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(71) Applicant(s)  
**Nestec S.A.**

(72) Inventor(s)  
**Denisart, Jean-Paul;Gavillet, Gilles;Yoakim, Alfred**

(74) Agent / Attorney  
**Shelston IP, Level 21 60 Margaret Street, Sydney, NSW, 2000**

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(74) Agents: RUPP, Christian et al.; Mitscherlich & Partner,  
Postfach 33 06 09, 80666 München (DE).

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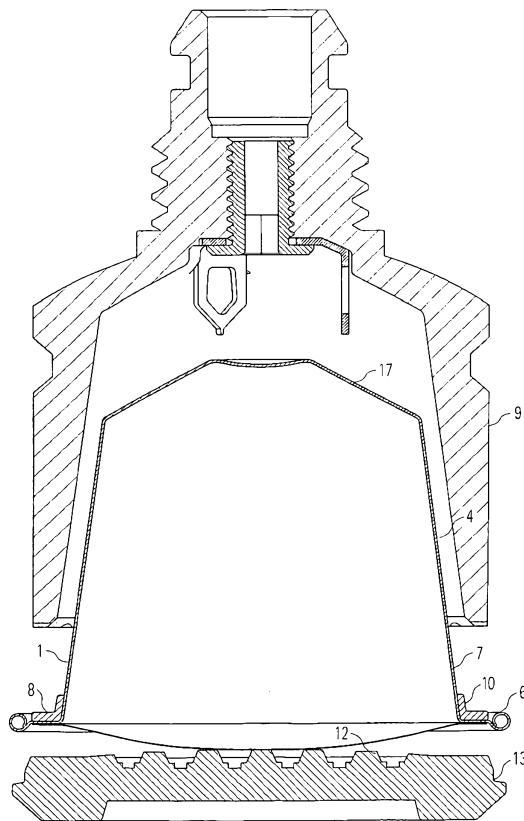
(71) Applicant (for all designated States except US): NESTEC  
S.A. [CH/CH]; Avenue Nestlé 55, CH-1800 Vevey (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): YOAKIM, Alfred [CH/CH]; Chemin de la Routiaz 2, CH-1806 St-Légier-la-Chiézaz (CH). GAVILLET, Gilles [CH/CH]; Plattez, CH-1670 Ursy FR (CH). DENISART, Jean-Paul [CH/CH]; Ch. de la Jaque 15, CH-1093 La Conversion VC (CH).

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(54) Title: SYSTEM WITH CAPSULE HAVING SEALING MEANS



(57) Abstract: A system comprising: - a capsule-based beverage producing device, and - a capsule for containing beverage ingredients, wherein the beverage production device (2) is provided with: - means for injecting a liquid into the capsule (1) - means for draining a beverage from the capsule (1), and - an enclosing member (9) transferable from an opened state to a defined closed state, in which the enclosing member (9) enclose the outer surface of the capsule (1). A sealing member (8, 11, 26) is associated to the capsule (1), the sealing member (8, 11, 26) being compressible when engaged by the enclosing member (9) in the closed state and the sealing member being effective to compensate for the clearance between the enclosing member and the capsule (1); which clearance would exist without the sealing member of the capsule (1), when the enclosing member (9) is in its defined closed position.

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## SYSTEM WITH CAPSULE HAVING SEALING MEANS

### FIELD OF THE INVENTION

[0001] The present invention generally relates to a beverage producing system for use in connection with capsules as well as to a method for producing beverages from ingredients contained in such capsules.

[0002] Any discussion of the prior art throughout the specification should in no way be considered as an admission that such prior art is widely known or forms part of common general knowledge in the field.

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### BACKGROUND OF THE INVENTION

[0003] The background of the present invention is the field of sealed capsules which contain beverage or other comestible (e.g. soup) ingredients. By means of an interaction of these ingredients with an injected liquid, a beverage or other comestibles, such as for example soups, can be produced. The interaction can be for example a process of extraction, brewing or dissolution. Such a capsule is particularly adapted to contain ground coffee in order to produce a coffee beverage by injecting hot water under pressure into the interior of the capsule and draining a coffee beverage from the capsule.

[0004] A capsule as shown in FR 2160634 relates to an apparatus for making coffee beverage from a cartridge in which a water injection device is placed hermetically against the upper side of the cartridge. The water injection device includes a seal which is applied on the upper rim of the capsule.

[0005] EP 0361569 A1 does not show a sealed capsule, but a coffee filter unit which is not sealed when placed into the coffee machine but simply press fitted in a cartridge casing, such that water can be poured on a filter paper provided at the open upper side of the coffee filter unit. To avoid spilling of water outside the filter unit's upper rim, the peripheral portion of a filter paper is clamped between the outer rim of the coffee filter unit wall and the surrounding wall of the machine. Such a design is an

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device filtering a beverage at atmospheric pressure which is not adapted to withstand the typical water injection pressure of e.g. more than 3 bars or even much higher pressure which reigns in the capsule when e.g. an espresso-style coffee is to be produced.

5 [0006] FR 2617389 describes a capsule-based coffee machine in which a capsule to be extracted is placed on a capsule holder. The capsule holder is then rotated bayonet-like, wherein the final rotational position depends on the torque which the user applies on a handle for rotating the capsule holder. The machine itself does therefore not have a defined closure position since the final closure position depends on the 10 amount of torque applied by the user. The sealing between the capsule and the machine is therefore not defined by the design of the machine, but arbitrarily depends on the user's handling of the machine. Typically, the higher the rotational force exerted, the more clearance can be compensated. However, such system provides several drawbacks. First of all, it requires the closing device to remain purely tightened 15 by hand and it cannot be otherwise mechanically, electrically or hydraulically assisted. It requires a certain strength to screw the capsule holder on the machine from the user and the user may have difficulties to unscrew the capsule holder afterwards. Furthermore, the sealing is difficult to control and it may be that the capsule holder is insufficiently tightened so that pressure leakage can occur.

20 [0007] In contrast to the rotational bayonet-style closing according to FR 2617389, the present invention relates to machines in which the closure of the parts of the machine which surround the capsule and thus also the sealing is not an arbitrary function of the user's force, but a defined state which depends on the arrangement of the capsule in the machine.

25 [0008] This is, for example, the case in machines in which the final phase of the closure movement is essentially an axial (i.e., translational or a curvilinear) but non-rotational movement.

[0009] Prior art systems and methods for obtaining fluid comestibles from substances-containing capsules- are, for example, known from EP-A-512470 30 (counterpart of US 5,402,707). The machine of EP-A-512470 takes an example from a bayonet-style closure device.

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[0010] The capsule 101 as shown in Fig. 1 has a frustoconically-shaped cup 102 which may be filled e.g. with roasted and ground coffee 103 and which is closed by a foil-like tear face cover 104 welded and/or crimped to a flange-like rim which extends laterally from the side-wall of cup 102. A capsule holder 111 comprises a flow grill 112 with relief surface element members 113.

[0011] The capsule holder 111 is accommodated in its support 115 which has a lateral wall 124 and a bore 127 for the passage of extracted coffee beverage.

[0012] As can be seen from fig. 1 the extraction system further comprises a water injector 107 having a water inlet channel 120 and a capsule cage 108 with an internal recess of which the shape substantially corresponds to the outer shape of the capsule. On its outer part, the capsule cage 108 comprises a spring 122 holding a ring 123 for releasing the capsule on completion of extraction.

[0013] In operation, a capsule 101 is placed in the capsule holder 111. The water injector 107 perforates the upper face of the cup 102. The lower tear face 104 of the capsule rests on the radially arranged members 113 of the capsule holder 111.

[0014] The water is injected through the channel 120 of the water injector 107 and impinges on the bed 103 of coffee. The pressure in the capsule 101 increases and the tear face 104 increasingly follows the shape of the radial opening relief members 113. Such radial opening relief members could be replaced by pyramid-shaped reliefs or other shapes of relief. When the constituent material of the tear face reaches its breaking stress, the tear face tears along the relief members. The extracted coffee flows through the orifices of the flow grill 112 and is recovered in a container (not shown) beneath the bore 127.

[0015] The principles of this extraction process as far as it can be maintained in connection with the present invention can be summarized as follows:

[0016] -An initially sealed capsule is inserted in capsule holder means;

[0017] -The capsule holder means is then associated to the water injection means of the machine such that a capsule cage (108 in Fig. 4) overlaps the sealed capsule;

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[0018] -In a first wall of the capsule at least one opening is generated for introducing water under pressure;

[0019] -Water being injected under pressure into the capsule through the opening in the first wall is interacting with the ingredients contained in the capsule while traversing 5 the interior of the capsule and is then made to leave the capsule through at least one opening/perforation created in the second wall.

[0020] The ingredients in the capsule constitute the "bottleneck" of the flow path of the water and will therefore cause a pressure drop between the upstream and the downstream side of the liquid flow through the capsule, which pressure drop will even 10 increase during the interaction between the liquid and the ingredients for example due to a swelling of the ingredients. Correspondingly it has to be assured that the only water flow is actually taking place through the interior of the capsule (arrow A1) and that no water can flow from the water injector into the interstice between the capsule cage 108 and the exterior of the capsule 101 and then to the draining bore 127 of the 15 device. The arrow A2 illustrates this undesired water flow path. In other words, any water flow exterior to the capsule 101 has to be stopped by a sealing engagement being positioned in the interstice between the capsule cage 108 and the capsule 101 and in the flow path between the water injector and the beverage-draining bore. In the embodiment as shown in Fig. 1 such sealing engagement can be achieved at least to 20 a certain degree by the pinching engagement between the capsule cage 108, the flange-like rim of the side wall of the capsule 101 and the capsule holder 111, 115.

[0021] In case the sealing engagement is not working properly and water is flowing outside the capsule, no pressure sufficient to cause the tearing of the tear face will be built up inside the capsule or, alternatively, the pressure will be causing no complete 25 tearing of the tear face and therefore resulting in a poor extraction of the substance. In such a scenario water will be drained from the beverage production device without having interacted or fully interacted under sufficient pressure conditions, with the ingredients contained in the capsule.

[0022] New machines are now commercially available which are based on an axial 30 closure movement and no longer on a bayonet-style closure. These machines provides more user convenience, they can be mechanically, electrically or hydraulically assisted for an easier closing and they can be made of less expensive materials (such

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as plastic). For instance, a few patents describe different closure principles such as in EP 0604615, EP 1090574; EP 1327407; WO 2004/071259 or WO 2005/004683.

[0023] Therefore, there is no possibility for the user to control the degree of tightening of the closure about the capsule. As long as the intrinsically defined closed state, of the devices working on an axial closure movement, is working properly, this leads to satisfying results. If, however, the seal has been damaged or its efficiency has decreased overtime for different reasons (due to wear, ageing, obstruction by solid residue, etc.) or also, in the event, the closed position is misaligned (e.g., horizontally offset vis-a-vis the ideal closure position due to wear, fatigue or manufacturing tolerances), there is the risk of having no tight sealing or even a clearance between the enclosing member and the capsule.

[0024] According to the prior art, sealing engagement is done by lining the inner wall and/or pressing edge of the capsule cage with a rubber-elastic joint. In other words, according to said prior art approach the sealing engagement is assured by a permanent structure which is fixed to or attached to the beverage-producing device. This has the disadvantage that after intensive use (i.e., over a high number of extraction cycles), a wearing off of the permanent sealing means can take place such that the extraction conditions of the beverage may deteriorate and quality of the beverage accordingly negatively affected.

[0025] In particular, any "leak" at the exterior of the capsule reduces the pressure inside the capsule. On the other hand, a sufficient extraction pressure is a key factor for the quality of espresso-style coffee.

[0026] It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

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## DISCLOSURE OF THE INVENTION

[0027] According to a first aspect there is provided a beverage production system comprising a capsule-based beverage producing device, for use with a capsule for containing beverage ingredients, the capsule comprising:

[0028] 30 a first wall element in the form of a cup-like base body;

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a second wall element in the form of a foil member;  
a flange-like rim area at which the foil member is sealingly connected to the cup-like base body in an airtight fashion thereby to seal the ingredients within the interior of the capsule; and

5 a sealing member;

wherein the beverage production device is provided with:

means for injecting a liquid under pressure into the capsule  
means for draining a beverage from the capsule, and  
an enclosing member transferable from an opened state to a defined

10 closed state, in which the enclosing member encloses the outer surface of the capsule,  
a capsule holder having relief elements which tear and perforates the foil member  
wherein the sealing member is compressed when engaged by the enclosing

15 member in the closed state  
the sealing member is effective to compensate for the clearance between the enclosing member and the capsule; which clearance would exist without the sealing member of the capsule, when the enclosing member is in its defined closed position, and wherein the sealing member is present both on the flange-like rim and a

20 portion of a side wall of the base body.

[0028] Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise", "comprising", and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

25 [0029] The sealing member can be resilient under compression and be engaged by the enclosing member in the closed state.

[0030] The enclosing member can be arranged such that in the final phase of its transfer movement from its opened state to its closed state, it carries out an essentially axial (e.g., linear or curvilinear but non-rotational) relative movement with regard to the

30 capsule without a relative rotation of the capsule.

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[0031] The enclosing member is preferably arranged with regard to the capsule such that during the transfer movement from the opened state to the closed state, the capsule essentially stays in place.

[0032] The sealing member is preferably arranged to exert a biasing force against a matching pressing surface of the beverage production device.

[0033] The sealing member is preferably of sufficient thickness to compensate within a certain range of variation of clearance. Preferably, the sealing member has a thickness (at rest), as measured in the main direction of the compressive forces of from 0.5 and 5 mm, preferably of from 1 and 3 mm.

[0034] The pressing surface is preferably comprised has a linear and/or frustoconical contour when seen in a radial section view.

[0035] The pressing surface can present a non-linear contour when seen in a side view.

[0036] Preferably the contour of the pressing surface can be provided with corrugations.

[0037] The sealing engagement thereby can be designed to be only effective as long as the enclosing member exerts a minimum compressive force on the capsule, but is automatically released as soon as the compressive force falls below said minimum compressive force.

[0038] Grooves can be provided in the circumference of the enclosing member, which grooves act as air inlet passages for feeding air through these grooves and through the released sealing engagement between the capsule and the enclosing member.

[0039] The sealing member can be made of a rubber-elastic material.

[0040] The sealing member can be made from the constituent material of the capsule such as a polymeric material.

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[0041] The sealing member can be an integral part of one of the wall elements.

[0042] The sealing member can be separate to the wall elements.

[0043] Preferably the sealing member has the shape of an O-ring or a ring having a L-shaped cross-section.

5 [0044] The sealing member can be attached to one of the wall elements using an adhesive or by welding or by pinching or crimping or a combination thereof.

[0045] The enclosing member can comprise additional sealing means adapted to assist to the sealing engagement between the enclosing member and the capsule.

10 [0046] The sealing pressure acting at the sealing engagement can have a radial and/or axial component relative to the center axis of the capsule.

[0047] Another aspect of the invention provides a method for producing a beverage, the method comprising the following steps:

- positioning a capsule in a beverage production device while closure means of the beverage production device are in an opened state, the capsule comprising:

15 a first wall element in the form of a cup-like base body;

a second wall element in the form of a foil member;

a flange-like rim area at which the foil member is sealingly connected to the cup-like base body in an airtight fashion thereby to seal beverage ingredients within the interior of the capsule; and

20 a sealing member, the sealing member being present both on the flange-like rim and a portion of a side wall of the base body;

wherein the beverage production device further includes a capsule holder having relief elements designed to tear and perforate the foil member,

- the method further comprising:

25 - transferring the closure means from the opened state to a defined closed state, while in the final phase of the transfer movement the closure means engage and bias the sealing member of the capsule, wherein the sealing member of the capsule compensates any clearance between the enclosing member and the capsule when the enclosing member is in its defined closed state, which clearance would exist without

30 the compensatory effect of the sealing member of the capsule,

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- injecting a liquid under pressure into the capsule through at least one opening in the first wall element
- tearing the foil member by the relief elements, thereby providing at least one outlet in the foil member for the liquid to leave the capsule and

[0048] The sealing member of the capsule can compensate any clearance between the enclosing member and the capsule when the enclosing member is in its defined closed state, which clearance would exist without the compensatory effect of the sealing member of the capsule.

[0049] In the final phase of the transfer movement the closure means can at least partially compress the sealing means of the capsule.

[0050] Preferably the sealing engagement of the closure means and the sealing means of the capsule withstands an internal pressure in the range of 2 to 20 bars, preferably 4 to 15 bars.

15 [0051] The term "matching pressing surface" as used herein is typically a portion of the beverage production device. This can be a surface of the enclosing member which is typically one part of the device which covers at least one side of the capsule upon closing of the device to encompass the capsule. The term "internal pressure" refers to the relative pressure above ambient atmospheric pressure that can be measured in  
20 the fluid conduit of the fluid injection device just before the fluid inlet in capsule (but downstream of any non-return valve) during extraction.

[0052] Advantageously, the present invention, at least in a preferred form aims at an improvement of a system which comprises:

25 - an enclosing member of the beverage production device which can receive the capsule and is transferable from an open state to a preset defined closed state,

30 - a capsule configured with a seal that provides, each time a capsule is engaged by the enclosing member an effective fluidly sealed configuration of the capsule, so that water enters into the capsule through a controlled fluid path through the capsule when the enclosing member has been closed in said defined closed state about the capsule, and

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- the beverage production device having means for injecting pressurized water into the interior of the capsule.

[0053] Advantageously, the invention particularly aims at an improvement of a compensatory sealing engagement between the enclosing member and the outer 5 surface of the capsule.

[0054] More advantageously, the present invention thus especially aims at an improvement of the capsules, such that state-of-the-art beverage production devices with built-in sealing means as for example shown in EP-A-512470 can also be used in connection with a capsule according to the present invention.

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#### **BRIEF DESCRIPTION OF THE DRAWINGS**

[0055] Further advantages, features and objects of the present invention will become evident for the man skilled in the art when reading the following detailed description of embodiments of the present invention taking in conjunction with the 15 figures of the enclosed drawings.

[0056] Fig. 1 shows an extraction capsule known from EP-A-512470,

[0057] Fig. 2 shows a first embodiment of the present invention in which a capsule is placed on the capsule holder but has not yet reached its closing position in the beverage production device,

20 [0058] Fig. 3 shows an enlarged in view of Fig. 2,

[0059] Fig. 4 shows the first embodiment in a state, in which a capsule has reached its closing position between a bell member and the capsule holder,

[0060] Fig. 5 shows a perspective view of a capsule holder, a bell member and a capsule according to the first embodiment in a position in which the capsule has not 25 yet reached its closing position,

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[0061] Fig. 6 shows a second embodiment of the present invention,

[0062] Fig. 7 is an enlarged view of a detail of Fig. 6,

[0063] Fig. 8 is a perspective view of the second embodiment,

[0064] Fig. 9 shows the second embodiment in a state in which the capsule has  
5 reached its closing position,

[0065] Fig. 10 shows a third embodiment in which the sealing member of the capsule is part of the side wall of the capsule,

[0066] Fig. 11 is a detailed view of Fig. 10,

[0067] Fig. 12 shows the sealing engagement according to the third embodiment,  
10 Fig. 13 shows a fourth embodiment in which the sealing member is part of the top wall member of the capsule, and

[0068] Fig. 14 shows the fourth embodiment in the final state.

#### **PREFERRED EMBODIMENT OF THE INVENTION**

15 [0069] With reference to Fig. 2 now a first detailed embodiment will be explained.

[0070] Note that in the following the invention will be explained referring to a certain design of a capsule, i.e. a design according to which the capsule comprises a cup-like base body and a closing foil member. However, it is to be understood than other designs of the capsule are viable, such as e.g. capsules having a lenticular form with  
20 two essentially matching and opposing walls (e.g. foils) being sealed at the e.g. ring-shaped edge. Generally a capsule according to the present invention comprises at least two opposing wall members which are connected to each other at the edges to form a sealed flange-like rim area, thus enclosing a sealed interior.

[0071] The capsules are inserted into the beverage production device while still  
25 being sealed.

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[0072] Comparable to the prior art also this embodiment shows a capsule holder 13 having relief elements 12 which are designed to tear and perforate a foil member 5 closing off a cup-like base body 4 of the capsule 1. Note that other tearing elements than the relief elements can be thought of.

5 [0073] This tearing of the foil member can e.g. occur as soon as the pressure inside the capsule exceeds a threshold value. Note that the relief elements can have any protruding shape able to cause a (partial) tearing of the foil member. As an example only pyramids, needles, bumps, cylinders, elongated ribs are cited.

10 [0074] In an alternative, the foil member 5 could be replaced by a wall that can be pierced against at least one relief element before water is injected in the capsule, for instance, as resulting of the closure of the machine about the capsule.

15 [0075] Within the capsule 1 ingredients 3 are contained, wherein the ingredients 3 are selected such that a beverage can be produced when having a liquid entering the capsule in the region of the top wall 17 of the capsule 1 and then interact with such ingredients 3. Preferred ingredients are e.g. ground coffee, tea or any other ingredients from which a beverage or other liquid or viscous comestible (e.g. soup) can be produced.

20 [0076] Fig. 2 shows a state in which such a capsule has been placed (while still being sealed) on a capsule holder 13, the foil member 5 resting on the relief element 12 side of the capsule holder 13 and the cup-like base body 4 of the capsule 1 being already partly surrounded by the circumferential wall 25 of an enclosing member 9 of the beverage production device. The shown enclosing member has the shape of a bell. Other shapes are viable, wherein the design of the interior contours (recess) of the enclosing member is generally adapted to substantially match the contours of the capsule 1.

25 [0077] Note that the foil member 5 as shown is not exactly flat due to a defined over pressure inside the capsule, which over pressure is generated by introducing e.g. a protective gas when producing the filled capsule.

30 [0078] The enclosing (bell) member 9 furthermore comprises an annular support skirt 18, the function of which will be explained later, an external thread 19 for

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mounting the bell member in a beverage production device and a water inlet opening 20 for feeding a liquid such as for example hot water under pressure to a water injector 14 which is releasable mounted (screwed) to the bell member 9.

5 Note that the thread 19 is just an example for connection means, be it releasable or permanent connection means.

[0079] The other components of the beverage production device, such as e.g. the mechanism for displacing the bell member and eventually also the capsule holder are known from the prior art in the field of capsule-based espresso machines.

10 [0080] The water injector comprises at least one perforation element (blade, pin, etc.) 24 designed to produce at least one opening in the top wall 17 of the capsule 1 when the capsule holder 13 and the bell member 9 are moved close together e.g. by a manually operated or a automatic mechanism. A channel (not shown in the drawings) traverses the perforation element 14 such that water can be fed to the interior of the capsule 1 once the perforation element 14 protrudes into the interior of the capsule 1 15 (see figure 4).

20 [0081] The capsule 1 comprises said top wall 17, a sidewall 7 and a flange-like rim 6, wherein the foil member 5 is sealed to said flange-like rim 6 to close-off hermetically the cup-like base body 4 of the capsule 1. Again, other designs for the capsule are possible as long as the capsule can be sealed and contain the mentioned ingredients. For instance, the capsule can include one or more filters. A bottom filter can be placed in contact with the inner surface of the foil 5 and/or a top filter can be placed at least partially in contact with the inner surface of the body 4.

25 [0082] According to the present invention the outer surface of the capsule 1 presents a dedicated sealing member 8. The sealing member 8 can be resilient due to the material used and/or due to the geometrical shape of the sealing member 8.

[0083] Further on, the sealing member 8 can be integral to the capsule 1 or a separate piece. In the latter case the sealing member can be mounted releasably to the base body 4 or fixed thereto e.g. by welding or by means of an adhesive.

30 [0084] In case the sealing member 8 is a separate piece attached to the capsule 1, it can be mounted to the capsule as one integral piece. Alternatively it can be applied

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in fluid or viscous form and then can be cured (e.g. polymerize) once applied onto the outer surface of the capsule, which is the case e.g. when applying silicone.

[0085] If a resilient material is used for the sealing member 8, preferably rubber-elastic materials are used. The term "rubber-elastic" means any suitable material 5 having rubber elasticity including but not limited to elastomers, silicones, plastics, latex, balata or others. Particularly suitable materials are: EPDM (Ethylene Propylene Diene Monomer), NBR (Acrylic Nitrile Rubber), TPE (thermoplastic elastomer) or silicone rubber. These materials have particular good flex, compressive properties and can resist high temperatures without cracking.

10 [0086] In case the material of the sealing member is the same as the one used for the capsule (e.g. a metal such as aluminum or plastics), preferably the resilient nature of the sealing member is procured by the geometrical shape of the sealing member.

[0087] In the embodiment according to Fig. 2 the sealing member 8 is resiliently deflectable due to the lip-shaped form. It is made from the same material as the 15 capsule, preferably plastics. It can be an integral piece of the base body 4 of the capsule 1.

[0088] The flexible free lip 8 extends from the outer edge of the flange-like rim 6 and is inclined outwards. In the shown embodiment the flexible lip is the edge of the side walls of the base body of the capsule, which edge is bent by an angle of more 20 than about 90 degrees, preferably comprised between 95 and 175 degrees.

[0089] Note that such deflectable sealing member 8 can be placed at any position onto the capsule 1 as long as the position is adapted for an exterior sealing engagement of the sealing member 8 and the enclosing member 9 between the water injector 14 and the perforations in the foil member 5. The sealing member 8 can also 25 be provided on the region of the top wall 17 of the capsule 1 surrounding the water injector 14 when the water injector 14 is in a position protruding into the interior of the capsule 1. The sealing member 8 can also be arranged to cover different portions (bottom, side wall, flange-like rim) of the capsule.

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[0090] As can be seen in detail in Fig. 3, the bell member 9 according to this embodiment does not comprise any dedicated resilient sealing member. However, the bell member optionally can also comprise an (additional) resilient sealing member.

[0091] A divergently inclined sealing surface 15 of the bell member 9 is designed to 5 cooperate with the resiliently deflectable sealing member 8 of the capsule 1. The inclination of the sealing surface is opposite to the inclination of the free flexible lip constituting the sealing member.

[0092] Depending on the form and material of the sealing member 8 of the capsule 10 1, the cooperating surface of the bell member 9 can have any shape, position and orientation which is adapted for a sealing engagement with the sealing member 8 of the capsule 1.

[0093] Fig. 4 shows the state in which the bell member 9 and the capsule holder 13 15 are brought in closing pressure engagement and due to the water entering the interior of the capsule and building up a pressure there the pyramidal relief members 12 of the capsule holder 13 have already produced openings in the foil member 5 of the capsule 1.

[0094] The closed state shown in Figure 4 is an intrinsically set state defined by the machine design and not by the user's manipulation. In order to be transferred from the 20 opened state of the enclosing member 9 shown in Figure 2 to the closed state shown in Figure 4, the enclosing member has undergone an essentially linear relative displacement with regard to the capsule 1. In the present embodiment it is assumed that the capsule 1 is not carrying out any displacement and stays in place during the closing process. However, alternatively or additionally to the displacement of the enclosing member 9 also the capsule 1 can carry out an essentially linear movement.

[0095] In the shown example the capsule 1 does not rotate relative to the enclosing 25 member 9. Upon insertion of the capsule the blade element 24 of the water injector 14 has created a perforation 16 in the top wall 17 of the capsule 1. When a sufficient pressure of fluid has been built inside the capsule, the beverage produced from the ingredients contained in the capsule can be drained in small interstices between the 30 relief members 12 and the surrounding foil member 5.

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[0096] In the state shown in Fig. 4 the resiliently deflectable sealing member 8 of the capsule 1, i.e. the flexible lip, is biased against the corresponding inclined sealing surface 15 of the enclosing member 9. The annular support skirt 18 now covers the end of the flange-like rim 6 of the capsule 1 to ensure that the sealing member 8 and the capsule as such remain in position when the sealing surface 15 of the bell member exerts a certain pressure force of the sealing member 8.

[0097] Actually, the lip-shaped sealing member 8 represents an example of a construction for providing a self-reinforcing sealing engagement. Water coming from the water injector will be pressurized within the interstice between the exterior of the capsule and the enclosing member and will eventually arrive at the lip-shaped sealing member. The lip-shaped sealing member will block the water flow as it is biased against the sealing surface of the annular member. This blocking effect will lead to the pressure raising at the upstream-side of the sealing member which in turn will lead to the sealing member being pressed even stronger against the sealing surface and thus to a sealing engagement which is the stronger the higher the pressure at the sealing engagement.

[0098] In the embodiment of Fig. 5 grooves 22 are provided in the circumference of capsule holder 13, which grooves 22 act to evacuate water which could settle or accumulate on the upper surface of the capsule holder 13 or dripping out of the capsule before the capsule has been removed.

Thus, when seen in a side view as e.g. in Figure 5, the enclosing member 9 can present circumferential corrugations, the grooves being just an example.

[0099] The sealing member is designed to compensate/fill such corrugations in the closed state of the enclosing member 9. However, e.g. due to manufacturing tolerances, misalignments, wear or fatigue of the parts of the beverage production device, even without expressively foreseen corrugations there is always a risk of a clearance and/or insufficient tightness of the sealing engagement between the capsule 1 and the enclosing member 9. According to the present invention, the sealing member is compressed sufficiently in order to compensate for any foreseen an/or unforeseen clearance which could exist otherwise.

[0100] When seen in a radially sectioned view as e.g. in Figure 4, the contour of the rim of the enclosing member 9, i.e. the pressing surface, does not present radial

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corrugations. The radial section of the pressing surface rather presents linear and/or frustroconical sections or a combination thereof. Thus the pressing surface according to the present invention is designed to compress or slightly displace the sealing member.

5 [00101] Fig. 6 shows an embodiment essentially corresponding to a variant of the first embodiment of Fig. 2. The sealing member 8 according to this embodiment is compressible and/or displaceable (i.e. it can slightly „flow“ when pressurized by the enclosing member). It covers both a portion of the side wall 7 and the area between the outer end of the flange-like rim 6 of the capsule 1 and said side wall 7. (The 10 sealing member can also cover only a portion of the side wall 7 of the base body 4 of the capsule 1.) The sealing member 8 according to this embodiment has a non-symmetrical, i.e. L-shaped cross-section.

[00102] Alternatively, the sealing member 8 can have other shapes such as e.g. a film applied to the capsule, an O-ring, etc.

15 [00103] When the capsule 1 is in a position as shown in Fig. 4 and then, after having finished the beverage production process, the holder 13 is opened, there is a risk that the capsule 1, instead of falling down, remains sucked into the bell member 9 due a "vacuum effect". As shown in Fig. 8 the invention proposes to provide for a mechanism which-assures that the type sealing engagement between the capsule 1 and the bell 20 member 9 is only present as long as the bell member 9 is engaged against the capsule holder 13, but automatically released such that air can get into the space between the top wall 17 and the side walls 7 of the capsule 1 and the inner wall of the bell member 9, respectively.

25 [00104] As can be seen from Fig. 8, especially in case the sealing member 8 covers a portion of the side walls 7 of the capsule 1, the annular front surface of the bell member 9 can be provided with grooves 21 which, act as air inlet passage for feeding air. The grooves allow the intake of air once the biasing force between the bell member 9 and the capsule holder 13 is released. Air is thus flowing into this space and it will be easier for the user to take out the capsule 1. Eventually, the capsule 1 will 30 even automatically fall down from the bell element 9.

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[00105] Fig. 9 shows the state of the second embodiment in which the front surface 23 of the bell member 9 is in sealing engagement with the sealing member 8 of the capsule 1.

[00106] Figures 10 to 12 show a third embodiment of the present invention in which 5 the resilient nature of the sealing member is due to the geometrical shape of the capsule itself. In the depicted embodiment the sealing member has the shape of a step 26, i.e. a sudden increase of the diameter of the side wall 7 of the capsule 1. Note that the geometrical form is not limited to the shown step and other forms are 10 viable as long as they procure a resilient or at least deformable nature of the sealing member.

[00107] The step-like sealing member 26 according to this embodiment is only one example for a hollow sealing member (in contrast e.g. to the "filled" sealing member 8 according to the second embodiment, figures 6 to 9). When the resiliency of the sealing member is procured by the geometrical shape, usually a deflection of the sealing member occurs (here: inwards and downwards deformation of the step). On the other hand, when the resilient nature is due to the material used and a "filled" sealing member is used, usually a compression and/or displacement of the material 15 occurs.

[00108] The sealing surface 15 according to this embodiment is inclined. Thus the 20 sealing pressure has a first component being directed radially inside and another component being directed axially (downwards in figure 12).

[00109] As can be seen especially from figure 12, the foil member 5 can be wrapped (see reference 27) over the rim of the capsule.

[00110] Fig. 13 and Fig. 14 show a fourth embodiment in which the sealing member 25 is an O-ring 11. The O-ring is geometrically arranged and, preferably fixed, on the top wall 17 of the capsule 1. This is just an example of providing a sealing member at the exterior of the capsule 1 at the side which faces the water injector and which will be perforated in order to create the water inlets to the capsule 1. The O-ring 11 is positioned to peripherally surround the area in which the water 30 injector 14 perforates the top wall 17 of the capsule 1. The sealing member 11 is thus compressed by the bottom 28 of the enclosing member 9 and (see figure 14) secured

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in place by the upper end of the circumferential side wall 25 of the enclosing member 9.

[00111] Note that the bottom 28 can be substantially flat or inclined to ensure a sufficiently water-tight interface with the sealing member 11 when the capsule is fully 5 engaged in the enclosing member 9 at closing of the device.

[00112] As an alternative to the O-ring 11, also a deflectable lip-like sealing member (e.g. comparable to the lip 8 according to the first embodiment, see figure 2) can be placed protruding from the top wall 17 of the capsule 1, i.e. the wall facing the water injector 14.

10 [00113] In any case, the bottom 28 will exert an axial compression force on the sealing member 11.

[00114] In case e.g. an O-ring is placed on the side wall 7 of the capsule 1, the radial component of the compression force will prevail.

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**List of reference numeral:**

1	capsule
2	beverage production device („coffee machine„)
3	ingredients
4	First wall element (e.g. cup-like base body of the capsule)
5	Second wall-element (e.g. foil member)
6	flange-like rim
7	side wall of the base body
8	sealing member
9	enclosing member (e.g. bell-shaped member)
10	transition area
11	O-ring
12	relief elements
13	capsule holder
14	water injector
15	sealing surface of the enclosing (bell-shaped) member
16	perforation in the first (e.g. bottom) wall of the capsule
17	Top wall of the capsule
18	annular support ring of the enclosing (bell) member
19	thread for mounting the enclosing (bell) member
20	water inlet opening of the enclosing (bell) member
21	grooves in the annular front surface of the enclosing (bell) member
22	grooves in a support ring of the capsule holder
23	annular front surface of the enclosing (bell) member
24	perforation element (blade) of the water injector
25	circumferential wall of the enclosing (bell) member
26	stepped sealing member
27	Wrapping of the foil member
28	Bottom wall of the enclosing member

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**THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-**

1. A beverage production system comprising a capsule-based beverage producing device, for use with a capsule for containing beverage ingredients, the capsule comprising:
  - 5 a first wall element in the form of a cup-like base body;
  - a second wall element in the form of a foil member;
  - a flange-like rim area at which the foil member is sealingly connected to the cup-like base body in an airtight fashion thereby to seal the ingredients within the interior of the capsule; and
  - 10 a sealing member;wherein the beverage production device is provided with:
  - means for injecting a liquid under pressure into the capsule
  - means for draining a beverage from the capsule, and
  - 15 an enclosing member transferable from an opened state to a defined closed state, in which the enclosing member encloses the outer surface of the capsule,
  - a capsule holder having relief elements which tear and perforates the foil member
  - 20 wherein the sealing member is compressed when engaged by the enclosing member in the closed state
  - the sealing member is effective to compensate for the clearance between the enclosing member and the capsule; which clearance would exist without the sealing member of the capsule, when the enclosing member is in its defined closed position, and wherein the sealing member is present both on the flange-like rim and a portion of a side wall of the base body.
  - 25 2. A system according to claim 1, wherein the sealing member is resilient under compression when it is engaged by the enclosing member in the closed state.
  3. A system according to claim 2, wherein the sealing member is effective to resist to an internal pressure of at least 5 bar.
  - 30 4. A system according to claim 1 or 2, wherein the sealing member is effective to resist to an internal pressure of at least 10 bar.

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5. A system according to any one of the preceding claims, wherein the enclosing member is arranged such that in the final phase of its transfer movement from its opened state to its closed state, it carries out an essentially axial relative movement with regard to the capsule without a relative rotation of the capsule.
- 5 6. A system according to any one of the preceding claims, wherein the enclosing member is arranged with regard to the capsule such that during the transfer movement from the opened state to the closed state, the capsule essentially stays in place.
- 10 7. A system according to any one of the preceding claims, wherein the sealing member is arranged to exert a biasing force against a matching pressing surface of the beverage production device.
8. A system according to claim 6 or 7, wherein the pressing surface is comprised has a linear and/or frustoconical contour when seen in a radial section view.
- 15 9. A system according to claim 6 or 7, wherein the pressing surface has a non-linear contour when seen in a side view.
10. A system according to claim 9, wherein the contour of the pressing surface is provided with corrugations.
11. A system according to any one of the preceding claims, wherein the sealing 20 member is made of a rubber-elastic material.
12. A system according to any one of the preceding claims, wherein the sealing member is made from the constituent material of the capsule.
13. A system according to claim 1, wherein the sealing member is provided at least in the transition area of the flange-like rim and one of the wall elements.
- 25 14. A system according to claim 1, wherein the sealing member is an integral part of one of the wall elements.

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15. A system according to claim 1, wherein the sealing member is separate to the wall elements.
16. A system according to claim any one of the preceding claims, wherein the sealing member has the shape of an O-ring or a ring having a L-shaped cross-section.
- 5 17. A system according to anyone of claims 15 or 16, wherein the sealing member is attached to one of the wall elements using an adhesive or by welding or by pinching or crimping or a combination thereof.
- 10 18. A system according to any one of the preceding claims, wherein the sealing engagement is only effective as long as the enclosing member exerts a minimum pressure on the capsule, but is automatically released as soon as the pressure falls below said minimum pressure.
- 15 19. A system according to any one of the preceding claims, wherein grooves are provided in the circumference of the enclosing member, which grooves act as air inlet passages for feeding air through these grooves and through the released sealing engagement between the capsule and the enclosing member.
- 20 21. A system according to any one of the preceding claims, wherein the enclosing member comprises additional sealing means adapted to assist to the sealing engagement between the enclosing member and the capsule.
- 20 21. A system according to any one of the preceding claims, wherein the sealing pressure acting at the sealing engagement has a radial an/or axial component relative to the center axis of the capsule.
22. A method for producing a beverage, the method comprising the following steps:
  - positioning a capsule in a beverage production device while closure means of the beverage production device are in an opened state, said capsule comprising:
    - a first wall element in the form of a cup-like base body;
    - a second wall element in the form of a foil member;
    - a flange-like rim area at which the foil member is sealingly connected to the cup-like base body in an airtight fashion thereby to seal beverage ingredients

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within the interior of the capsule; and

a sealing member, the sealing member being present both on the flange-like rim and a portion of a side wall of the base body; wherein

5 relief elements designed to tear and perforate the foil member, - the method further comprising:

- transferring the closure means from the opened state to a defined closed state, while in the final phase of the transfer movement the closure means engage and bias the sealing member of the capsule, wherein the sealing member of the capsule 10 compensates any clearance between the enclosing member and the capsule when the enclosing member is in its defined closed state, which clearance would exist without the compensatory effect of the sealing member of the capsule,

- injecting a liquid under pressure into the capsule through at least one opening in the first wall element

15 - tearing the foil member by the relief elements, thereby providing at least one outlet in the foil member for the liquid to leave the capsule .

23. A method according to claim 22, wherein the sealing member is resilient under compression when it is engaged by the enclosing member in the closed state.

24. A method according to claim 22 or 23, wherein the opening in the first wall 20 element is separated from the opening in the second wall element by a pressure-tight sealing engagement of an element of the beverage production device and a sealing member of the capsule, such that the liquid can only flow through the capsule, but not at the exterior of the capsule.

25. A method according to any one of claims 22 to 24, wherein in the final phase 25 of the transfer movement the enclosing member compresses the sealing member of the capsule at least partially.

26. A method according to any one of claims 22 to 25, wherein the sealing engagement of the enclosing member and the sealing member of the capsule withstands a pressure in the range of 2 to 20 bars.

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27. A method according to any one of claims 22 to 25, wherein the sealing engagement of the enclosing member and the sealing member of the capsule withstands a pressure in the range of 4 to 15 bars.
28. A method according to any one of claims 22 to 27, wherein the pressure-tight sealing engagement is caused by the sealing member of the capsule and that such sealing engagement is not present when using a capsule without such sealing member.
29. A beverage or other comestible, produced according to a method according to any one of claims 22 to 28.
30. A beverage production system, said system substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.
31. A method for producing a beverage, said method being substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

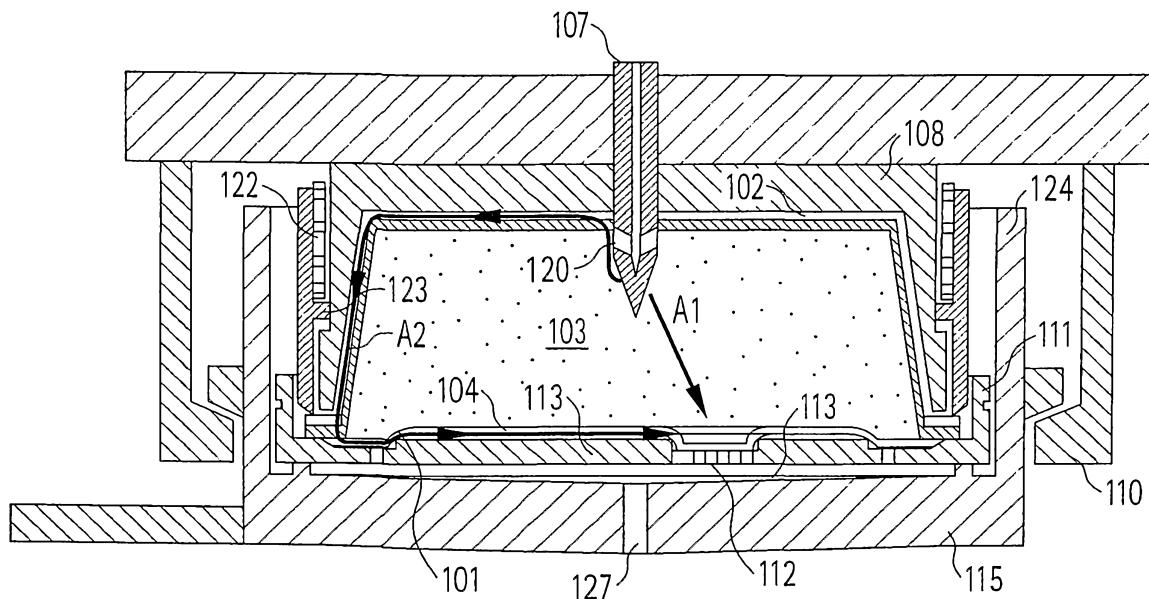


Fig. 1

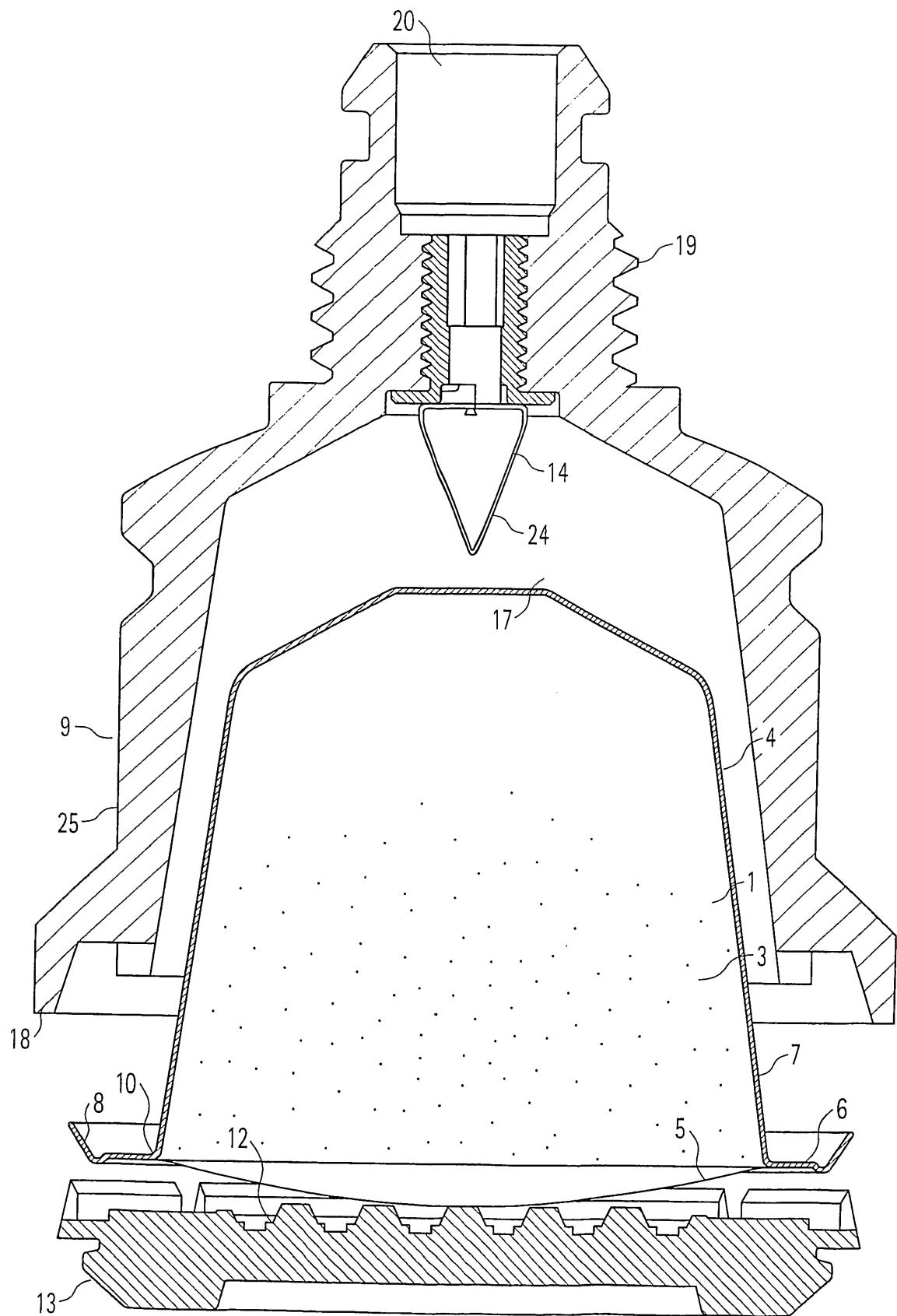


Fig. 2

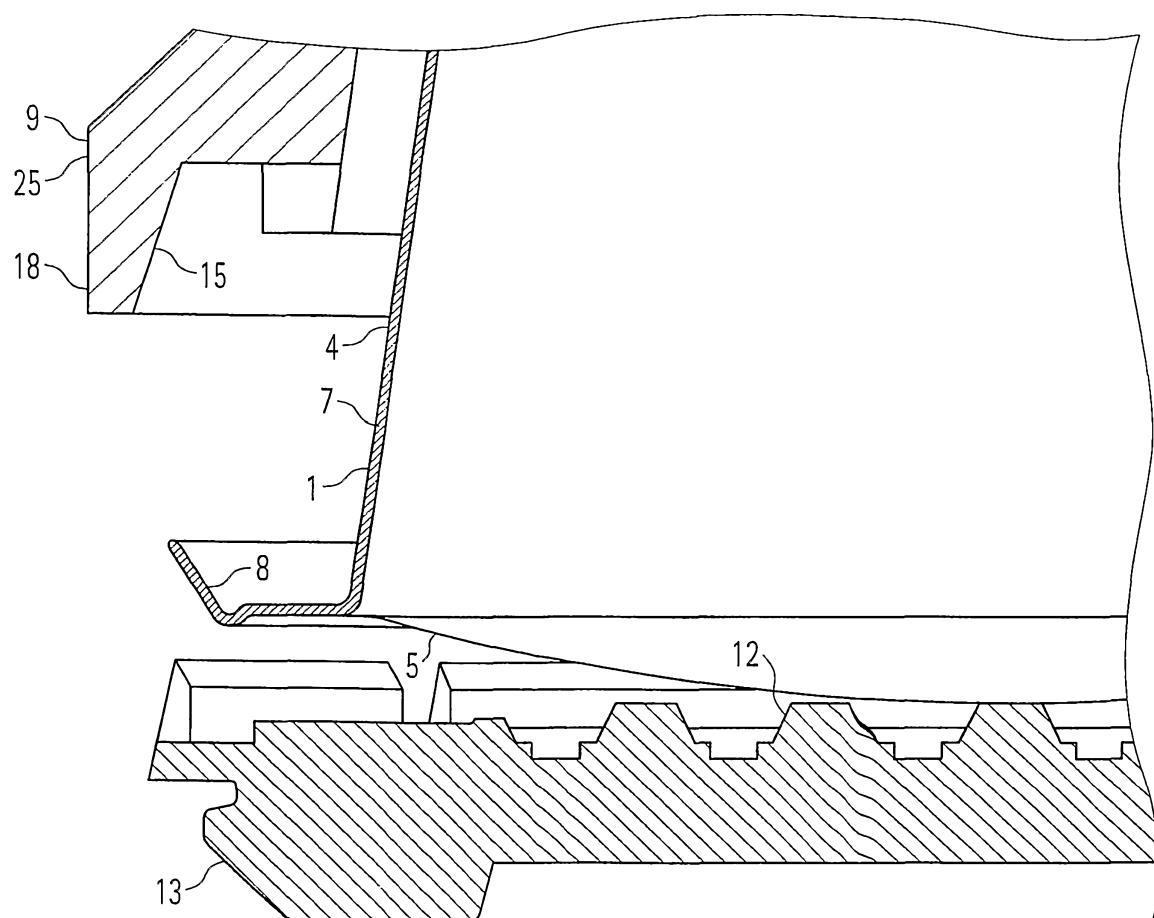


Fig. 3

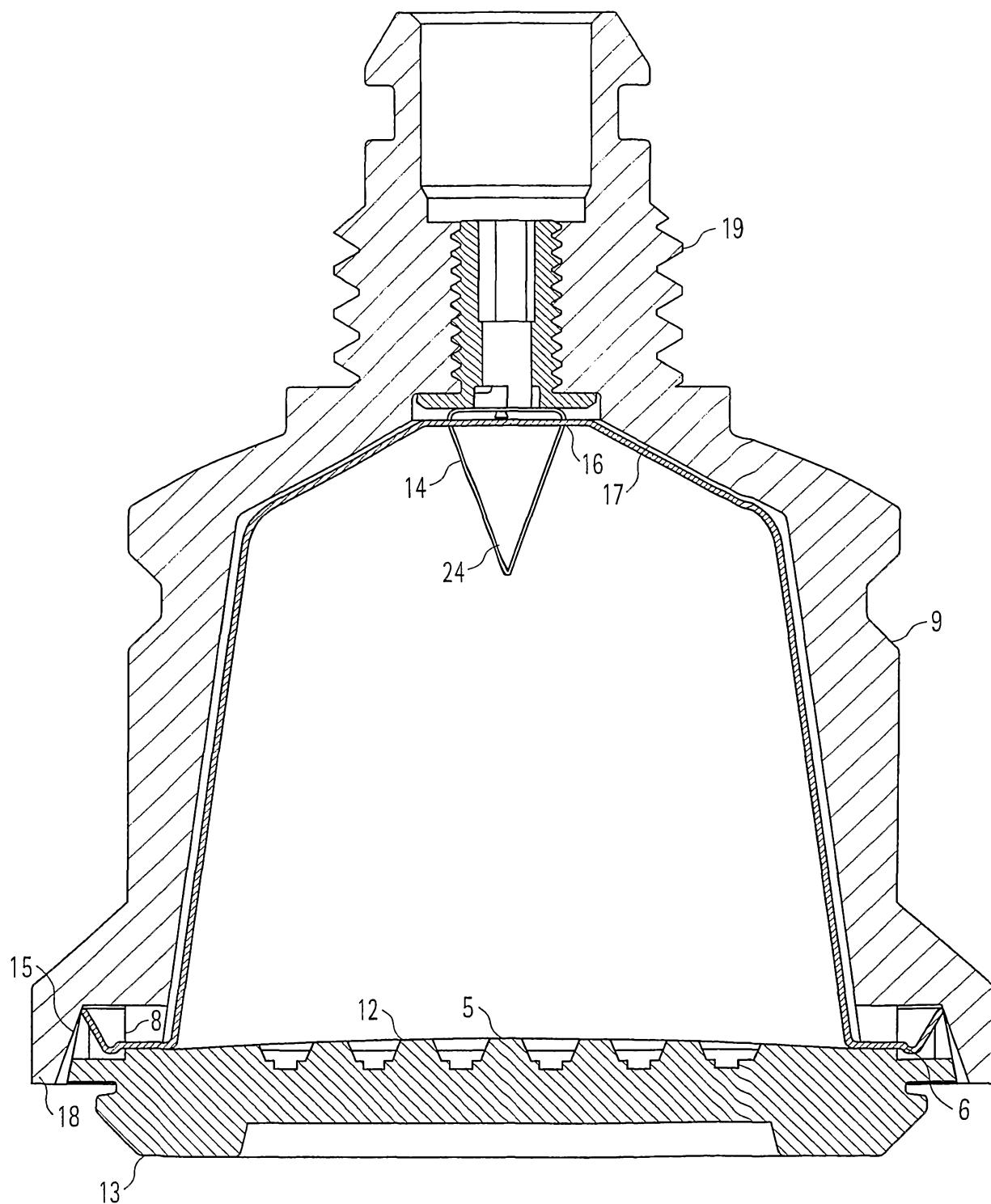


Fig. 4

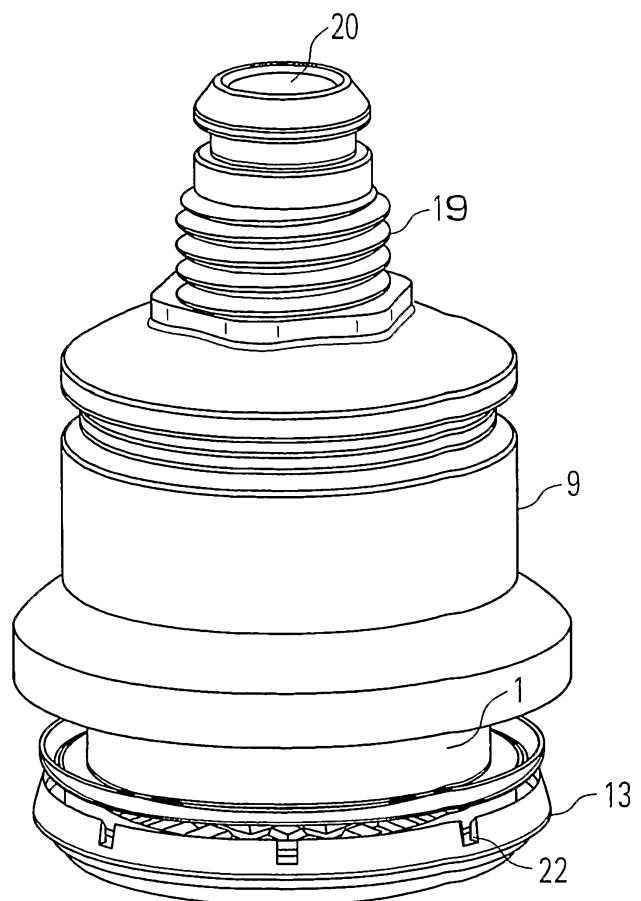


Fig. 5

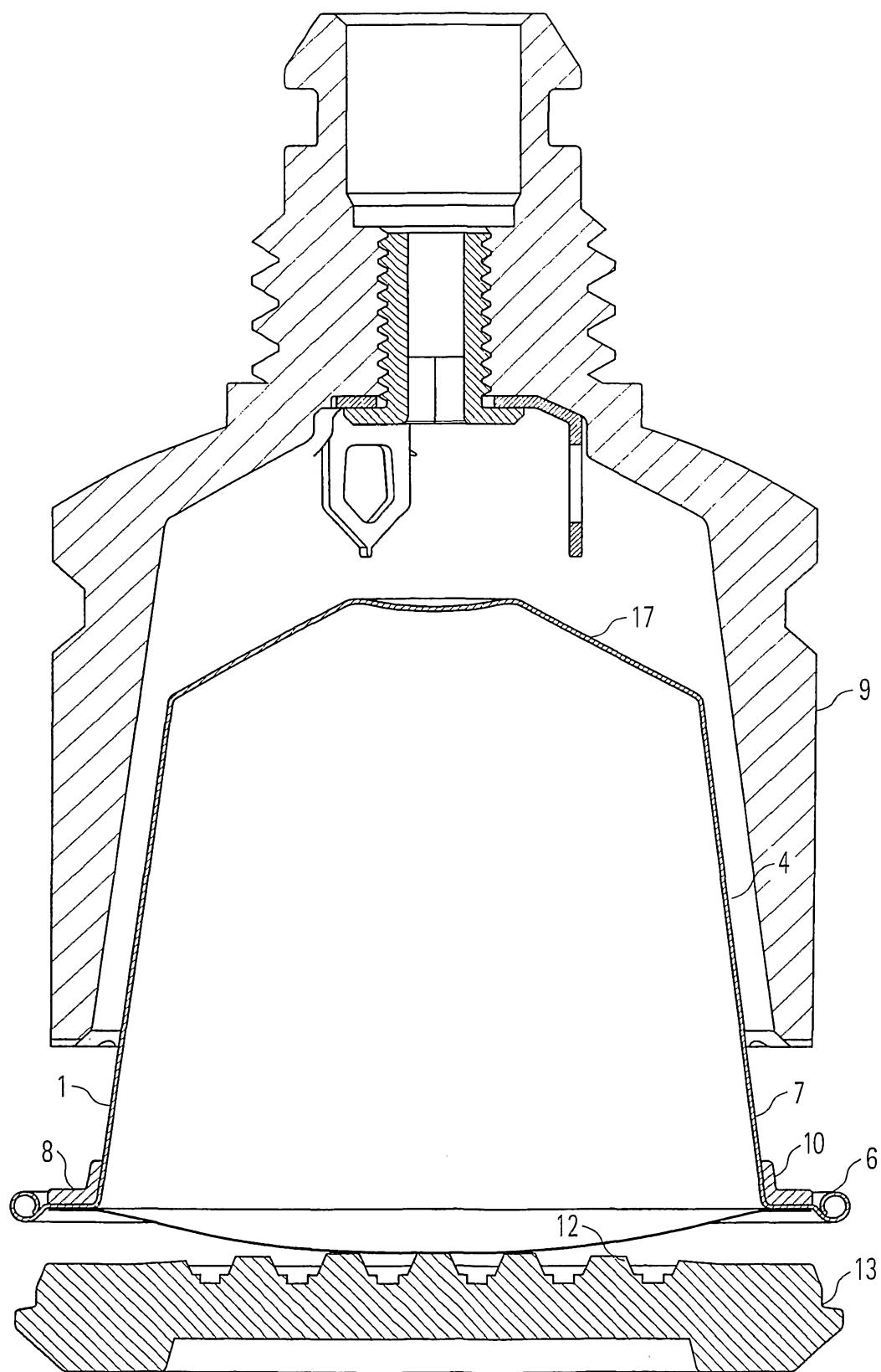


Fig. 6

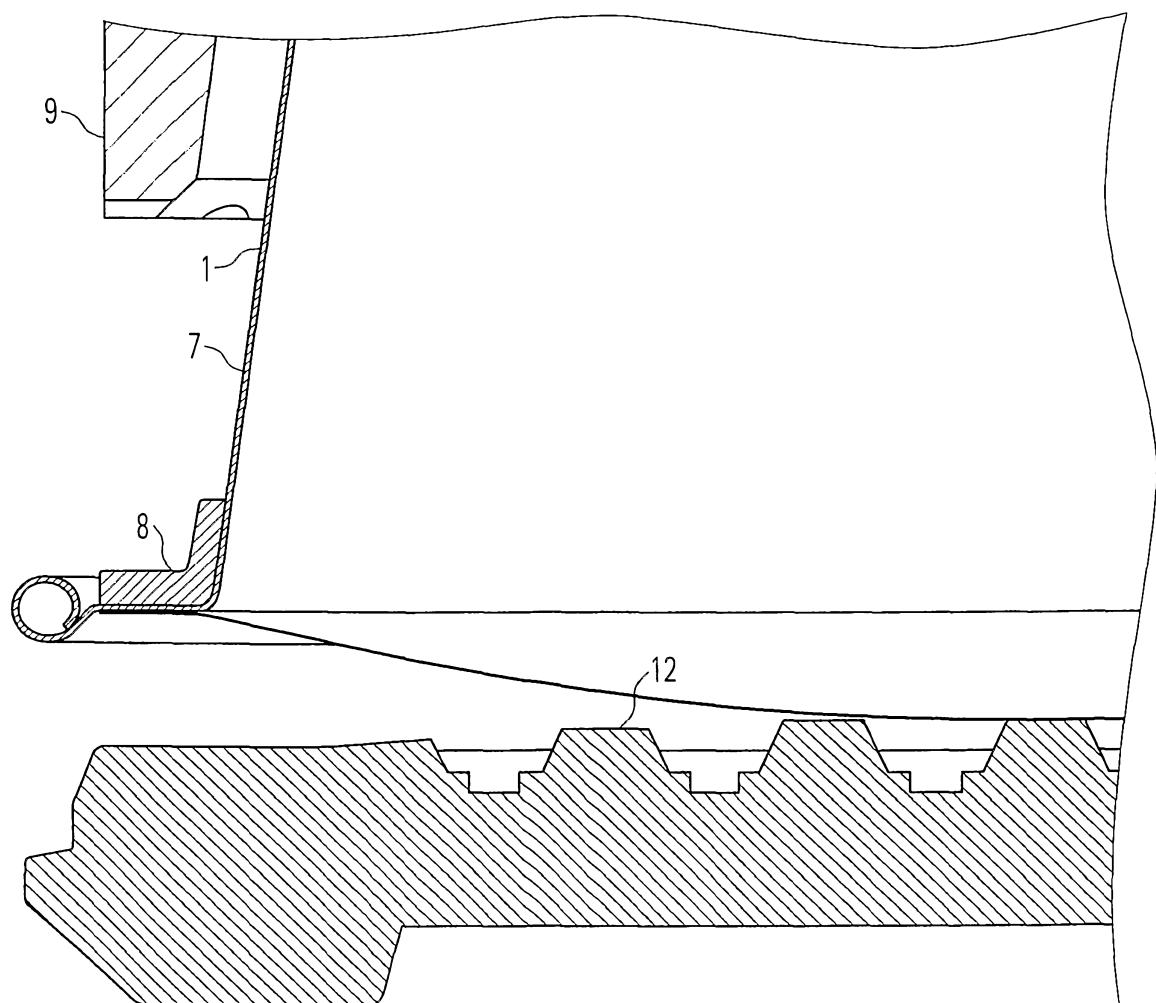


Fig. 7

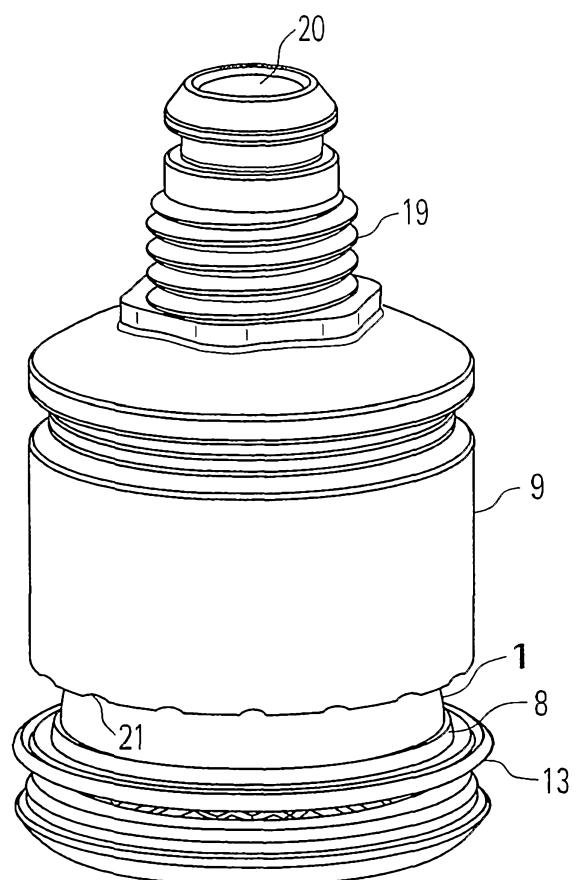


Fig. 8

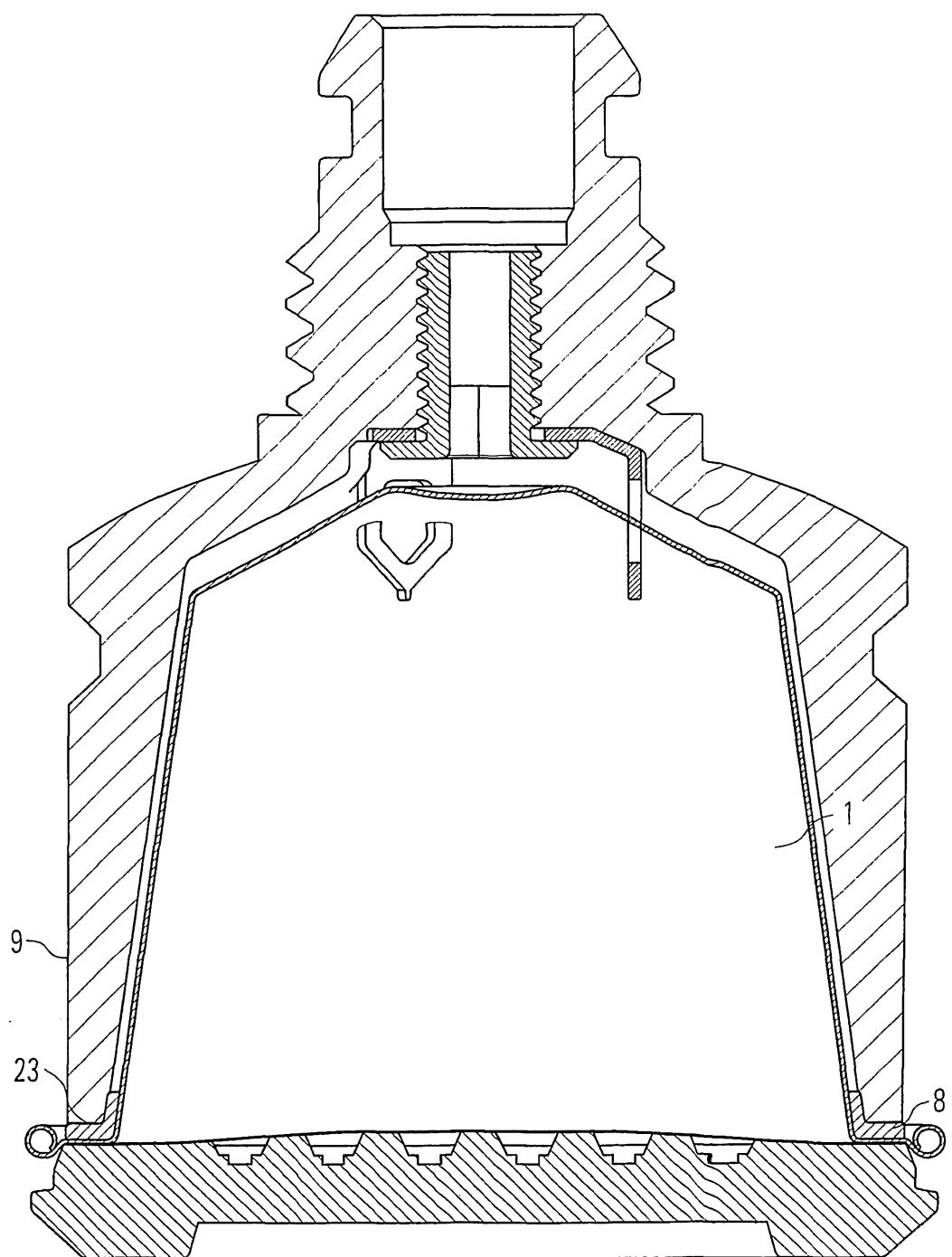


Fig. 9

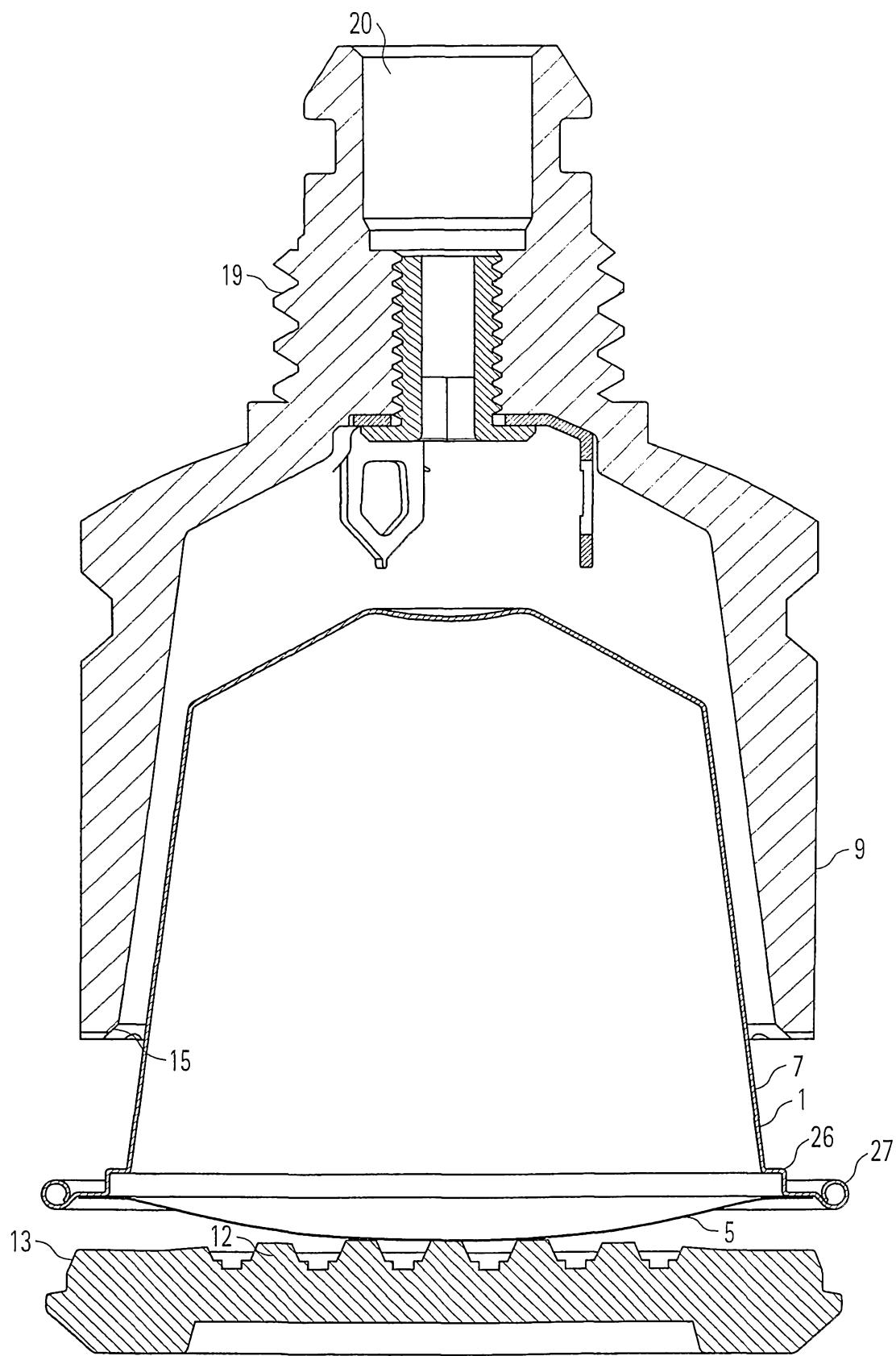


Fig. 10

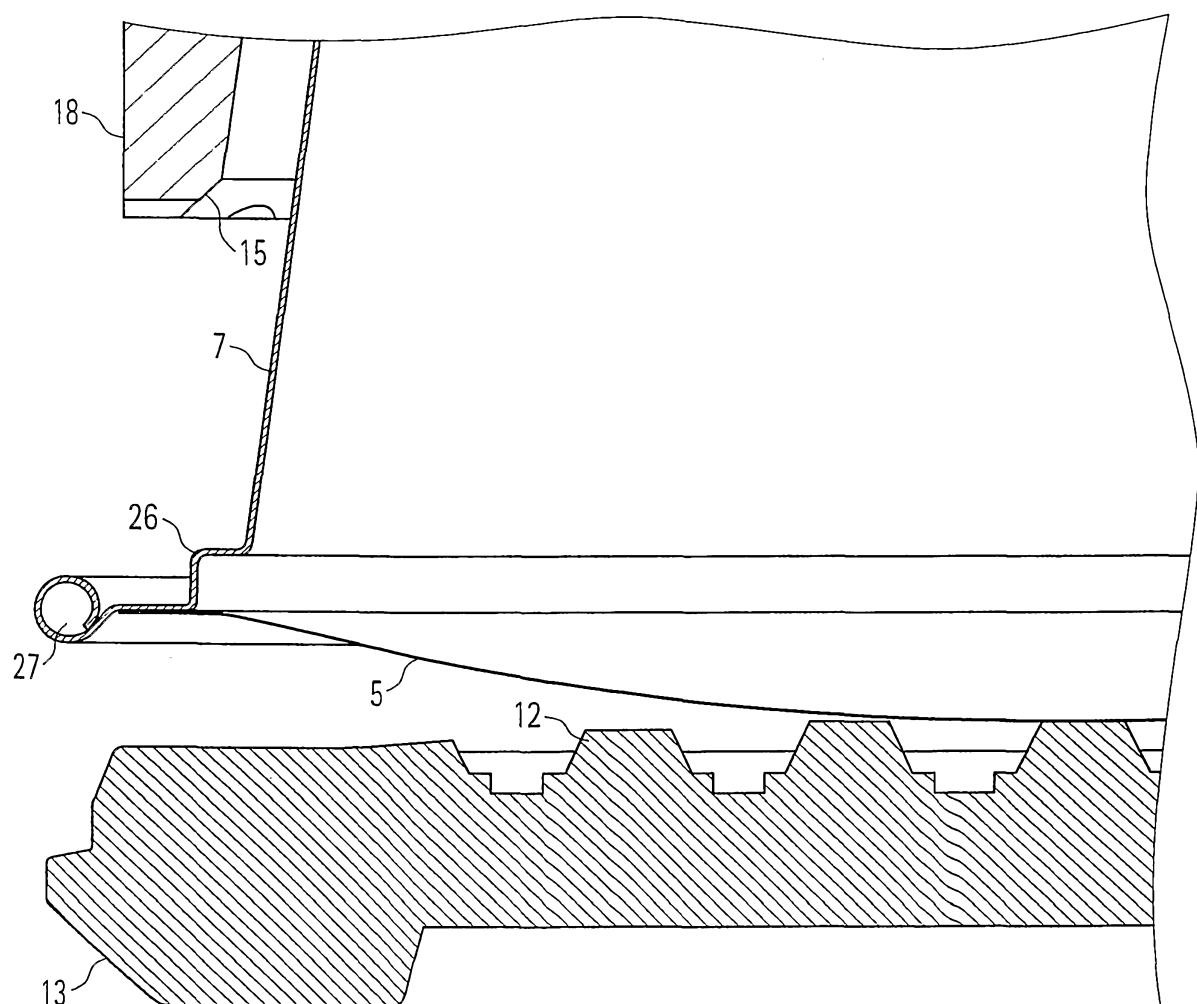


Fig. 11

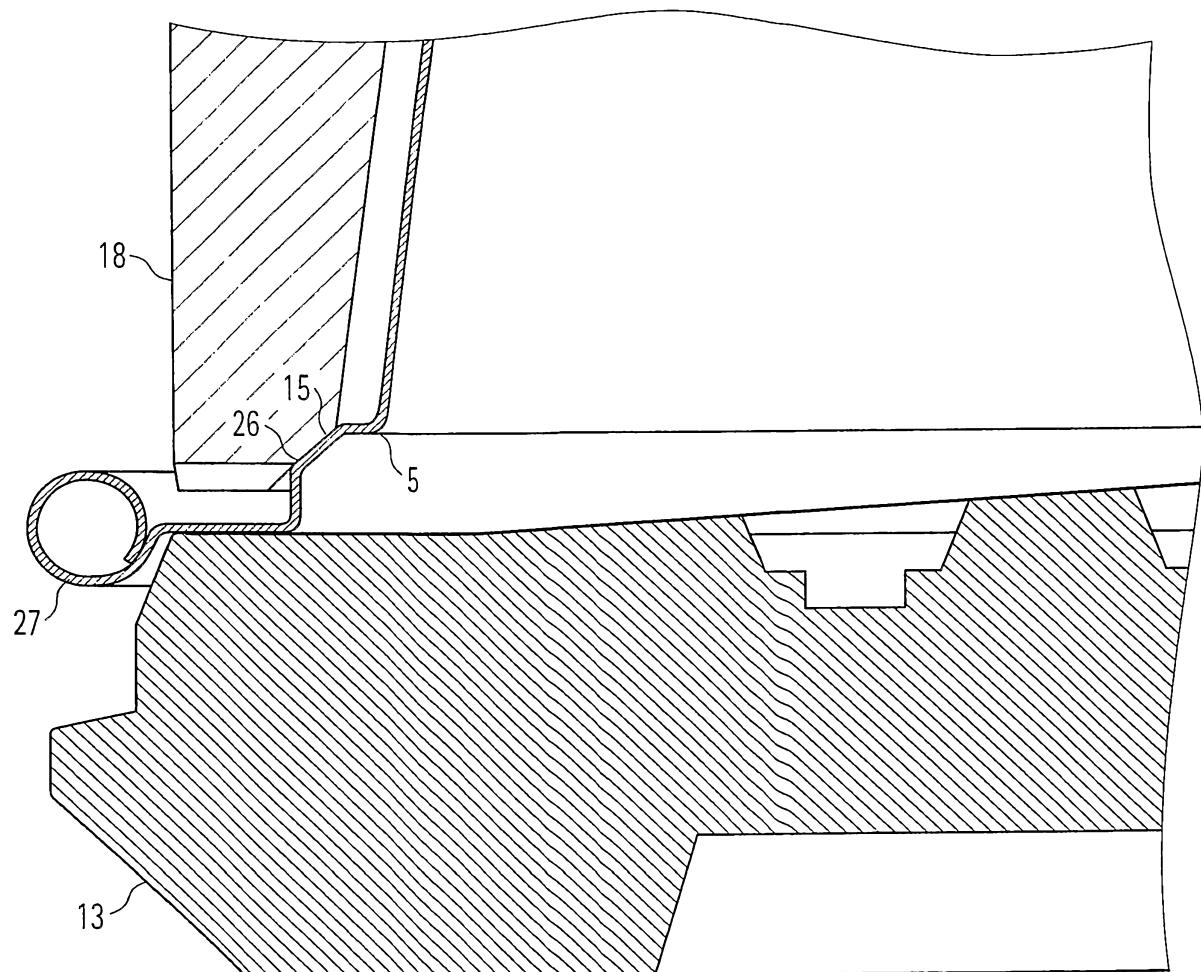


Fig. 12

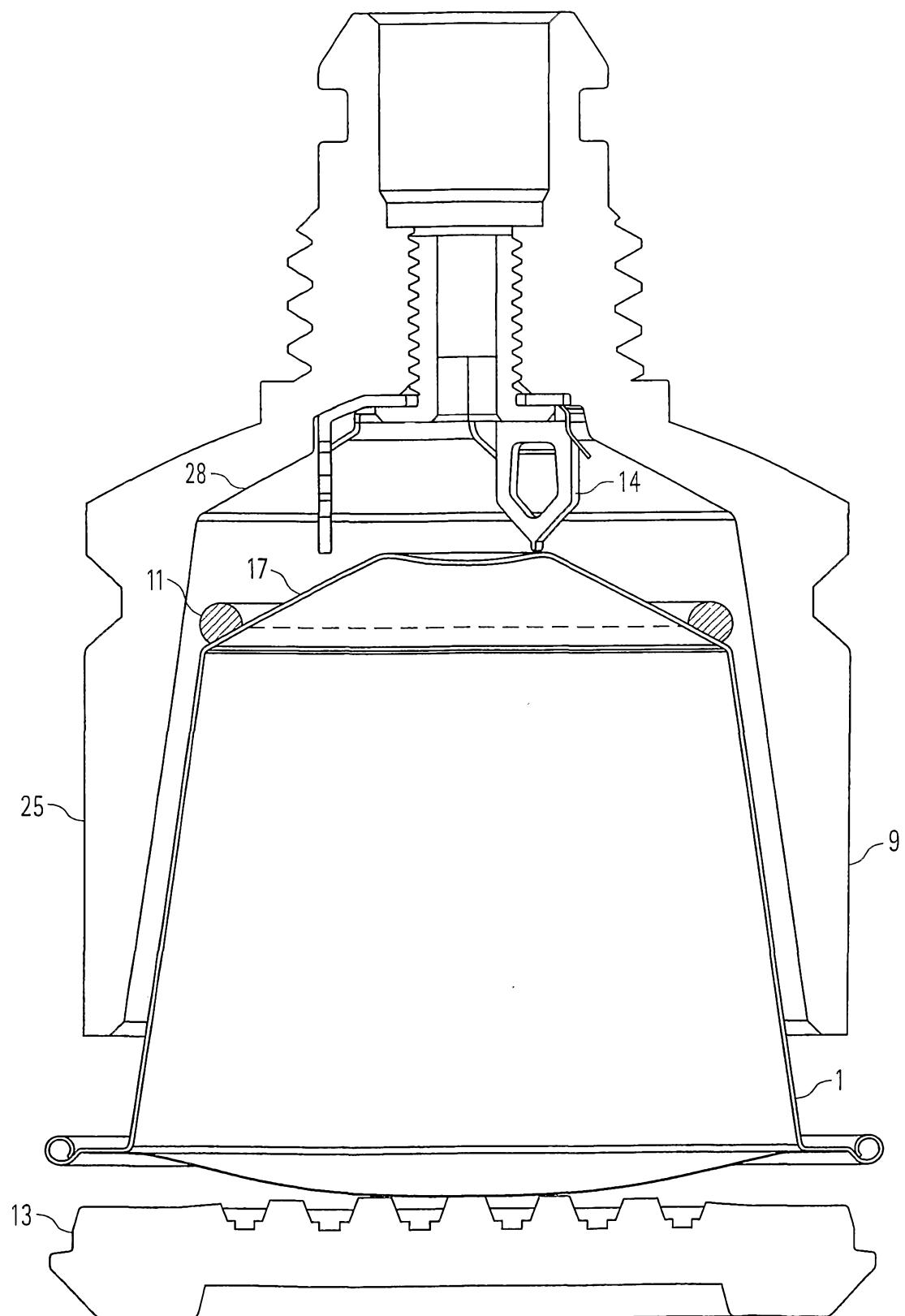


Fig. 13

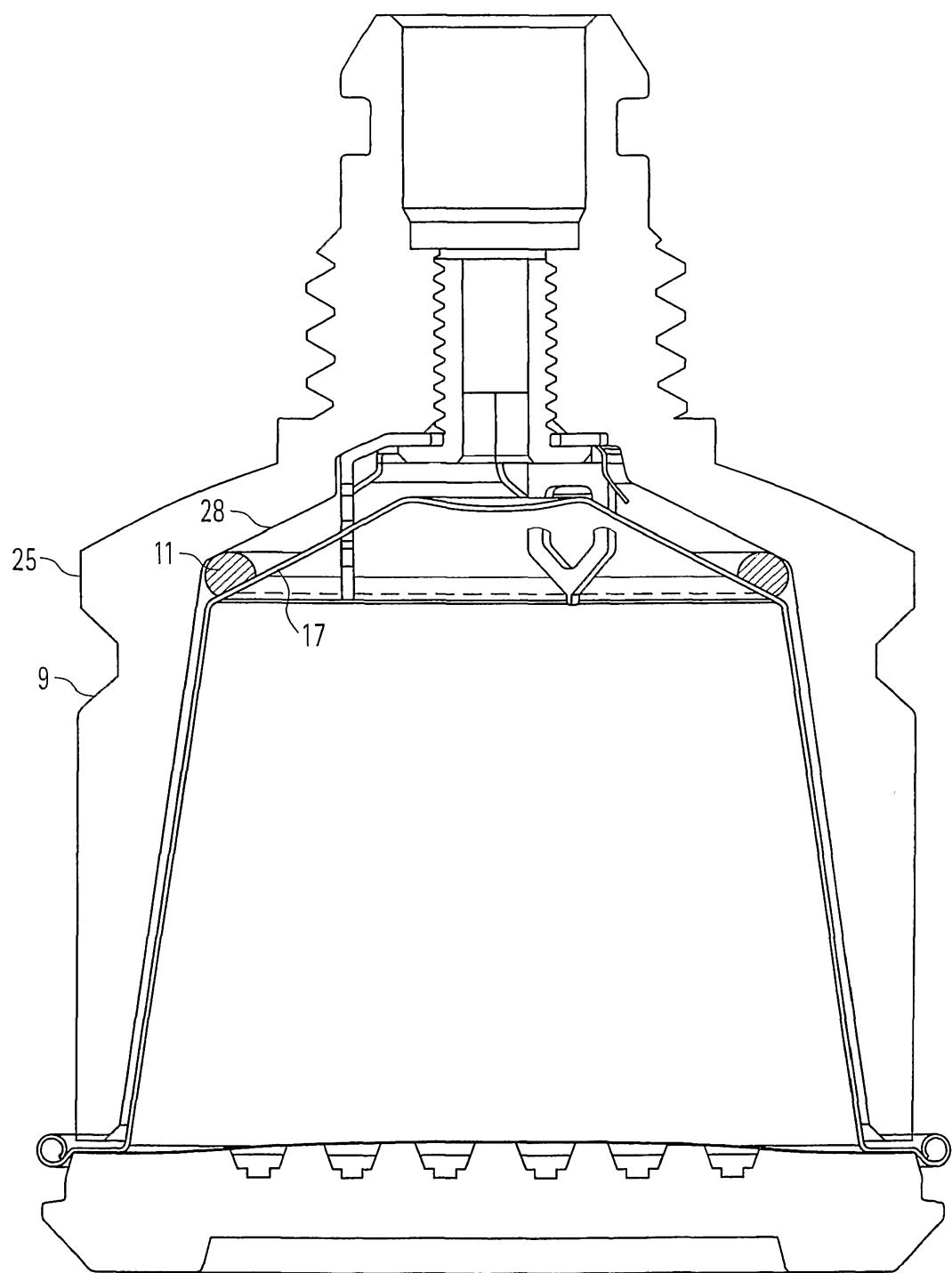


Fig. 14