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## (54) Tamper-indicating closure and package

(57) A tamper-indicating closure (14 or 70 or 72 or 84) includes a one-piece integrally molded plastic closure shell having a base wall (26) with a peripheral skirt (28) and at least one internal thread (30) for securing the closure to a container. A seal ring (32 or 76 or 88) includes a cylindrical first portion (34 or 80 or 92) coupled to the base wall radially inwardly of the skirt and a frustoconical second portion (36 or 82 or 90) extending radially inwardly from a free edge of the first portion. The second portion of the seal ring is adapted to fold upwardly and outwardly toward the first portion upon engagement with a container finish. A tamper-indicating band (50) is frangibly connected to an end of the skirt spaced from the base wall. A stop flange (56) extends axially and radially inwardly from a free end of the band for abutment with a stop bead (24) on the container finish (18). The stop flange is circumferentially continuous adjacent to the band, and has a free edge spaced from the band with slots (58) separating the free edge into separately flexible portions.

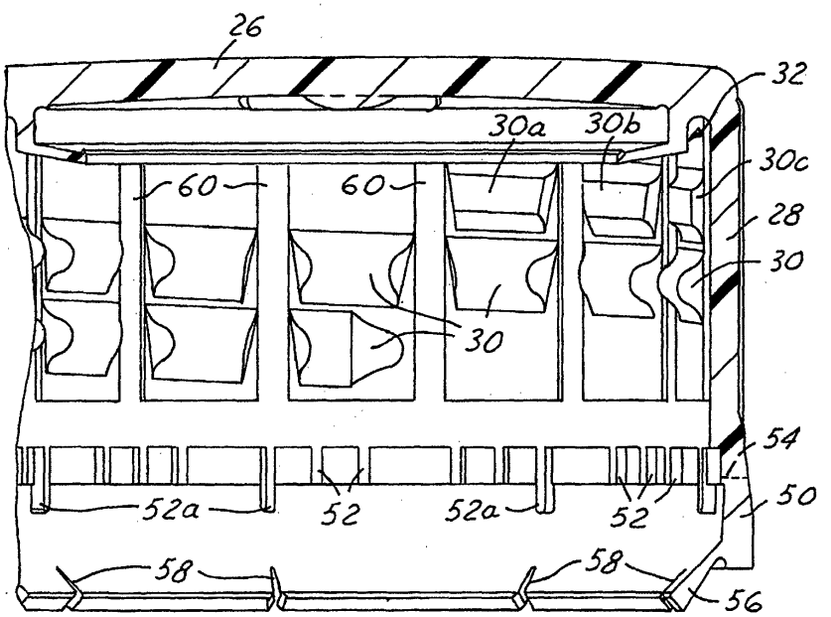


FIG.3

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## Description

**[0001]** The present invention relates to tamper-indicating closures and packages, and more particularly to a linerless tamper-indicating closure that is particularly well suited for use in a cold soft drink closure and container package.

## Background and Summary of the Invention

**[0002]** It is a general object of the present invention to provide a linerless closure that includes tamper-indicating capability, and is particularly well suited for use in applications in which the internal volume of the closure and container package is at elevated pressure between filling and use.

**[0003]** A tamper-indicating closure in accordance with presently preferred embodiments of the invention includes a one-piece integrally molded plastic closure shell having a base wall with a peripheral skirt and at least one internal thread for securing the closure to a container. A seal ring includes a cylindrical first portion coupled to the base wall radially inwardly of the skirt and a frustoconical second portion extending radially inwardly from a free edge of the first portion. The second portion of the seal ring is adapted to fold upwardly and outwardly toward the first portion upon engagement with a container finish. A tamper-indicating band is frangibly connected to an end of the skirt spaced from the base wall. A stop flange extends axially and radially inwardly from a free end of the band for abutment with a stop bead on the container finish, The stop flange is circumferentially continuous adjacent to the band, and has a free edge spaced from the band with slots separating the free edge into separately flexible portions.

**[0004]** The closure in accordance with the preferred embodiments of the invention preferably further includes channels extending axially through the thread(s) on a radially inner surface of the skirt, such that the channels effectively separate the thread(s) into adjacent thread segments. The thread segments adjacent to the base wall of the closure preferably have an inner surface that is cylindrical and concentric with the skirt. This feature facilitates molding of the closure. In accordance with another aspect of the invention, there is provided a closure and container package that includes a container having a finish with an axial edge surrounding a mouth, at least one external thread and an external stop bead on a side of the thread(s) remote from the mouth, and a one-piece integrally molded tamper-indicating closure as described above.

## Brief Description of the Drawings

**[0005]** The invention, together with additional objects, features and advantages thereof, will be best understood from the following description, the appended claims and the accompanying drawings in which:

FIG. 1 is a fragmentary perspective view of a closure and container package in accordance with one presently preferred embodiment of the invention;

FIG. 2 is a fragmentary sectional view of the closure and container package in FIG. 1;

FIG. 3 is a fragmentary sectional view diametrically bisecting a closure in accordance with a presently preferred embodiment of the invention;

FIG. 4 is a fragmentary sectional view of the closure of FIG. 3 prior to inversion of the stop flange;

FIGS. 5 and 6 are fragmentary sectional views ofthe portions of FIG, 4 within the respective areas 5 and 6;

FIGS. 7 and 8 are fragmentary sectional views, similar to that of FIG. 5, but showing respective modified embodiments of the invention; and

FIG. 9 is a fragmentary sectional view that illustrates another mode of operation of the invention,

## Detailed Description of Preferred Embodiments

**[0006]** FIGS. 1 and 2 illustrate a closure and container package 10 in accordance with one presently preferred embodiment of the invention as including a container 12 to which a closure 14 is secured. Container 12 has a body 16 and a cylindrical finish 18. Finish 18 has an axial end 20 that surrounds the container mouth, one or more external threads 22 for securing closure 14, and an external stop bead 24 on a side of thread(s) 22 remote from the container mouth. Container 12 is preferably of one-piece integrally molded plastic construction, although glass containers can be employed in conjunction with the closures of the present invention.

**[0007]** Closure 14 includes a one-piece integrally molded plastic shell having a base wall 26 and a peripheral skirt 28. One or more internal threads 30 extend around the internal surface of skirt 28 for securing closure 14 to finish external thread(s) 22. A seal ring 32 extends from base wall 26. As best seen in FIGS. 3-5, seal ring 32 in closure 14 as formed includes a cylindrical first portion 34 that extends axially downwardly from the underside of base wall 26 concentric with, adjacent to but spaced radially inwardly from closure skirt 28. (Directional words such as "upper" or "downward" are employed by way of description and not limitation with reference to the upright orientation of the closure and package illustrated in the drawings. Directional words such as "axial" and "radial" are taken with respect to the central axis of the container finish or closure skirt as appropriate, and are employed by way of description and not limitation. All dimensions are nominal and are given by way of example only.) Seal ring 32 further includes a second portion 36 that extends from the free end of first portion 32. Second portion 36 is frustoconical in the closure as formed, being at an exemplary angle of 80° to the axis of the closure skirt. Frustoconical second portion 36 thus preferably extends axially downwardly and radially inwardly from its integral junction with cylindrical

first portion 34. A first circumferentially continuous triangular rib 38 extends axially upwardly toward the closure base wall from a position adjacent to the free edge of second portion 36. A second circumferentially continuous triangular rib 40 extends axially downwardly around the undersurface of closure base wall 26 at a position radially inward from but adjacent to cylindrical portion 34 of seal ring 32. Ribs 38, 40 are both coaxial with ring first portion 34 and closure skirt 28. In the embodiment of the invention illustrated in FIGS. 1-6, ribs 38, 40 have radial inner and outer surfaces at angles of 90° with respect to each other. The radially inner face of rib 40 is preferably at an angle of 45° with respect to the closure axis, and the radially outer face of rib 38 is preferably at an angle of 45° with respect to the upper surface 42 of seal ring portion 36 from which ring 38 extends. Cylindrical ring portion 34 has a radially inner face 44, and ring portion 36 has an axially lower face 46.

**[0008]** A tamper-indicating band 50 is connected to the lower or free end of closure skirt 28 by a plurality of circumferentially spaced frangible bridges 52. Bridges 52 are molded into the radially inner face of closure skirt 28. After molding, the closure skirt is circumferentially scored at 54, so that band 50 is connected to skirt 28 only by bridges 52. A stop flange 56 extends radially inwardly from a position adjacent to the free end of band 50. In the closure as formed (FIGS. 3-6), stop flange 56 extends axially outwardly from the band, and is inverted prior to assembly to a container so as to extend radially inwardly and axially upwardly with respect to the closure shell, as illustrated in FIG. 2. Stop flange 56 is circumferentially continuous adjacent to band 50, so as to form a single circumferentially continuous hinge pivotally connecting the stop flange to the band. At the free edge of band 56, a plurality of circumferentially spaced slots 58 extend part way into the band, effectively to divide the free edge of the stop flange into separately flexible flange segments. This stop flange construction helps maintain integrity of the stop flange during inversion, while accommodating differential flexure around the stop flange during application to a container.

**[0009]** A circumferential array of channels or grooves 60 extend along the inner surface of skirt 28 through internal thread(s) 30. Channels 60 vent the inside volume of the container to atmosphere upon initial opening of the closure. Channels 60 thus function effectively to divide thread(s) 30 into circumferentially adjacent and aligned thread segments. Thread segments 30a, 30b and 30c (FIG. 3) adjacent to closure base wall 26 and seal ring 32 are radially truncated as compared with the remainder of the thread segments, having radially inner surfaces on a common cylinder of revolution coaxial with closure skirt 28, rather than the rounded inner surfaces of the remaining thread segments, as illustrated in FIG. 3. This feature facilitates passage of the mold part that is positional between ring portion 34 and skirt 28 after molding. It will be noted in FIG. 3 that bridges 52 are not uniformly circumferentially spaced around the closure. Some of the bridges 52a are elongated onto the inside of band 50. These elongated bridges or leaders cooperate with band 24 (FIG. 2) to help hold the skirt in position. Closure 14 is injection or compression molded of plastic such as polypropylene.

**[0010]** As closure 14 is applied to finish 18 of container 12 after filling the container, end 20 of finish 18 contacts surface 46 of second portion 36 of seal ring 32. Continued application of the closure folds second portion 36 axially upwardly and radially outwardly, until rib 38 engages and digs into the opposing undersurface of closure base wall 26, and rib 40 engages and digs into opposing surface 42 of ring second portion 36. At this point, surface 42 of ring portion 36 is in facing engagement with surface 44 of ring portion 34 in the embodiment of FIGS. 1-6, This digging action of ribs 38, 40 helps maintain ring portion 36 in sealing engagement with the axial end of finish end 20 and the radially outer surface portion of the finish end, as best seen in FIG. 2. In the meantime. Stop flange 56 flexes radially outwardly against the inside face of band 50 and passes over stop bead 24 on container finish 18. Band 56 then flexes radially inwardly to the configuration illustrated in FIG. 2 for opposed engagement with bead 26. When it is attempted to remove closure 14 from container finish 18, flange 56 abuts bead 24, and the force of further removal fractures bridges 52 so that band 50 becomes separated from skirt 28 and indicates tampering with the closure.

**[0011]** FIG. 7 illustrates a closure 70 in accordance with a modified embodiment of the invention. Closure 70 is similar to closure 14 in FIGS. 1-6, except that ribs 38, 40 in closure 14 have been eliminated in closure 70. (Reference numerals in FIGS. 7-9 that are identical to numerals in FIGS. 1-6 indicate identical or similar components.)

**[0012]** FIG. 8 illustrates a closure 72, in which an annular shoulder 74 extends around base wall 26 at the junction of the base wall with skirt 28. A seal ring 76 extends from the axially facing undersurface 78 of shoulder 74. Seal ring 76 includes a cylindrical first portion 80 extending from surface 78 and a conical second portion 82 extending from the low end of first portion 80. First portion 80 is foreshortened as compared with first portion 34 in FIGS. 1-6. Shoulder 74 thus couples seal ring 76 to base wall 26, but stiffens the seal ring against outward flexing upon engagement of the seal ring with a container finish.

**[0013]** FIG. 9 illustrates a package 84 that includes a closure 86 and a container 12. Closure 86 is similar to closure 70 in FIG. 7, but the dimensions of seal ring 88 are such that second portion 90 is folded back toward first portion 92 upon full engagement with container finish 18, but does not abut first portion 92, Seal ring second portion 90 is still in opposed abutting engagement with closure base wall 26. Closure 86 can be used in applications in which the contents of the container are at relatively low pressure, such as bottled water appli-

cations at an internal pressure of about 10 psi. For applications at higher internal pressure, such as cold soft drinks at a pressure of about 40 to 60 psi, the embodiments of FIGS. 1-8, particularly the embodiments of FIGS. 1-6 would be preferred. Ribs 38-40 (FIGS. 2-5) may be added to the embodiment of FIG. 9 to improve sealing at elevated pressure.

**[0014]** There have thus been disclosed a tamper-indicating closure and package that fully satisfy all of the objects and aims previously set forth. The invention has been disclosed in conjunction with several presently preferred embodiments thereof, and a number of modifications and variations have been described. Other modifications and variations will readily suggest themselves to persons of ordinary skill in the an. For example, drain openings can be provided at the juncture of the stop flange and the tamper-indicating band, as illustrated for example in U.S. patents 6,152,316 and 6,253,940. The closure shell can be fabricated to include barrier material to resist transmission of gases, water vapor and/or flavorants through the closure, as illustrated for example in EP 1081058A2. Bridges 52 may be formed by scoring rather than molding, as illustrated for example in U.S. Patent 5,564,319. The frangible connection between the skirt and band may be in the form of a thin frangible web rather than frangible bridges. The closure and container finish may employ two or more threads. The invention is intended to embrace all such modifications and variations as fall within the spirit and broad scope of the appended claims.

## Claims

**1.** A tamper-indicating closure (14 or 70 or 72 or 84) that comprises:

a one-piece integrally molded plastic closure shell including
a base wall (26) having aperipheral skirt (28) with at least one internal thread (30) for securing the closure to a container,
a seal ring (32 or 76 or 88) including a cylindrical first portion (34 or 80 or 92) coupled to said base wall radially inwardly of said skirt and a frustoconical second portion (36 or 82 or 90) extending radially inwardly from a free edge of said first portion,
said second portion being adapted to fold upwardly and outwardly against said base wall and toward said first portion upon engagement with a container finish (18), and
a tamper-indicating band (50) frangibly connected to an end of said skirt spaced from said base wall,

**characterized in that** said tamper-indicating band includes a stop flange (56) pivotally extending axially and radially inwardly from adjacent to a free end of said band for abutment with a stop bead (24) on a container finish, said flange being circumferentially continuous adjacent to said band and having a free edge spaced from said band with slots (58) separating said free edge into separately flexible portions.

**2.** The closure set forth in claim 1 wherein said seal ring (32) includes a first rib (38) extending toward said base wall from a free end of said second portion (36), and said base wall (26) includes a second rib (40) extending from said base wall adjacent to and spaced radially inwardly from said first portion of said seal ring, said second portion being adapted to fold upwardly and outwardly upon engagement with a container finish such that said first rib axially engages said base wall and said second rib axially engages said second portion of said seal ring to hold said second portion in sealing engagement with the container finish.

**3.** A closure and container package (10) that includes a container (12) having a finish (18) with an axial edge surrounding a mouth (20), at least one external thread (22), and an external stop bead (24) on a side of said thread remote from said edge, and a one-piece integrally molded plastic closure (14 or 70 or 72 or 84) as set forth in claim 1 or 2.

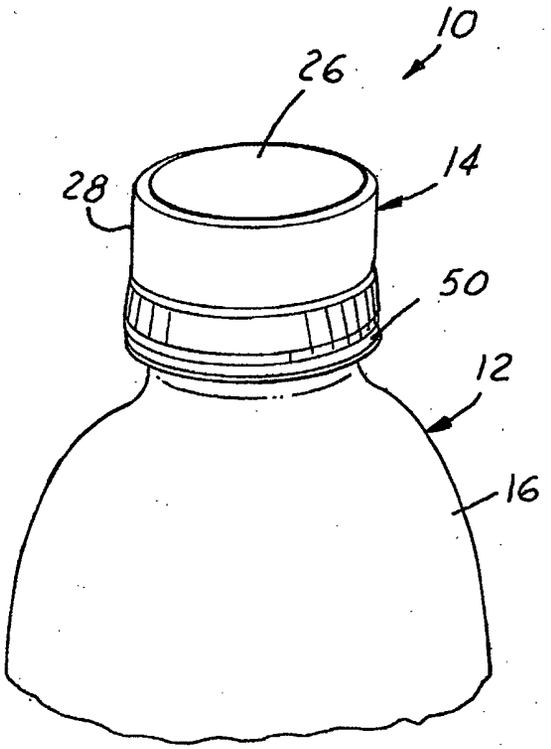


FIG. 1

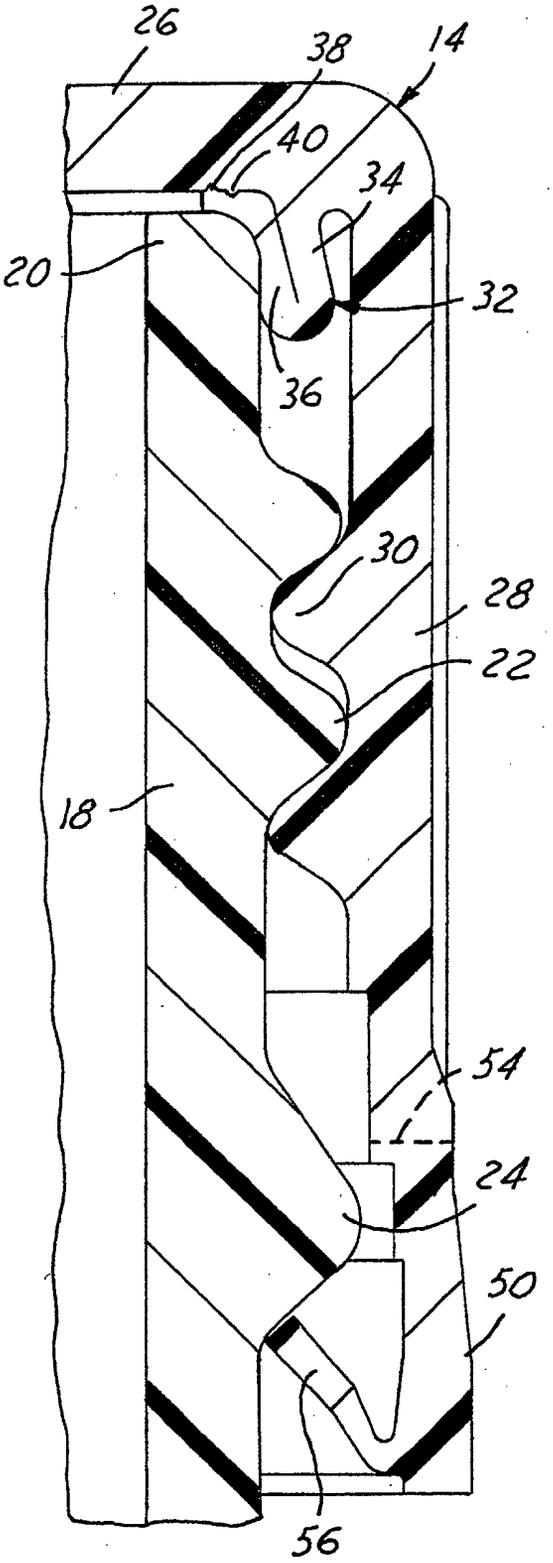


FIG. 2

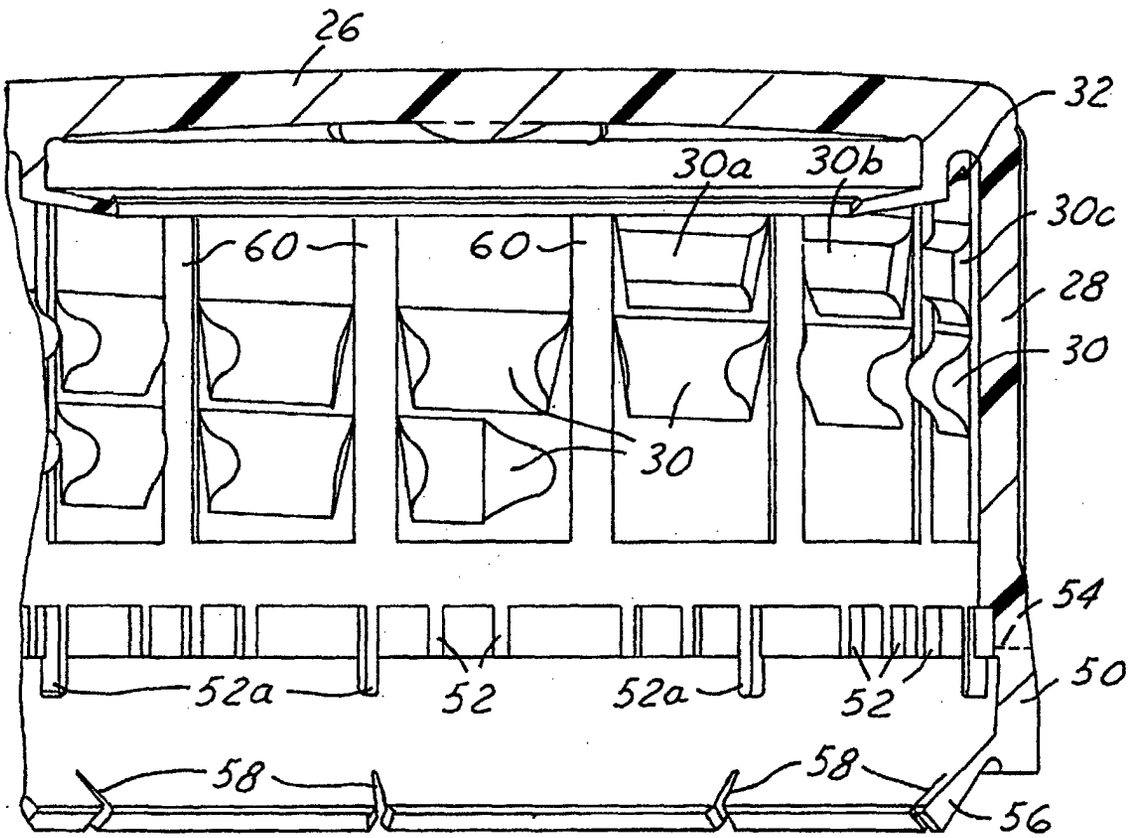


FIG. 3

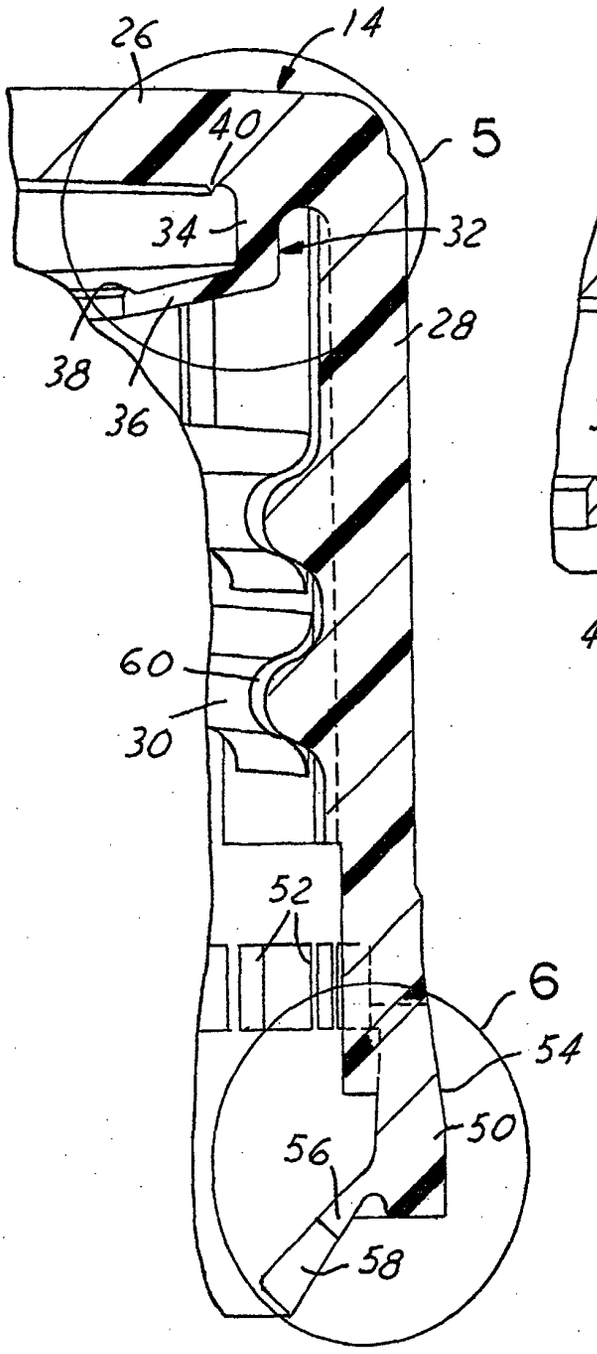


FIG. 4

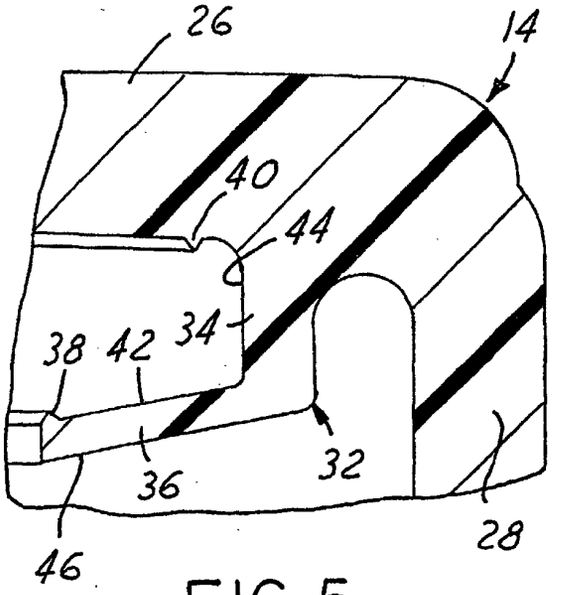


FIG. 5

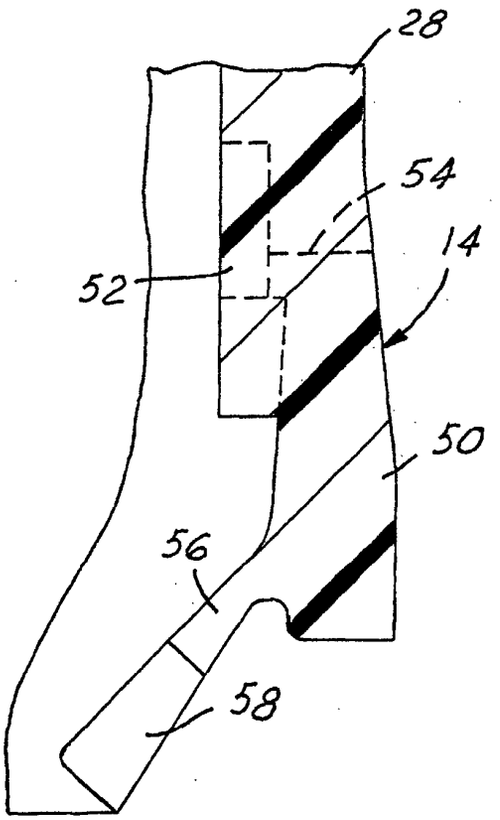


FIG. 6

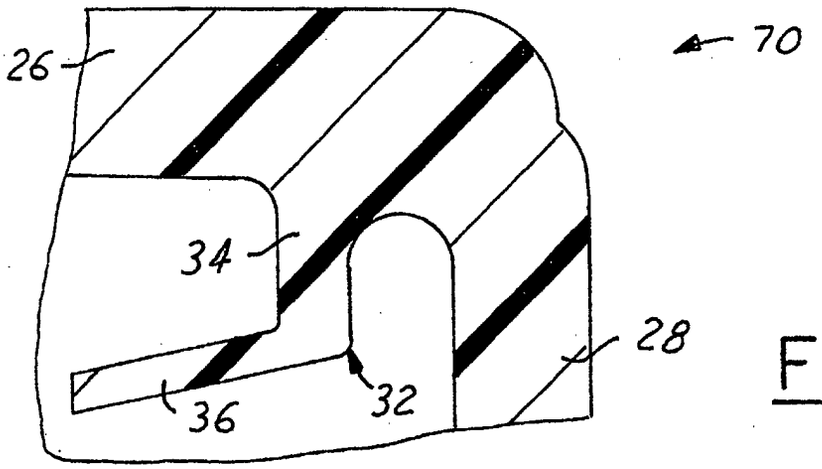


FIG. 7

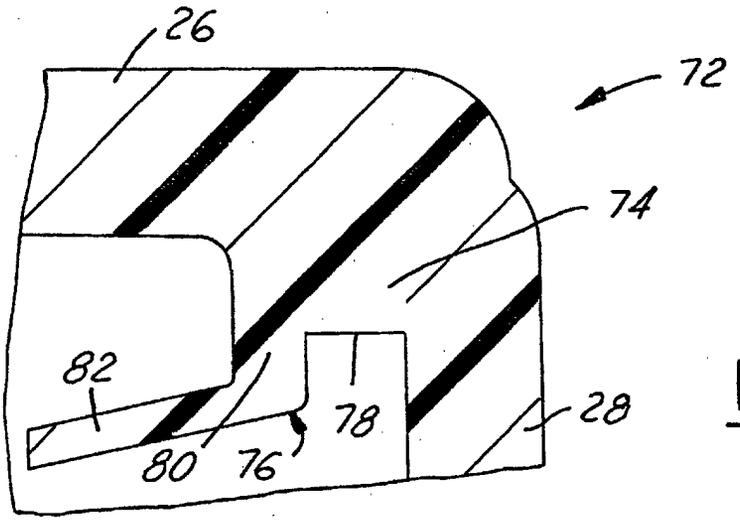


FIG. 8

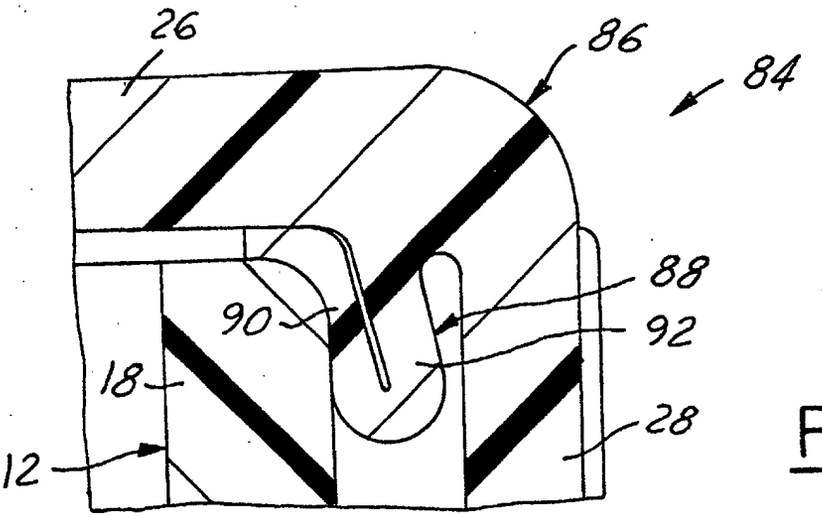


FIG. 9