

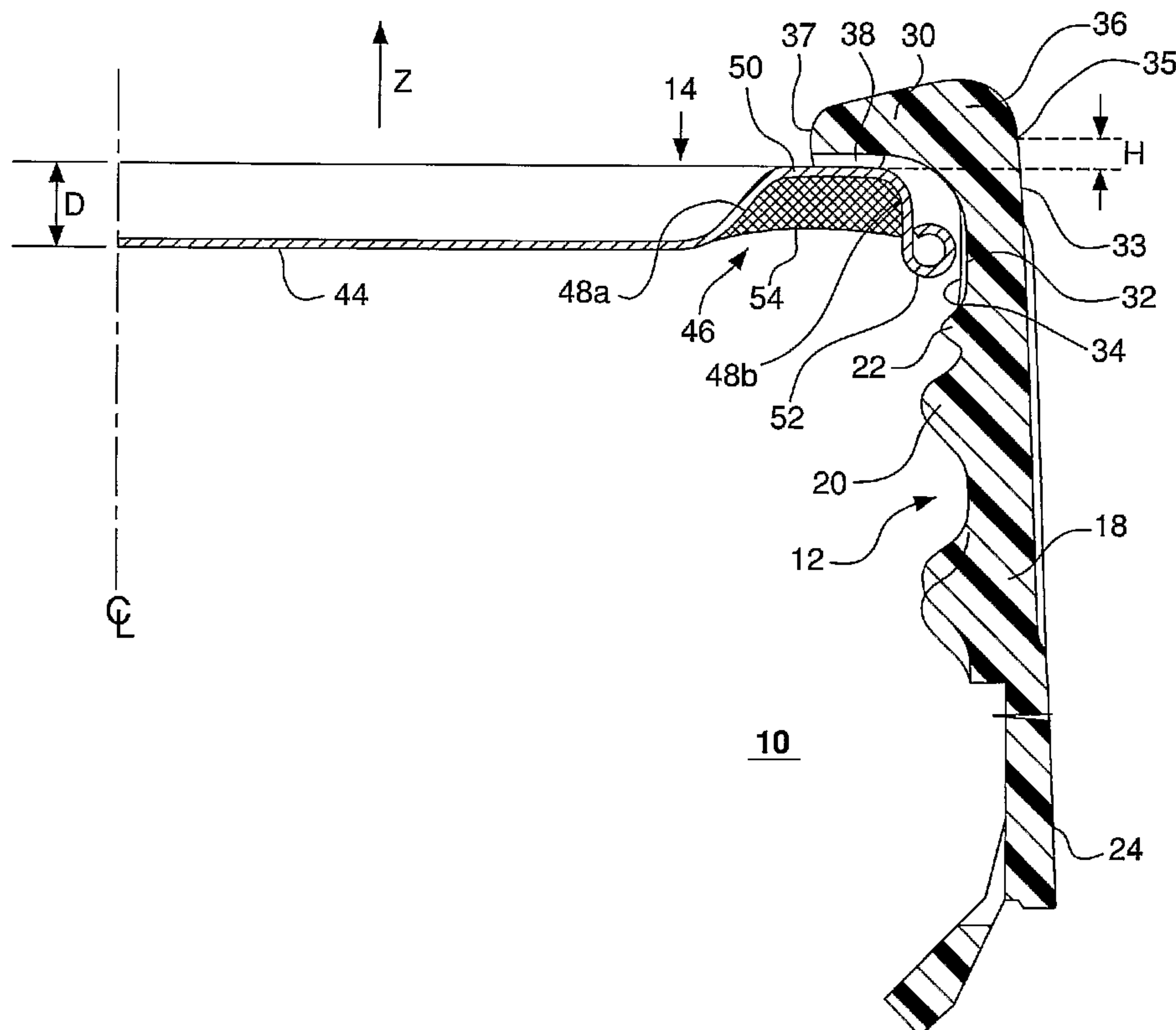


(86) Date de dépôt PCT/PCT Filing Date: 2004/08/11
(87) Date publication PCT/PCT Publication Date: 2005/03/03
(45) Date de délivrance/Issue Date: 2012/11/27
(85) Entrée phase nationale/National Entry: 2006/02/24
(86) N° demande PCT/PCT Application No.: EP 2004/008990
(87) N° publication PCT/PCT Publication No.: 2005/019059
(30) Priorité/Priority: 2003/08/26 (US10/649,121)

(51) Cl.Int./Int.Cl. *B65D 51/14* (2006.01),
B65D 41/34 (2006.01)
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(54) Titre : SYSTÈME DE FERMETURE COMPOSITE COMPRENANT UNE PIÈCE RAPPORTÉE A BORD ROULE
PÉRIPHÉRIQUE

(54) Title: COMPOSITE CLOSURE HAVING AN INSERT WITH A PERIPHERAL CURL



(57) Abrégé/Abstract:

A composite closure (10) for a standard 40 mm opening is configured to form a cavity (40) to house a curl (52) of the insert disc. The shell (12) of the closure extends vertically to provide the cavity, and a transition (36) of the shell is thickened to provide strength for the shell's retaining ring. Employing a curl on the insert disc enables the insert disc to be formed of conventional coated steel. Because the channel of the retaining ring (30) is not semi-toroidal or like shape, the container may be formed by a blow trim process without an extra reaming step for preparing the internal portion of the container neck.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 March 2005 (03.03.2005)

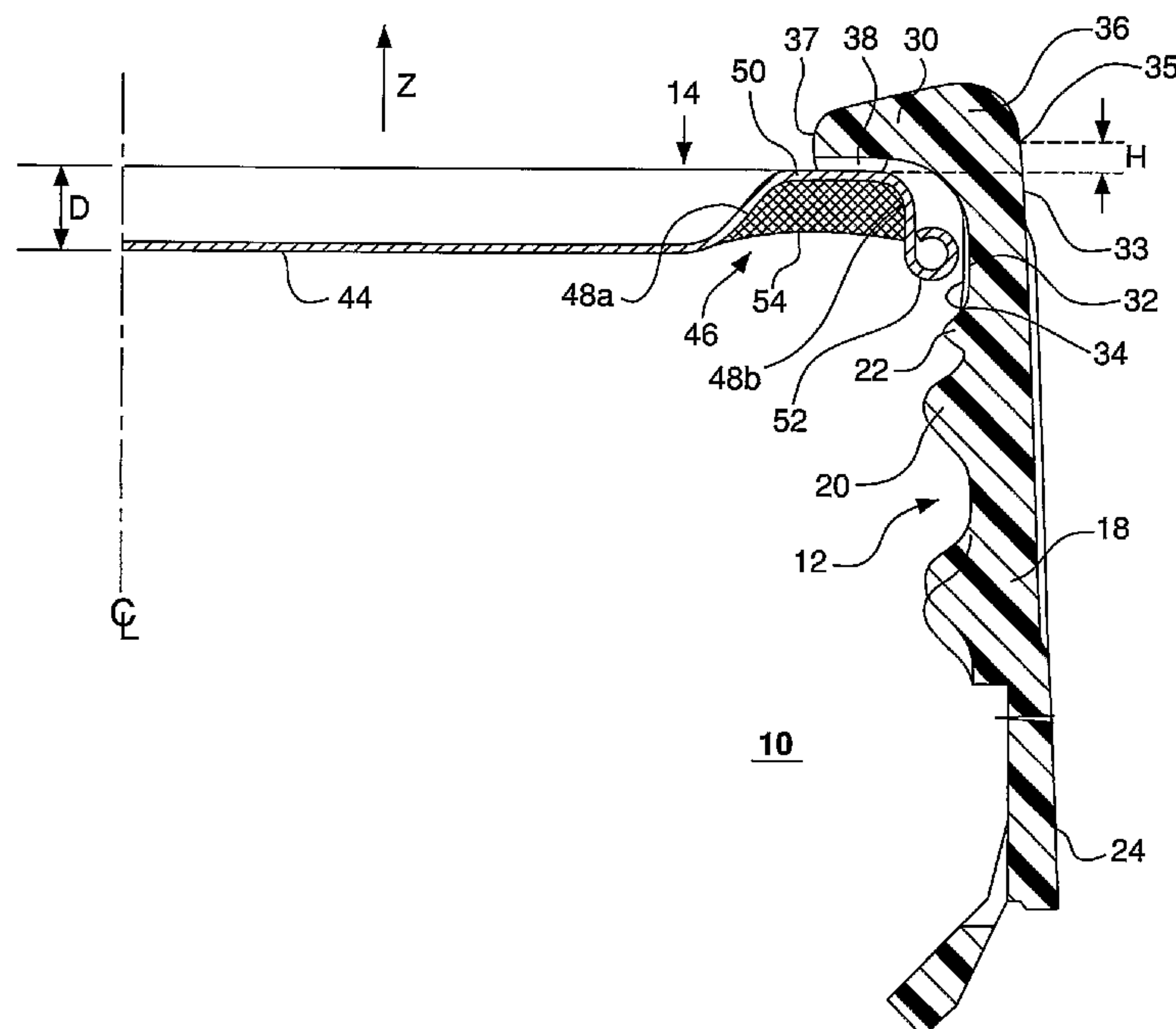
PCT

(10) International Publication Number
WO 2005/019059 A1

- (51) International Patent Classification⁷: **B65D 51/14**, 41/34
- (21) International Application Number: PCT/EP2004/008990
- (22) International Filing Date: 11 August 2004 (11.08.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
10/649,121 26 August 2003 (26.08.2003) US
- (71) Applicant (for AE, AG, AL, AM, AT, AU, AZ, BA, BB, BE, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CY, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, SZ, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW only): **CROWN PACKAGING TECHNOLOGY INC** [US/US]; 11535 S. Central Avenue, Alsip, IL 60803-2599 (US).
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: COMPOSITE CLOSURE HAVING AN INSERT WITH A PERIPHERAL CURL



(57) Abstract: A composite closure (10) for a standard 40 mm opening is configured to form a cavity (40) to house a curl (52) of the insert disc. The shell (12) of the closure extends vertically to provide the cavity, and a transition (36) of the shell is thickened to provide strength for the shell's retaining ring. Employing a curl on the insert disc enables the insert disc to be formed of conventional coated steel. Because the channel of the retaining ring (30) is not semi-toroidal or like shape, the container may be formed by a blow trim process without an extra reaming step for preparing the internal portion of the container neck.

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GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

COMPOSITE CLOSURE HAVING AN INSERT WITH A PERIPHERAL CURL

This invention relates to closures for containers, and more particularly to composite closures having an insert disc and an integral skirt and retaining ring.

Composite closures are commercially popular for use
5 in products that are filled at an elevated temperature, such as food containers that are "retorted" after sealing. In some retort processes, a container is filled and then heated to a temperature above about 220°F (104°C), often 250 to 260°F (121 to 127 °C) under
10 external pressure to sterilize the food sealed in it.

Composite closures suitable for such conditions generally comprise a sealing disc or cover, usually formed of metal, which is encircled and housed within a separately formed moulded plastic band or shell. The disc
15 may have a raised peripheral crown that presents a downwardly opening groove containing a sealant or gasket for forming a seal with a rim or finish of the opening of a container. Such a seal is relatively insensitive to the thermal expansion and contraction that occur during
20 retorting. The shell is rotatable relative to the disc so as to enable the closure to be opened in sequence such that the shell overcomes thread friction, then urges against the disc to break its seal. Sequential opening diminishes the maximum torque required for opening.

25 US-4,813,561 shows a composite retortable closure having a metal disc with a raised peripheral bead. The bead presents a downwardly opening groove that contains a sealant or gasket material for making a seal with the top, outer, and/or inner surface of the rim of the
30 container. The disc is rotatably housed within an

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encircling moulded plastic shell having an inwardly projecting curved lip that extends to and engages the top of the bead of the disc. As the shell is tightened, the undersurface of the lip bears downwardly on the disc bead
5 thereby forcing the sealant material into sealing engagement with the container rim.

US-6,276,543 discloses a closure including a metal disc and a moulded plastic band. The disc has a centre portion and an annular raised crown disposed around the
10 centre portion. The crown has a groove formed on an underside thereof that contains a gasket engageable with a rim of the container. The band has an inwardly extending semi-toroidal annular hook and a skirt extending downward from the hook. An underside of the
15 hook includes pads, vents, and an annular recess. The plurality of pads urges downward against the crown exerting downward force on the crown. An annular recess is formed in the underside of the hook and defines an end of the pads. The plurality of vents is disposed between
20 the pads, and an end of the vents is defined by the annular recess, whereby the vents provide communication between the thread and the environment to enable evaporation of liquids disposed within the closure. US-5,346,082 shows a composite closure having some similar
25 features.

A particular conventional composite closure, which incorporates features generally described in the patents referred to in the background section of the present disclosure, is commercially popular in a 40 mm size in
30 the infant formula packaging industry and supplied by the

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assignee. Such conventional 40 mm containers are generally formed by a blow-trim process in which a container is formed with a moil attached above the finish of the container. The term "moil" is used herein to refer to the lost head or top section of a blow moulded bottle which is required for the production process. This section is subsequently removed and normally recycled back with the virgin resin into the blowing equipment.

A groove may be formed on an exterior surface between the lost head (moil) and the container. A knife may be inserted into the groove to separate the lost head (moil) from the container. Because a bottom portion of the groove may be formed according to the shape of the meld, the conventional container, formed by the blow-trim process, is typically formed with a radius or smooth transition between the exterior surface of the neck and its rim.

According to the present invention, there is provided a retortable composite closure for a finish no larger than 55 mm including: an insert disc including a circular centre portion, a downwardly opening channel disposed circumferentially about the centre portion, and a curl disposed circumferentially about the channel; the channel is formed by an obliquely oriented channel inner sidewall extending radially outwardly and upwardly from the disc centre portion, a substantially vertically oriented outer sidewall extending upwardly from the curl, and a substantially flat top disposed between the channel inner sidewall and channel outer sidewall, the channel receiving a sealant therein; and a shell encircling the

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insert disc, the shell including a retaining ring for urging downwardly on the channel, a transition extending radially outwardly and downwardly from the ring, and a downwardly depending skirt, an interior portion of the transition forming a cavity for receiving the curl, an exterior surface of the shell including a substantially vertical portion that extends upwardly in the z-direction past the uppermost portion of the disc channel.

A vertical portion of the shell exterior surface preferably yields to an inwardly oriented radius at a yield point that defines a boundary of the exterior surface vertical portion. The yield point has a superior position along the z-axis compared with the uppermost portion of the channel. An exterior surface of the shell preferably includes a substantially straight portion that extends upwardly in the z-direction past the uppermost portion of the disc channel. The configuration of an upper portion of the shell enables a cavity to be formed to house the curl on a closure of relatively small diameter, such as a closure for no larger than a standard 55 mm finish, and preferably for a 40 mm finish.

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According to another aspect of the invention, there is provided a retortable composite closure for a finish of 55 mm or less, including: an insert disc of coated steel including a circular centre portion, a downwardly opening channel disposed circumferentially about the centre portion, and a curl disposed

5 circumferentially about the channel; the channel being formed by an obliquely oriented channel inner sidewall extending radially outwardly and upwardly from the disc centre portion, a substantially vertically oriented outer sidewall extending upwardly from the curl, and a substantially flat top disposed between the channel inner sidewall and channel outer sidewall, the channel receiving a sealant therein;

10 and a shell of plastic material encircling the insert disc, the shell including a retaining ring for urging downwardly on the channel, a transition extending radially outwardly and downwardly from the ring, and a downwardly depending skirt, an interior portion of the transition forming a cavity for receiving the curl, an exterior surface of the shell including a substantially vertical portion that extends upwardly in the z-direction past

15 an uppermost portion of the disc channel; and in which, in use, the interior portion of the transition is spaced apart from the outer portion of a container neck such that the cavity is sufficiently large to receive and house the curl with the interior portion of the transition being spaced apart from the curl and wherein the vertical portion of the shell exterior surface yields to an inwardly oriented radius at a yield point that defines a

20 boundary of the exterior surface vertical portion, the yield point having a superior position along the z-axis compared with the uppermost portion of the channel, wherein the transition has a minimum thickness, in longitudinal cross section, that is greater than a thickness of a distal portion of the ring and of the skirt between

25 threads, the transition thickness being measured between a first tangent drawn on an interior surface of the transition and a second tangent drawn on an exterior surface of the transition such that the first tangent and the second tangent are parallel, and in which the structural strength of the closure allows a net internal pressure created by a retort process to be present during the retort process without loss of seal.

According to another aspect of the invention, there is provided a

30 method for forming a retortable package having a standard opening of 55 mm or less

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and suitable for a retort process, said method consisting essentially of the steps of:
forming the closure as described above; blow moulding a container assembly
including a container and an integral lost head, the container and the integral lost
head defining an outwardly opening notch therebetween, an upper outer edge of the
5 container having a radius and including a neck having an inner sidewall that is
substantially vertical and a rim, the neck inner sidewall and rim forming a
substantially square corner therebetween, an upwardly extending interior portion of
the shell and an exterior portion of the container neck forming a cavity therein for
receiving the curl; and cutting the container from the lost head at the notch.

10 According to a further aspect of the invention, there is provided a
package combination comprising: the retortable composite closure as described
above; and a container including a neck having an inner sidewall that is substantially
vertical and a rim that is disposed within the channel such that the sealant forms a
seal between the container neck and the closure while the closure is in a fully
15 engaged position, the neck inner sidewall and rim forming a substantially square
corner therebetween, an upwardly extending interior portion of the shell and an
exterior portion of the container neck forming a cavity therebetween for receiving the
curl; in which the container neck is formed by lost head trimming in the absence of an
additional reaming step.

20 A preferred embodiment of the invention will now be described, by way
of example, with reference to the drawings, in which:

Figure 1 is a longitudinal cross sectional view of a portion of a closure
according to the present invention;

Figure 2 is a longitudinal cross sectional view of the closure, shown in
25 Figure 1, and container combination;

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Figure 3 is a comparison of a portion of a conventional composite closure shape with that of the corresponding portion of the closure of Figure 1;

Figure 4 is a cross sectional view of a portion of a container having an attached lost head (moil);

Figure 5A (PRIOR ART) is an enlarged cross sectional view of a thread portion of a closure shell employed on conventional retortable 40 mm closures; and

Figure 5B is an enlarged cross sectional view of a portion of the closure of Figure 1.

A closure 10 is provided that includes a shell 12 and an insert disc 14. Closure 10 is capable of application to a container 16. Shell 12, which preferably is formed of a plastic, such as an injection moulded thermoplastic, includes a circumferential skirt 18 and a retaining ring 30 extending radially inwardly from skirt 18.

Skirt 18 has threads 20 and a lifting and retaining bead 22 formed on an interior surface thereof, and a tamper-evident band 24 extending downwardly at the bottom of skirt 18. Retaining bead 22 is disposed above an upper end of threads 20. The present invention, however, is not limited to the particular configuration of the retaining bead, and encompasses a closure (not shown) omitting a retaining bead. Preferably, in such alternative configuration, a top portion of the threads is capable of retaining the insert disc and lifting the insert disc during a sequential opening process, as will be understood by persons familiar with composite closure design and configuration. The term "retaining structure"

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is employed herein to broadly refer to all types of lifting and/or retaining components, including lifting and/or retaining beads, portions of threads that are suitable for the lifting and/or retaining function, and
5 any other structure capable of retaining an insert within a closure shell and/or lifting an insert disc upon unscrewing (or other opening process) of a closure shell.

Tamper evident band 24, which may be of any type, is dependent from a lower portion of skirt 18, and separated
10 therefrom by a frangible connection. Preferably, band 24 is integrally formed with skirt 18 and retaining ring 30 in an injection moulding process, as will be understood by persons generally familiar with manufacturing of closures. Figures 1 and 2 illustrate tamper evident band
15 24 in its unapplied state and applied state, respectively.

Retaining ring 30 is coupled to skirt 18 through a transition 36. An exterior or upper surface of retaining ring 30 extends radially inwardly and preferably
20 downwardly and terminates at a distal edge 37. Preferably, plural pads 38 extend downwardly from an inner region of ring 30 and are circumferentially spaced apart to provide water washing slots and conversely, ventilation passages for drying, as will be understood by
25 persons generally familiar with composite closure design.

An interior surface 32 is formed by retaining ring 30, transition 36, and (depending on where defined) an upper portion of skirt 18. As more fully described below, interior surface 32 defines a portion of a cavity 40.
30 Also, an exterior sidewall surface 33 is formed by skirt

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18 and transition 36. Optionally, plural ribs 34 may be disposed on interior surface 32 such that they project into cavity 40. Preferably, ribs 34 are substantially vertically oriented and circumferentially spaced apart.

5 The quantity, size, and cross sectional shape of ribs 34 may be chosen to limit the magnitude of lateral movement of disc 14. Other than ribs 34, interior surface 32 preferably is substantially free of protrusions that would affect its capability of housing curl 52.

10 Insert disc 14 includes a circular centre portion 44, a channel 46, and a curl 52. Channel 46 is downwardly opening and disposed circumferentially about centre portion 44, and curl 52 is disposed at the periphery of channel 46. Channel 46 includes an inner sidewall 48a
15 extending upwardly and radially outwardly from a peripheral portion of disc centre portion 44 and an opposing outer sidewall 48b extending upwardly from curl 52. Preferably inner sidewall 48a is substantially straight and inclined at an oblique angle, and outer
20 sidewall is substantially straight and substantially vertical. A substantially flat top portion 50 is disposed between upper ends of disc inner and outer sidewalls 48a and 48b. A gasket or sealant, such as plastisol 54, is disposed in channel 46.

25 As illustrated in Figure 2, container 16, on which closure 10 is applied, includes a neck 60 that terminates in a rim 62. Threads 64 are disposed on an exterior portion of neck 60. An inner surface 66a and an outer surface 66b are formed on the upper portion of neck and
30 yield to rim 62. Preferably, container 16 is formed of a

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plastic that is suitable for a retort process (such as up to 250 to 260°F), and the invention encompasses glass containers.

The conventional 40 mm closures (described above) commonly employ an insert disc formed of stainless steel at least in part because of the relatively small diameter of such closure. In this regard, in larger composite closures, such as a composite closure for industry standard 63 mm finishes, a coated steel insert having a peripheral curl is employed. Because corrosion, if any, occurs at the distal edge of a coated steel insert, the curl inhibits and/or hides such corrosion, and/or separates the corrosion from the food products. Conventional 40 mm composite closures (for example, of the type sold by the assignee for infant formula and like products), however, have not employed insert discs formed of coated steel at least in part because of the difficulty of providing sufficient space within the relatively small diameter closure in which to house a curl on the periphery of the disc.

Moreover, because the insert discs of the conventional 40 mm composite closures employ a semi-toroidal shaped channel (in longitudinal cross section), a radius or smooth transition (such as, for example, no right angle or sharp corner) on the exterior portion of the neck of the conventional container is required. The configuration of such closures also requires or makes preferred a rounded and/or tapered surface at the transition or juncture between the container rim and the interior diameter of the container neck in order to mate

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with the arcuate (in longitudinal cross section) annular hook, as for example shown in US-5,346,082.

Accordingly, a rounded or tapered interior surface of the container neck is typically performed by a reaming
5 operation after the container is otherwise formed. The extra reaming process and use of stainless steel for the insert disc add cost to the conventional 40 mm composite closure and package in whole.

Referring to closure 10, cavity 40 is formed by
10 interior surface 32 of shell 12 so as to enable curl 52 to be disposed therein. An opposing surface of the exterior surface of container neck 60 may be considered to form part of cavity 40. Exterior surface 33 of shell
12 proximate transition 36 is substantially vertical and
15 extends upwardly (substantially in the z-direction according to the coordinates indicated in the Figures 1 and 2). Preferably, exterior sidewall surface 33 is substantially vertical until it smoothly yields to a radius that extends inwardly toward ring 30. As
20 illustrated in Figure 1, the point at which exterior sidewall surface 33 yields from the vertical z-axis is indicated as point 35. Point 35 may also be defined as the point at which exterior sidewall surface 33 substantially deviates from a substantially straight line
25 (in longitudinal cross section). Preferably, point 35 is vertically spaced apart (that is, has a superior position along the z-axis) from an uppermost portion of disc 14. . Even more preferably, point 35 is vertically spaced apart therefrom by a distance H, which preferably is at least
30 0.015 inches (0.88 mm), and even more preferably by at

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least 0.025 inches (0.635 mm). Also, the preferred vertical distance from point 35 to an uppermost portion of the curl 52 is at least 0.070 inches (1.778 mm) and more preferably at least 0.080 inches (2.032 mm).

5 At least for enhancing the structural strength of closure 10, transition 36 has a minimum thickness (in longitudinal cross section) that is greater than the distal portion of ring 18 and shell 12 between the threads 20. The strength is important because plastic
10 containers cannot be retorted using conventional means of applying overpressure in the process. This is due to deformability of plastic at the elevated temperatures of a retort process. The present invention allows a slight 'net' internal pressure to be present during the retort
15 process without losing the seal. The thickness of transition 36 may be measured by any appropriate means, such as for example measuring the thickness between a first tangent drawn on interior surface 32 and a second tangent drawn on the exterior surface 33 of the
20 transition 36 where the first tangent and second tangent are parallel. Preferably, the thickness of transition 36 is at least 0.070 inches (1.778 mm) measured from parallel tangents at the approximate midpoint of the arcuate portion of interior surface 32, as illustrated by
25 reference T on Figure 2.

As illustrated in Figure 2, closure 10 is applied to container 16 such that closure threads 20 engage with container threads 64. Retaining ring 30, in the fully engaged position of closure 10, urges downwardly on
30 channel upper surface 46 through pads 38. Because of its

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configuration, the inner portion of shell 12 is spaced apart from the outer portion of neck 60 such that cavity 40 is sufficiently large to receive and house curl 52, thereby enabling the use of conventional coated steel as the material of insert disc. The configuration of transition 36 provides sufficient strength for closure 10.

Channel 46 preferably has a depth D, as shown illustrated in Figure 1, of least 0.045 inches (1.143 mm), and more preferably at least 0.070 inches (1.778 mm) to provide ample channel volume to enable plastisol 54 to adequately seal each side of the container rim 66a and 66b. A portion of plastisol 54 is removed from Figure 2 for clarity, and an approximate position of plastisol 54 relative to container neck 60 prior to the application of closure 10 onto container 16 is shown in phantom. In this regard, plastisol 54 is shown in its approximate position prior to such application, and it is expected that the shape of plastisol 54 will deform upon such application, as will be understood by persons generally familiar with the structure and function of composite closures in light of the present disclosure.

As illustrated in Figures 1 and 2, the shape of channel 46 enables sealing of container rim 62 without having a rounded and/or tapered surface on the interior of container neck 60. For example, as particularly illustrated in the Figure 2, inner surface 66a of container rim 62 may have a substantially square or sharp corner such as is formed by the moil trimming process without a separate reaming process. An opposing, outer

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surface 66b of rim 62 may have a conventional shape or a shape that matches that of inner surface 66a. The present invention encompasses, however, minor cleaning or deburring processes to prepare inner surface 66a after it
5 is cut from lost head (moil) 70.

Figure 3 provides an illustration of shell 12 compared with an existing shell commonly employed on a 40 mm composite closure, known commercially as the "Tri-Safe" (TM) closure, features of which are shown in US-
10 5,078,290 and US-5,031,787, but which is generally employed for hot fill processes, typically at about 185°F (85°C) rather than for retort processes. Figure 3 is drawn approximately to scale. In this regard Figure 3 illustrates the magnitude of the configuration of
15 transition 36.

The present invention encompasses a method of forming a container and closure combination, including the steps of providing a composite closure 10 as described above, and blow moulding a container assembly
20 including container 16 with a lost head (moil) 70 attached thereto. An outwardly opening notch 72 is formed between the container and lost head (moil) 70. In the blow moulding process, outer portion 66b is formed in the meld so as to form the bottom portion of the notch.

25 After moulding, lost head (moil) 70 may be separated from the container by a cutting process, such as by a knife, hot wire, laser, or like apparatus. The blow moulding and moil trimming processes will be understood by persons generally familiar with blow-trim technology.
30 As described above, container 16 described above and

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formed by such a process may receive application of closure 10 without the necessity of undergoing an extra reaming or like machining step.

Figures 5A and 5B illustrate a preferred
5 configuration of threads 20. Figure 5A (PRIOR ART) illustrates a conventional buttress-type thread employed on conventional 40 mm retortable composite closures.

Conventional packages (after filling) are heated to an elevated temperature using steam at an elevated
10 pressure. For plastic containers, however, the pressure differential between outside and inside the package is maintained below a maximum magnitude. Accordingly, despite external pressure higher than atmospheric pressure, the internal pressure sometimes exceeds the
15 external pressure due to thermal expansion of the package contents. Threads shown in Figure 5A enable the closure to resist high relative internal pressure during the retort process. Accordingly, retortable composite closures employing a plastic container typically employ
20 such buttress-type threads having a substantially flat or approximately horizontal surface for securing the closure to the container. However, during manufacture, a closure having such threads is typically removed from a meld by an unscrewing process.

25 The inventor has found that a retortable composite closure disclosed herein is suitable for heating in a conventional retort process with threads capable of being removed from a meld during manufacturing by conventional stripping. It is theorized that the deep channel enhances
30 the plastisol seal (such as, about the sharp edge 66a)

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and enhances the retention of closure 10 during retorting under conditions at which internal pressure of the package is slightly greater than the pressure external to the package. Threads 24 have a generally smooth cross
5 sectional profile that is generally without flat or substantially horizontal surfaces, thereby enabling shell 12 to be stripped from a meld during manufacturing. In this regard, shell 12 deflects and the ramp-like top portion of the thread cams on the corresponding surface
10 of the meld.

The invention is described above by way of example only and changes may be made within the scope of the invention, as defined by the claims. For example, the invention is not limited to closures configured for
15 sequential opening, but rather encompasses closures in which two or more of the initial thread friction is overcome, the disc is forced from the container rim to break the seal, and the tamper evident band is broken substantially simultaneously.

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CLAIMS:

1. A retortable composite closure for a finish of 55 mm or less, including:

an insert disc of coated steel including a circular centre portion, a downwardly opening channel disposed circumferentially about the centre portion, and
5 a curl disposed circumferentially about the channel; the channel being formed by an obliquely oriented channel inner sidewall extending radially outwardly and upwardly from the disc centre portion, a substantially vertically oriented outer sidewall extending upwardly from the curl, and a substantially flat top disposed between the channel inner sidewall and channel outer sidewall, the channel receiving a sealant
10 therein; and

a shell of plastic material encircling the insert disc, the shell including a retaining ring for urging downwardly on the channel, a transition extending radially outwardly and downwardly from the ring, and a downwardly depending skirt, an interior portion of the transition forming a cavity for receiving the curl, an exterior
15 surface of the shell including a substantially vertical portion that extends upwardly in the z-direction past an uppermost portion of the disc channel; and

in which, in use, the interior portion of the transition is spaced apart from the outer portion of a container neck such that the cavity is sufficiently large to receive and house the curl with the interior portion of the transition being spaced
20 apart from the curl and

wherein the vertical portion of the shell exterior surface yields to an inwardly oriented radius at a yield point that defines a boundary of the exterior surface vertical portion, the yield point having a superior position along the z-axis compared with the uppermost portion of the channel,

25 wherein the transition has a minimum thickness, in longitudinal cross section, that is greater than a thickness of a distal portion of the ring and of the skirt between threads, the transition thickness being measured between a first tangent

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drawn on an interior surface of the transition and a second tangent drawn on an exterior surface of the transition such that the first tangent and the second tangent are parallel, and in which the structural strength of the closure allows a net internal pressure created by a retort process to be present during the retort process without
5 loss of seal.

2. The closure of claim 1, wherein an exterior surface of the shell includes a substantially straight portion that extends upwardly in the z-direction past the uppermost portion of the disc channel.

3. The closure of claim 2, wherein the straight portion of the shell exterior
10 surface yields to an inwardly oriented radius at a yield point that defines a boundary of the exterior surface vertical portion, the yield point having a superior position along the z-axis compared with the uppermost portion of the channel.

4. The closure of claim 1 or claim 3, wherein the yield point is disposed above the uppermost portion of the channel by a distance H of at least 0.38 mm.

15 5. The closure of claim 4 wherein the distance H is at least 0.635 mm.

6. The closure of any one of claims 1 to 5, wherein the transition has a thickness T, in longitudinal cross section, of at least 1.778 mm measured from parallel tangents at the approximate midpoint of an interior surface of the transition.

7. The closure of any one of claims 1 to 6, further comprising ribs
20 disposed on the interior portion of the shell for limiting lateral movement of the disc.

8. The closure of any one of claims 1 to 7, wherein the skirt includes a retaining structure disposed thereon for at least one of retaining and lifting the insert disc upon opening.

9. The closure of any one of claims 1 to 8, wherein the finish is 40 mm
25 size.

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10. The closure of any one of claims 1 to 9, wherein the skirt includes threads and the threads have a rounded top surface thereby facilitating removal of the shell from a mould during manufacture.

11. The closure of any one of claims 1 to 10, wherein the channel has a
5 depth D of at least 1.778 mm, thereby enabling the sealant to form a seal with a container neck and rim, the disc being formed of a coated steel.

12. A method for forming a retortable package having a standard opening of 55 mm or less and suitable for a retort process, said method consisting essentially of the steps of:

10 forming the closure of any one of claims 1 to 10;

blow moulding a container assembly including a container and an integral lost head, the container and the integral lost head defining an outwardly opening notch therebetween, an upper outer edge of the container having a radius and including a neck having an inner sidewall that is substantially vertical and a rim,
15 the neck inner sidewall and rim forming a substantially square corner therebetween, an upwardly extending interior portion of the shell and an exterior portion of the container neck forming a cavity therein for receiving the curl; and

cutting the container from the lost head at the notch.

13. The method of claim 12, further comprising the step of applying the
20 closure to the container after the cutting step such that the container rim is disposed within the channel and the sealant forms a seal between the container neck and the closure while the closure is in a fully engaged position.

14. A package combination comprising:

the retortable composite closure of any one of claims 1 to 9; and

25 a container including a neck having an inner sidewall that is substantially vertical and a rim that is disposed within the channel such that the

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sealant forms a seal between the container neck and the closure while the closure is in a fully engaged position, the neck inner sidewall and rim forming a substantially square corner therebetween, an upwardly extending interior portion of the shell and an exterior portion of the container neck forming a cavity therebetween for receiving
5 the curl;

in which the container neck is formed by lost head trimming in the absence of an additional reaming step.

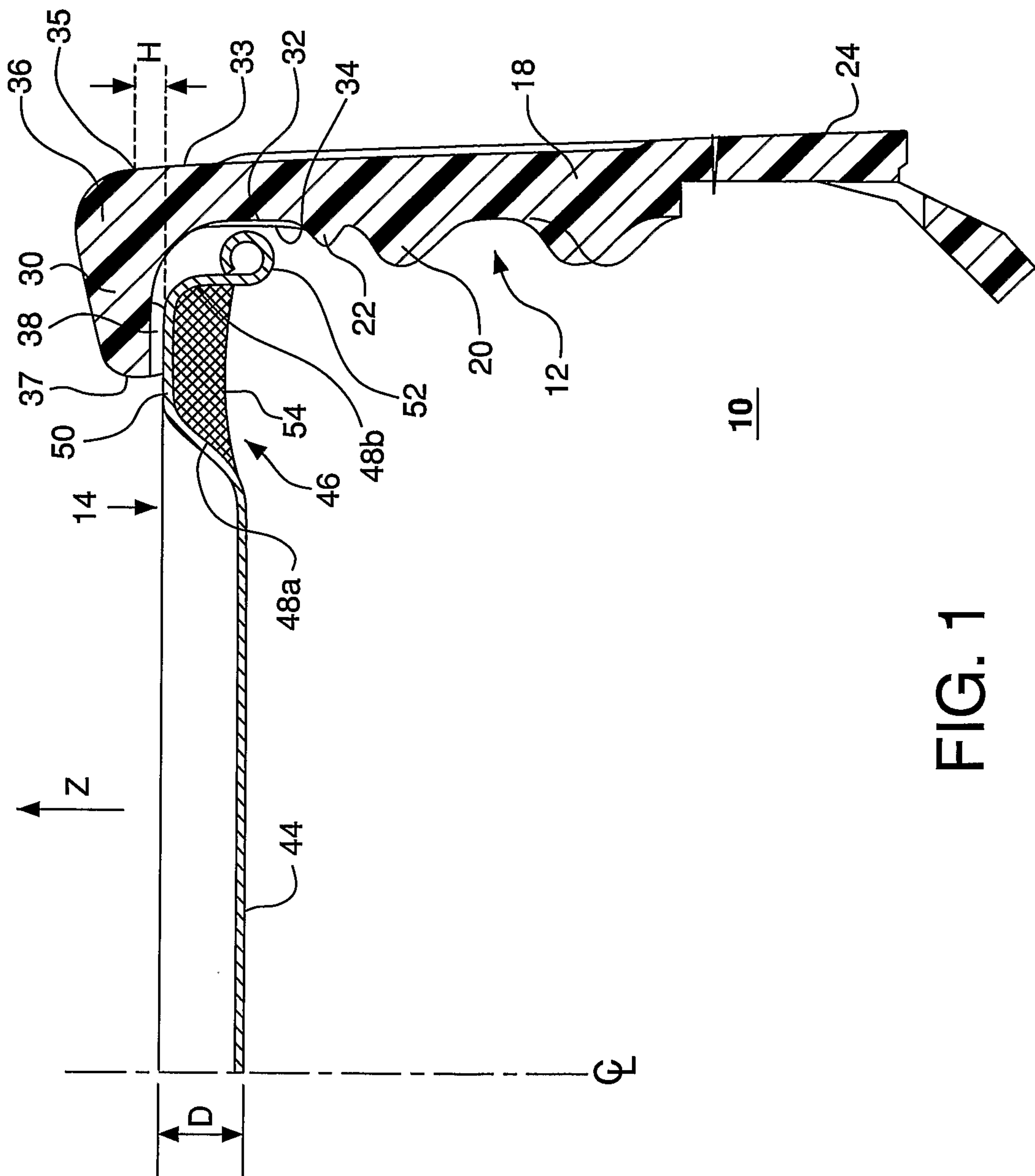
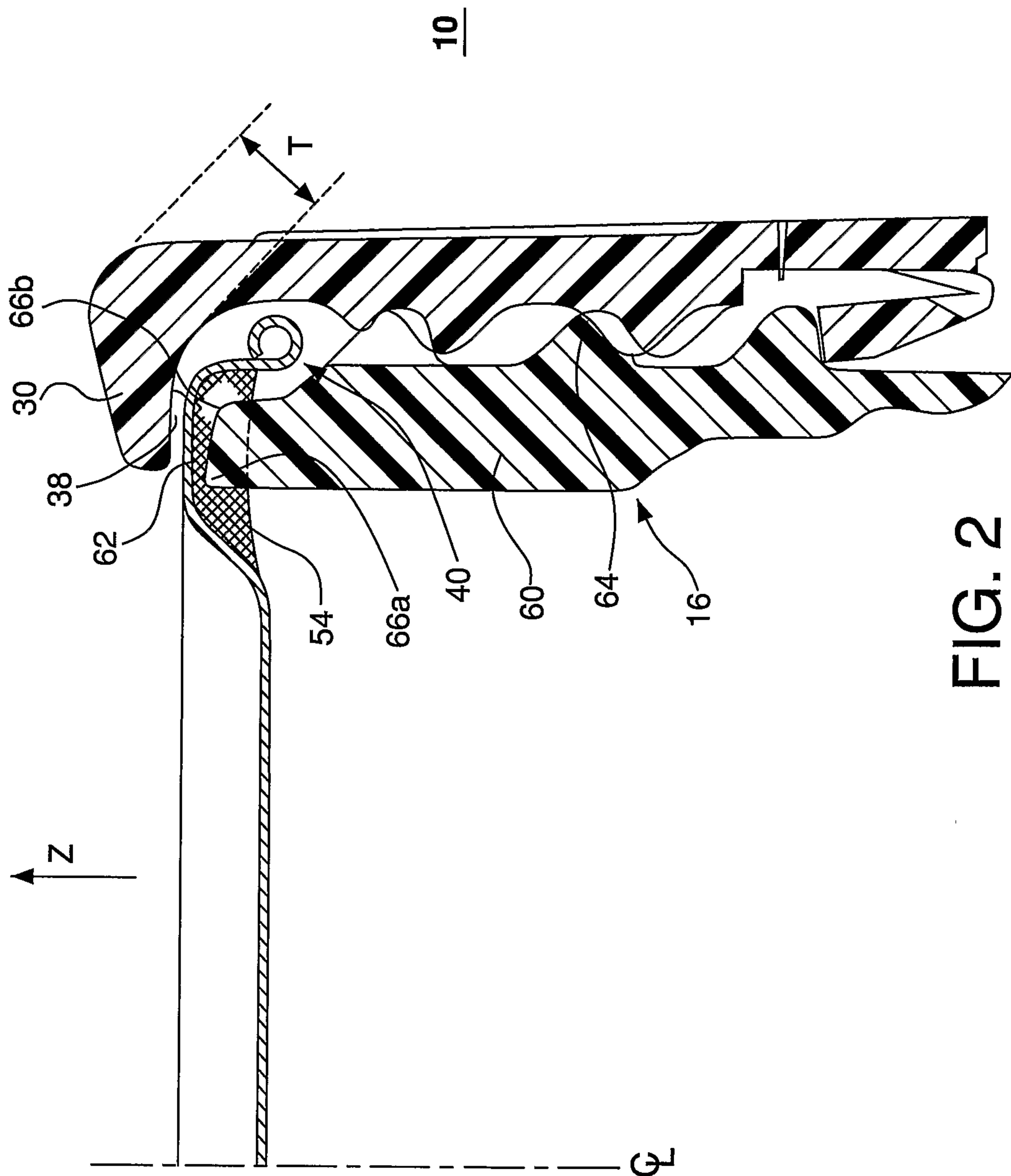


FIG. 1

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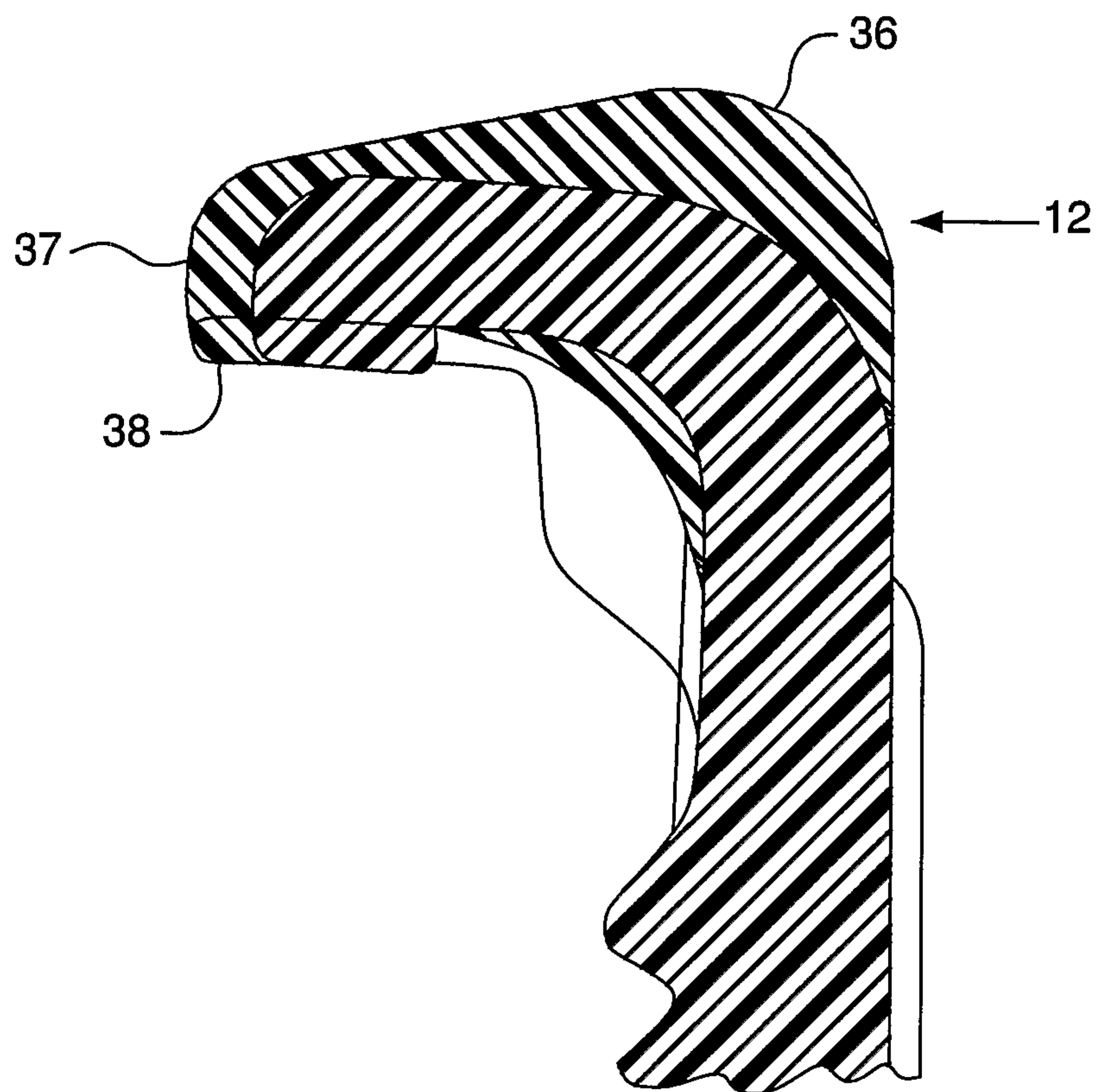


FIG. 3

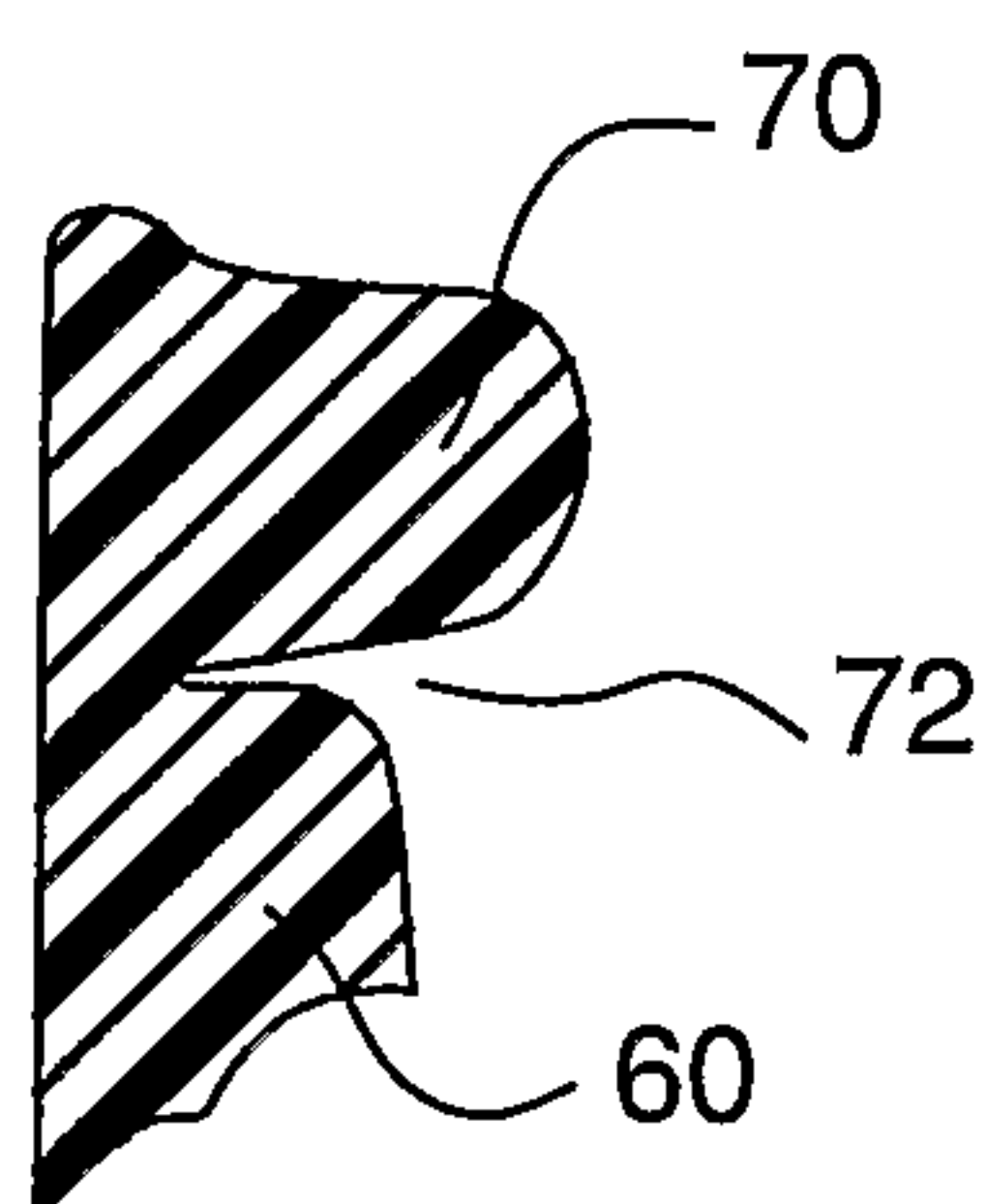


FIG. 4

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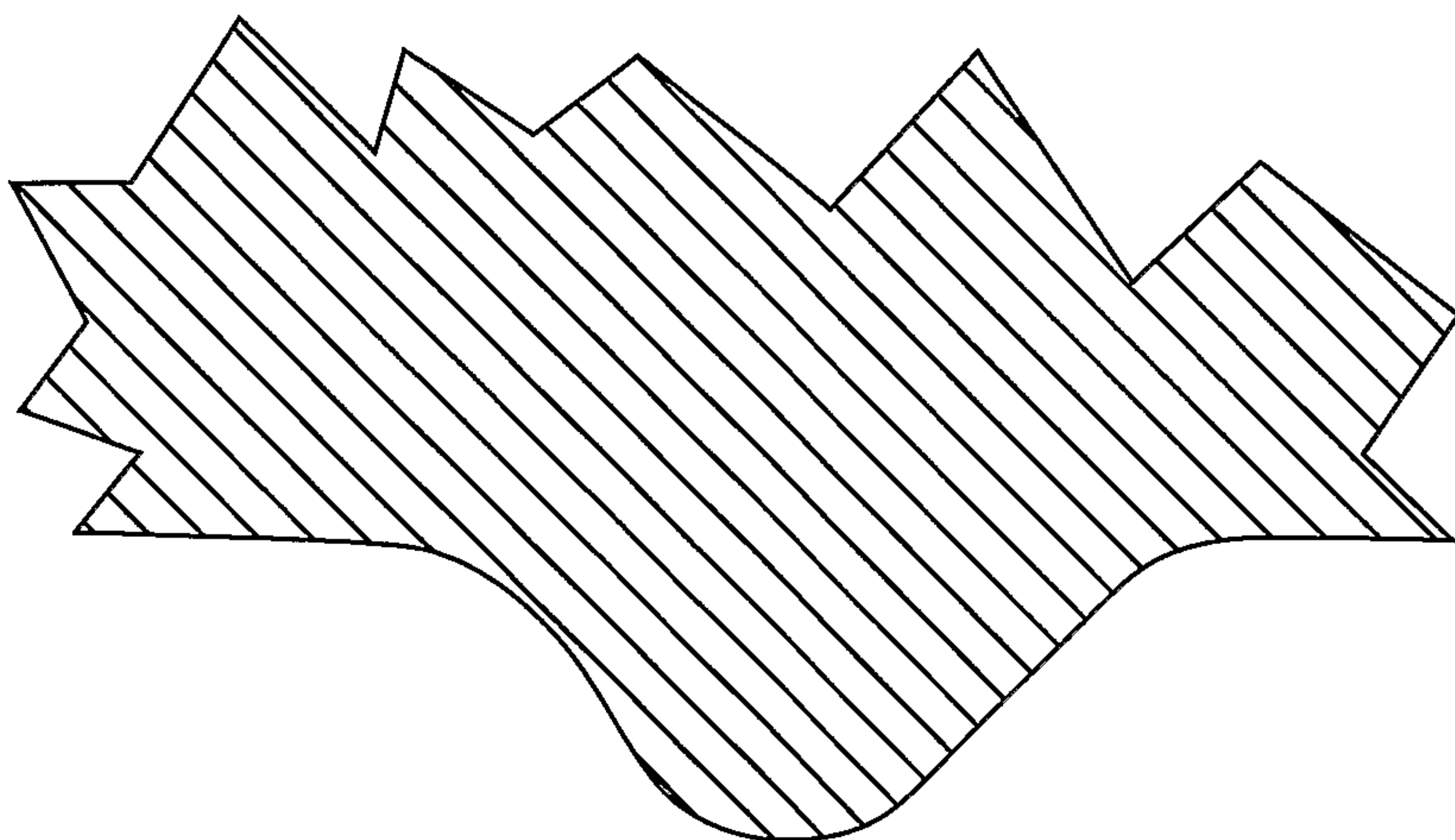


FIG. 5B

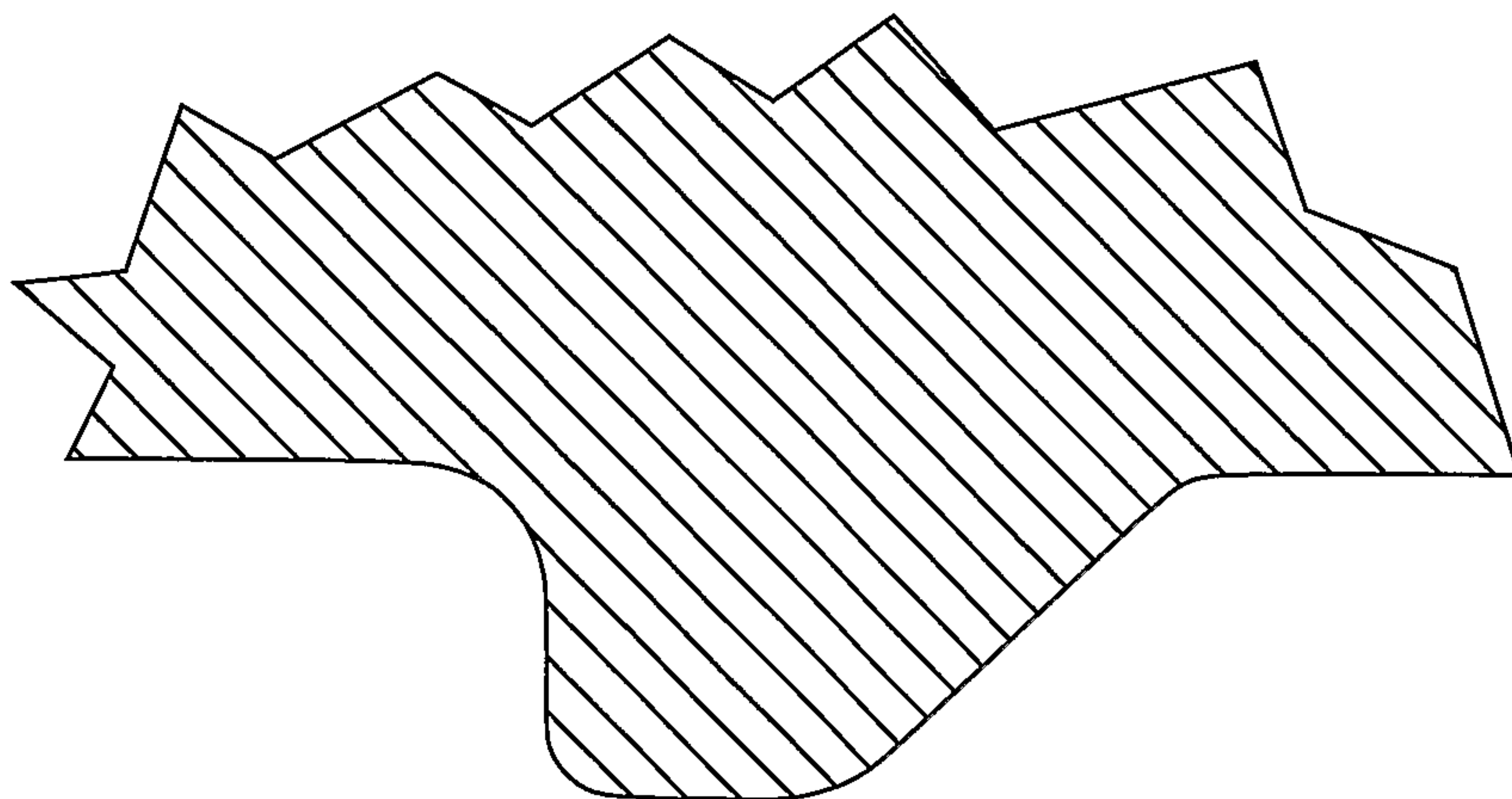


FIG. 5A
Prior Art

