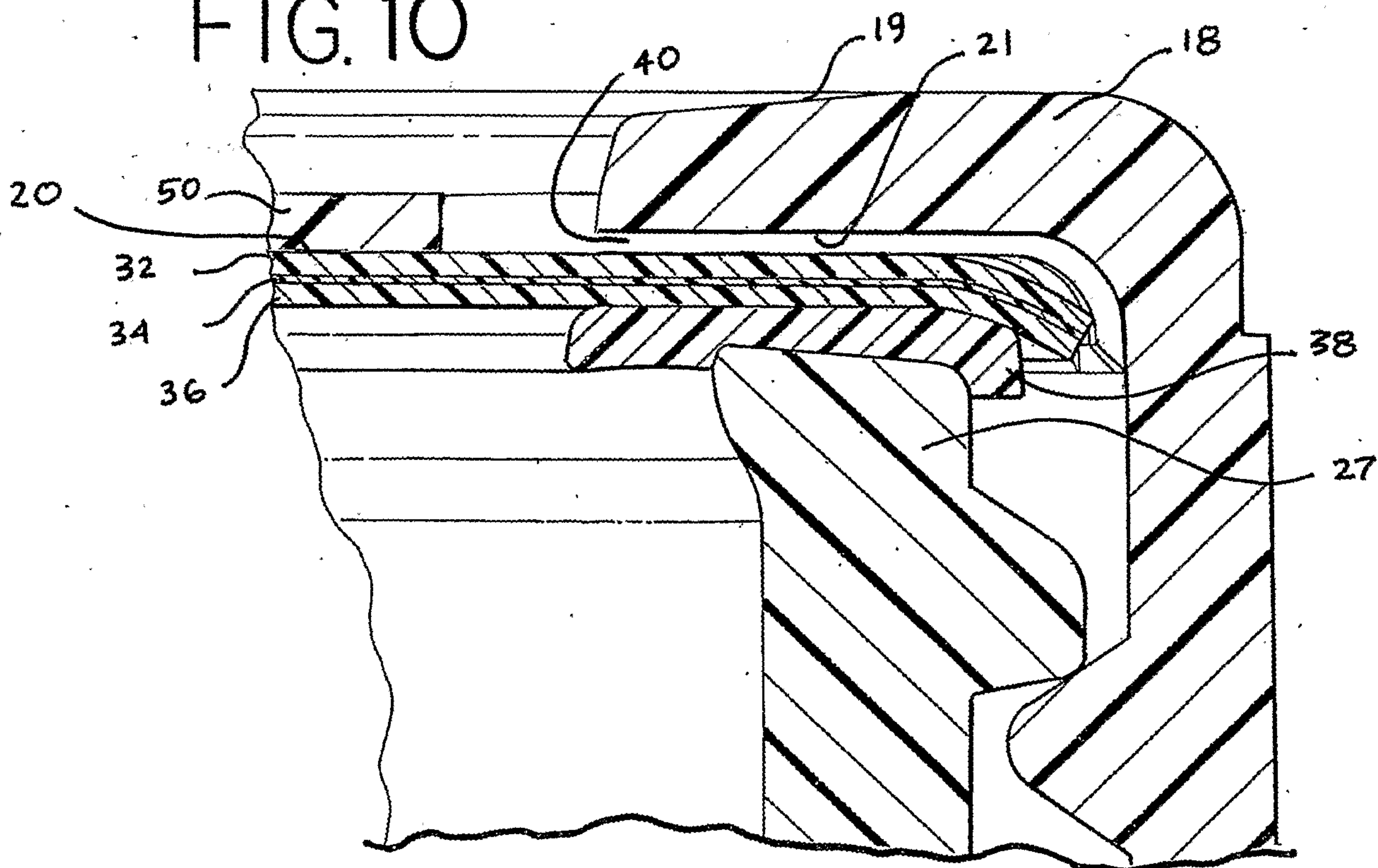


FIG. 10



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FIG. 11

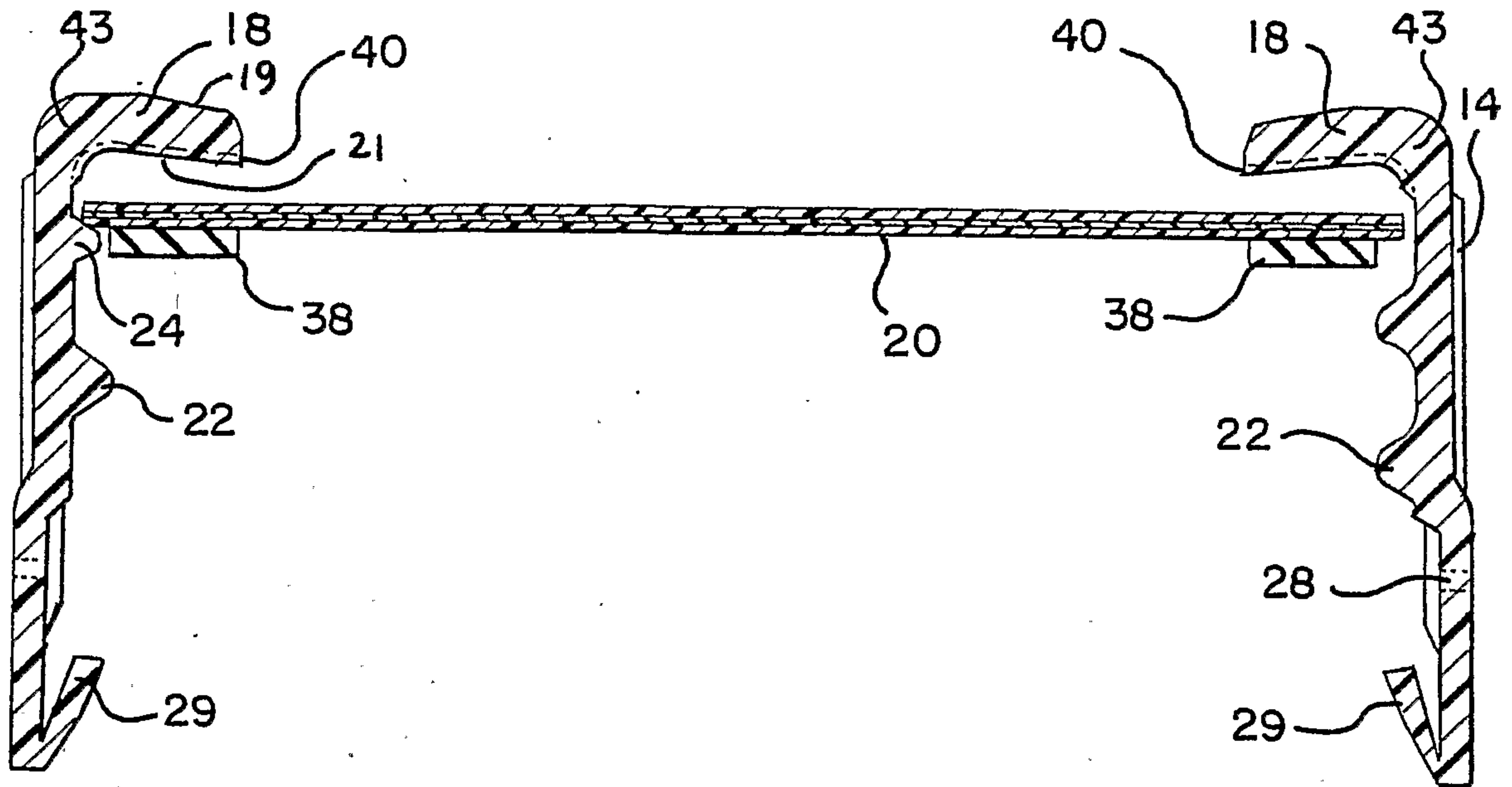
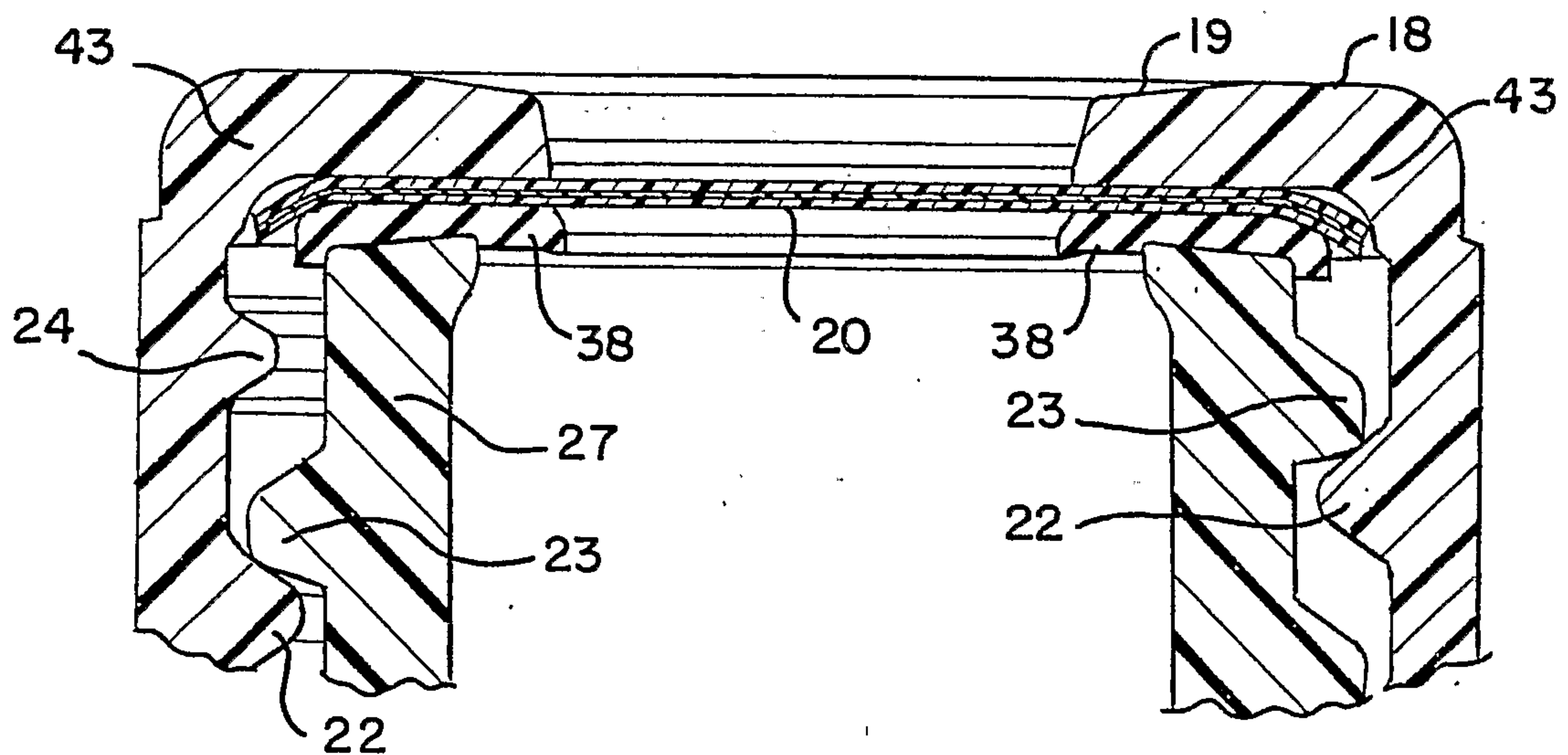


FIG. 12



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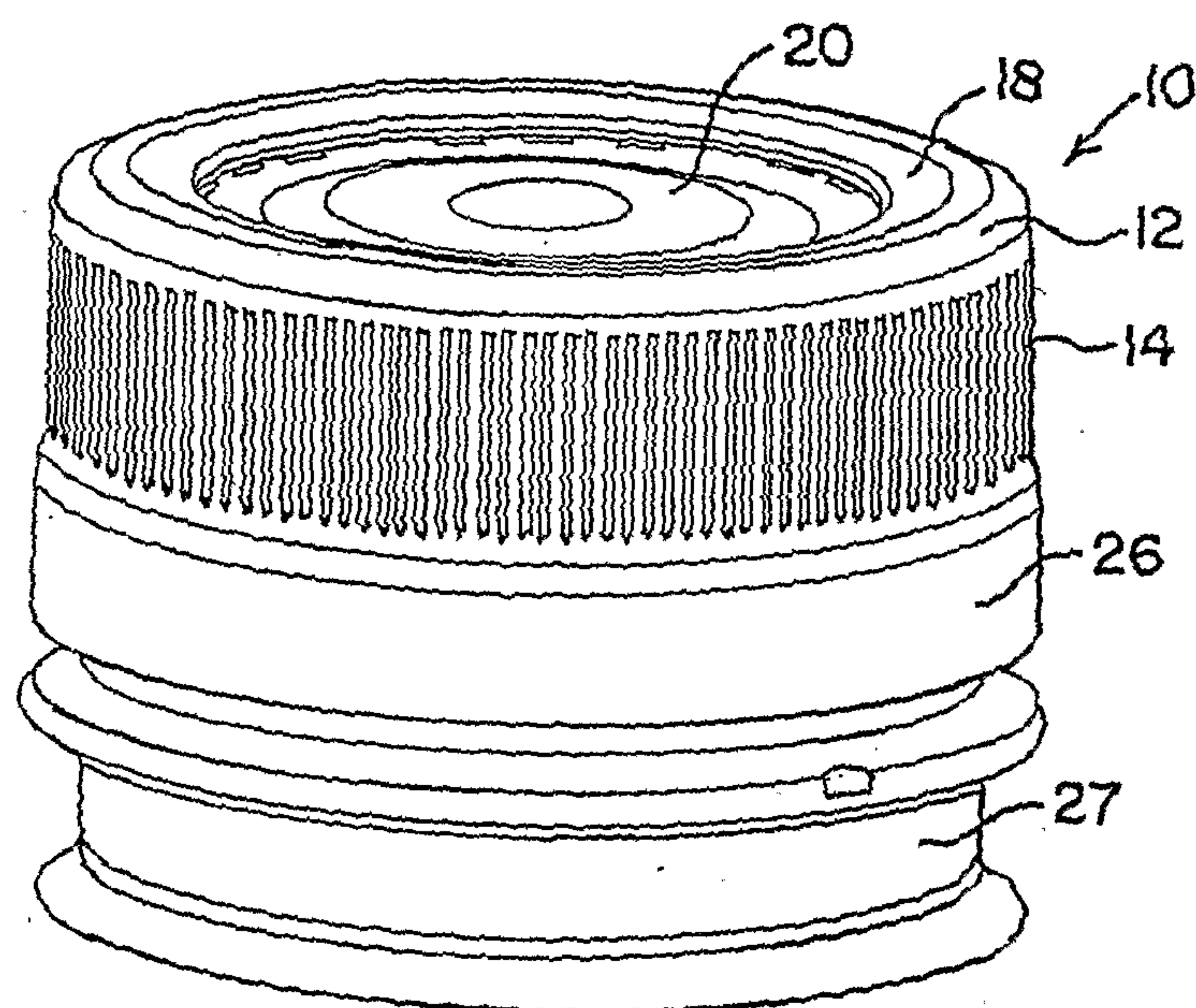


FIG. 13

FIG. 14

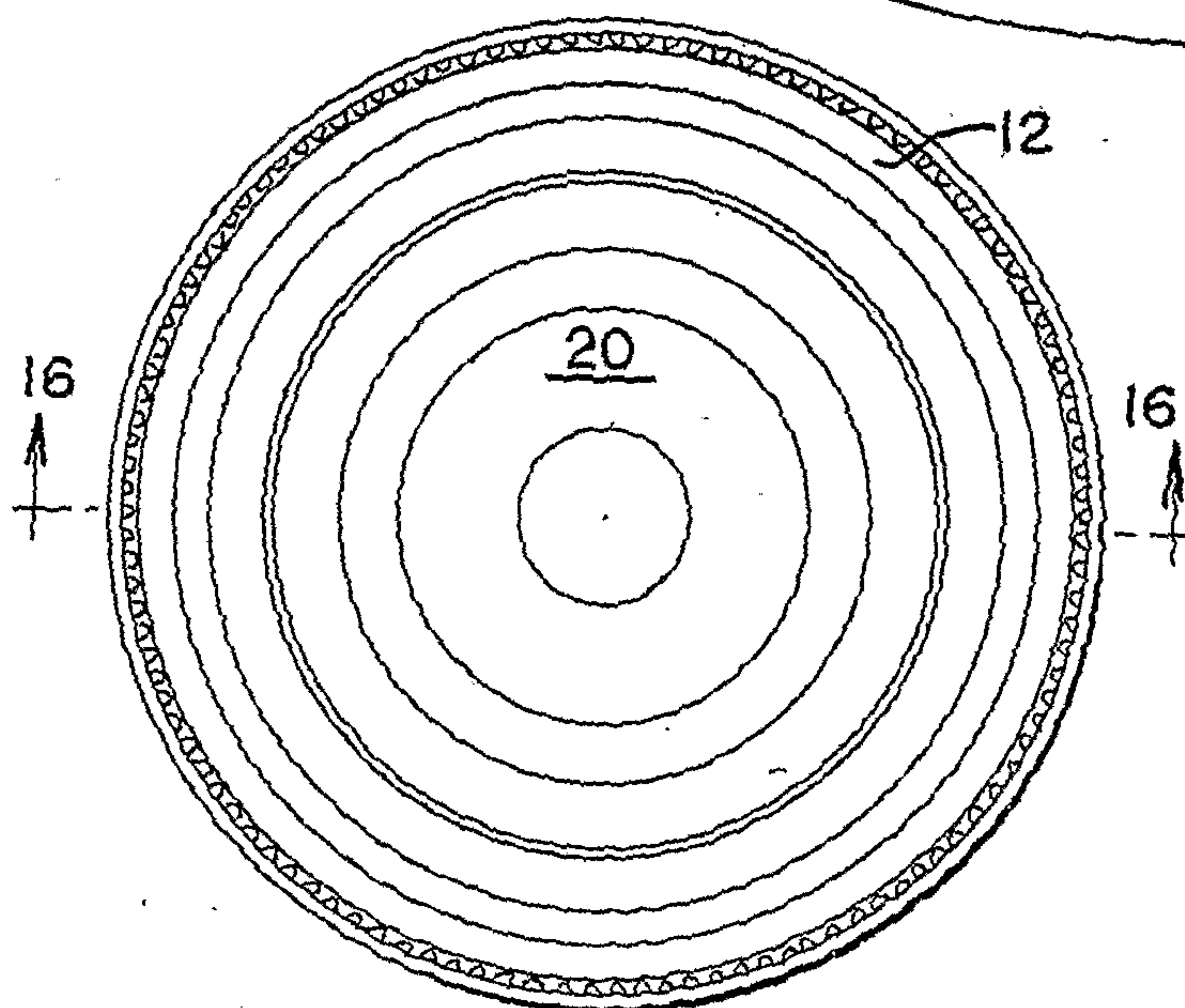
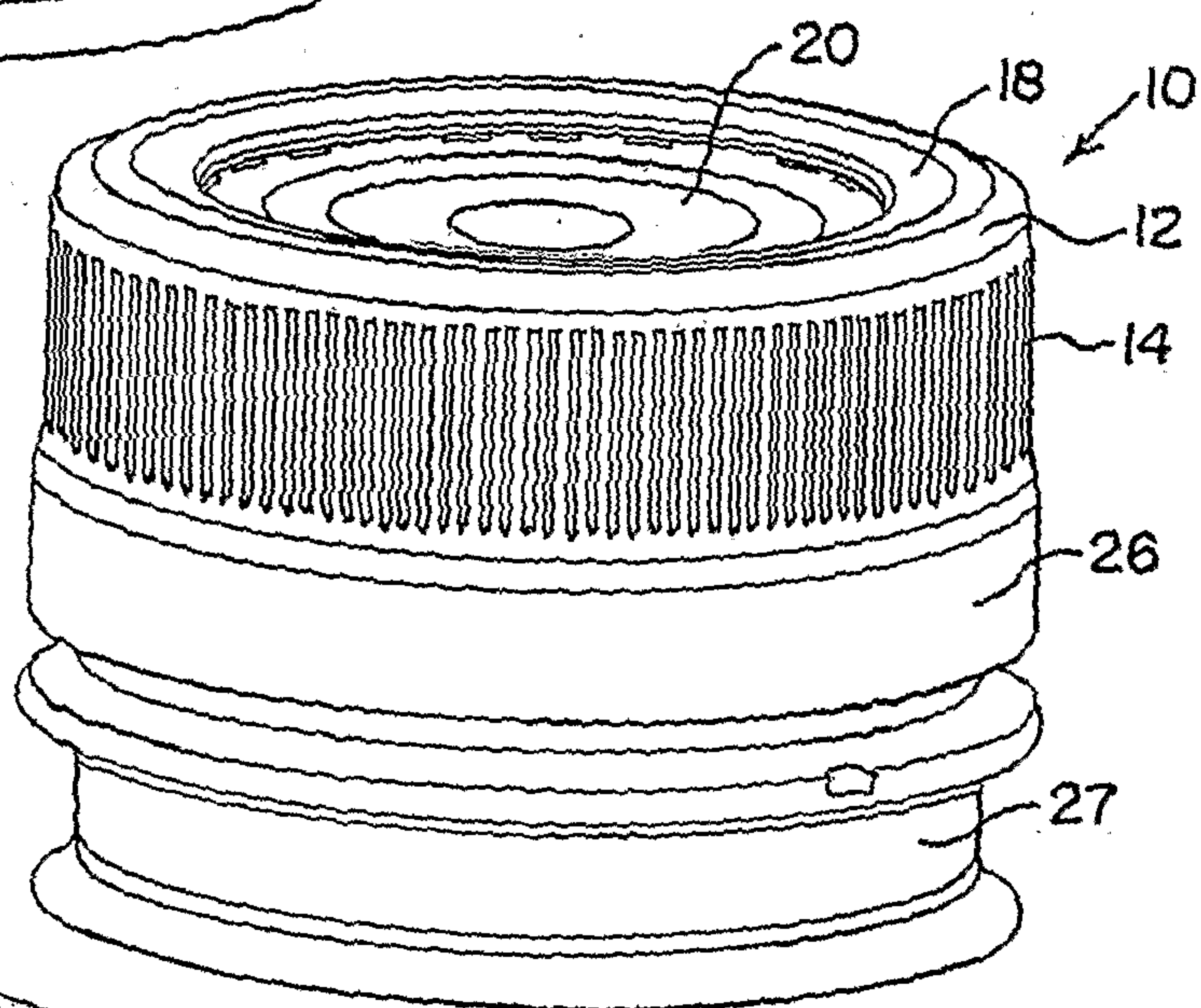


FIG. 15

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FIG. 16

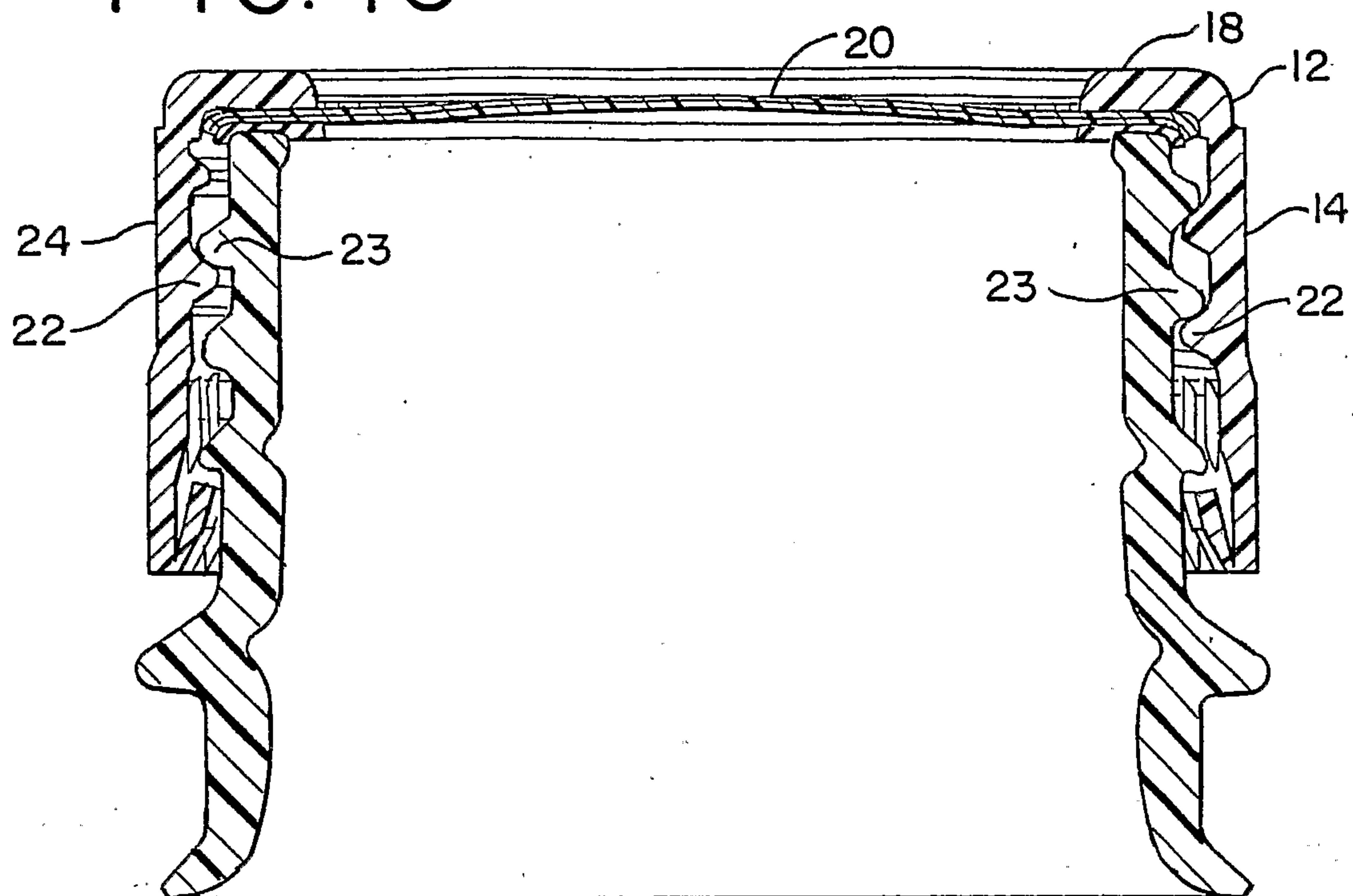
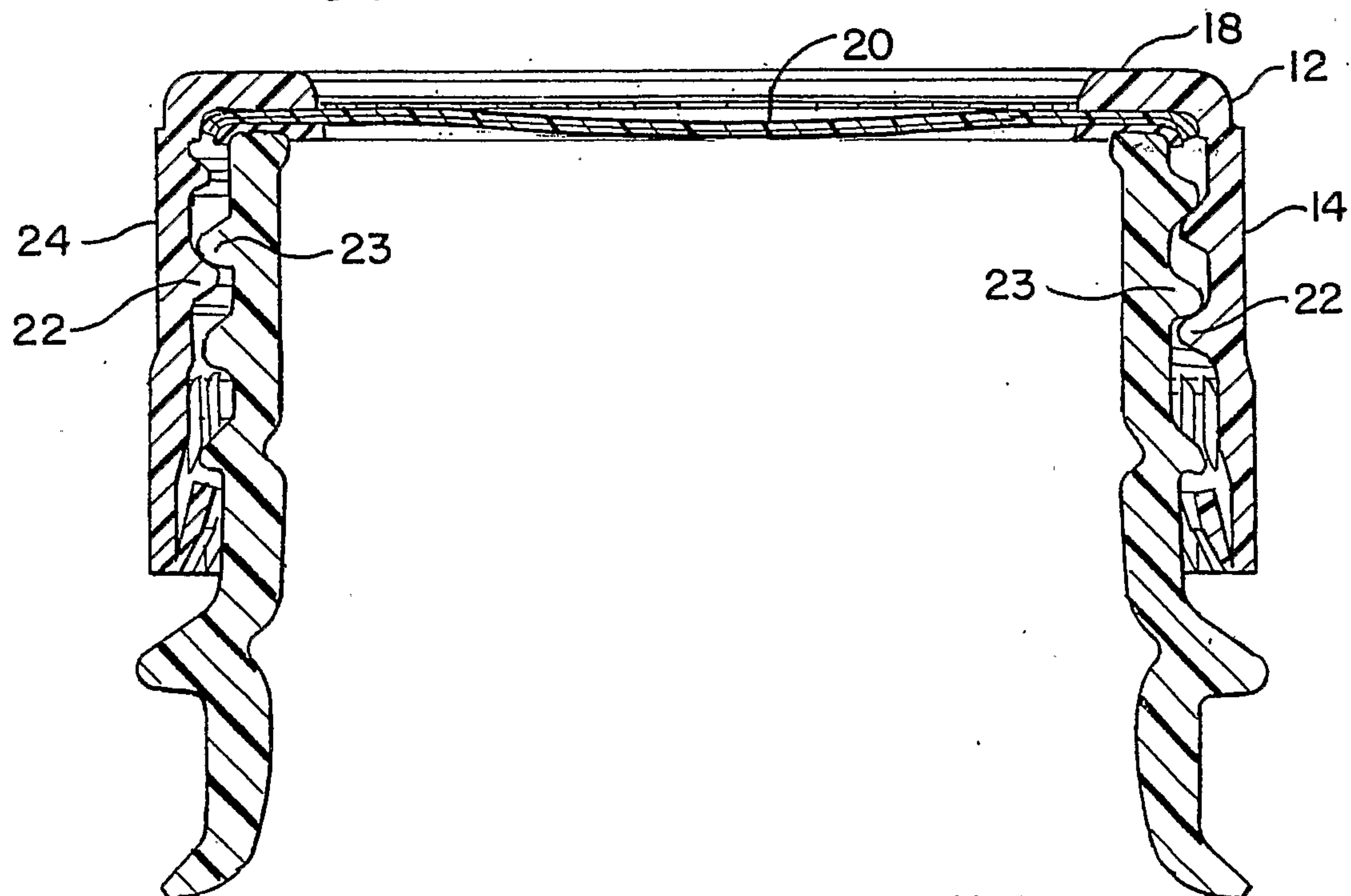


FIG. 17



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FIG. 18

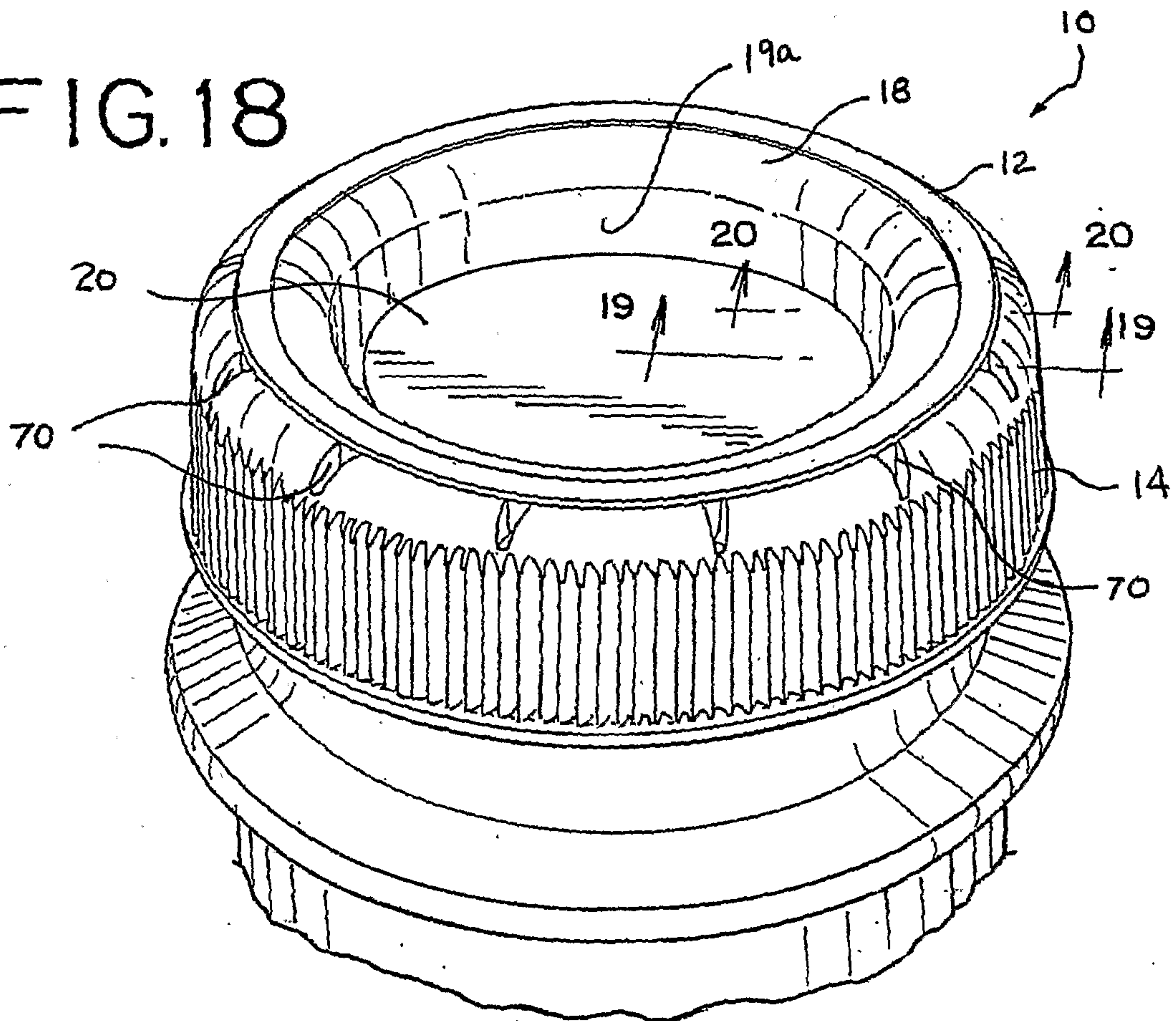


FIG. 19

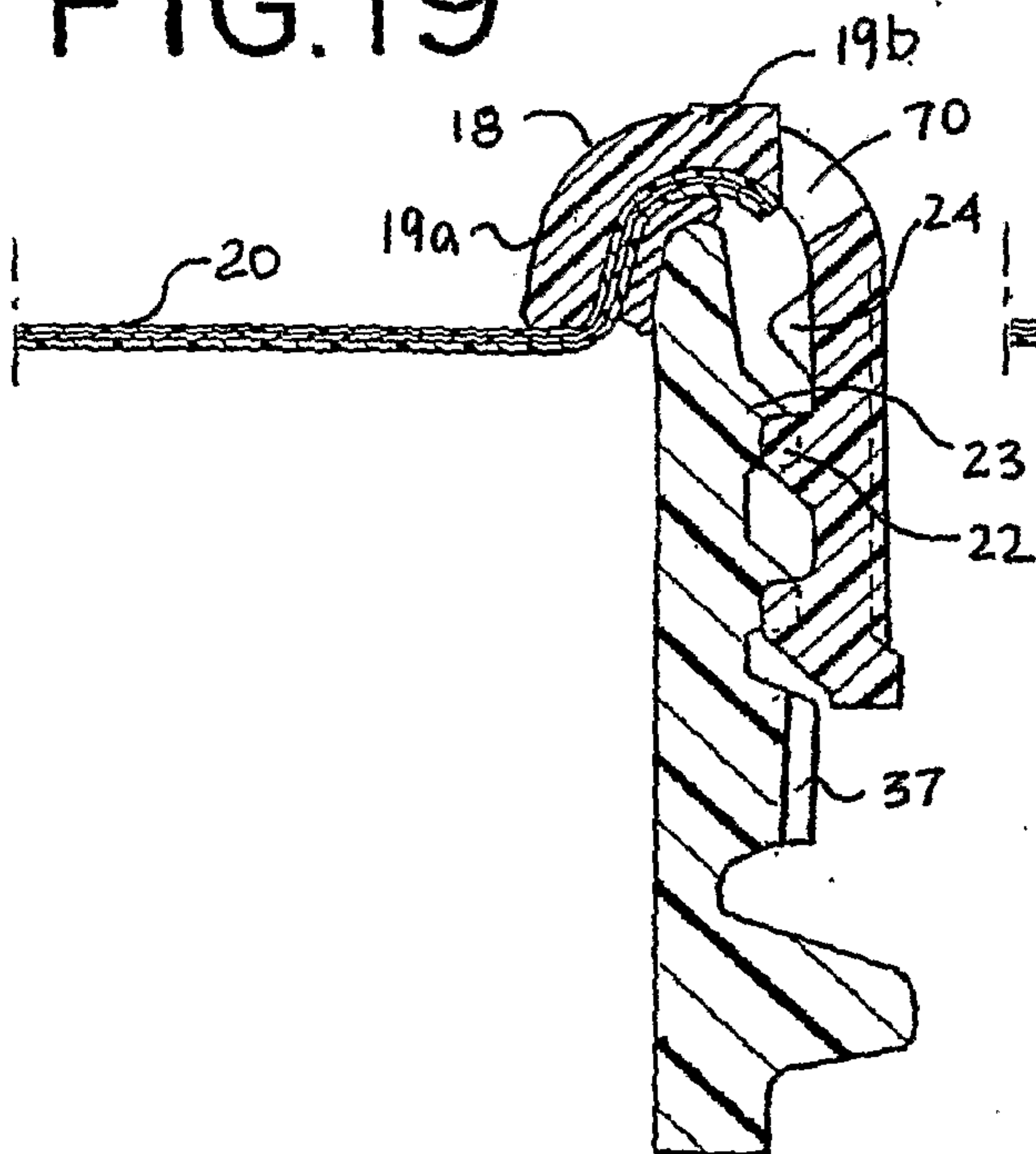
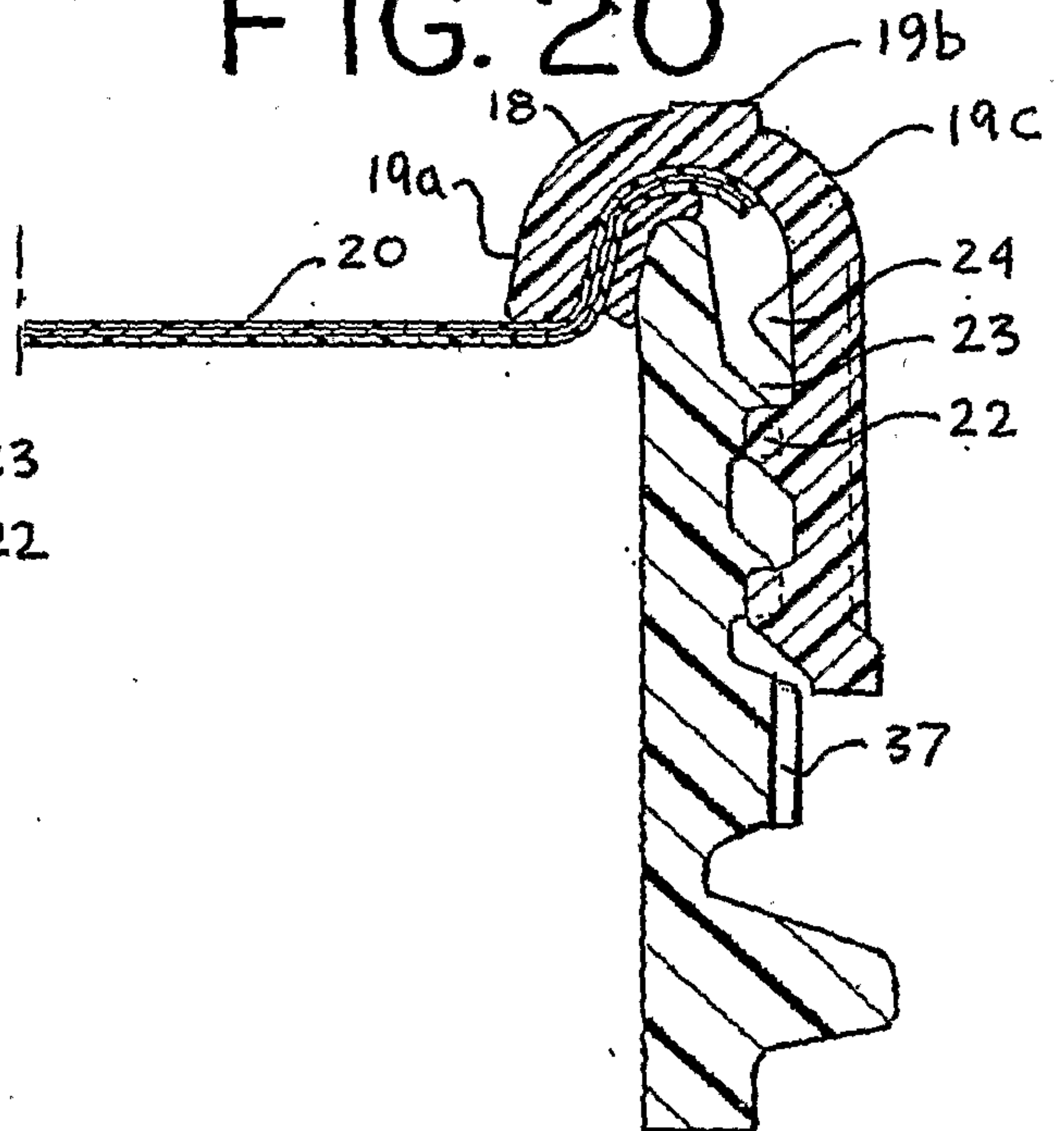
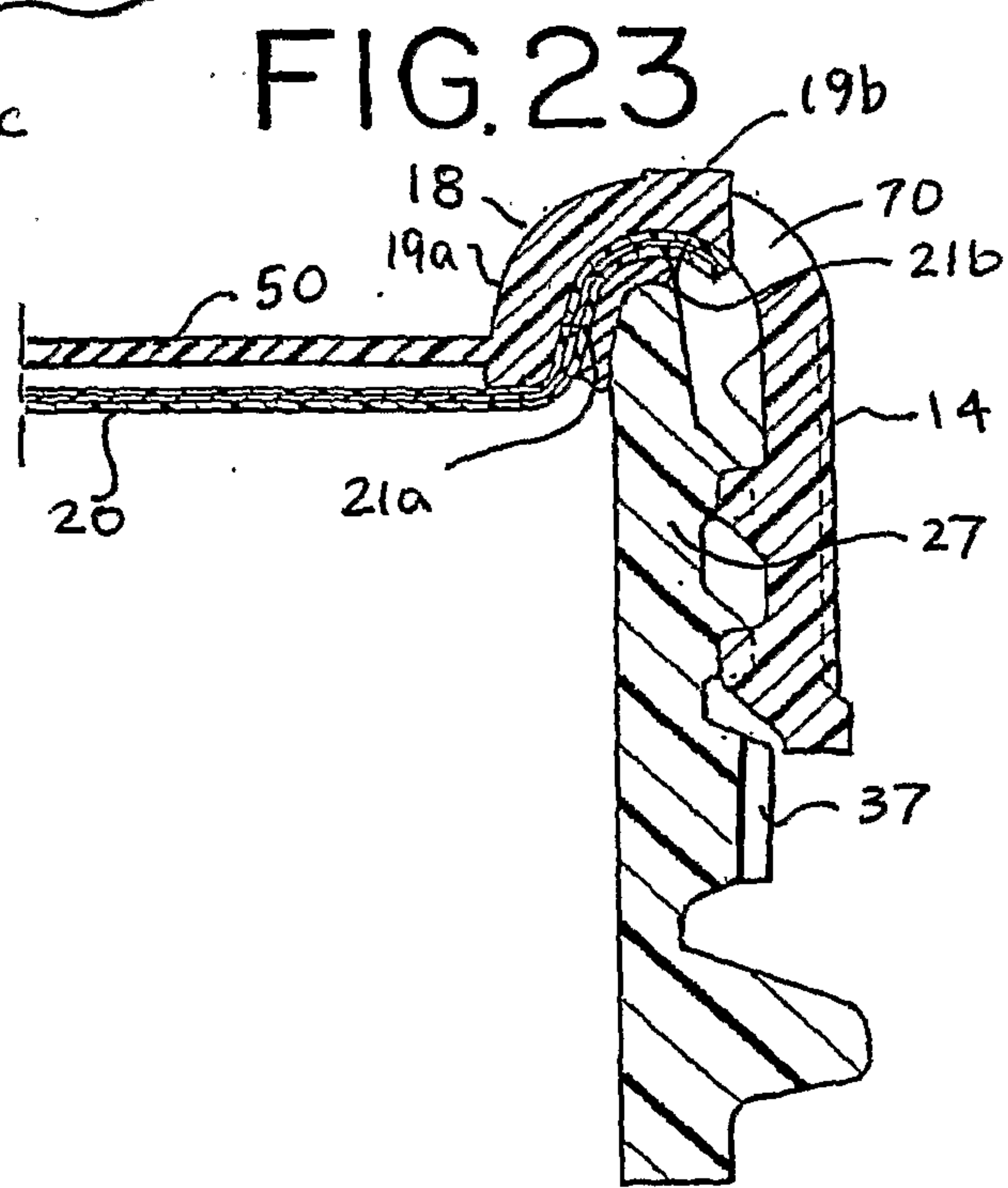
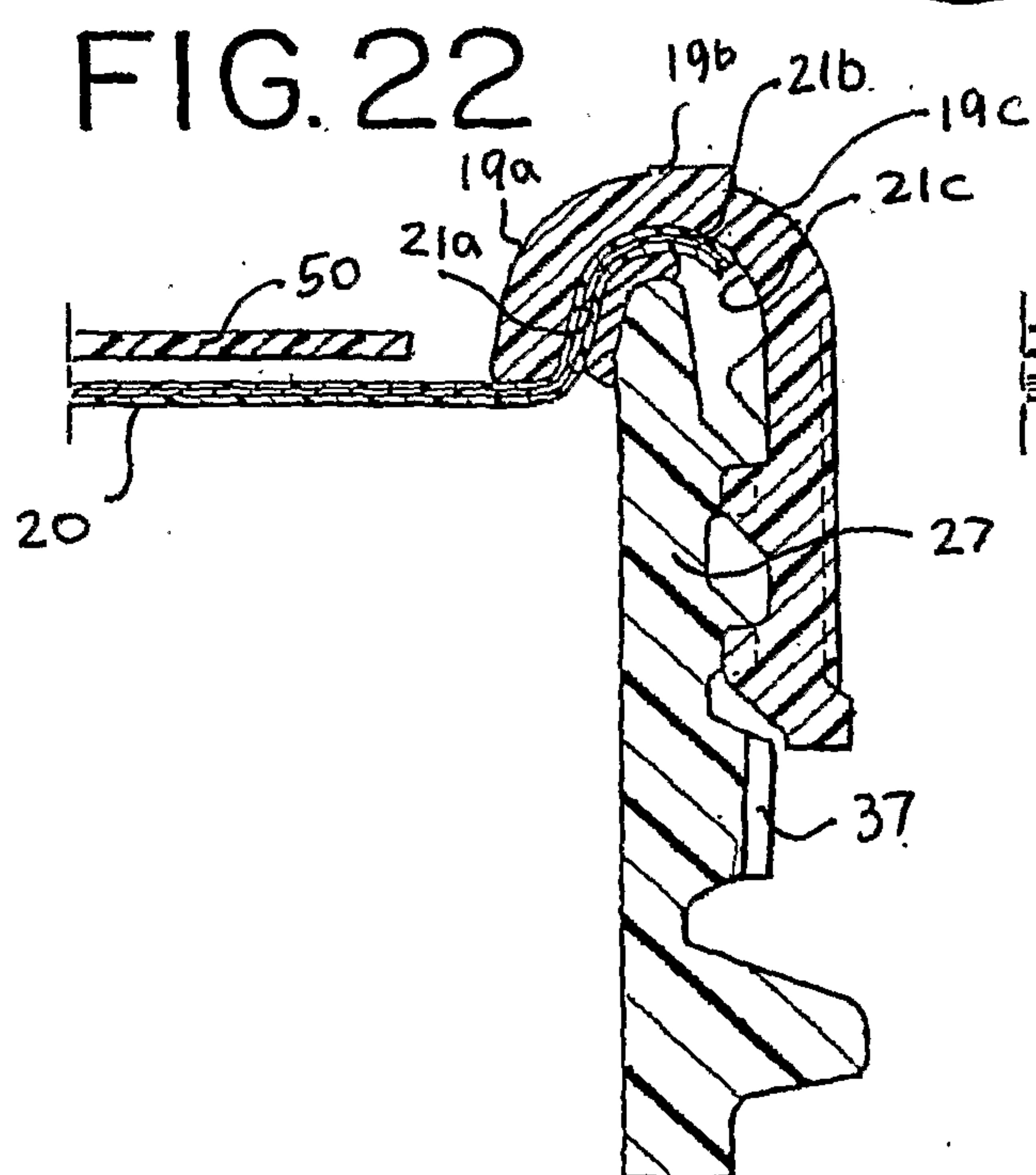
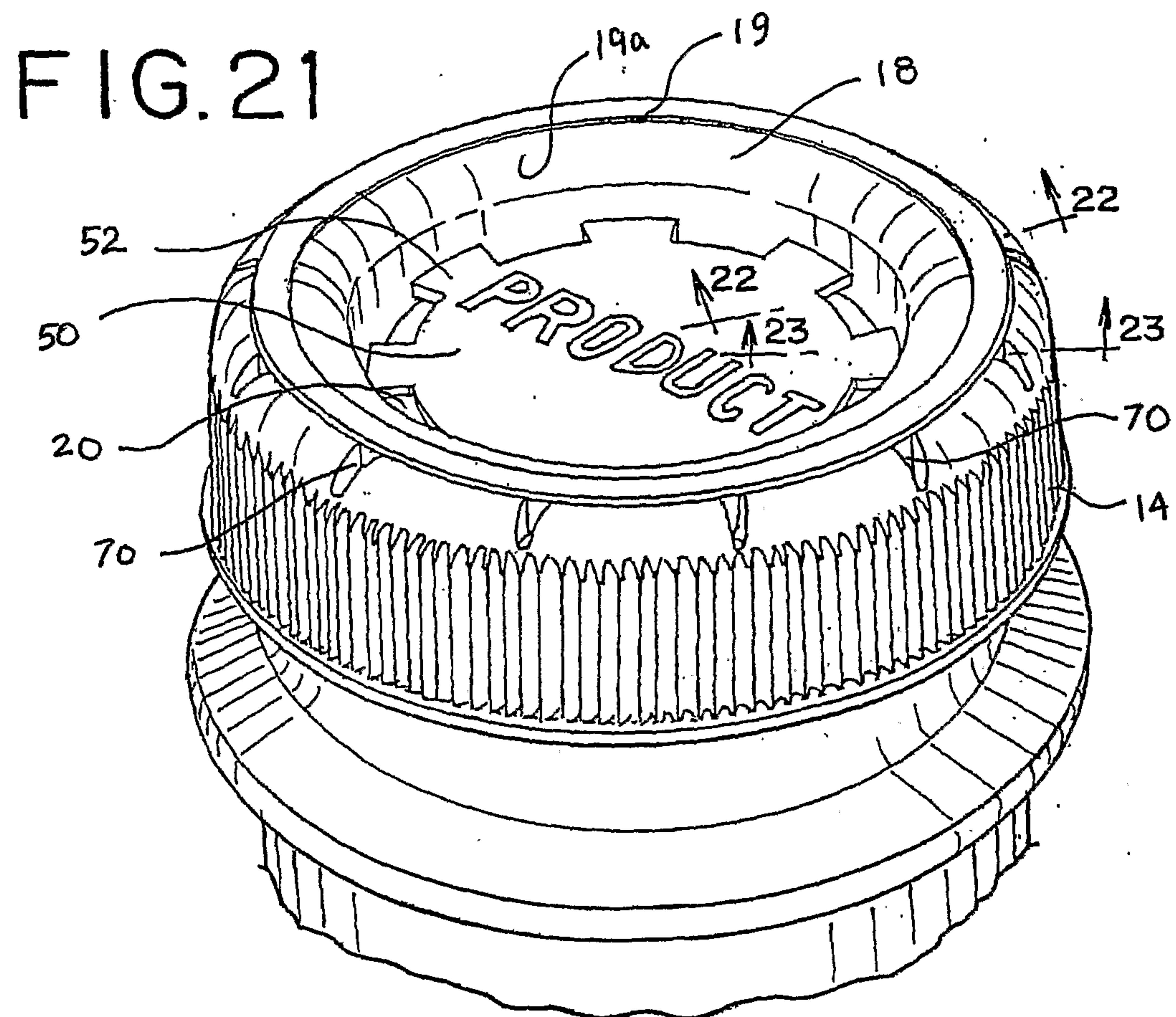


FIG. 20



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FIG. 24

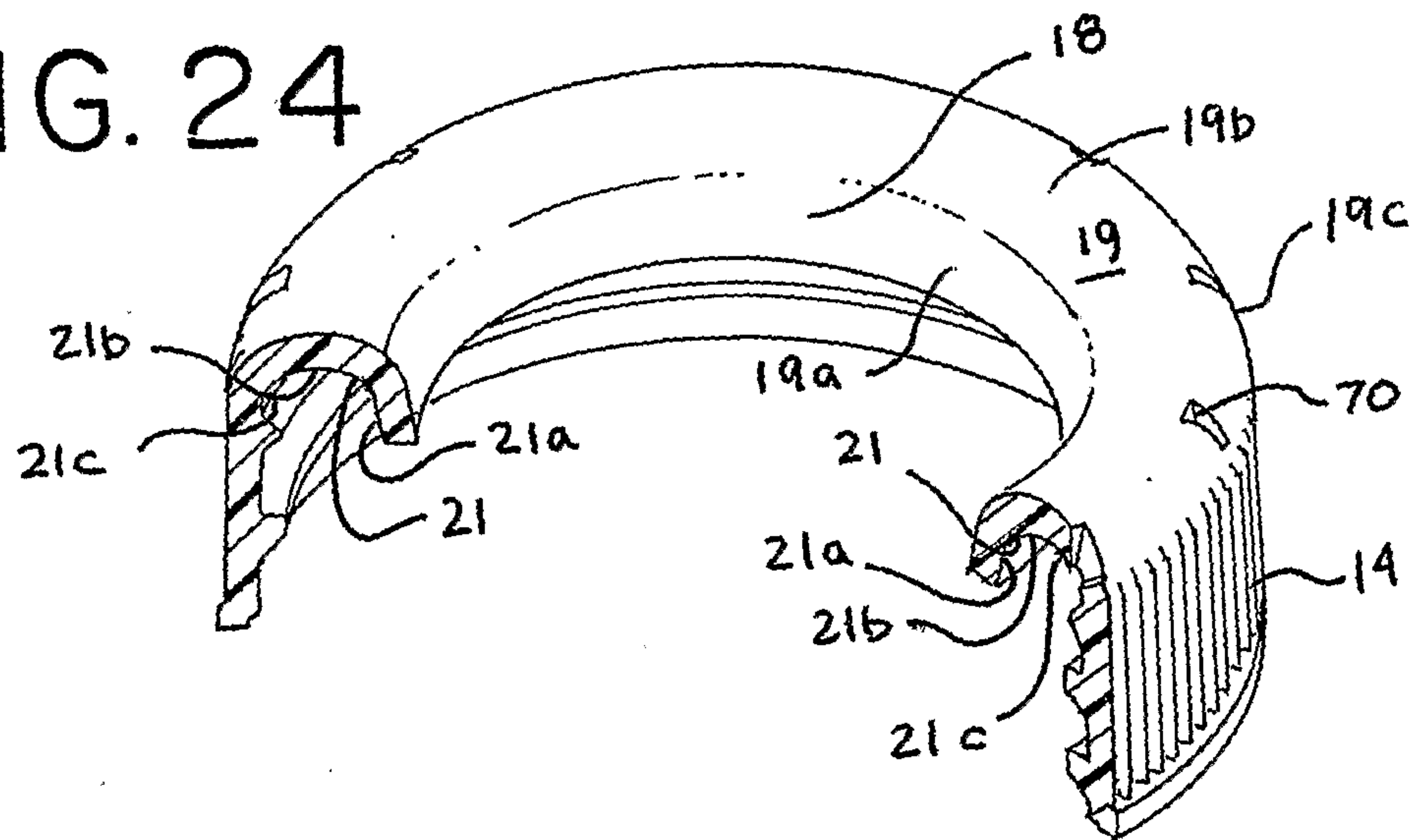


FIG. 25

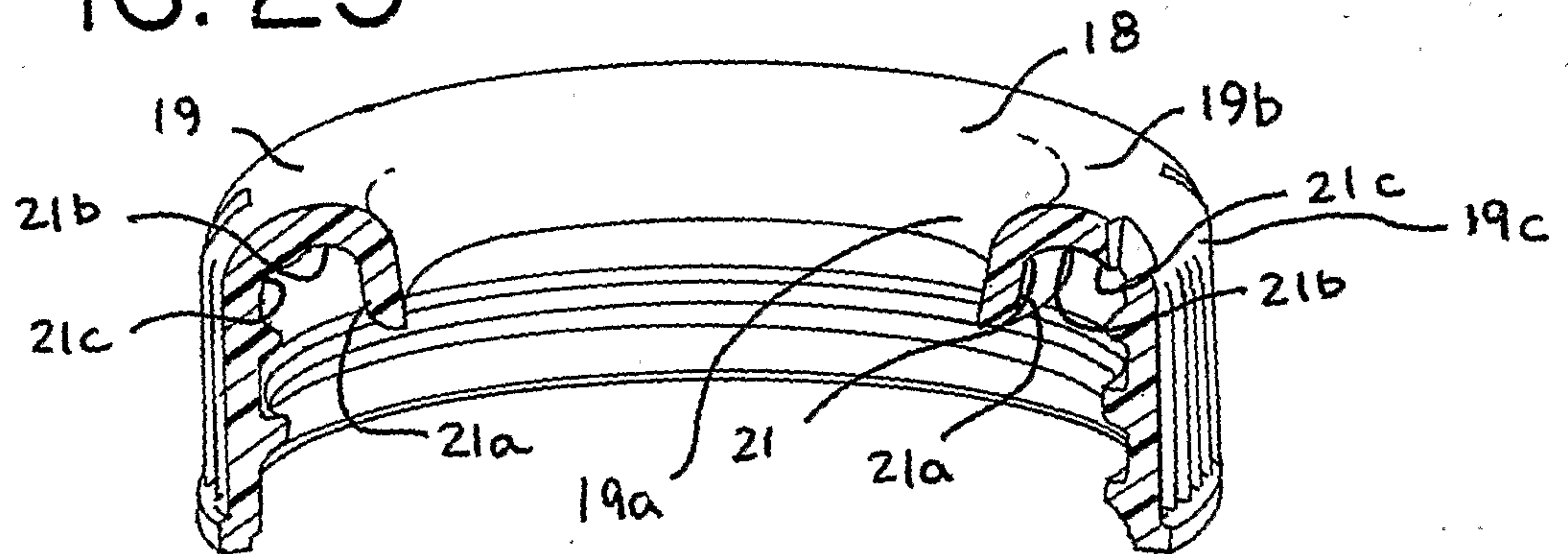
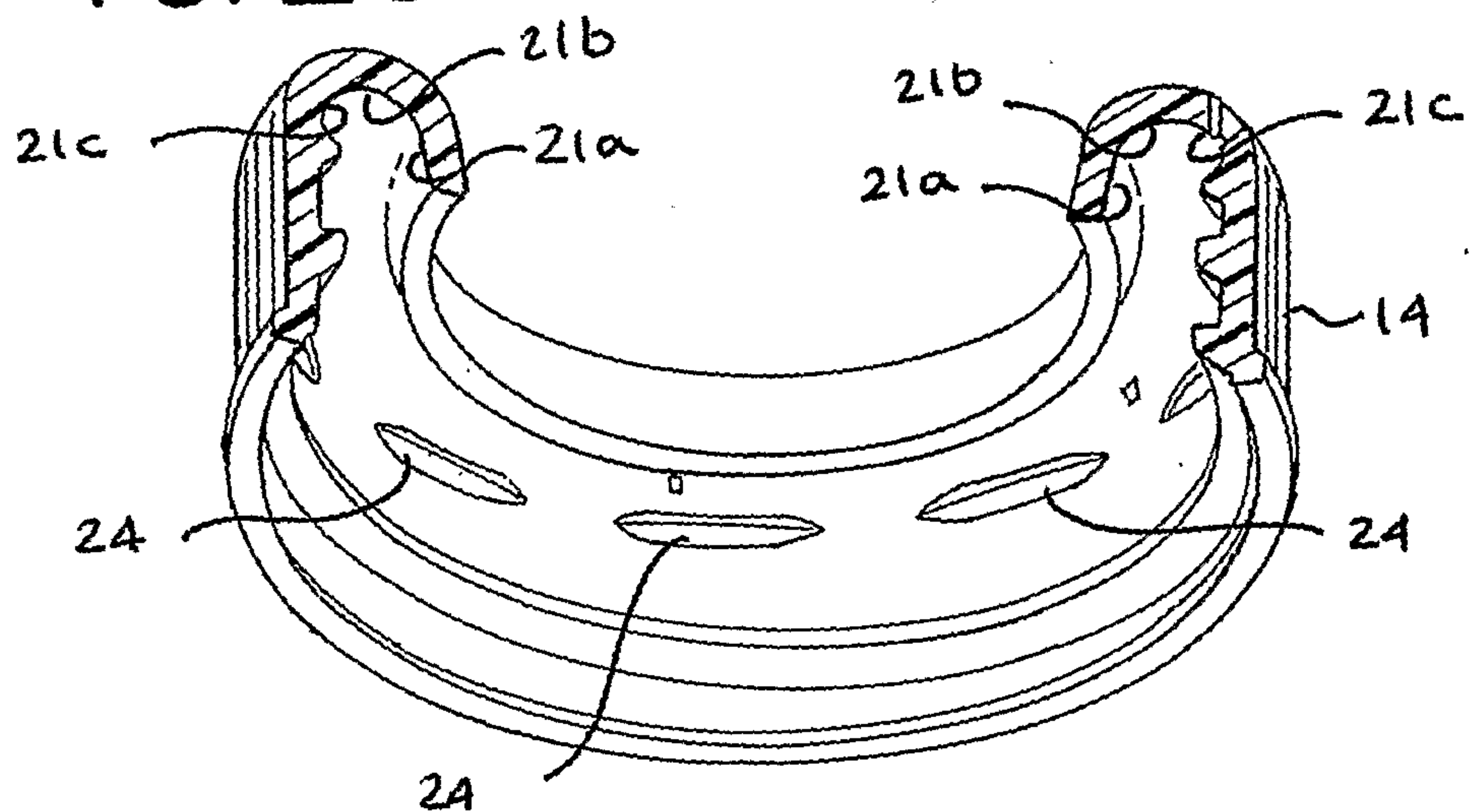


FIG. 26



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FIG. 27A

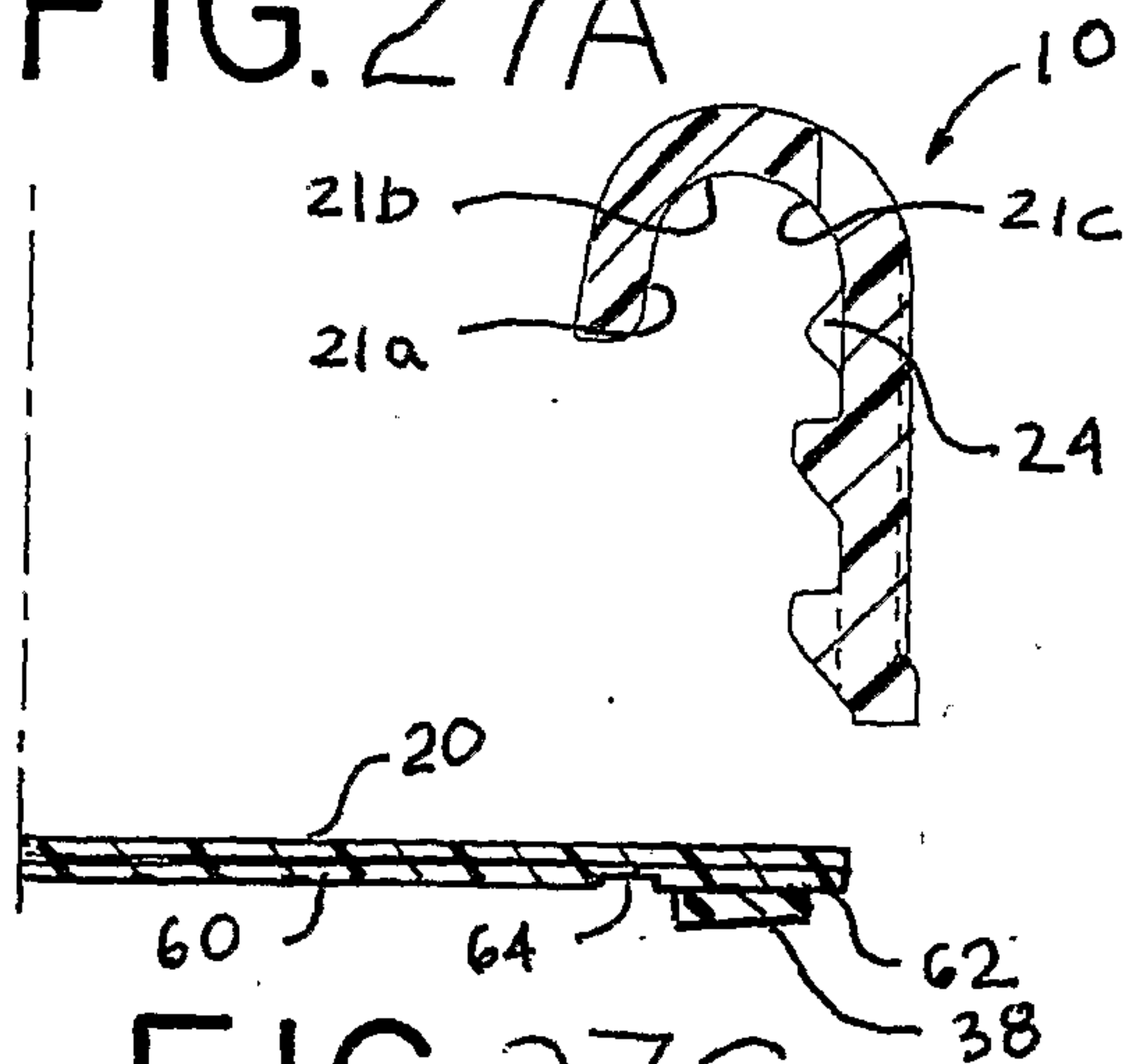


FIG. 27B

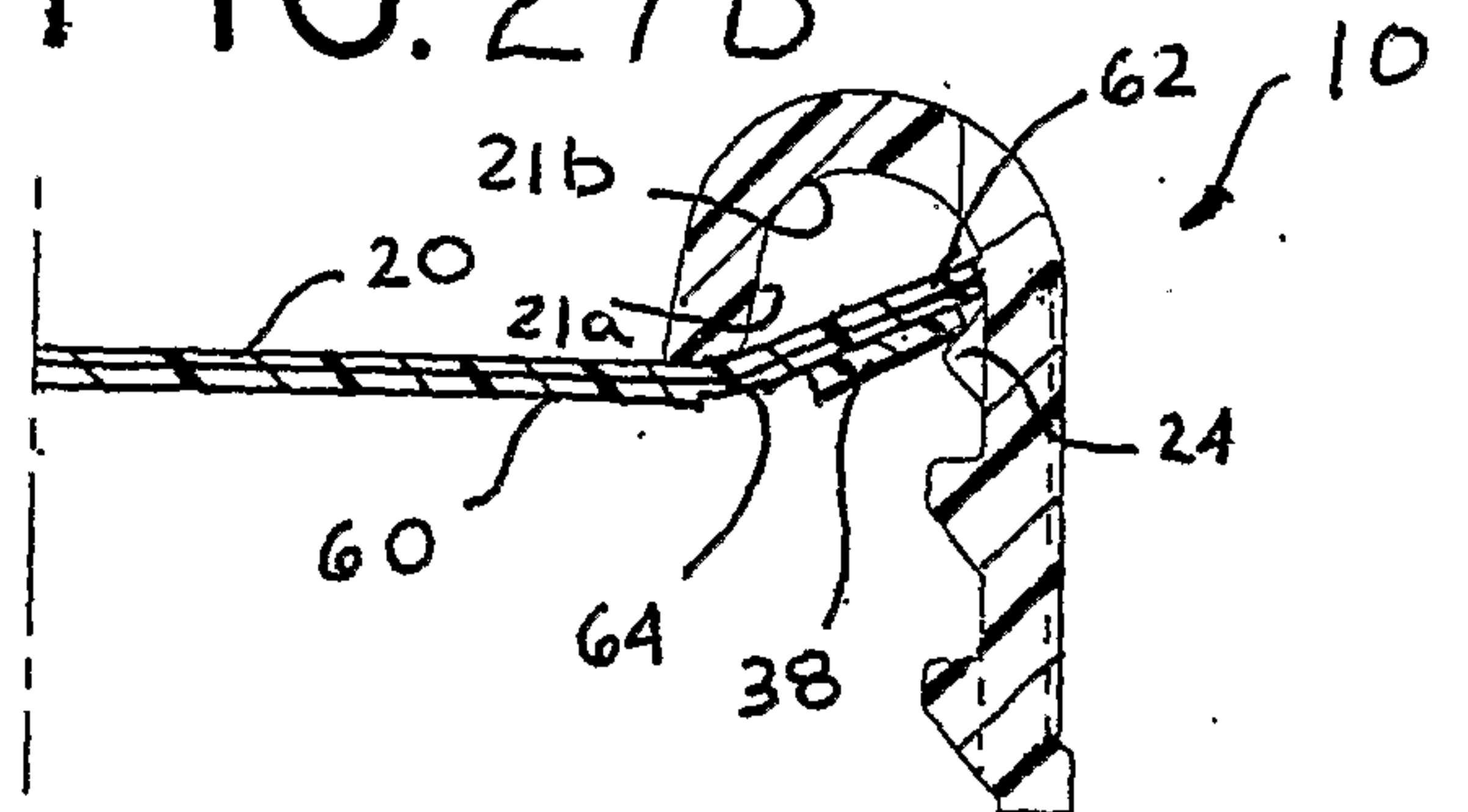


FIG. 27C

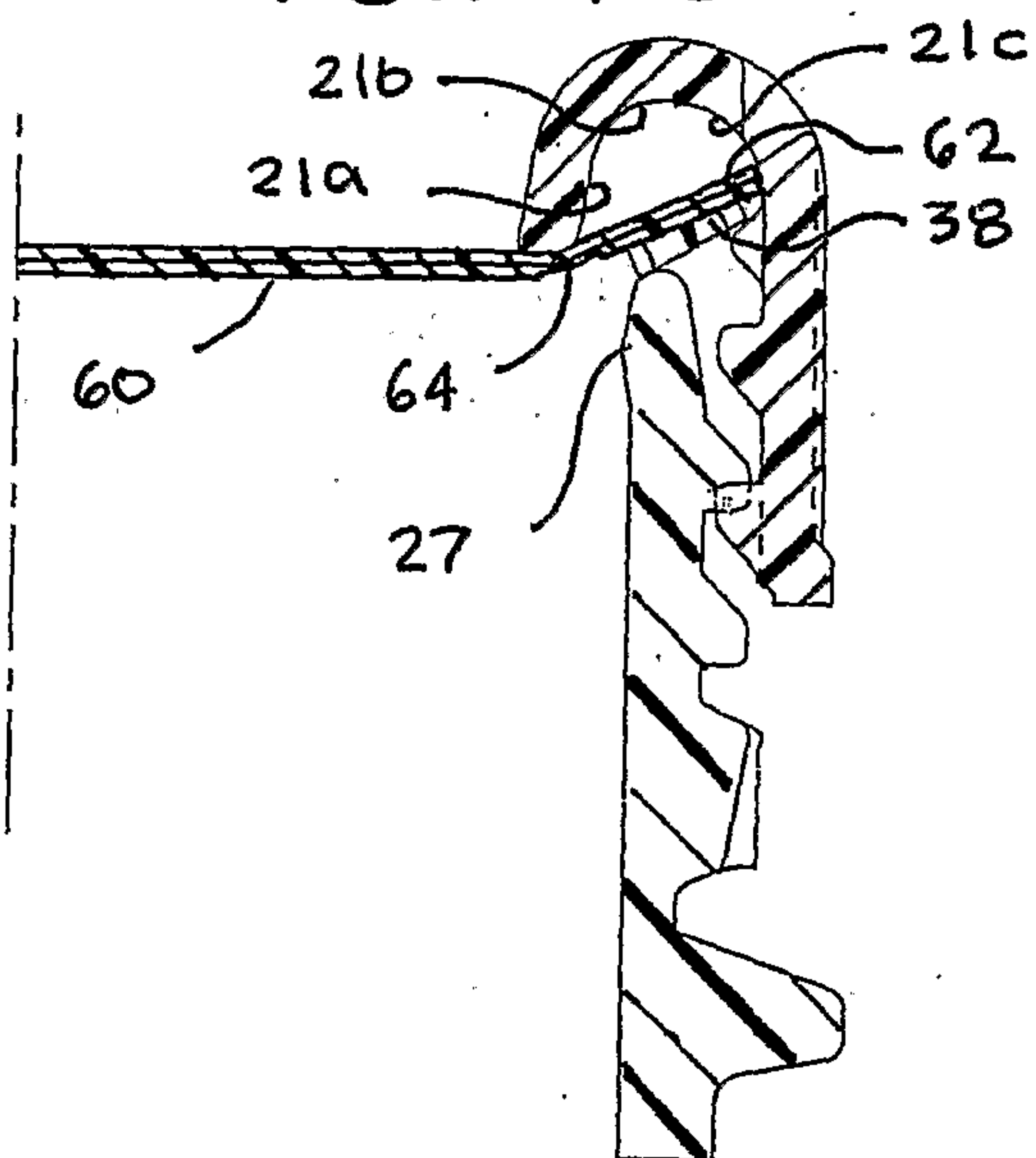


FIG. 27D

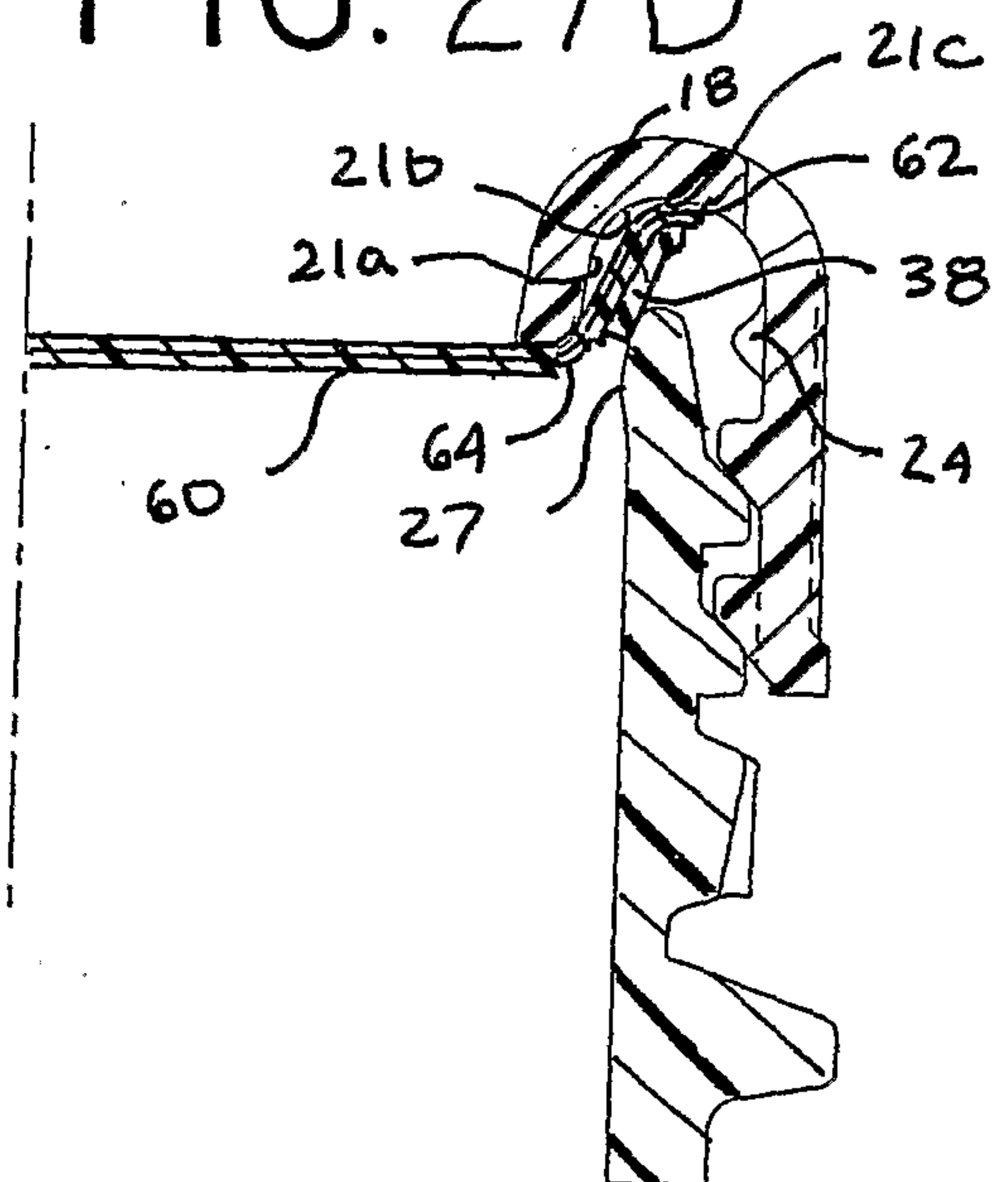


FIG. 27E

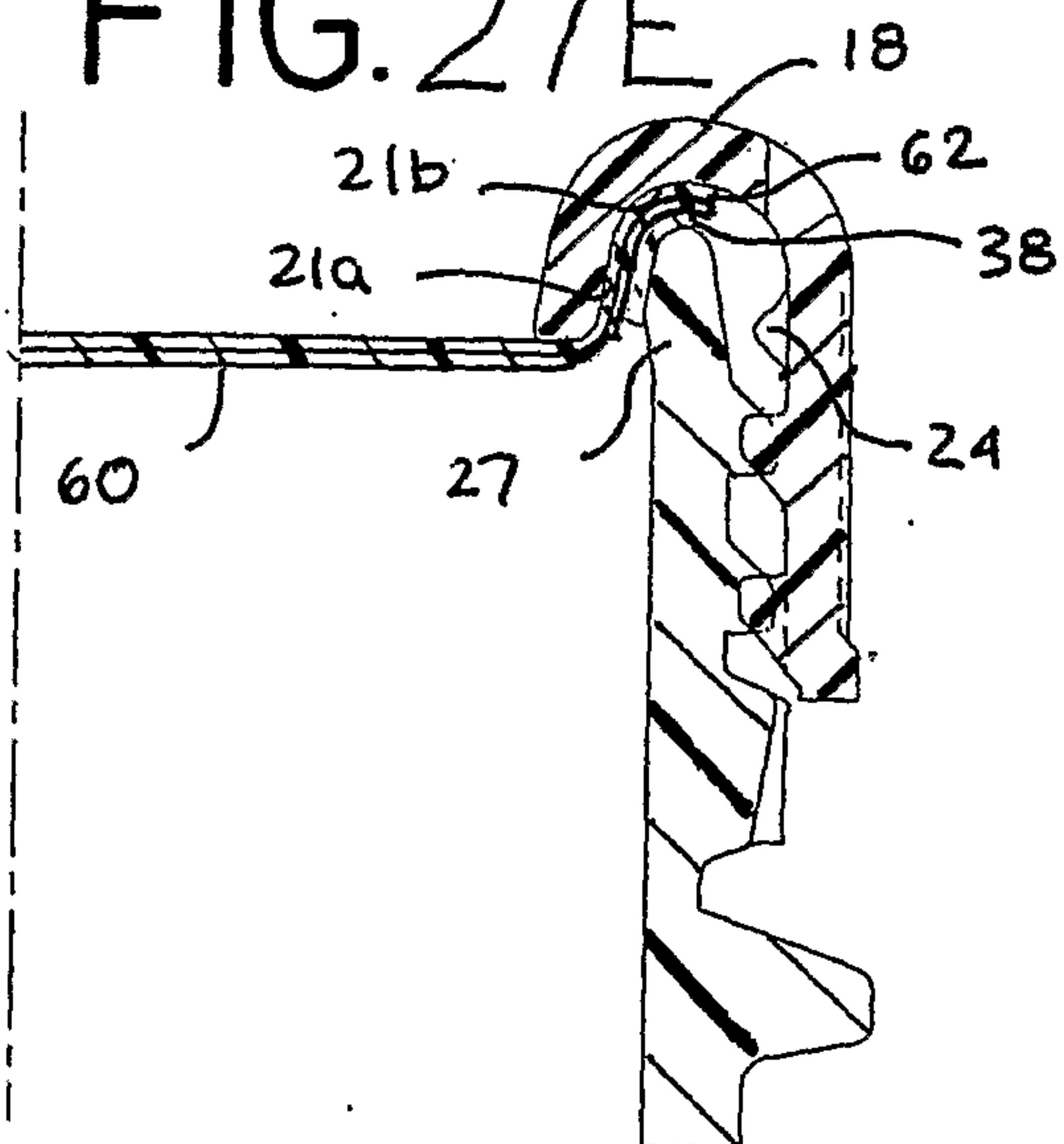
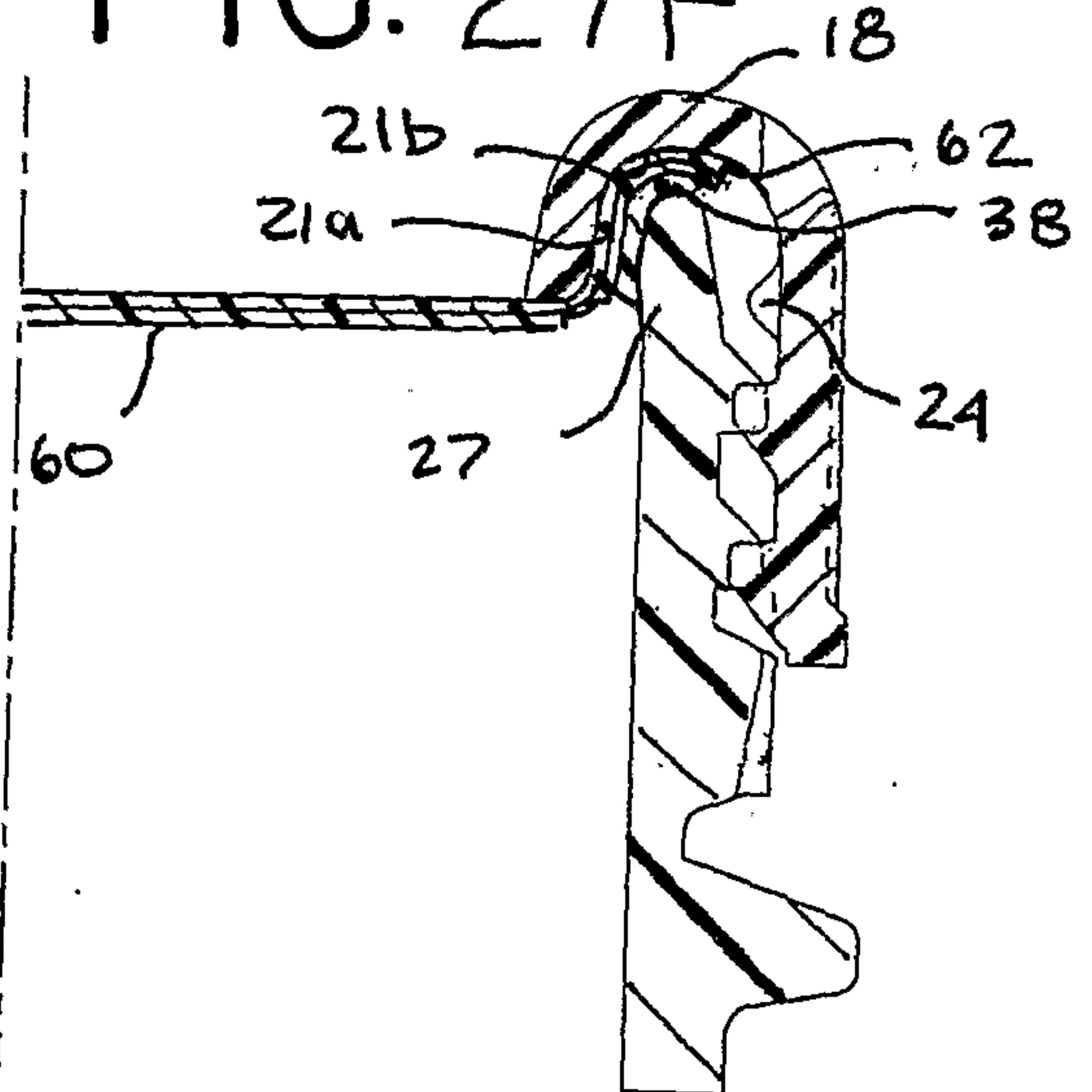


FIG. 27F



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FIG. 28

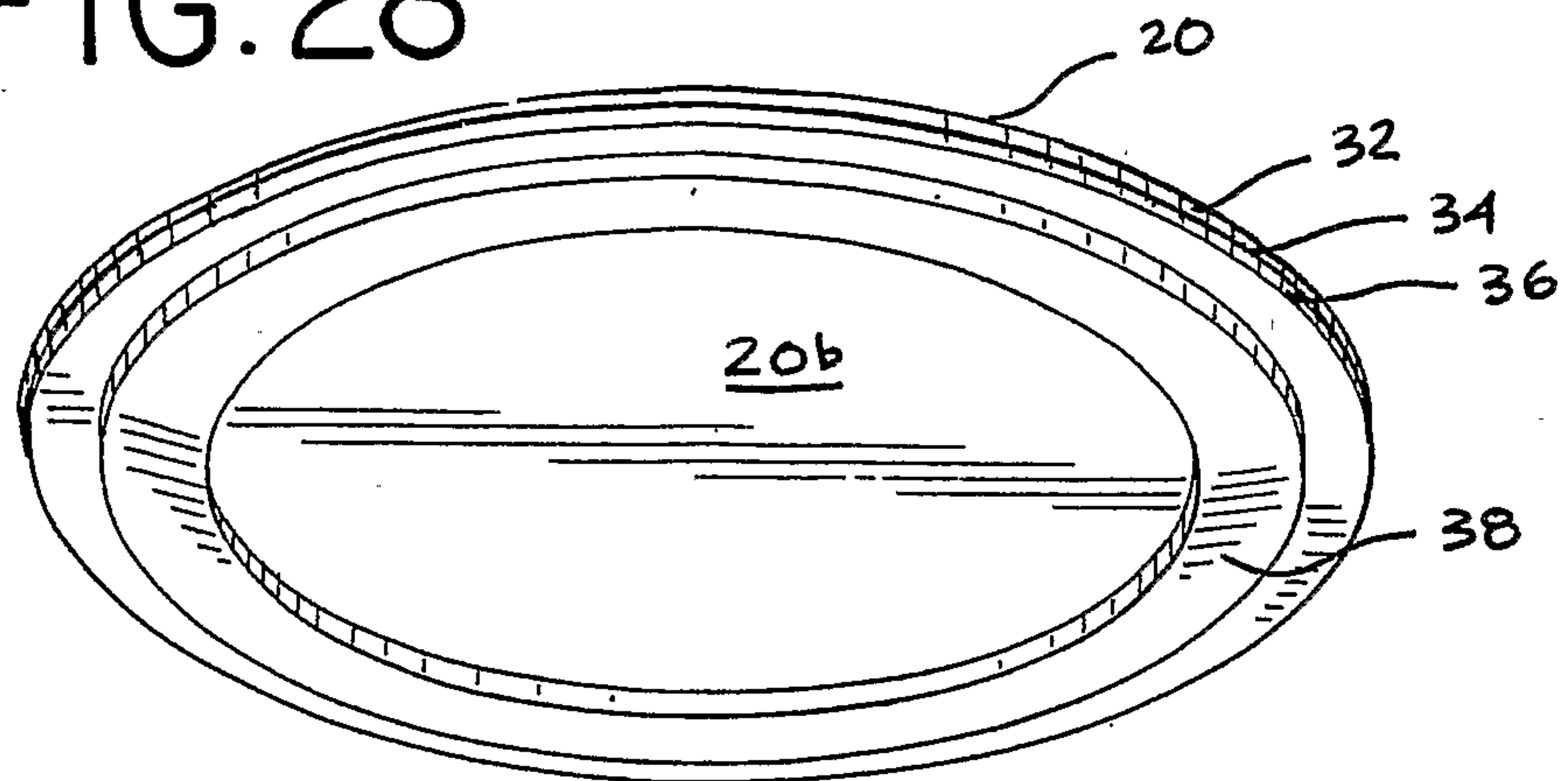


FIG. 29

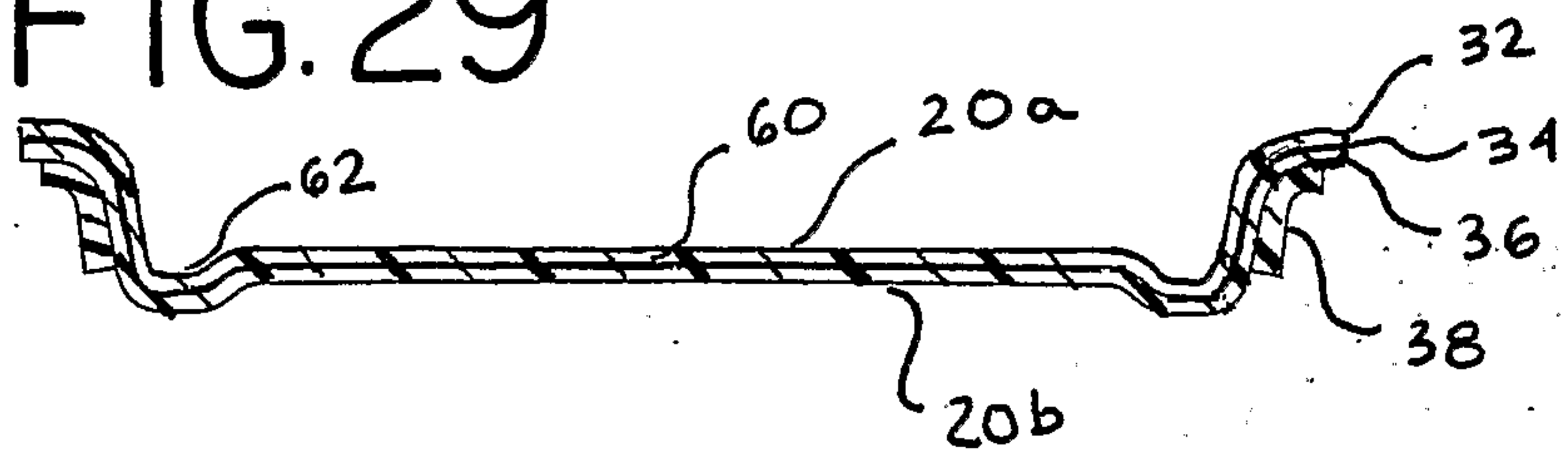


FIG. 30

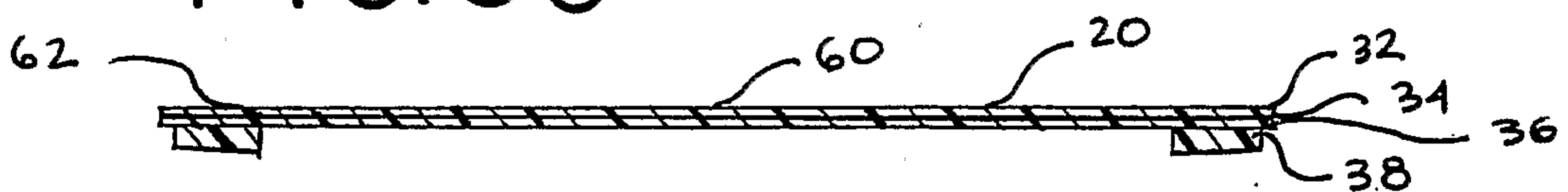


FIG. 31

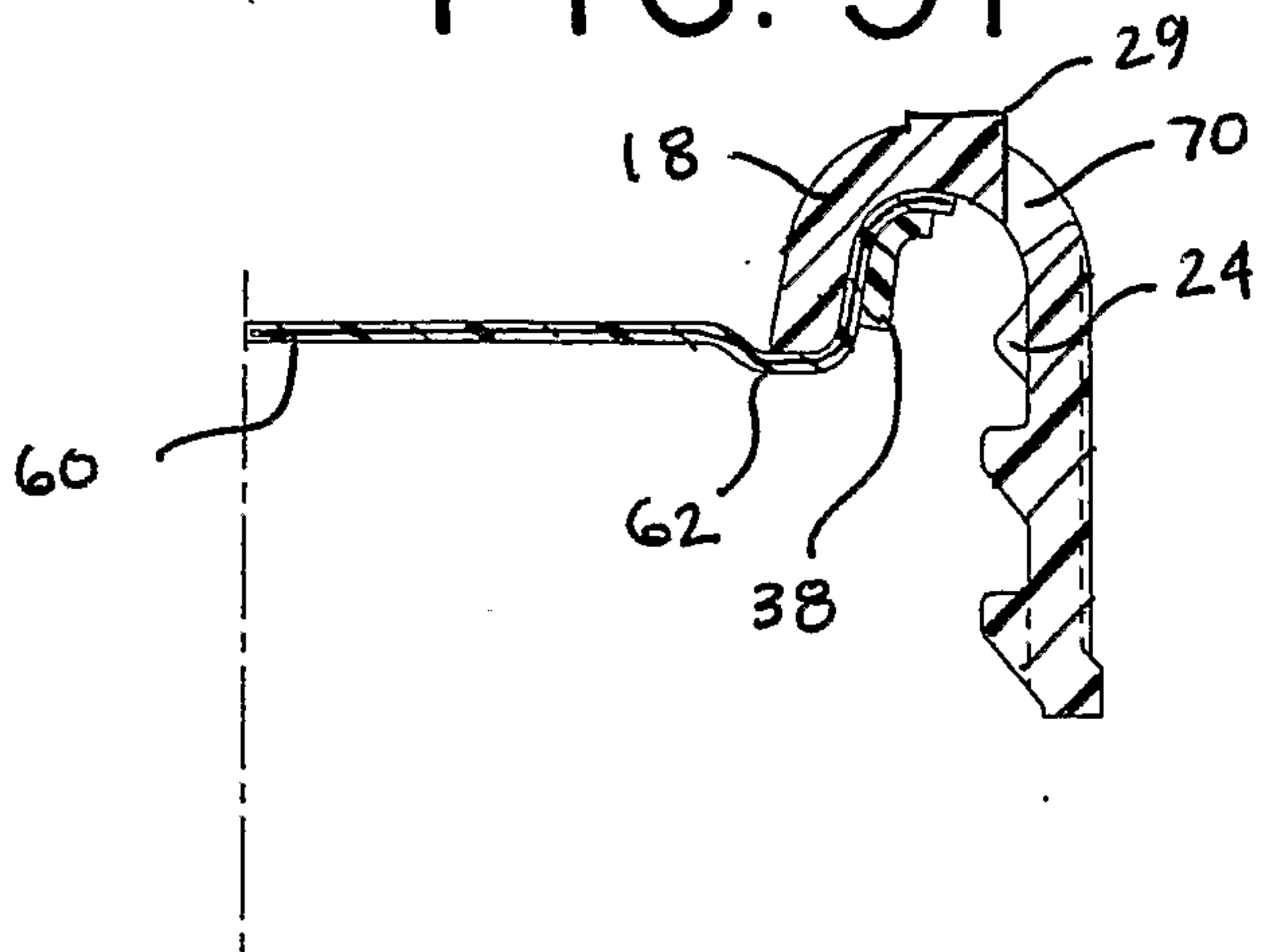


FIG. 32

