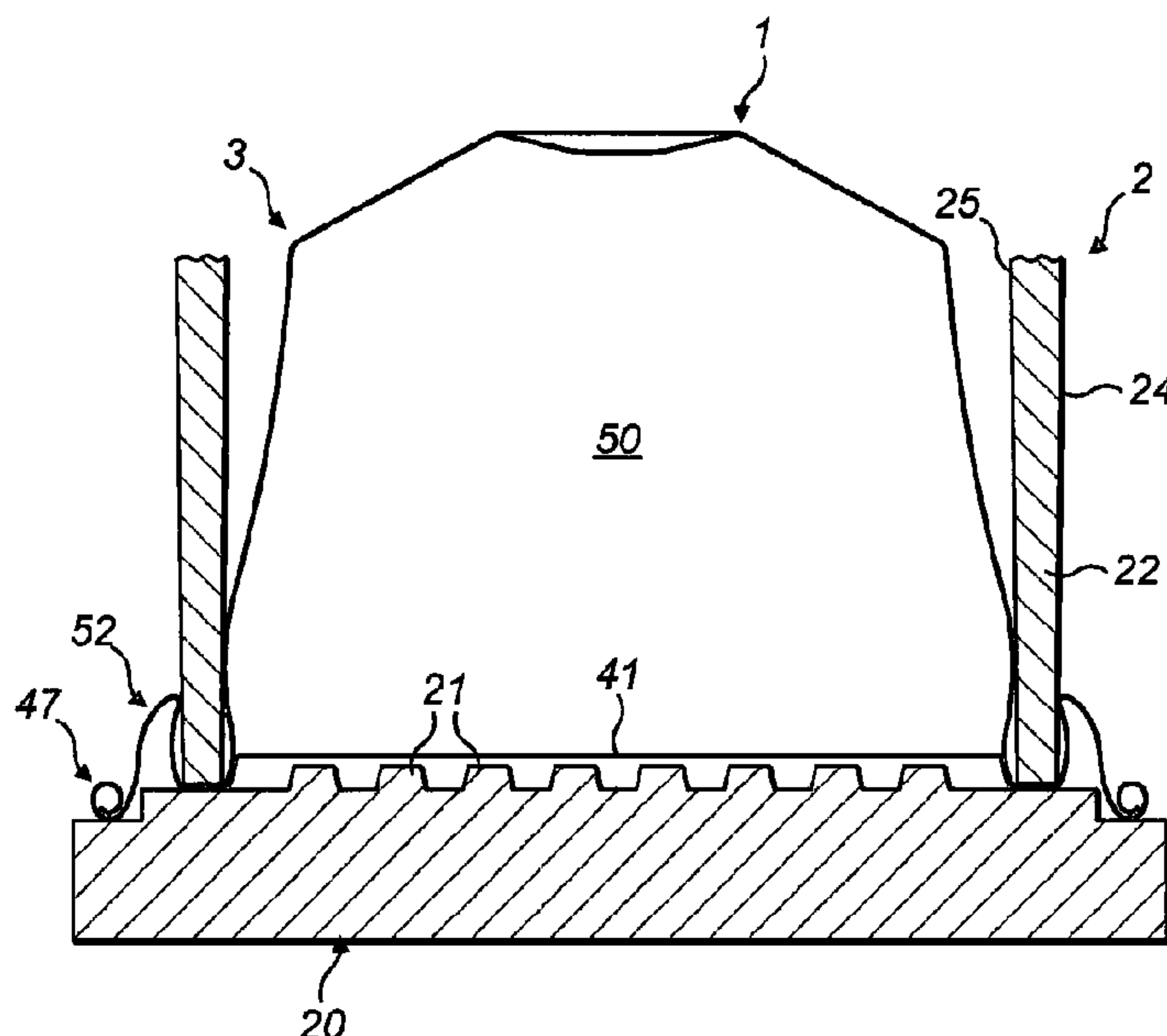




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(72) Inventeurs/Inventors:  
HALLIDAY, ANDREW, GB;  
SHABUDIN, ESAK, GB;  
JELLEY, SIMON, GB;  
BANISTER, STUART, GB  
(73) Propriétaire/Owner:  
KONINKLIJKE DOUWE EGBERTS B.V., NL  
(74) Agent: GOWLING WLG (CANADA) LLP

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(54) Title: A BEVERAGE PREPARATION SYSTEM, A CAPSULE AND A METHOD FOR FORMING A BEVERAGE



(57) Abrégé/Abstract:

A beverage producing system is provided comprising a capsule containing beverage ingredients and a beverage preparation machine. The capsule comprises a cup-shaped body and a lid; the cup-shaped body having a base and a side wall and the lid being sealed to the cup-shaped body. The side wall is dimensioned to be contacted by an enclosing member of the beverage preparation machine on closure of the enclosing member to buckle the side wall to form a valley zone bridging the enclosing member. The side wall is adapted such that said valley zone forms at least one sealing interface between the enclosing member and the side wall. A capsule and a method are also disclosed.



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(71) Applicant: **KRAFT FOODS R&D, INC** [US/US]; Three  
Parkway North, Deerfield, IL 60015 (US).

(72) Inventors: **HALLIDAY, Andrew**; Mondelez UK R&D  
Limited, Ruscote Avenue, Banbury, Oxon OX16 2QU  
(GB). **SHABUDIN, Esak**; Mondelez UK R&D Limited,  
Ruscote Avenue, Banbury, Oxon OX16 2QU (GB). **JEL-  
LEY, Simon**; 4 Farringford Close, Cambridge, Cambridgeshire  
CB4 3LU (GB). **BANISTER, Stuart**; 59 Allan Avenue,  
Peterborough, Cambridgeshire PE2 8TN (GB).

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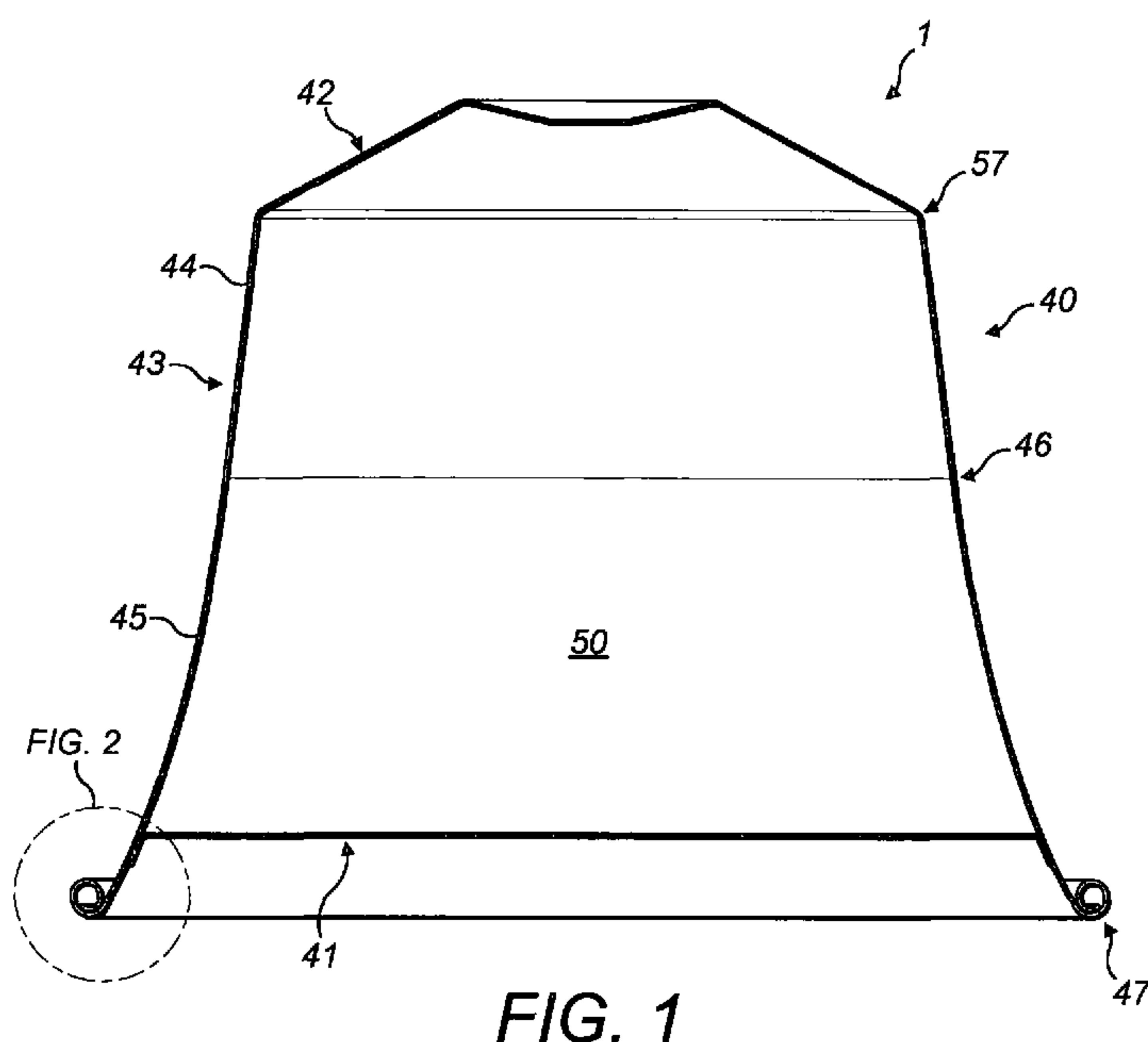
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(57) Abstract: A beverage producing system is provided comprising a capsule containing beverage ingredients and a beverage preparation machine. The capsule comprises a cup-shaped body and a lid; the cup-shaped body having a base and a side wall and the lid being sealed to the cup-shaped body. The side wall is dimensioned to be contacted by an enclosing member of the beverage preparation machine on closure of the enclosing member to buckle the side wall to form a valley zone bridging the enclosing member. The side wall is adapted such that said valley zone forms at least one sealing interface between the enclosing member and the side wall. A capsule and a method are also disclosed.

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A Beverage Preparation System, a Capsule and a Method for  
forming a Beverage

The present disclosure relates to a beverage  
5 preparation system, a capsule and a method for forming a  
beverage. The beverage preparation system is of the type  
comprising a beverage preparation machine wherein the  
capsule is designed for insertion into the beverage  
preparation machine to permit a pressurised liquid to be  
10 flowed through the capsule in order to produce a beverage  
from interaction with beverage ingredients contained within  
the capsule.

Background

15 Beverage preparation systems which comprise a beverage  
preparation machine and a capsule containing beverage  
ingredients are known in the art. One such system is taught  
in EP 1700548, which discloses a capsule comprising a cup-  
like base body and a closing foil member. The capsule is  
20 designed for insertion in a beverage production device in  
which a liquid under pressure enters the capsule in order to  
interact with ingredients in the capsule to form a beverage  
which is output for consumption. The capsule of EP 1700548  
is provided with a dedicated sealing member to prevent a by-  
25 pass flow of water around the exterior of the capsule in  
use. The sealing member is in the form of a hollow sealing  
member on the outer surface of the capsule, for example in  
the form of a step which is contacted on closure of an  
enclosing member of the beverage preparation machine.

30 The present disclosure provides an alternative capsule  
which may be used as part of such a beverage preparation



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system. The capsule may be economical to produce and provide effective sealing in use.

#### Summary of the Disclosure

5 In a first aspect the present disclosure provides a beverage producing system comprising:

a capsule containing beverage ingredients; and

a beverage preparation machine;

10 the capsule comprising a cup-shaped body and a lid; the cup-shaped body having a base and a side wall and the lid being sealed to the cup-shaped body;

the capsule being designed for insertion into the beverage preparation machine to permit a pressurised liquid to be flowed through the capsule in order to produce a  
15 beverage from interaction with the beverage ingredients;

the beverage preparation machine having an enclosing member adapted to be selectively movable between an open position to permit insertion of the capsule into the beverage preparation machine and a closed position in which  
20 the enclosing member sealingly engages the capsule;

wherein the side wall is dimensioned to be contacted by the enclosing member on movement of the enclosing member into the closed position to buckle the side wall to form a valley zone bridging the enclosing member;

25 wherein the side wall is adapted such that said valley zone forms at least one sealing interface between the enclosing member and the side wall.

In a second aspect, the present disclosure provides a  
30 capsule for preparing a beverage comprising a cup-shaped body and a lid; the cup-shaped body having a base and a side wall and the lid being sealed to the cup-shaped body;

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the capsule being designed for insertion into a beverage preparation machine to permit a pressurised liquid to be flowed through the capsule in order to produce a beverage from interaction with the beverage ingredients;

5 the beverage preparation machine being of the type having an enclosing member adapted to be selectively movable between an open position to permit insertion of the capsule into the beverage preparation machine and a closed position in which the enclosing member sealingly engages the capsule;

10 wherein the side wall is dimensioned to be contacted by the enclosing member on movement of the enclosing member into the closed position to buckle the side wall to form a valley zone bridging the enclosing member;

wherein the side wall is adapted such that said valley  
15 zone forms at least one sealing interface between the enclosing member and the side wall.

In a third aspect the present disclosure provides a method for preparing a beverage comprising the steps of:

- 20 - providing a capsule as described above;  
- providing a beverage preparation machine having an enclosing member;  
- moving the enclosing member into an open position;  
- inserting the capsule into the beverage preparation  
25 machine;  
- closing the enclosing member so as to sealingly engage the enclosing member with the capsule;  
- flowing a pressurised liquid through the capsule to produce a beverage from interaction with the beverage  
30 ingredients; and  
- outputting the beverage for consumption;

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wherein on closure of the enclosing member the side wall of the capsule is contacted by the enclosing member to thereby buckle the side wall to produce a valley zone bridging the enclosing member;

5        wherein said valley zone forms at least one sealing interface between the enclosing member and the side wall.

Advantageously, in the above aspects, buckling of the side wall allows for a relatively large-scale deformation of the side wall to take place to allow formation of the valley zone bridging the enclosing member. This deformation may include folding of the material of the side wall and/or elastic and/or plastic straining of the material of the side wall.

15

The above aspects may further comprise one or more of the following features:

The valley zone may form a sealing interface with a leading edge of the enclosing member.

20

The side wall may be adapted such that during closure of the enclosing member the side wall is plastically drawn over the leading edge of the enclosing member.

Advantageously this may allow the side wall to be conformed to the shape of any grooves (or similar) provided in the

25

leading edge.

The valley zone may be adapted to be nipped against a capsule holder of the beverage preparation machine part.

The side wall may be adapted to undergo plastic deformation during said buckling.

30

The side wall may be adapted such that, following buckling of the side wall, the side wall defines a ridge zone located outside the enclosing member. As above,



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buckling of the side wall allows for a relatively large-scale deformation of the side wall to take place to allow formation of the ridge zone. This deformation may include folding of the material of the side wall and/or elastic  
5 and/or plastic straining of the material of the side wall.

The ridge zone may be adapted to be forced inwardly against an outer face of the enclosing member to form a sealing interface with the outer face of the enclosing member.

10 Advantageously, a sealing interface may be provided with both the leading edge and the outer face of the enclosing member. In addition, the formation of the valley zone may also cause an outward pressure to be exerted by the side wall on the inner face of the enclosing member to form  
15 a further sealing interface.

Prior to insertion, the side wall may have a flared shape.

Prior to insertion, at least a portion of the side wall may be concavely curved.

20 Prior to insertion, the side wall may extend away from the lid at an angle from 45 to 80 degrees.

The capsule may comprise a rim formed at an end of the cup-shaped body remote from the base.

The rim may be formed integrally with the cup-shaped  
25 body.

The rim may be formed by a rolled-over portion of the side wall.

Prior to insertion, the capsule may be flangeless except for the optional provision of a rim.

30 Prior to insertion, the side wall may extend from the base to the rim to define a curved surface without any abrupt angular changes in geometry.

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Prior to insertion, the side wall may comprise a pre-selected zone which has been configured or treated to promote a reliable deformation of the side wall. The pre-selected zone may be a circumferential line or band of the side wall. The pre-selected zone may be configured or treated by altering the rigidity, strength, ductility or other suitable material characteristic of the side wall within (or adjacent to) the pre-selected zone to promote reliable deformation of the side wall during closure of the enclosing member. The rigidity, strength, ductility or other suitable material characteristic of the side wall may be altered by one or more of work hardening, localised thickening, creasing, scoring or thinning of the material of the side wall.

Prior to insertion, the side wall may comprise a frustoconical section proximate the base and a flared section distal the base.

The flared section may extend for a distance of 40 to 80% of a longitudinal height of the capsule or for a distance of 50 to 70% of the longitudinal height of the capsule or for a distance of approximately 60% of the longitudinal height of the capsule.

The lid may be sealed to the side wall at a location radially inside a point of contact, in use, of a leading edge of the enclosing member on the side wall. The lid may be sealed to an inner surface of the side wall. The lid may be sealed at a location on the side wall above the point of contact of the leading edge of the enclosing member. The lid may be positioned a distance of from 2.5 to 3.0 mm from the distal end of the side wall. The distance may be selected to be substantially twice the height of the rim, where present. In one example, the rim may have a height of 1.35 mm and the



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lid may be located 2.7 mm above the distal end of the side wall. These features singularly or in combination may help to ensure that the enclosing member does not bear down on the capsule so as to trap beverage ingredients in between  
5 the leading edge and the capsule holder which may have a detrimental effect on the fluid-tightness of the seal.

The side wall may comprise a distal portion that extends beyond the location where the lid is sealed to the side wall.

10 The distal portion of the side wall may form a roll-over edge of the capsule.

A leading edge of the enclosing member may comprise a plurality of grooves or indentations, and the side wall may be adapted such that the plastic deformation of the side  
15 wall conforms the side wall to the grooves or indentations to provide an effective seal.

The cup-shaped body may be formed from aluminium, an aluminium alloy or a laminate comprising at least one layer formed from aluminium or an aluminium alloy. A lacquer layer  
20 may be applied to one or both faces of the cup-shaped body. Alternatively, another, suitably ductile material could be utilised in place of the aluminium or aluminium alloy.

The aluminium alloy may, for example, be of grade 3005, 3105, 8011 or 8079. Preferably, the aluminium alloy will  
25 have an 'O' temper rating.

The laminate, where used, may comprise a ductile structural layer formed from a material such as aluminium or an aluminium alloy together with a resilient layer formed from a polymer. The laminate may comprise only a single  
30 layer of aluminium or aluminium alloy together with a single layer of polymer together with an optional lacquer layer applied to the aluminium or aluminium alloy.

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The polymer layer may, for example, comprise a material selected from the group of: polyvinyl chloride (PVC), polypropylene (PP), low density polyethylene (LDPE), medium density polyethylene (MDPE), high density polyethylene (HDPE), fluorinated ethylene propylene (FEP), polytetrafluoroethylene (PTFE), polyethylene terephthalate (PET), polyamide (PA), ethylene propylene diene monomer (EPDM), polychloroprene or isobutylene.

The lid may be formed from aluminium, an aluminium alloy or a laminate comprising at least one layer formed from aluminium or an aluminium alloy. Alternatively, another, suitably ductile material could be utilised.

The cup-shaped body may be formed from a single integral piece of material. The single piece of material may be cold formed to form the shape of the cup-shaped body, including any flared section. A deep-drawing technique may be used to cold form the cup-shaped body. Where the material of the cup-shaped body comprises a laminate with a polymer layer, a warm-drawing technique may be used where the material is subjected to an increased temperature to promote easier deformation of the polymer material but without detrimental effects on the material characteristics of the aluminium layer.

The cup-shaped body and rim may be integral.

The cup-shaped body may have a thickness in the range of 80 to 500 microns. In some aspects the thickness may be in the range of 90 to 300 microns. Where the cup-shaped body is formed solely from aluminium or an aluminium alloy (optionally with one or more lacquer layers) a thickness in the range of 80 to 120 microns may be preferred. Where the cup-shaped body is formed from a laminate material comprising a polymer layer a thickness in the range 100 to



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500 microns is preferred. The thickness of the material may be varied throughout the cup-shaped body.

The rim may have an outer diameter of approximately 37 mm.

5 Prior to insertion, the capsule may have a height of from 25 to 31 mm. In some aspects the height may be from 29 to 30 mm. Deformation of the capsule during use will tend to reduce the longitudinal height.

The capsule may form a single-use, disposable element.

10 The capsule may contain a beverage ingredient or mixture of beverage ingredients. As a non-limiting example, the beverage ingredient may comprise roasted ground coffee.

#### Brief Description of the Drawings

15

Examples of the present disclosure will now be described in more detail, for exemplary purposes only, with reference to the accompanying drawings, in which:

20 Figure 1 is a cross-sectional view of a first embodiment of capsule according to the present disclosure;

Figure 2 is an enlarged view of a detail of Figure 1;

Figure 3 is a schematic illustration of the capsule of Figure 1 together with an enclosing member of a beverage  
25 preparation machine;

Figure 4 is an enlarged view of a detail of Figure 3;

Figure 5 is a schematic illustration of the arrangement of Figure 3 with the enclosing member in a closed position;

Figure 6 is an enlarged view of a detail of Figure 5;

30 Figure 7 is a perspective view of a further embodiment of capsule according to the present disclosure;



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Figure 8 shows a schematic cross-section through a part of the capsule of Figure 7 after insertion into a beverage preparation machine;

Figure 9 is a perspective view of a further embodiment of capsule according to the present disclosure; and

Figure 10 shows a schematic cross-section through a part of the capsule of Figure 9 after insertion into a beverage preparation machine.

## 10 Detailed Description

Figure 3 shows schematically a part of a beverage preparation system according to the present disclosure. The beverage preparation system comprises a beverage preparation machine and a capsule 1.

Figures 1 and 2 show a first embodiment of capsule 1 according to the present disclosure for use with the beverage preparation machine. The capsule 1 will be described in more detail below but may have the general form of a cup-shaped body 40 having a base 42 at one end and a side wall 43 extending from the base 42 towards an opposed end which is closed-off by a lid 41.

As shown in Figure 3, the beverage preparation machine comprises an enclosing member 2 and a capsule holder 20. The enclosing member 2 is selectively movable relative to a capsule holder 20 between an open position, to permit insertion of the capsule 1 into the beverage preparation machine, and a closed position, in which the enclosing member sealingly engages the capsule 1 against the capsule holder 20 in a manner that will be described below.

The enclosing member 2 may be moved between the open and closed positions by means of a conventional mechanism

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well known in the art. For example, the means may involve a mechanical mechanism activated by a manually-movable lever or an automatic or semi-automatic mechanism where movement is driven by a motor. The enclosing member 2 may be moved  
5 while the capsule holder 20 remains stationary. Alternatively, the enclosing member 2 may remain stationary and the capsule holder 20 be moved. In a further alternative arrangement, both the enclosing member 2 and the capsule holder 20 may move during the opening and closing  
10 operations.

The enclosing member 2 and the capsule holder 20 in the closed position together define a receptacle 3 for holding the capsule 1 during a dispensing operation.

The beverage preparation machine may further comprise  
15 other conventional elements which are not illustrated in the accompanying drawings and are well known in the art of beverage preparation machines. For example, the beverage preparation machine may comprise either a facility for storing an aqueous medium, such as an internal reservoir, or  
20 a facility for connection to an external supply of aqueous medium, such as mains water. The aqueous medium will typically be water. A pump or equivalent may be provided for supplying the aqueous medium in a pressurised state to the capsule 1. The aqueous medium will typically be supplied at  
25 a pressure of up to 9 to 14 bar. A heater may be provided for heating the aqueous medium to a desired temperature. The heater may heat the aqueous medium in the reservoir (where present) or may heat the aqueous medium on-demand as it passes through a conduit or over a thermoblock to the  
30 receptacle 3. The beverage preparation machine may comprise base piercing means for piercing the base 42 of the capsule 1 to permit the aqueous medium to enter the capsule 1 and



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interact with the beverage ingredients therein.

Alternatively, the capsule 1 may be provided with one or more pre-formed openings to allow entry of the aqueous medium from the receptacle 3 into the capsule 1.

5       The enclosing member 2 may be of the type described in EP 1700548 comprising an annular element 22 having a leading edge 23 in the form of an annular rim, an inner face 25 facing the receptacle 3 and an outer face 24 facing an exterior. The leading edge 23 may be provided with a  
10   plurality of grooves as taught in EP 1700548. An upper end (not shown) of the enclosing member 2 may be coupled to a supply of the aqueous medium and may provide a mounting for one or more perforation elements intended to pierce the base  
42 of the capsule 1 in use.

15       The capsule holder 20 may be of the type described in EP 1700548 comprising relief elements 21 which are designed to tear and perforate the lid 41 of the capsule 1. The tearing of the lid 41 may occur due to internal  
pressurisation of the capsule 1 caused by inflowing aqueous  
20   medium. The relief elements 21 may have any protruding shape able to cause a partial tearing of the foil member, e.g. pyramids, needles, bumps, cylinders, or elongated ribs.

As shown in Figure 1, the capsule 1 of the first embodiment comprises the cup-shaped body 40 and the lid 41  
25   together enclose a beverage ingredient chamber 50 which may be filled with a beverage ingredient or mixture of beverage ingredients. As a non-limiting example, the beverage ingredient may comprise roasted ground coffee.

In the illustrated example, the cup-shaped body 40 is  
30   made from aluminium or an aluminium alloy. However, other materials may be utilised. The cup-shaped body 40 includes the base 42 and the side wall 43. There may be, as



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illustrated, a geometric discontinuity at the junction between the base 42 and the side wall 43, for example, in the form of a shoulder 57. Alternatively, the base 42 and the side wall 43 may have a smooth geometric transition.

5       The cup-shaped body 40 may have a thickness in the range of 80 to 500 microns. The thickness of the material may be varied throughout the cup-shaped body 40. In the illustrated example the thickness is 120 microns.

10       The side wall 43 may have a flared shape, wherein the diameter of the capsule at the lid end is greater than at the base 42. The flared shape may be achieved, for example, by configuring the side wall 43 to have at least a portion that is concavely curved when viewed from the exterior of the capsule 1.

15       The whole axial length of the side wall 43 may be flared, for example concavely curved. Alternatively, only a flared section 45 distal the base 42 may be flared. For example, the flared section 45 may extend for a distance of 40 to 80% of a longitudinal height of the capsule,  
20       preferably 50 to 70% of the longitudinal height of the capsule. In one example, the flared section 45 extends for a distance of approximately 60% of the longitudinal height of the capsule.

25       In the example illustrated in Figure 1, the side wall 43 comprises a frustoconical section 44 proximate the base 42 and a flared section 45 distal the base 42.

30       The capsule 1 may be provided with a rim 47 formed at an end of the cup-shaped body 40 remote from the base 42. The rim 47 may be formed integrally with the cup-shaped body 40. In the illustrated example, the rim 47 is formed by a rolled-over portion 48 of the side wall 43.

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Where a rim 47 is provided, the side wall 43 may extend from the base 42 to the rim 47 to define a curved surface without any abrupt angular changes in geometry. For example, any transition, e.g. at point 46 as shown in Figure 1, from  
5 a flared section 45 to a frustoconical section 44 (or section of another shape, e.g. cylindrical) can be configured to be smooth.

According to the present disclosure, the capsule 1 may be flangeless except for the optional provision of a rim 47.  
10 In other words, the side wall 43 may not include a flange, as taught for example in EP1700548 which extends substantially perpendicularly from the side wall 43.

The lid 41 may be formed from aluminium, an aluminium alloy or a laminate containing aluminium. The lid 41 may be  
15 sealed to the side wall 43 at a location 58 radially inside and above a point of contact, in use, of the leading edge 23 of the enclosing member 2 on the side wall 43. For example, the lid 41 may be positioned a distance from the distal end of the side wall 43 which is twice the height of the rim 47.  
20 In the illustrated example, the rim 47 may have a height of 1.35 mm. Consequently, the lid 41 may be located 2.7 mm above the distal end of the side wall 43 (which in this case equates to the lowermost edge of the rim 47). This helps to ensure that the enclosing member 2 does not bear down on the  
25 capsule 1 so as to trap beverage ingredients in between the leading edge 23 and the capsule holder 20 which could have a detrimental effect on the fluid-tightness of the seal. To achieve this, the lid 41 may be sealed to the flared section 45 of the side wall 43 and not, as in the prior art, to a  
30 flange that extends substantially perpendicularly to the side wall.



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The side wall 43 may comprise a distal portion 59 that extends beyond the location 58 where the lid 41 is sealed to the side wall 43. The distal portion 59 may include the rolled-over portion 48 of the rim 47, where present.

5 In use of the beverage preparation system, the enclosing member 2 is first moved into the open position and the capsule 1 is inserted into a location in between the capsule holder 20 and the enclosing member 2. Depending on the design of the beverage preparation machine, the capsule  
10 1 may be inserted by gravity or by manual placement or a combination thereof. In addition, the initial insertion may place the capsule 1 in proximity to the enclosing member 2 such that subsequent movement of the enclosing member 2 carries the capsule 1 therewith into engagement with the  
15 capsule holder 20. Alternatively, initial insertion may place the capsule 1 in proximity to the capsule holder 20 such that the capsule 1 remains substantially stationary during closure of the enclosing member 2.

The enclosing member 2 is then closed so as to  
20 sealingly engage the enclosing member 2 with the capsule 1. During this step the base 42 of the capsule 1 may be pierced by the perforation elements of the enclosing member 2.

Pressurised aqueous medium is then flowed into the capsule 1 to produce a beverage from interaction with the  
25 beverage ingredients. During this step internal pressurisation of the beverage ingredient chamber 50 causes the lid 41 to be deformed outwardly against the relief elements 21 of the capsule holder 20 resulting in at least partial tearing of the lid 41 which opens up an exit path  
30 from the capsule 1 for the beverage.

The beverage is then output for consumption.



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As shown in Figures 4 and 5, during the step of closing the enclosing member 2 relative to the capsule holder 20 the side wall 43 of the capsule 1 is contacted by the enclosing member 2 to thereby buckle the side wall 43 to produce a valley zone 51 bridging the enclosing member 2. The valley zone 51 forms at least one sealing interface between the enclosing member 2 and the side wall 43.

The point of contact between the leading edge 23 of the annular element 22 and the capsule 1 is on the flared section 45 of the side wall 43. Importantly, the point of contact is at a point on the side wall 43 which is axially spaced from the capsule holder 20 such that there is room for the side wall 43 to deform downwards towards the capsule holder 20 enough to allow for formation of the valley zone 51 before the side wall 43 is nipped against the capsule holder 20. The buckling and induced movement of the side wall 43 causes the side wall 43 to undergo plastic deformation. In particular, as the side wall 43 is deformed downwards, the side wall 43 may be plastically drawn over the leading edge 23 of the enclosing member 2 which encourages the material of the side wall 43 to be closely conformed to the grooves of the leading edge 23. Thus, the valley zone 51 may form a sealing interface with the leading edge 23 of the enclosing member 2.

The formation of the valley zone 51 may also form a ridge zone 52 which is located outside the enclosing member 2 when it reaches the closed position. As shown most clearly in Figure 6, the ridge zone 52 may comprise an annular feature having an inner wall 54 adjacent the outer face 24 of the annular element 22 and an outer wall 55 facing away from the enclosing member 2. An apex 53 of the ridge zone 52 points back towards the base 42 of the capsule 1.

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Compression of the material of the ridge zone 52 during deformation may cause the apex 53 and/or the inner wall 54 of the ridge zone 52 to be forced inwardly against the outer face 24 to form a sealing interface with the enclosing member 2.

Further, the formation of the valley zone 51 may also cause an outward pressure to be exerted by the side wall 43 on the inner face 25 of the enclosing member 2 to form a further sealing interface.

Where the capsule 1 comprises a side wall 43 formed from a laminate material as discussed above having a polymer layer, closure of the enclosing member 2 may compress at least the polymer layer of the laminate material when forming any of the sealing interfaces mentioned above. The compression of the polymer layer may aid the conforming of the side wall 43 to the shape of the leading edge 23. In particular the polymer layer may aid filling of any gaps arising due to the presence of grooves in the leading edge 23. Preferably, the polymer layer is directed outwardly to be directly contacted by the leading edge 23. In addition, during use the hot water passed through the receptacle 3 may act to slightly soften the material of the polymer layer. Such softening may lead to further deformation of the side wall 43 under the compressive loading of the enclosing member 2. This effect may help to reinforce the fluid seal between the enclosing member 2 and the capsule 1 by tending to seal up any gaps having hot water leaking there through.

The formation of the valley zone 51 will also typically cause a reduction in the longitudinal height of the capsule 1 relative to its height prior to insertion.

Figures 7 to 10 shows further variants of capsule 1 according to the present disclosure. Corresponding features



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of the first embodiment and these variants are denoted by corresponding reference signs. Features of the first embodiment and these variants may be interchanged as desired.

5 Prior to insertion, the side wall 43 is provided with a pre-selected zone in order to promote reliable buckling and formation of the valley zone 51. The pre-selected zone may be a circumferential line or band of the side wall 43. The pre-selected zone may be configured or treated by altering  
10 the rigidity, strength, ductility or other suitable material characteristic of the side wall 43 within (or adjacent to) the pre-selected zone to promote reliable deformation of the side wall during closure of the enclosing member 2. The rigidity, strength, ductility or other suitable material  
15 characteristic of the side wall 43 may be altered by one or more of work hardening, localised thickening, creasing, scoring or thinning of the material of the side wall.

For example, as illustrated in Figure 7, a work hardened circumferential band 49 may be formed around the  
20 side wall 43. The work hardening may be achieved by creasing and uncreasing the side wall material or by other suitable means.

Alternatives to a work hardened band include the side wall 43 being provided with a zone of increased thickness or  
25 alternatively a thinned section of material 49' as shown in Figure 9; the side wall 43 being provided with a score line in the side wall 43; or a section of the side wall being subjected to thermal treatment, either before or after drawing.

30 During closure of the enclosing member 2 the work hardened band 49 is more resistant to buckling than adjacent zones of the side wall 43. Therefore, as shown in Figure 8,



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the apex 67 of the ridge zone 63 will reliably be formed at an interface between the work hardened band 49 and the adjacent portion of the side wall 43. A similar mechanism takes place where a localised thickened portion of the side wall 43 is provided. Conversely, where the side wall 43 is weakened locally by, for example, the thinned section 49' or scoring, buckling is promoted at this point. Consequently, the apex 67 of the ridge zone will be reliably be formed by material within the thinned section 49'/at the score line as shown in Figure 10.

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Claims:

1. A beverage producing system comprising:  
a capsule containing beverage ingredients; and  
5 a beverage preparation machine;  
the capsule comprising a cup-shaped body and a lid; the  
cup-shaped body having a base and a side wall and the lid  
being sealed to the cup-shaped body;

the capsule being designed for insertion into the  
10 beverage preparation machine to permit a pressurised liquid  
to be flowed through the capsule in order to produce a  
beverage from interaction with the beverage ingredients;

the beverage preparation machine having an enclosing  
member adapted to be selectively movable between an open  
15 position to permit insertion of the capsule into the  
beverage preparation machine and a closed position in which  
the enclosing member sealingly engages the capsule;

wherein the side wall is dimensioned to be contacted by  
the enclosing member on movement of the enclosing member  
20 into the closed position to buckle the side wall to form a  
valley zone bridging the enclosing member;

wherein the side wall is adapted such that said valley  
zone forms at least one sealing interface between the  
enclosing member and the side wall.

25

2. A beverage producing system as claimed in claim 1,  
wherein the valley zone forms a sealing interface with a  
leading edge of the enclosing member.

30 3. A beverage producing system as claimed in claim 1 or  
claim 2, wherein the side wall is adapted such that during

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closure of the enclosing member the side wall is plastically drawn over the leading edge of the enclosing member.

4. A beverage producing system as claimed in any one of  
5 claims 1 to 3, wherein the valley zone is adapted to be nipped against a capsule holder of the beverage preparation machine part.

5. A beverage producing system as claimed in any one of  
10 claims 1 to 4 wherein the side wall is adapted. to undergo plastic deformation during said buckling.

6. A beverage producing system as claimed in any one of  
15 claims 1 to 4, wherein the side wall is adapted such that, following buckling of the side wall, the side wall defines a ridge zone located outside the enclosing member.

7. A beverage producing system as claimed in claim 6,  
wherein the ridge zone is adapted to be forced inwardly  
20 against an outer face of the enclosing member to form a sealing interface with the outer face of the enclosing member.

8. A beverage producing system as claimed in any one of  
25 claims 1 to 7, wherein prior to insertion, the side wall has a flared shape.

9. A beverage producing system as claimed in any one of  
claims 1 to 8, wherein prior to insertion, at least a  
30 portion of the side wall is concavely curved.



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10. A beverage producing system as claimed in any one of claims 1 to 9, wherein the capsule comprises a rim formed at an end of the cup-shaped body remote from the base.

5 11. A beverage producing system as claimed in claim 10, wherein the rim is formed integrally with the cup-shaped body.

12. A beverage producing system as claimed in claim 10 or  
10 claim 11, wherein the rim is formed by a rolled-over portion of the side wall.

13. A beverage producing system as claimed in any one of claims 1 to 12, wherein prior to insertion, the capsule is  
15 flangeless except for the optional provision of a rim.

14. A beverage producing system as claimed in any one of claims 1 to 13, wherein prior to insertion, the side wall extends from the base to the rim to define a curved surface  
20 without any abrupt angular changes in geometry.

15. A beverage producing system as claimed in any one of claims 1 to 13, wherein prior to insertion, the side wall comprises a pre-selected zone which has been configured or  
25 treated to promote a reliable deformation of the side wall.

16. A beverage producing system as claimed in any one of claims 1 to 15, wherein prior to insertion, the side wall comprises a frustoconical section proximate the base and a  
30 flared section distal the base.

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17. A beverage producing system as claimed in claim 16, wherein the flared section extends for a distance of 40 to 80% of a longitudinal height of the capsule.

5

18. A beverage producing system as claimed in claim 16 or claim 17, wherein the flared section extends for a distance of 50 to 70% of the longitudinal height of the capsule.

10

19. A beverage producing system as claimed in any one of claims 16 to 18, wherein the flared section extends for a distance of approximately 60% of the longitudinal height of the capsule.

15

20. A beverage producing system as claimed in any one of claims 1 to 19, wherein the lid is sealed to the side wall at a location radially inside a point of contact, in use, of a leading edge of the enclosing member on the side wall.

20

21. A beverage producing system as claimed in claim 20, wherein the side wall comprises a distal portion that extends beyond the location where the lid is sealed to the side wall.

25

22. A beverage producing system as claimed in claim 21; wherein the distal portion of the side wall forms a roll-over edge of the capsule.

30

23. A beverage producing system as claimed in any one of claims 1 to 22, wherein a leading edge of the enclosing member comprises a plurality of grooves or indentations, and



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the side wall is adapted such that the plastic deformation of the side wall conforms the side wall to the grooves or indentations to provide an effective seal.

- 5 24. A capsule for preparing a beverage comprising a cup-shaped body and a lid; the cup-shaped body having a base and a side wall and the lid being sealed to the cup-shaped body; the capsule being designed for insertion into a beverage preparation machine to permit a pressurised liquid  
10 to be flowed through the capsule in order to produce a beverage from interaction with the beverage ingredients; the beverage preparation machine being of the type having an enclosing member adapted to be selectively movable between an open position to permit insertion of the capsule  
15 into the beverage preparation machine and a closed position in which the enclosing member sealingly engages the capsule; wherein the side wall is dimensioned to be contacted by the enclosing member on movement of the enclosing member into the closed position to buckle the side wall to form a  
20 valley zone bridging the enclosing member; wherein the side wall is adapted such that said valley zone forms at least one sealing interface between the enclosing member and the side wall.

- 25 25. A capsule as claimed in claim 24 wherein the side wall is adapted to undergo plastic deformation during said buckling.

- 30 26. A capsule as claimed in claim 24 or claim 25, wherein the side wall has a flared shape.

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27. A capsule as claimed in any one of claims 24 to 26, wherein at least a portion of the side wall is concavely curved.

5

28. A capsule as claimed in any one of claims 24 to 27, wherein the capsule comprises a rim formed at an end of the cup-shaped body remote from the base.

10

29. A capsule as claimed in claim 28, wherein the rim is formed integrally with the cup-shaped body.

30. A capsule as claimed in claim 28 or claim 29, wherein the rim is formed by a rolled-over portion of the side wall.

15

31. A capsule as claimed in any one of claims 24 to 30, wherein the side wall extends from the base to the rim to define a curved surface without any abrupt angular changes in geometry.

20

32. A capsule as claimed in any one of claims 24 to 30, wherein the side wall comprises a pre-selected zone which has been configured or treated to promote a reliable deformation of the side wall.

25

33. A capsule as claimed in any one of claims 24 to 32, wherein the capsule is flangeless except for the optional provision of a rim.

30

34. A capsule as claimed in any one of claims 24 to 33, wherein the side wall comprises a frustoconical section



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proximate the base and a flared section distal the base.

35. A capsule as claimed in claim 34, wherein the flared section extends for a distance of 40 to 80% of a longitudinal height of the capsule.

36. A capsule as claimed in claim 34 or claim 35, wherein the flared section extends for a distance of 50 to 70% of the longitudinal height of the capsule.

10

37. A capsule as claimed in any one of claims 34 to 36, wherein the flared section extends for a distance of approximately 60% of the longitudinal height of the capsule.

15

38. A capsule as claimed in any one of claims 24 to 36, wherein the lid is sealed to the side wall at a location radially inside a point of contact, in use, of a leading edge of the enclosing member on the side wall.

20

39. A capsule as claimed in claim 38, wherein the side wall comprises a distal portion that extends beyond the location where the lid is sealed to the side wall.

25

40. A capsule as claimed in claim 39, wherein the distal portion of the side wall forms a roll-over edge of the capsule.

30

41. A capsule as claimed in any one of claims 24 to 40, wherein the cup-shaped body is formed from aluminium, an aluminium alloy or a laminate comprising at least one layer formed from aluminium or an aluminium alloy.

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42. A capsule as claimed in any one of claims 24 to 41,  
wherein the lid is formed from aluminium, an aluminium alloy  
or a laminate comprising at least one layer formed from  
5 aluminium or an aluminium alloy.

43. A capsule as claimed in any one of claims 24 to 42,  
wherein the cup-shaped body has a thickness in the range of  
80 to 500 microns.

10

44. A method for preparing a beverage comprising the steps  
of:

- providing a capsule as claimed in any one of claims  
24 to 43;

15

- providing a beverage preparation machine having an  
enclosing member;

- moving the enclosing member into an open position;

- inserting the capsule into the beverage preparation  
machine;

20

- closing the enclosing member so as to sealingly  
engage the enclosing member with the capsule;

- flowing a pressurised liquid through the capsule to  
produce a beverage from interaction with the beverage  
ingredients; and

25

- outputting the beverage for consumption;

wherein on closure of the enclosing member the side  
wall of the capsule is contacted by the enclosing member to  
thereby buckle the side wall to produce a valley zone  
bridging the enclosing member;

30

wherein said valley zone forms at least one sealing  
interface between the enclosing member and the side wall.



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45. The method of claim 44 wherein the side wall undergoes plastic deformation during said buckling.

5 46. The method of claim 44 or claim 45, wherein the valley zone forms a sealing interface with a leading edge of the enclosing member.

47. The method of claim 46, wherein the side wall is  
10 plastically drawn over the leading edge of the enclosing member.

48. The method of claim 46 or claim 47, wherein the valley zone is nipped against a capsule holder of the beverage  
15 preparation machine part.

49. The method of any one of claims 44 to 48, wherein buckling of the side wall forms a ridge zone located outside the enclosing member.

20

50. The method of claim 49, wherein the ridge zone is forced inwardly against an outer face of the enclosing member to form a sealing interface with the outer face of the enclosing member.

25

51. The method of any one of claims 44 to 50, wherein a leading edge of the enclosing member comprises a plurality of grooves or indentations, and the side wall is plastically deformed to conform the side wall to the grooves or  
30 indentations to provide an effective seal.

1 / 5

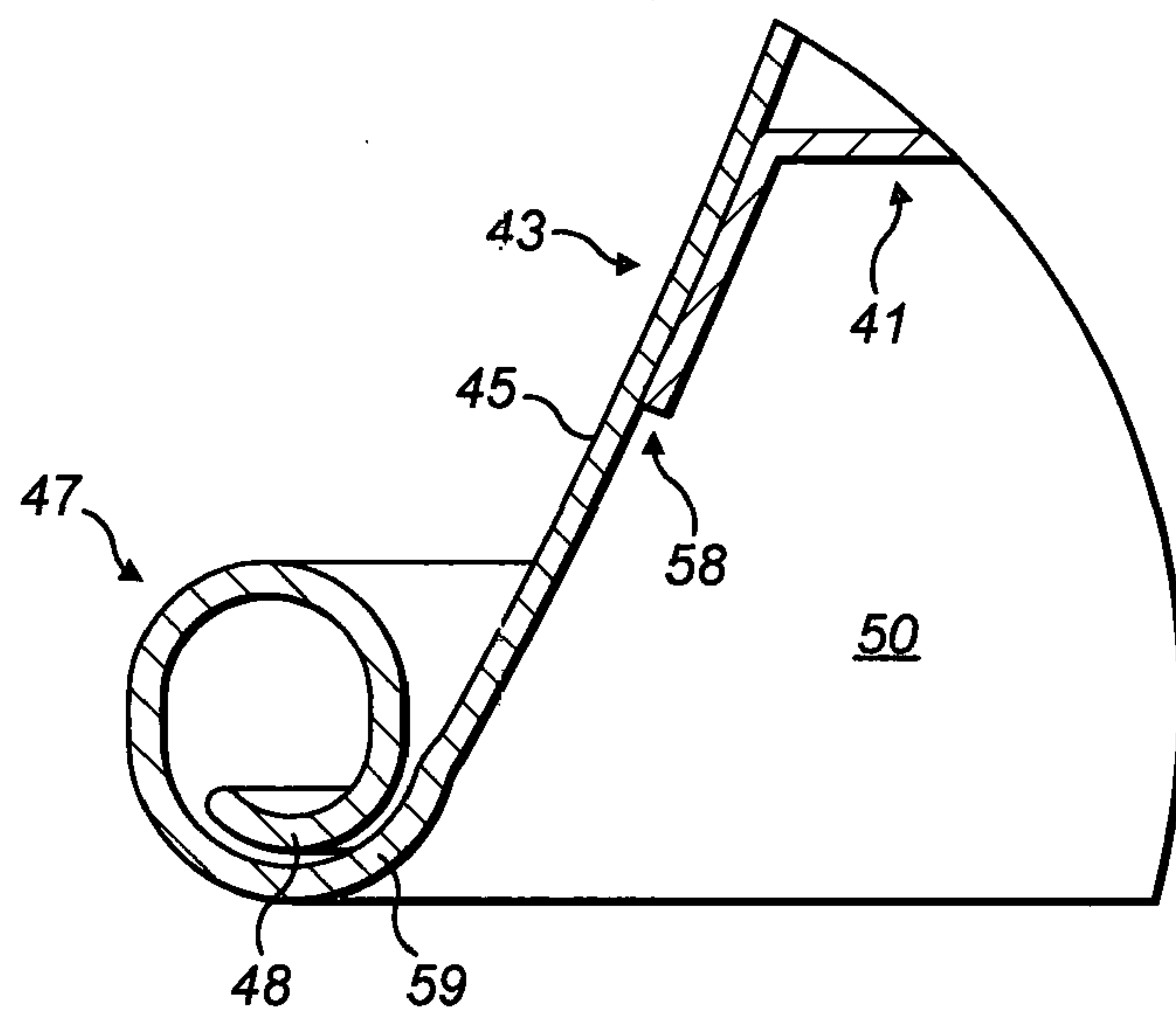
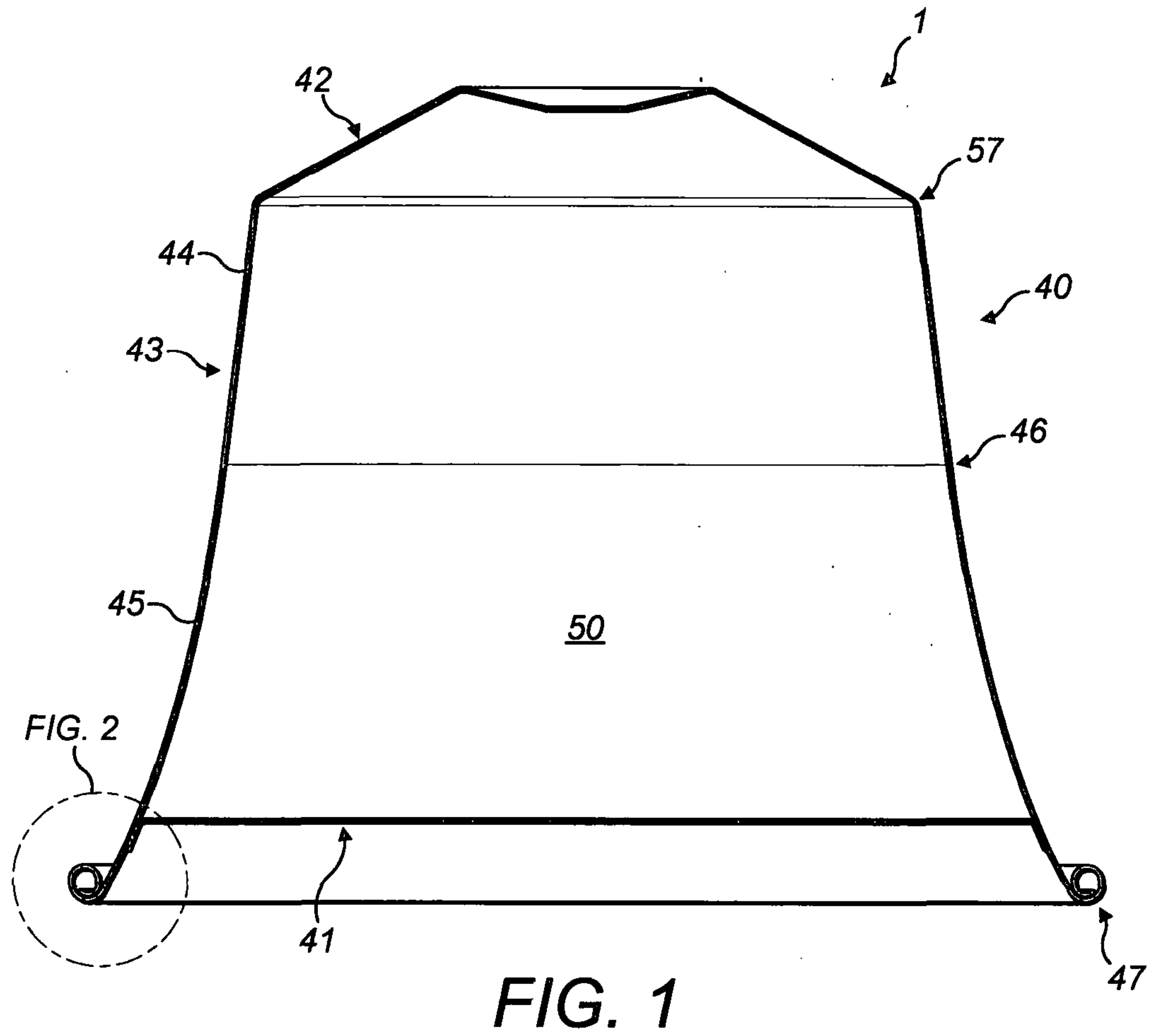
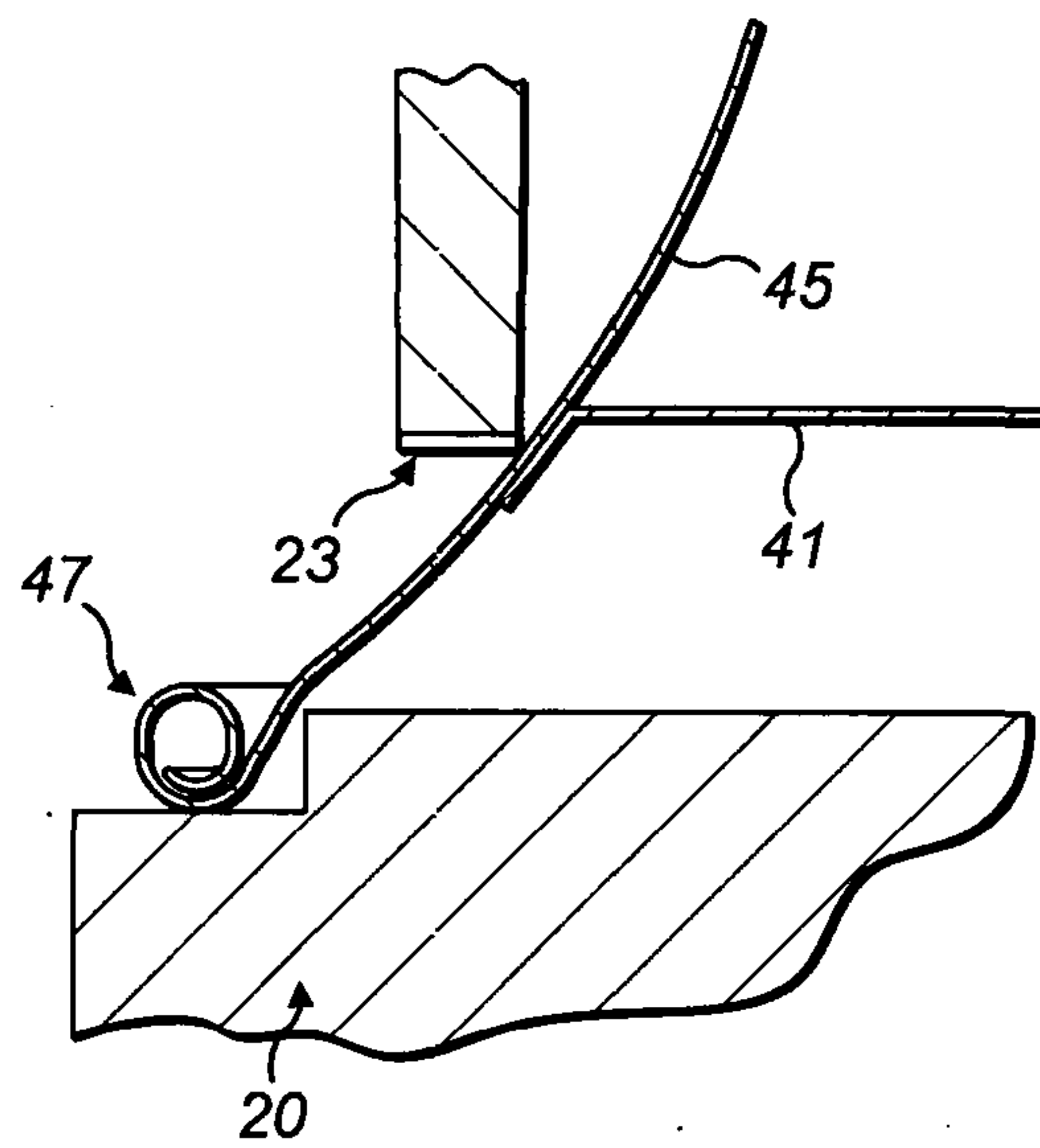
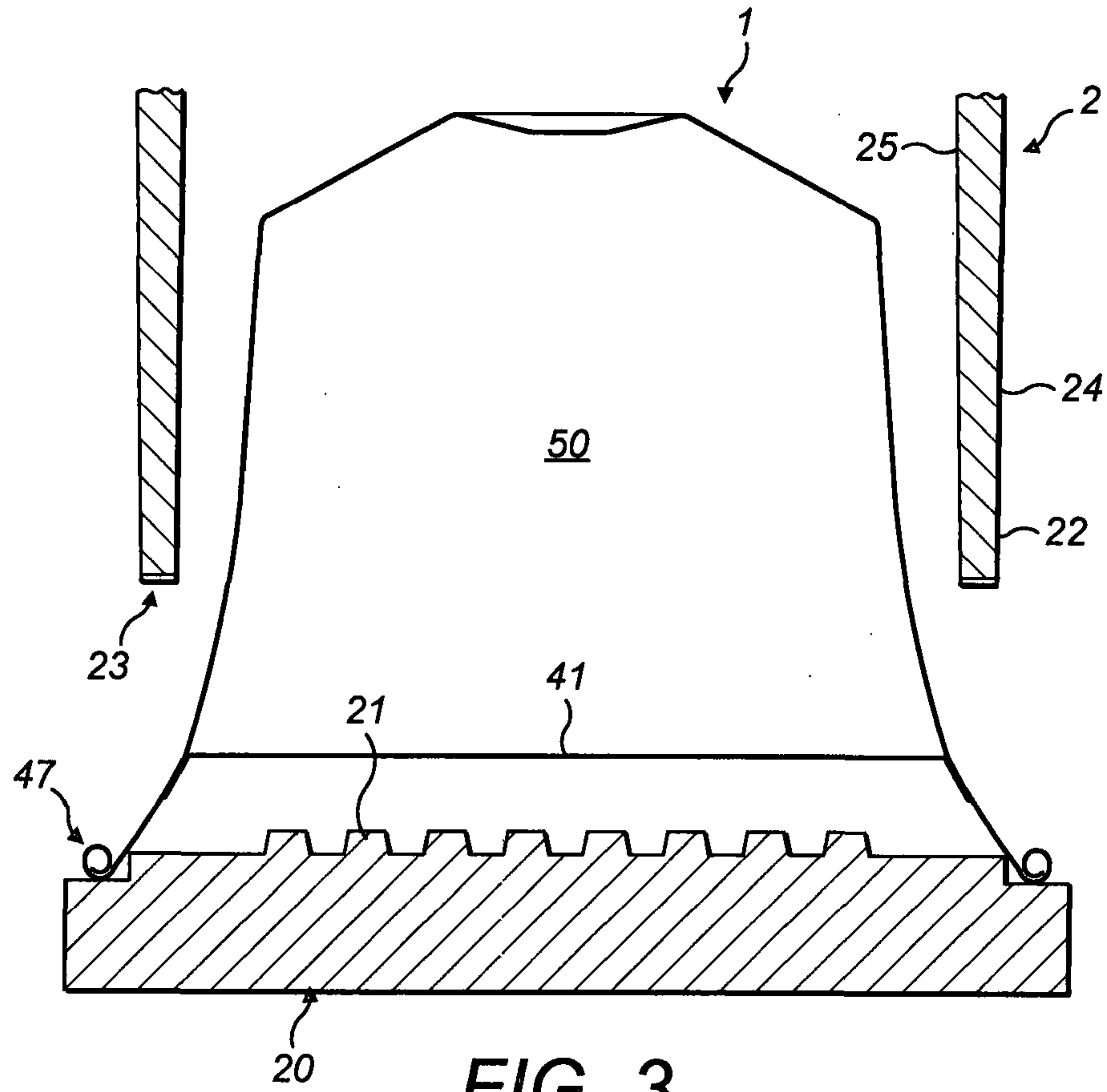


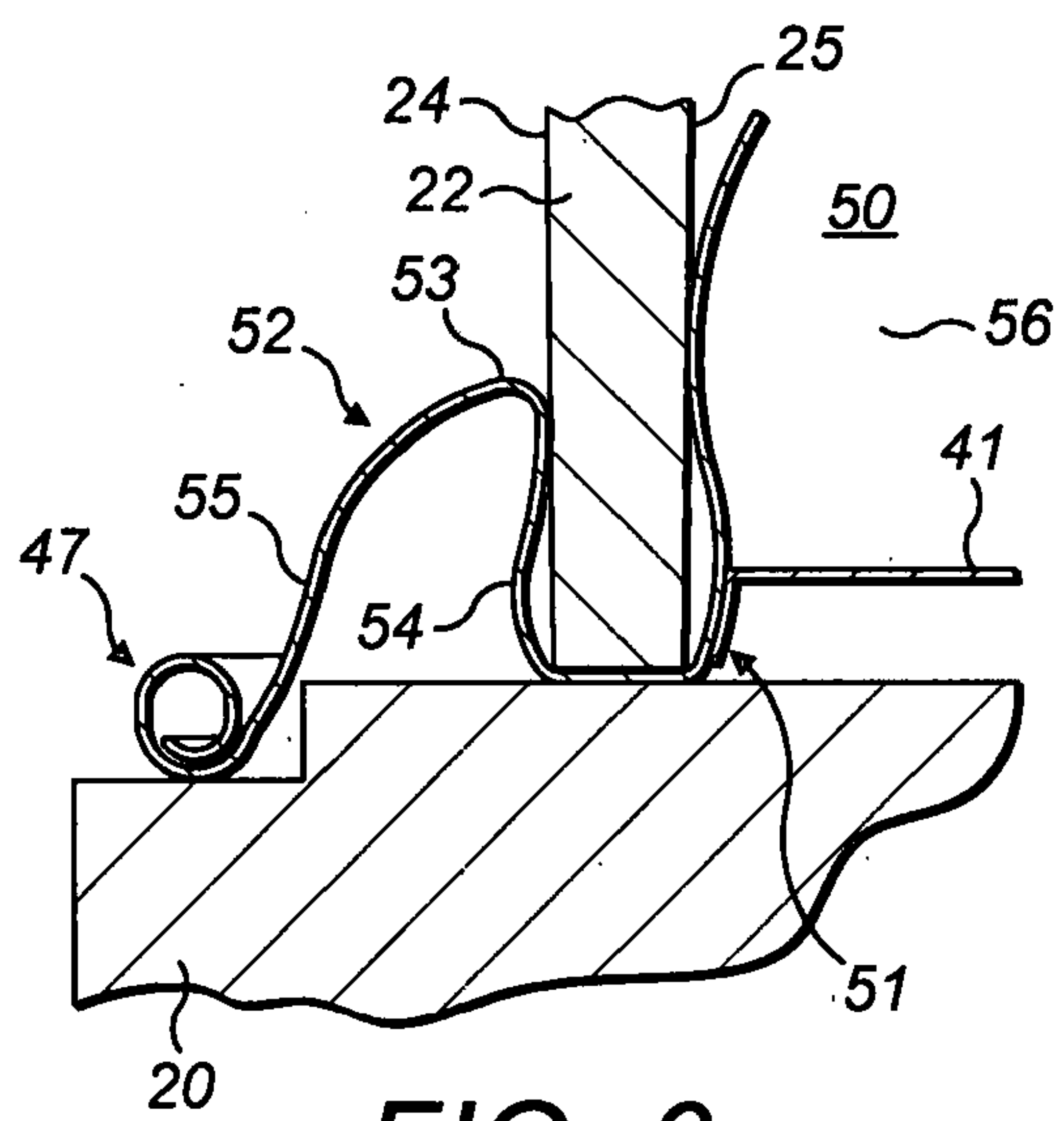
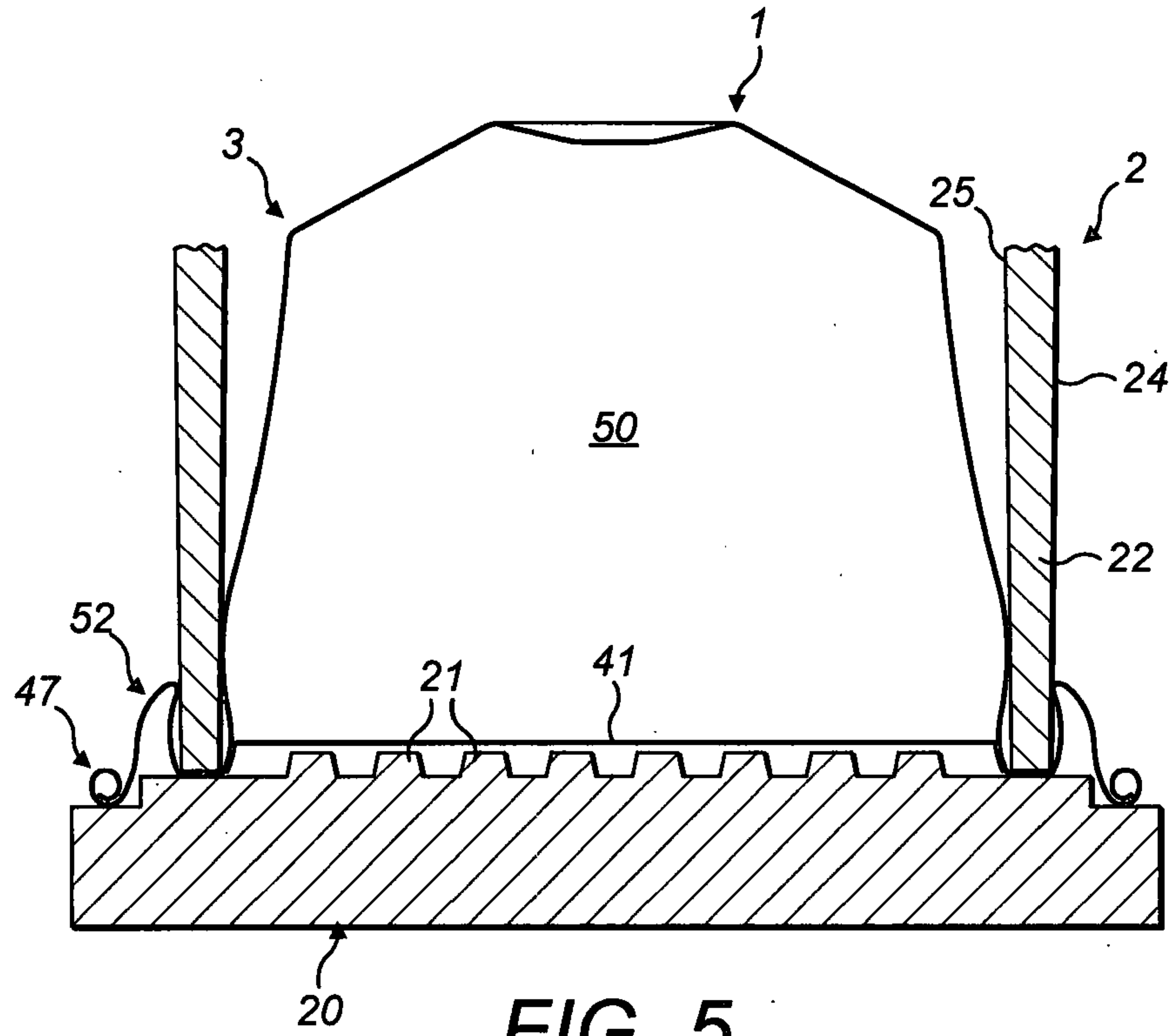
FIG. 2

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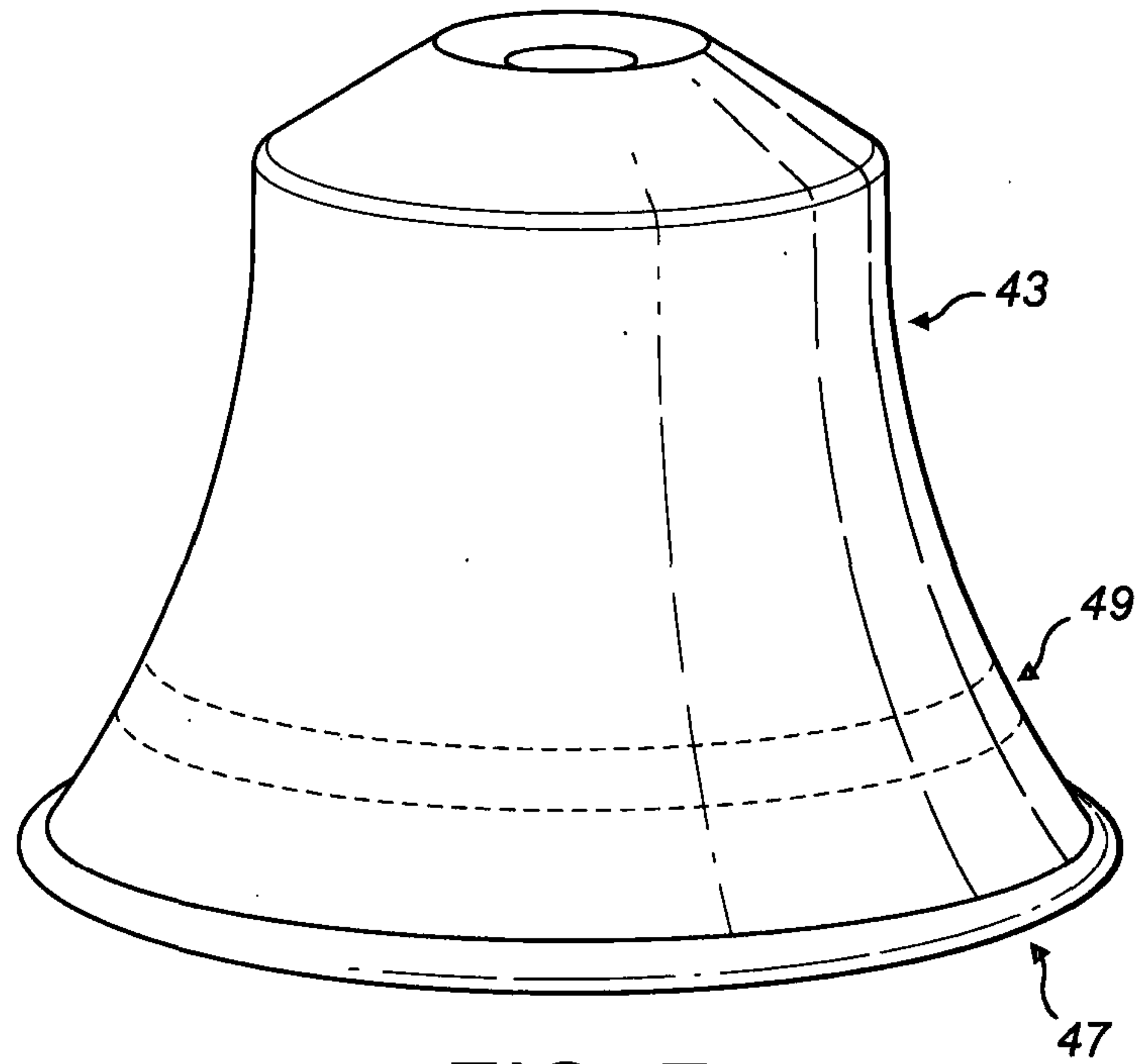
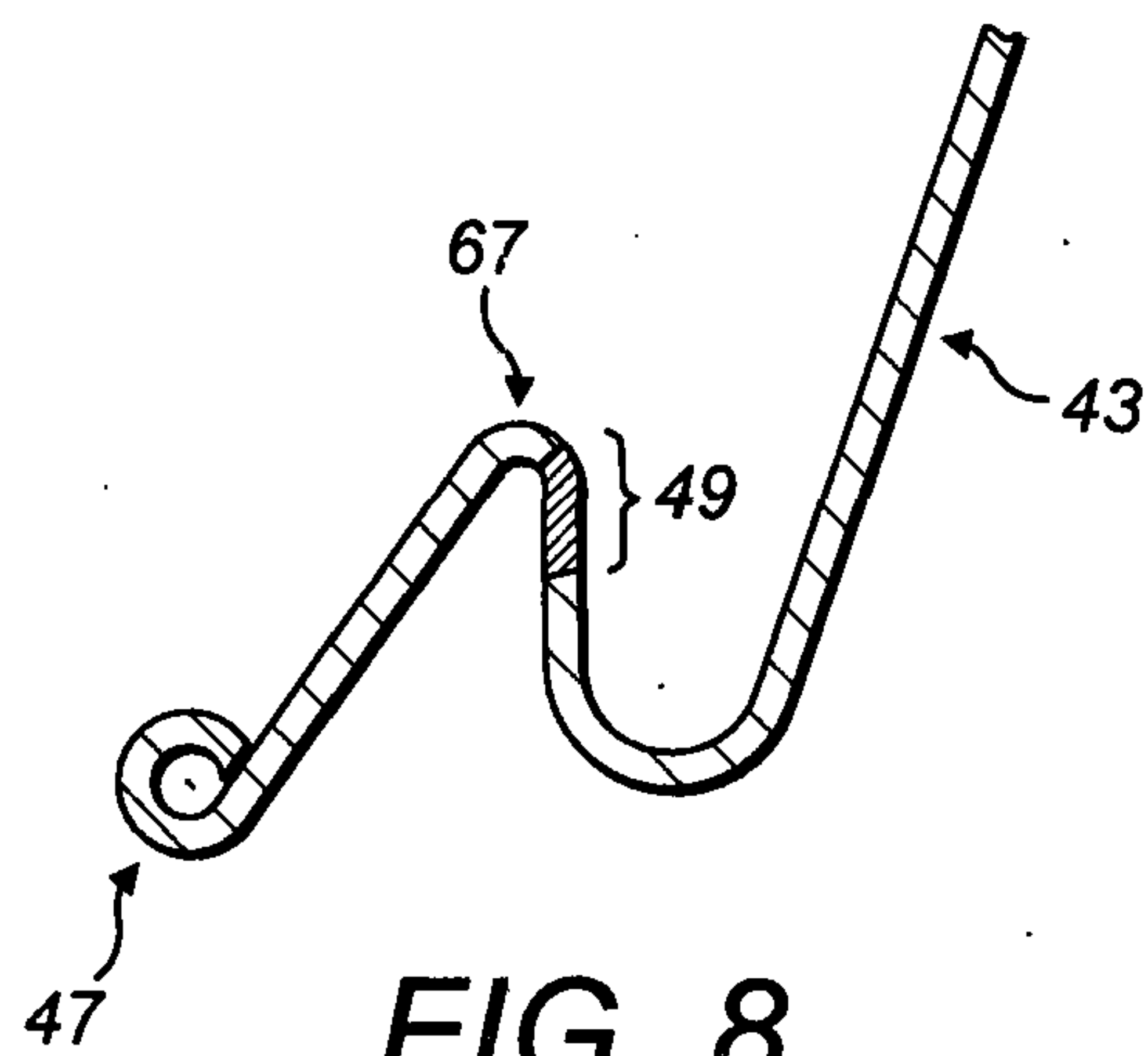




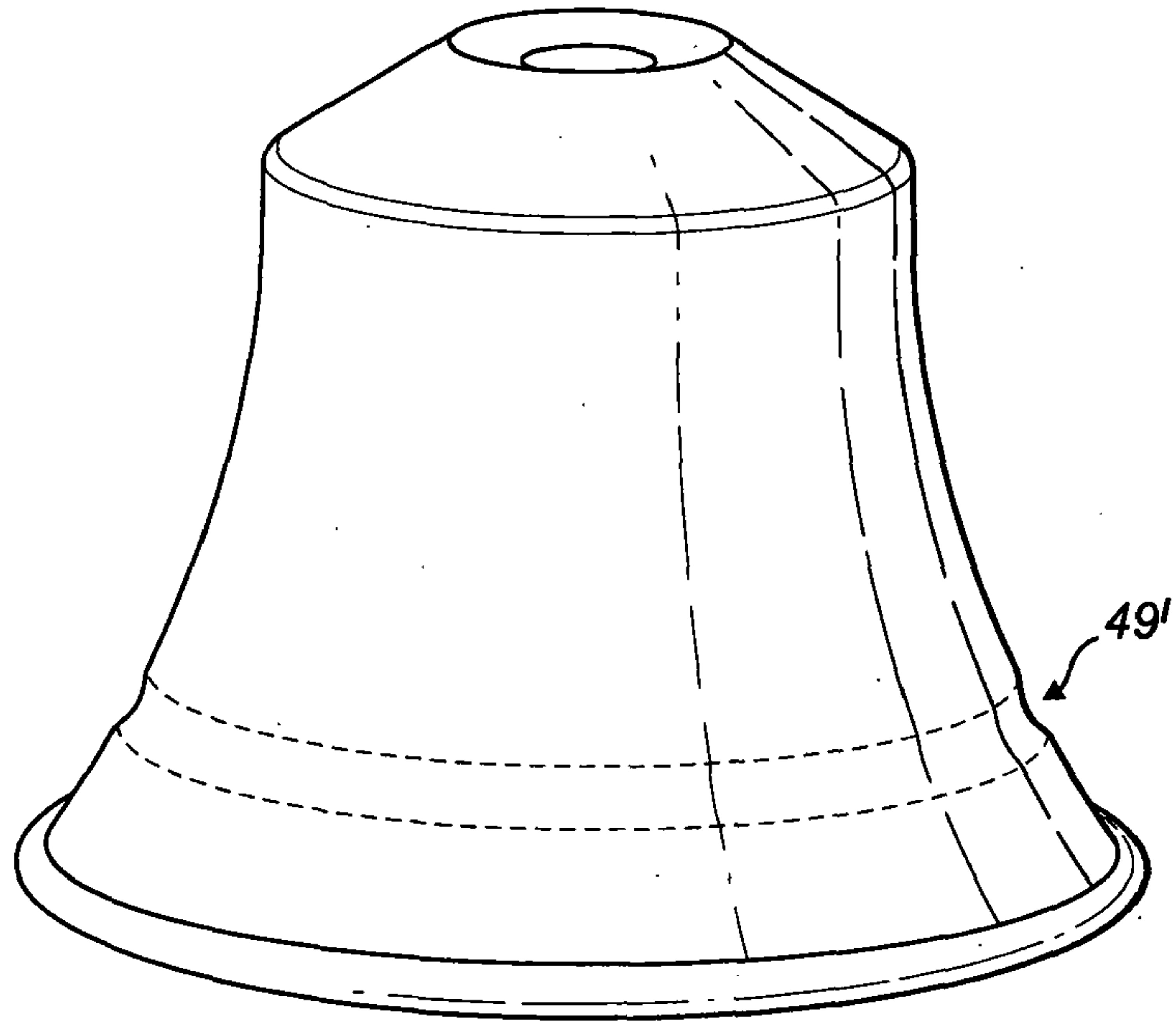
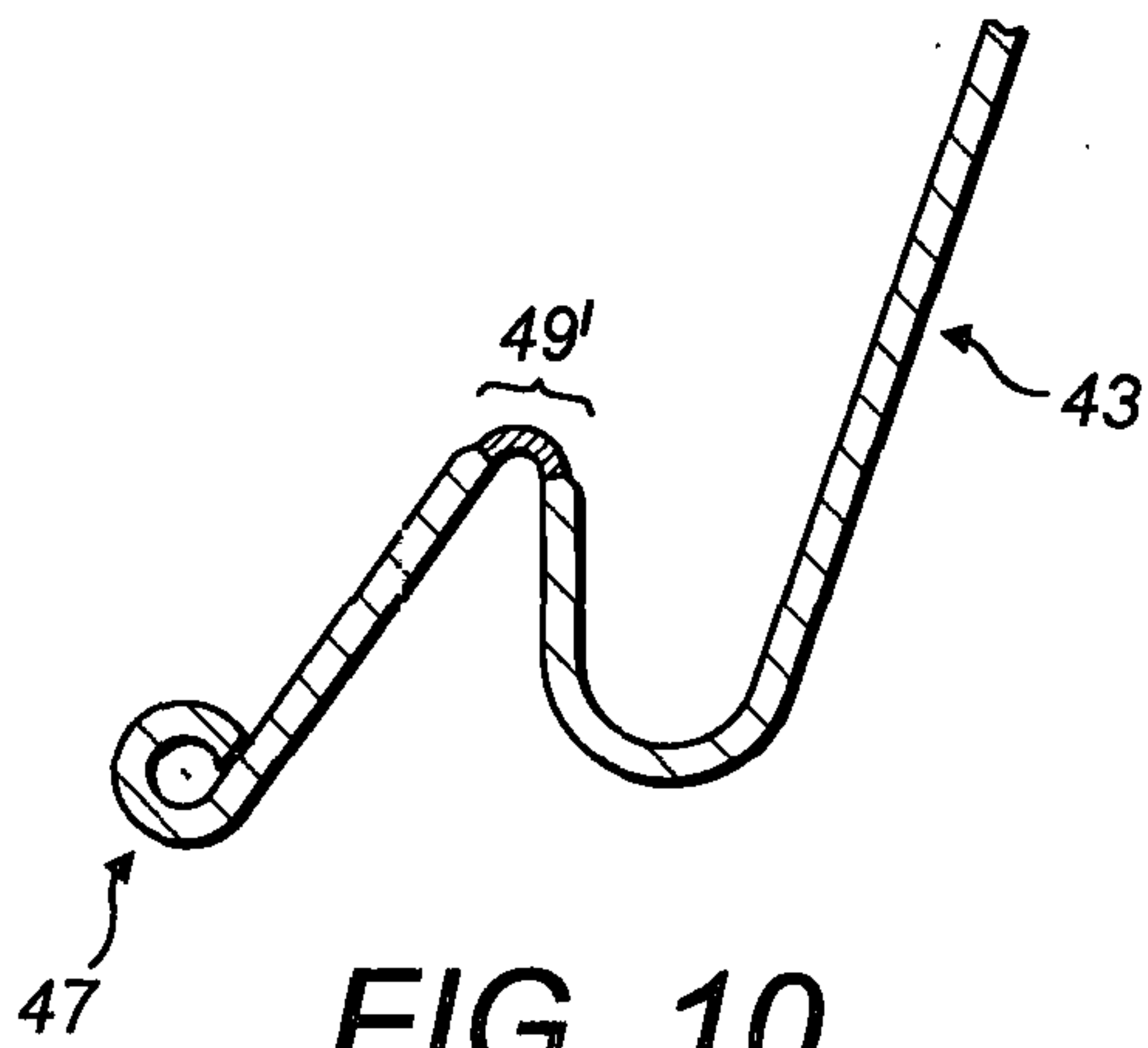
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**FIG. 7****FIG. 8**

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**FIG. 9****FIG. 10**



