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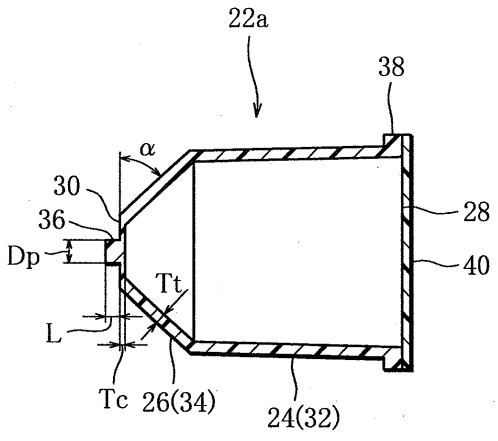
(54) LIQUID-CONTAINING CAPSULES AND TOBACCO ARTICLE PROVIDED WITH SAID CAPSULES

(57) A capsule (22a to 22f) containing a liquid of the present invention includes a capsule body (24) in a substantially cylindrical shape, the capsule body (24) having an end wall (26), a circumferential wall (32) and an open end (28), a seal member (40) as a closure wall closing the open end (28), a central portion (30) as a thin-walled region that is formed in a center of the end wall (26), the central portion (30) having a thickness thinner than thicknesses of the end wall (26) and the circumferential wall (32), and a protrusion (36) integrally protruding from a center of the central portion (30) toward an outside of the capsule body (24).

FIG. 3



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Description

Technical Field

[0001] The present invention relates to a capsule containing a liquid, which is to be incorporated in a smoking article such as a filter cigarette, and a smoking article in which the capsule is incorporated.

Background Art

[0002] If a liquid such as water or an aqueous solution is soaked into a filter of a smoking article such as a filter cigarette, not only are the characteristics of the flavor and taste of the mainstream smoke generated from the cigarette improved, but also a flavor or taste different from the original flavor or taste of the mainstream smoke can be added to the mainstream smoke, at the time of smoking. In this case, the capsule is incorporated into the filter in the state containing the liquid, and a user breaks the capsule, prior to smoking of the filter cigarette. Therefore, the liquid is spouted out from the broken capsule, and the spouted liquid soaks into the filter. For example, the user adds an external force to the capsule via the filter by pinching the filter between the fingers and breaks the capsule.

[0003] For example, when the capsule has a cylindrical shape, the capsule can include a plurality of grooves on one end wall thereof, and these grooves extend radially from an axis of the capsule (see FIG. 2 of Patent Document 1). When the capsule is crushed, the grooves are broken, and the liquid in the capsule is spouted through the broken grooves.

[0004] Further, a capsule can include two capsule half bodies, and these capsule half bodies are connected to each other via an annular seal (see FIG. 4C of Patent Document 2). According to the capsule like this, when the capsule is crushed, the annular seal is broken, and the liquid in the capsule is spouted through the broken seal.

[0005] Furthermore, there is known a cooling unit for a cigarette, and the cooling unit includes the capsule containing a cooling liquid, and a hollow fragile protrusion equipped at the capsule (see FIG. 3 of Patent Document 3). According to the cooling unit like this, when the capsule is crushed, the fragile protrusion section is ruptured, the cooling liquid in the capsule is spouted into the cigarette through the ruptured fragile protrusion section, and the spouted cooling liquid extinguishes the burning cone of the cigarette.

Prior Art Document

Patent Document

[0006]

Patent Document 1: Japanese Patent No. 2515794
Patent Document 2: Japanese Unexamined Patent Application No. 2008-528053
Patent Document 3: Japanese Unexamined Patent Application No. 2005-318806

Summary of the Invention

Problems to be solved by the Invention

[0007] The grooves of Patent Document 1, the annular seal of Patent Document 2 and the fragile protrusion of Patent Document 3 all facilitate breakage of the capsules to some degree. However, breakage of the grooves and the annular seal, and rupture of the fragile protrusion still require considerable forces, and further easiness in breakability of the capsules is required.

[0008] Further, even if the grooves, the seal and the fragile protrusion are broken or ruptured, the spots of breakage or rupture are not unambiguously uniquely determined in the grooves, the seal and the fragile protrusion. Therefore, there is the fear that even when the liquid or the cooling liquid is spouted from the capsule, the spouted liquid or cooling liquid does not effectively soak into the filter or the cigarette.

[0009] An object of the present invention is to provide a capsule containing a liquid in which easiness in breakability is enhanced and a breaking position can be determined, and a smoking article in which the capsule is incorporated.

Means for Solving the Problems

[0010] The aforementioned object is achieved by a capsule containing a liquid of the present invention, and the capsule comprises an elastically deformable capsule body that has a substantially cylindrical shape, includes an end wall closing a distal end thereof and an open end opening a proximal end thereof, and receive a liquid therein, a thin-walled region formed on the end wall of the capsule body, and the thin-walled region being thinner than thicknesses of the end wall and a circumferential wall of the capsule body, a protrusion integrally protruding from the thin-walled region toward an outside of the capsule body, and a closure wall provided at the open end of the capsule body, the closure wall closing the open end.

[0011] According to the aforementioned capsule, when the circumferential wall of the capsule body receives an external force and is crushed, the internal pressure of the capsule increases, and therefore, the end wall bulges toward an outside. Such bulging of the end wall pulls the thin-walled region outward in the radial direction of the capsule body with respect to the protrusion. Therefore, in the thin-walled region of the end wall, the specific area adjacent to the root of the protrusion is especially stretched. Therefore, the thickness of the specific area further decreases, and the capsule is broken first in the specific area. Once the thin-walled region is broken in

this manner, the liquid in the capsule is spouted from the broken spot of the thin-walled region.

[0012] The capsule has such a size as to be capable of being incorporated into a smoking article such as a filter cigarette, especially into a filter of the smoking article.

[0013] The end wall of the capsule body may have a truncated cone shape or a cup shape. In this case, the end wall can include a central portion surrounding the protrusion and having a diameter smaller than a diameter of the end wall, and an annular portion connecting the central portion and the circumferential wall of the capsule body, and the thin-walled region is formed in the central portion. For example, the central portion may be a concave wall in a spherical shape.

[0014] Furthermore, the thin-walled region may be partially provided in the central portion, and in this case, the thin-walled region may include a plurality of V-shaped grooves extending radially to an outer circumference of the central portion from the protrusion.

[0015] Meanwhile, the end wall may be flat, and in this case, the thin-walled region may include a plurality of V-shaped grooves extending radially to an outer circumference of the end wall from the protrusion.

[0016] Whichever shape among the above described shapes the thin-walled region is in, bulging of the end wall especially stretches the specific area of the thin-walled region adjacent to the root of the protrusion when an external force is applied to the capsule, and as a result, the thin-walled region is broken first in the specific area.

[0017] Meanwhile, the capsule body may have an annular extended portion integrally extending from an outer circumferential edge of the end wall, and the extended portion like this and the end wall cooperate with each other to form a distal end portion of the capsule into a concave shape. In this case, the thin-walled region may include a plurality of V-shaped grooves extending radially to the extended portion from the protrusion, for example.

[0018] Furthermore, the end wall may be a concave wall in a spherical shape, and in this case, the thin-walled region may have an annular shape adjacent to the protrusion and surrounding the protrusion. Further, the capsule body may have a plurality of ribs on the circumferential wall, and these ribs are disposed at intervals in a circumferential direction of the capsule body.

[0019] Furthermore, the capsule body has a flange formed on an outer circumference of the open end, and in this case, the closure wall is a seal member in a sheet shape, the closure wall being connected to the flange to close the open end liquid-tightly.

[0020] Further, the present invention provides a smoking article equipped with one of the aforementioned capsules.

[0021] According to the aforementioned smoking article, when the user applies an external force from outside the smoking article to crush the capsule body of the capsule, the specific area adjacent to the root of the protrusion is broken first in the thin-walled region of the end wall of the capsule body, and from the broken spot, the liquid in the capsule spouts into the smoking article.

[0022] Further, the aforementioned extended portion and ribs increase the rigidity of the circumferential wall in the capsule body. Therefore, when an external force is applied to the circumferential wall of the capsule body, the end wall is deformed into an elliptical shape, and the deformation of the end wall like this significantly stretches the specific area of the thin-walled region located at the root of the protrusion, and breaks the specific area first.

Advantageous Effects of the Invention

[0023] The capsule of the present invention is equipped with the combination of the thin-walled region and the protrusion, and therefore, the combination thereof determines the breaking position in the thin-walled region, while enhancing breakage of the thin-walled region, that is, easiness in breakability of the capsule. Further, the smoking article of the present invention can easily and accurately spout the liquid in the capsule into the smoking article.

Brief Description of the Drawings

[0024]

FIG. 1 is a sectional view showing a filter cigarette in which a capsule is incorporated, as a smoking article.

FIG. 2 is a perspective view showing a capsule of embodiment E1.

FIG. 3 is a vertical sectional view of the capsule in FIG. 2.

FIG. 4 is an end view of the capsule in FIG. 2 seen from an end wall side.

FIG. 5 is a side view of a capsule which is one of modifications of embodiment E1.

FIG. 6 is a side view of a capsule which is one of the modifications of embodiment E1.

FIG. 7 is a side view of a capsule which is one of the modifications of embodiment E1.

FIG. 8 is a side view of a capsule which is one of the modifications of embodiment E1.

FIG. 9 is a perspective view showing a capsule of embodiment E2.

FIG. 10 is a vertical sectional view of the capsule in FIG. 9.

FIG. 11 is a sectional view taken along line XI-XI in FIG. 10.

FIG. 12 is a perspective view showing a capsule of embodiment E3.

FIG. 13 is a vertical sectional view of the capsule in FIG. 12.

FIG. 14 is a perspective view showing a capsule of embodiment E4.

FIG. 15 is a vertical sectional view of the capsule in FIG. 14.

FIG. 16 is a perspective view of a capsule body in FIG. 14.
FIG. 17 is a sectional view taken along line XVII-XVII in FIG. 15.
FIG. 18 is a perspective view showing a capsule of embodiment E5.
FIG. 19 is a vertical sectional view of the capsule in FIG. 18.
FIG. 20 is an end view of the capsule in FIG. 18 seen from a distal end side thereof.
FIG. 21 is a perspective view showing a capsule of embodiment E6.
FIG. 22 is a vertical sectional view of the capsule in FIG. 21.
FIG. 23 is an end view of the capsule in FIG. 21 seen from a distal end side thereof.
FIG. 24 is a graph showing a breaking load of capsules of embodiments E1 to E6 and comparative examples C1 to C4.
FIG. 25 is a perspective view of a capsule of comparative example C1.
FIG. 26 is a vertical sectional view of the capsule in FIG. 25.
FIG. 27 is a perspective view of a capsule of comparative example C2.
FIG. 28 is a vertical sectional view of the capsule in FIG. 27.
FIG. 29 is a perspective view of a capsule of comparative example C3.
FIG. 30 is a vertical sectional view of the capsule in FIG. 29.
FIG. 31 is a graph relating to the capsule in FIG. 2 and showing a relation of a load and a distortion.
FIG. 32 is a graph relating to the capsule in FIG. 18 and showing a relation of a load and a distortion.
FIG. 33 is a graph relating to the capsule in FIG. 21 and showing a relation of a load and a distortion.

Mode for Carrying out the Invention

[0025] Referring to FIG. 1, a filter cigarette 10 as a smoking article is shown, and a capsule of the present invention is incorporated in the filter cigarette 10. In this case, the filter cigarette 10 comprises a cigarette 12 and a composite filter 16 that is connected to one end of the cigarette 12 via winding of tip paper 14.

[0026] For example, the composite filter 16 includes filter elements 18 and 20 each in a cylindrical shape, and these filter elements 18 and 20 are separated from each other in an axial direction of the cigarette 12. The filter elements 18 and 20 each have a filter material of acetate fibers, paper or the like, for example, and a wrapping material in which the filter material is wrapped. Further, the filter element 18 which is positioned at the cigarette 12 side may have particles of activated carbon, an aroma material or the like inside the filter element 18.

[0027] A capsule 22 containing a liquid of the present invention is disposed between the filter elements 18 and 20, and the capsule 22 and the filter elements 18 and 20 are disposed in tubular shaped paper (not illustrated) to form the composite filter 16.

[0028] According to the aforementioned filter cigarette 10, a user applies an external force F to the capsule 22 from outside of the composite filter 16, prior to smoking the filter cigarette 10 or between puffs. As will be clear from the explanation that will be described later, the external force easily breaks the capsule 22 in a specific breaking position thereof. Therefore, the liquid in the capsule 22 is spouted toward the filter element 18 from the breaking position, and soaks into the filter element 18.

[0029] A water-soluble component contained in mainstream smoke of the cigarette 12 dissolves in the liquid soaked into the filter element 18, and thereby, the water-soluble component in the mainstream smoke which passes through the filter element 18 is decreased. As a result, flavor and taste of the cigarette 12 change. If an aromatic is contained in the liquid, fragrance and flavor of the aroma material are added to the mainstream smoke.

[0030] As the capsule 22 of the present invention described above, various shapes are conceivable, and specific embodiments of the capsule 22 will be described hereinafter.

[0031] FIG. 2 to FIG. 4 show a capsule 22a of embodiment E1. The capsule 22a includes a substantially cylindrical capsule body 24, and the capsule body 24 is elastically deformable. The capsule body 24 has an end wall 26 and an open end 28, and the end wall 26 closes a distal end of the capsule body 24. The capsule body 24 like this is obtained by injection-molding a synthetic resin. For example, as the synthetic resin forming the capsule body 24, low density polyethylene (NOVATEC LD manufactured by Japan Polyethylene Corporation) is usable.

[0032] As is obvious from FIG. 1, the capsule 22a has such a size as to be capable of being disposed in a cylindrical cavity which is secured between the filter elements 18 and 20 of the composite filter 16. For example, a length along a longitudinal direction of the capsule 22a is preferably shorter than a length along a longitudinal direction of the cavity by approximately 1 to 3 mm, and a maximum outside diameter of the capsule 22a is preferably smaller than an inside diameter of the cavity (diameters of the filter elements 18 and 20) by approximately 0.5 to 2 mm. More specifically, the maximum outside diameter of the capsule 22a is approximately 6 mm.

[0033] If the capsule 22a has the aforementioned size with respect to the cavity, not only production of the composite filter 16 which contains the capsule 22 in the cavity is facilitated, but also the user can easily recognize the capsule 22a in the composite filter 16, and further, a position and an orientation of the capsule 22a in the cavity are stabilized.

[0034] In the case of embodiment E1, as is clear from FIG. 2 and FIG. 3, the end wall 26 has a truncated cone shape, and includes a central portion 30 and a tapered portion 34. The central portion 30 has a diameter smaller

than a diameter of the end wall 26, while the tapered portion 34 forms an annular portion which connects the central portion 30 and a circumferential wall 32 of the capsule body 24. The central portion 30 has a diameter Dc (see FIG. 4) of 2 mm, for example, and a taper angle α of the tapered portion 34 is 45°, for example. In addition, an outside diameter, an inside diameter and a wall thickness of the circumferential wall 32 are gradually decreased slightly toward the tapered portion 34 from the open end 28. Therefore, strictly speaking, the circumferential wall 32 also forms a taper shape, and the diameter of the end wall 26 is smaller than a diameter of the open end 28, and a thickness of an end of the circumferential wall 32 adjacent to the end wall 26 corresponds to a thickness Tt of the tapered portion 34. For example, the thickness Tt is 0.3 mm.

[0035] A thickness Tc of the central portion 30 is smaller than the thickness Tt of the tapered portion 34. For example, the thickness Tc is preferably from 0.1 mm to 0.2 mm. In the case of embodiment E1, a whole of the central portion 30 forms a thin-walled region. Further, a rod-shaped protrusion 36 is formed in a center of the central portion 30, and the protrusion 36 protrudes toward outside the capsule body 24. A diameter Dp and a protrusion length L of the protrusion 36 are respectively 0.4 to 0.5 mm and 0.4 mm, for example.

[0036] The open end 28 of the capsule body 24 has a flange 38 on an outer circumference thereof, and a thickness and an outside diameter of the flange 38 are respectively 0.5 mm and 6.6 mm, for example. The open end 28 is liquid-tightly closed by a seal member 40 as a closure wall. The seal member 40 is a sheet having flexibility, and is bonded to the flange 38 without inhibiting the elastic deformation of the capsule body 24.

[0037] For example, the seal member 40 is formed by a polyamide/low density polyethylene laminate sheet (NY #15/DL/LC-21, 50μm, manufactured by TAMAPOLY CO., LTD.), and is bonded to the flange 38 by a heat seal. As compared with the case in which the seal member 40 is directly bonded to the open end 28, a contact area (a heat seal area) between the seal member 40 and the flange 38 increases when the seal member 40 is bonded to the flange 38, and therefore, the seal strength of the seal member 40 is increased.

[0038] The capsule body 24 and the seal member 40 described above form the capsule 22a, and the capsule 22a like this contains a liquid inside it. For example, as the liquid which is contained in the capsule 22a, in addition to distilled water, an aqueous solution in which an additive such as an aroma material is dissolved in the distilled water is conceivable.

[0039] The capsule 22a of embodiment E1 described above contains 130 mg of liquid, for example. When the capsule 22a is disposed in the composite filter 16, the capsule 22a has a posture in which the end wall 26 is oriented to the filter element 18 at the cigarette 12 side, as is obvious from FIG. 1.

[0040] According to the filter cigarette 10 in which the capsule 22a is incorporated, the user holds the composite filter 16 with the fingers via the tip paper 14 prior to smoking the filter cigarette 10 or between puffs, and the external force F (see FIG. 1) can be applied to the capsule 22a in the composite filter 16 from both sides in a diameter direction of the capsule 22a. The external force F like this is followed by the elastic deformation of the capsule body 24, and crushes the capsule 22a. As a result, an internal pressure of the capsule 22a is increased.

[0041] As described above, the circumferential wall 32 of the capsule body 24 has the flange 38 at the open end 28, and slightly forms the taper shape, and therefore, in the circumferential wall 32, a portion at the end wall 26 side is crushed more easily as compared with a portion at the flange 38 side.

[0042] Therefore, the increase of the internal pressure in the capsule 22a causes the end wall 26 to bulge toward the outside. That is, the taper portion 34 of the end wall 26 is elastically deformed so as to expand toward the outside. The elastic deformation of the tapered portion 34 pulls the central portion 30 toward the outside in the radial direction with respect to the protrusion 36. Therefore, a specific area adjacent to a root of the protrusion 36 in the central portion 30 is especially stretched, and the thickness of the specific area significantly decreases. As a result, the central portion 30 is broken first in the specific area. In this case, the protrusion 36 becomes a trigger at the time of breaking the specific area of the central portion 30 and has a function of determining the breaking position in the central portion 30 and facilitating breakage of the central portion 30 as a thin-walled region.

[0043] Once the central portion 30 is broken, the internal pressure of the capsule 22a abruptly reduces, and the breakage of the central portion 30 does not further progress. Therefore, the breaking spot is limited to the specific area adjacent to the protrusion 36. Further abrupt reduction in the internal pressure is sensed by the user through the fingers of the user, and the user can confirm the breakage of the capsule 22a.

[0044] If the user keeps crushing the capsule 22a after the breakage of the central portion 30, the liquid in the capsule 22a spouts toward the filter element 18 from the breaking spot of the central portion 30, and soaks into the filter element 18.

[0045] Since the breaking position of the central portion 30 is limited to the specific position adjacent to the root of the protrusion 36, that is, the center of the end wall 26 as described above, the liquid spouted from the capsule 22a soaks into the center of the end surface in the filter element 18, and forms a liquid soaked area LA (FIG. 1) in a central region in the filter element 18. Accordingly the liquid spouted from the capsule 22a does not wet the tubular shaped paper and the tip paper of the composite filter 16.

[0046] If the filter cigarette 10 is smoked in a state in which the liquid soaks into the filter element 18, the water-soluble component contained in the mainstream smoke dissolves into the liquid in the filter element 18, and there-

fore, the water-soluble component in the mainstream smoke passing through the filter element 18 decreases, whereby the flavor and the taste of the mainstream smoke change. If an aroma material is contained in the liquid, the fragrance and flavor of the aroma material are added to the mainstream smoke, and the user also can enjoy the fragrance and the flavor of the aroma material at the same time.

[0047] The present invention is not limited to the capsule 22a of embodiment E1 described above.

[0048] Modifications and the other embodiments of the capsule 22 will be described hereinafter. Note that on explanation of the modifications and the other embodiments, members and portions which exhibit the same functions as the members and the portions of the embodiment and modification already described are assigned with the same reference sings, and explanation thereof will be omitted.

[0049] FIG. 5 to FIG. 8 respectively show modifications of the capsule 22a of embodiment E1. Capsules $22a_1$ to $22a_4$ of these modifications differ in the following points when compared with the capsule 22a of embodiment E1 or the capsule of the modification already described.

[0050] In more detail, the capsule $22a_1$ in FIG. 5 differs from the capsule 22a in a point that a protrusion length L1 of the protrusion 36 is increased to 1.0 mm.

[0051] The capsule $22a_2$ in FIG. 6 differs from the capsule $22a_1$ in a point that the end wall 26 has a cup shape.

[0052] The capsule $22a_3$ in FIG. 7 differs from the capsule 22a in a point that a diameter Dc1 of the central portion 30 is increased to 3 mm.

[0053] The capsule $22a_4$ in FIG. 8 differs from the capsule $22a_3$ in a point that the protrusion length L1 of the protrusion 36 is increased to 1.0 mm.

[0054] Needless to say, the capsule $22a_1$ to $22a_4$ have similar advantages to the advantage of the capsule 22a of embodiment E1.

[0055] FIG. 9 to FIG. 11 respectively show a capsule 22b of embodiment E2 and a part of the capsule 22b.

[0056] The capsule 22b differs from a group of the capsule 22a of embodiment E1 only in the shape of the central portion 30.

[0057] In the case of the capsule 22b, a central portion 42 has a plurality of V-shaped grooves 44 as a thin-walled region, while having a thickness Tc1 substantially the same as a thickness of the other region of the capsule body 24. The V-shaped grooves 44 are disposed radially on an outer surface of the central portion 42 with the protrusion 36 as a center, and extend to an outer circumference of the central portion 42 from the root of the protrusion 36. As shown in FIG. 11, a V-shape angle β of each of the V-shaped grooves 44 is 90°, for example, and a thickness Tc2 of a bottom of the V-shaped groove 44 is 0.17 mm, for example.

[0058] When the external force F is applied to the capsule 22b, the tapered portion 34 of the end wall 26 is expanded by elastic deformation as described above. Therefore, the bottom of each of the V-shaped grooves 44 is pulled outward in the radial direction of the end wall 26 with respect to the protrusion 36, the bottom is especially stretched at a specific area adjacent to the root of the protrusion 36, and the thickness of the bottom is reduced. As a result, the bottom of any of the V-shaped grooves 44 is broken first in the specific area, and from the breaking spot, the liquid in the capsule 22b is spouted.

[0059] Note that once any of the V-shaped grooves is broken, the internal pressure of the capsule 22b abruptly reduces, and therefore, the breaking spot is not further enlarged on the broken bottom of the V-shaped groove thereafter, or the bottoms of the other V-shaped grooves are not broken.

[0060] FIG. 12 and FIG. 13 show a capsule 22c of embodiment E3.

[0061] A capsule 22c differs from the capsule 22a only in the shape of the central portion 30 of the end wall 26. In more detail, namely, a central portion 46 of the capsule 22c is not flat, but is formed as a concave wall in a spherical shape which is recessed toward the inside of the capsule body 24, and has the diameter Dc and the wall thickness Tc.

[0062] In the capsule 22c like this, the central portion 46 is pulled outward in the radial direction from the protrusion 36 when the external force F is applied to the capsule 22c, and the central portion 46 is broken first in a specific area adjacent to the protrusion 36.

[0063] FIG. 14 to FIG. 17 respectively show a capsule 22d of embodiment E4 and a part thereof.

[0064] When the capsule 22b and the capsule 22d are compared, the capsule 22d differs in the following point.

[0065] The end wall 26 of the capsule 22d does not have the tapered portion 34, and a whole of the end wall 26 is formed as a flat wall. Further, in the case of the capsule 22d, the V-shaped groove 44 extends to the outer circumference of the end wall 26 from the protrusion 36, and has a bottom of a thickness Tc3. The thickness Tc3 is a value between Tc (0.12 mm) and Tc2 (0.17 mm), for example, 0.13 mm.

[0066] Furthermore, in the case of the capsule 22d, while a diameter Dp1 of the protrusion 36 is increased to 0.8 mm, a plurality of thin ribs 48 are formed on an inner circumferential surface of the capsule body 24 as is obvious from FIG. 16. These ribs 48 are disposed at equal intervals in a circumferential direction of the capsule body 24, and extend in an axial direction of the capsule body 24 to the open end 28 from the end wall 26. For example, a thickness of the rib 48 is 0.2 mm.

[0067] In the capsule 22d like this, a bottom of any of the V-shaped grooves 44 is broken first in a specific area adjacent to the root of the protrusion 36 when the external force F is applied to the capsule 22d.

[0068] FIG. 18 to FIG. 20 show a capsule 22e of embodiment E5.

[0069] In the case of the capsule 22e, the end wall 26 of the capsule body 24 is also formed as a recessed wall, and has an annular flat outer circumferential portion 70, and a central portion 72 which is recessed more than the

outer circumferential portion 70, and the central portion 72 is formed as a spherical wall similarly to the central portion 46 of the aforementioned capsule 22c.

[0070] The central portion 72 includes the protrusion 36 in a center thereof and an annular region 74 as a thin-walled region. The annular region 74 is adjacent to the root of the protrusion 36, surrounds the protrusion 36, and has the aforementioned thickness Tc. A thickness of the central portion 72 gradually increases as it is closer to the outer circumferential portion 70 from the annular region 74, and as shown in FIG. 19, an outer periphery of the central portion 72 connects to a corner edge at an inner side of an inner circumferential surface in the outer circumferential portion 70. Furthermore, a distal end surface of the protrusion 36 and an outer end surface of the outer circumferential portion 70 are located on the same virtual plane.

[0071] FIG. 21 to FIG. 23 show a capsule 22f of embodiment E6.

[0072] In the case of the capsule 22f, the end wall 26 of the capsule body 24 is formed as a concave wall, and the outer circumferential portion 70 of the end wall 26 forms an extended portion of the circumferential wall 32.

[0073] As is obvious from FIG. 22, a central portion 74 of the end wall 26 has a female conical shape, and is slightly recessed toward the inside of the capsule body 24. On an inner surface of the central portion 74, a plurality of V-shaped grooves 44 are formed as thin-walled regions similarly to the capsule 22b in FIG. 9. These V-shaped grooves 44 are disposed at equal intervals in the circumferential direction of the capsule body 24, and extend radially to the outer circumferential portion 70 from the protrusion 36. Note that in FIG. 22, only one of the V-shaped grooves 44 is shown.

[0074] Furthermore, a plurality of ribs 76 are integrally formed on the circumferential wall 32 of the capsule body 24. These ribs 76 extend in the axial direction of the capsule body 24 to the flange 38 from a distal end of the outer circumferential portion 70, and are disposed at equal intervals in the circumferential direction of the capsule body 24.

[0075] A width of the aforementioned rib 76 is not constant along the axial direction of the capsule body 24, and is gradually decreased toward the distal end of the outer circumferential portion 70 from the flange 38 as is obvious from FIG. 23.

[0076] FIG. 24 shows breaking loads (average values and standard deviations (S. D.)) of the capsules 22a to 22f of embodiments E1 to E6 respectively. The result of FIG. 24 is obtained by measuring the breaking loads at the point of time when the external force F is applied to the capsules 22a to 22f, and the central portions 30 and 46, or V-shaped grooves 44 of these capsules are broken at the aforementioned specific areas. Further, FIG. 24 also shows the measurement result of the breaking loads of the capsules in comparative examples C1 to C4 in combination.

[0077] Each of the capsules is filled with a liquid (distilled water) which occupies 94% of a capacity of the capsule, and in measurement of the breaking load, a creep meter (RHEOMETER II, manufactured by YAMADEN co., ltd.) is used.

[0078] Before the measurement result in FIG. 24 is mentioned, the capsules of comparative examples C1 to C4 will be briefly described. The capsules of comparative examples C1 to C4 basically have structures similar to those of the capsules 22a to 22d of embodiments E1 to E4, but differ in the following point.

[0079] FIG. 25 and FIG. 26 show a capsule of comparative example C1.

[0080] The capsule of comparative example C1 has a capsule body which has a substantially hexagonal shape and is slightly tapered, and an end wall 50 in a shape of a flat hexagonal pyramid. As is obvious from FIG. 26, each ridge of the end wall 50 has V-shaped grooves 52a and 52b respectively on outer and inner sides of the ridge , and the V-shaped grooves 52a and 52b form a thin-walled region that extends along the ridge. Therefore, a thickness of a bottom of the V-shaped grooves 52a and 52b is smaller than a thickness (for example, 0.45 mm) of the ridge, and is 0.12 mm, for example. According to the capsule of comparative example C1, any of the V-shaped grooves 52 of the end wall 50 is firstly broken in a bottom thereof when the aforementioned external force F is applied to the capsule.

[0081] FIG. 27 and FIG. 28 show a capsule of comparative example C2.

[0082] When comparative examples C1 and C2 are compared, the capsule of comparative example C2 differs from the capsule of comparative example C1 in a point that the capsule of comparative example C2 includes an end wall 54 having a shape of a flat truncated hexagonal pyramid, and on each of ridges of the end wall 54, and a V-shaped groove 56 similar to the V-shaped grooves 52a and 52b is formed only on an inner side of the ridge, respectively. In the case of the capsule of comparative example C2, any of the V-shaped grooves 56 of the end wall 54 is firstly broken in a bottom thereof, when the aforementioned external force F is applied to the capsule.

[0083] FIG. 29 and FIG. 30 show a capsule of comparative example C3.

[0084] The capsule of comparative example C3 is of the same type as the capsule of Patent Document 1 described above, and includes a cylindrical capsule body, a flat end wall 58, and a plurality of V-shaped grooves 60 as thin-walled regions which are formed on only an inner surface of the end wall 58. These V-shaped grooves 60 are radially distributed with a central portion of the end wall 58 left. Note that a thickness of a bottom of the V-shaped groove 60 is 0.13 mm.

[0085] Though not illustrated, a capsule of comparative example C4 differs from the capsule 22a only a point that the capsule of comparative example C4 does not have the protrusion 36, when the capsule is compared with the capsule 22a of embodiment E1.

[0086] As is obvious from FIG. 24, except for the capsule of comparative example C3, all the capsules of embodiments E1 to E6 and comparative examples C1, C2 and C4 have the breaking loads of 20 to 80 N. If the breaking load is within the range like this, the user can easily break the capsule. In this regard, the breaking load of the capsule of comparative example C3 corresponding to the capsule of Patent Document 1 exceeds 80 N, and breaking this capsule is not easy.

[0087] Meanwhile, the capsules of comparative examples C1 to C4 do not have the protrusions 36 which the capsules 22a to 22d of embodiments E1 to E4 have. Therefore, in the case of the capsules of comparative examples C1 to C4, the breaking position in the end wall cannot be determined. Further, the breaking loads of the capsules of embodiments E1 to E6 are smaller than the breaking loads of the capsules of comparative examples C2, C3 and C4. This shows that the protrusion 36 not only determines the breaking position in the end wall, but also contributes to reduction of the breaking load.

[0088] Furthermore, in the case of each of the capsules 22e and 22f of embodiments E5 and E6, the end wall 26 has the annular outer circumferential portion 70 which protrudes outward from the central portion 72 in addition to the protrusion 36. The outer circumferential portion 70 like this increases rigidity of the end wall 26. Therefore, in the case of the capsules 22e and 22f, the end wall 26 is deformed into an elliptical shape when the external force F applied to the capsule body 24 is transmitted to the end wall 26, and the central portion 72 is significantly pulled especially along a longitudinal axis of the ellipse.

[0089] In this case, the thin-walled regions (the annular region 74 and the V-shaped grooves 44) of the end wall 26 are easily broken at the root of the protrusion 36. Accordingly, as is obvious from FIG. 24, the capsules 22e and 22f of embodiments E5 and E6 have the breaking loads smaller than the breaking loads of the capsules 22a to 22d of embodiments E1 to E4. The breaking loads of the capsules 22e and 22f are about the same as the breaking load of the seamless capsule incorporated in a commercially available filter cigarette.

[0090] Meanwhile, in the case of the capsule 22c of embodiment E3, when a filling rate of a liquid (distilled water) was changed to 71% (v/v), 46% (v/v), and 21% (v/v) of the capacity of the capsule 22c, the breaking loads of the capsule 22c were 64.4 N, 70.1 N, and 95.0 N respectively. This means that the breaking load of the capsule varies in accordance with the filling rate of the liquid contained in the capsule, and as the filling rate of the liquid is higher, the breaking load of the capsule decreases. Therefore, as long as a hindrance does not occur to manufacture of a capsule, a higher filling rate of the liquid into the capsule is desirable.

[0091] FIG. 31 to FIG. 33 relate to the capsule 22a, the capsule 22e and the capsule 22f, and show relations between loads repeatedly applied to the capsule bodies of the capsules and distortions of the end walls in the capsule bodies. As is obvious when FIG. 31 to FIG. 33 are compared, it is found that the capsules 22e and 22f are distorted significantly with small loads as compared with the capsule 22a.

[0092] Furthermore, the ribs 76 of the capsule 22f increase rigidity of the circumferential wall 32 more than the rigidity of the circumferential wall 32 of the capsule 22e. Further, in the case of the capsule 22f, the central portion 72 has the female conical shape, and therefore, the external force F transmitted to the end wall 26 effectively concentrates on the root of the protrusion 36. As a result, the breaking load of the capsule 22f becomes smaller than the breaking load of the capsule 22e. Therefore, the capsule 22e may also have the ribs 76.

[0093] Meanwhile, the outer circumferential portion 70 effectively works in inhibiting an undesired external force from being directly applied to the protrusion 36. Therefore, the possibility of the capsules 22e and 22f being undesirably broken can be decreased at the time of manufacture of filter cigarettes.

[0094] Finally, the present invention is not limited by embodiment E1 and the modifications thereof and embodiments E2 to E6 mentioned above.

[0095] For example, while the capsule body 24 and the seal member 40 as a closure wall are both formed from low density polyethylene, the capsule body and the closure wall of the present invention can be also formed by a synthetic resin other than low density polyethylene, and are further formable from materials other than synthetic resins.

[0096] For example, while the capsule body 24 of the capsule 22a has a tapered shape in which the end wall 26 side has a small diameter, the capsule body of the present invention may be in a straight cylindrical shape, or a tapered shape in which the open end side has a small diameter.

[0097] Further, the end wall of the capsule body of the present invention is not limited to the truncated conical shape, the cup shape, a flat shape, a concave shape, or the like illustrated in the aforementioned embodiment, and further, the central portion of the end wall is not limited to the flat wall or the spherical wall as illustrated, either.

[0098] Further, the entire region of the end wall of the capsule body may form the thin-walled region, and the groove as the thin-walled region can have a shape other than the V-shape. Further, disposition of the groove is not limited to the radial shape, either.

[0099] The thickness of the thin-walled region is preferably from 0.12 mm to 0.17 mm in the range illustrated with respect to the capsule 22a, on the condition that the thickness of the thin-walled region is smaller than the thicknesses of the end wall and the circumferential wall of the capsule body.

[0100] The capsule body 24 of the capsule 22d has the plurality of ribs 48 on the inner circumferential surface thereof, whereas the capsule body 24 of the capsule 22f has the plurality of ribs 76 on the outer circumferential surface thereof. These ribs 48 and 76 are also similarly applicable to the capsules of the other embodiments and

the modifications described above.

[0101] In the case of the capsule body 24 of the capsule 22f, the central portion 72 of the end wall 26 may be a flat wall, and the annular outer circumferential portion 70 (the extended portion of the circumferential wall 32) is also applicable to the capsules of the other embodiments and the modifications.

[0102] In short, if only the capsule of the present invention includes the basic structure constituted of the capsule body, the thin-walled region, the protrusion and the closure wall, the other components (the shapes, disposition and the like) which the capsules of the respective embodiments have are applicable by being optionally combined with the capsules of the other embodiments.

[0103] Furthermore, it is needless to say that the capsule of the present invention can be not only incorporated into the filter of a filter cigarette, but also incorporated similarly into various smoking articles equipped with filters.

Explanation of Reference Signs

[0104]

10 Filter cigarette
14 Tip paper
16 Composite filter
18, 20 Filter element
22 ((22a to 22f) Capsule
26 End wall
28 Open end
30, 46 Central portion (thin-walled region)
32 Circumferential wall
34 Tapered portion (annular portion)
36 Protrusion
40 Seal member
42, 72 Central portion
44 V-shaped groove (thin-walled region)
70 Outer circumferential portion
48, 76 Rib

Claims

1. A capsule containing a liquid, comprising:

an elastically deformable capsule body that has a substantially cylindrical shape, includes an end wall closing a distal end thereof and an open end opening a proximal end thereof, and receives a liquid therein;
a thin-walled region formed on the end wall of said capsule body, said thin-walled region being thinner than thicknesses of the end wall and a circumferential wall of said capsule body;
a protrusion integrally protruding from said thin-walled region toward an outside of said capsule body; and
a closure wall provided at the open end of said capsule body, said closure wall closing the open end.

2. The capsule according to claim 1,
wherein the capsule has such a size as to be capable of being incorporated into a smoking article.

3. The capsule according to claim 1,
wherein the end wall has a truncated conical shape or a cup shape.

4. The capsule according to claim 1,
wherein the end wall has a truncated conical shape or a cup shape, and includes a central portion surrounding said protrusion and having a diameter smaller than a diameter of the end wall, and an annular portion connecting the central portion and the circumferential wall of said capsule body, and
said thin-walled region is formed in the central portion.

5. The capsule according to claim 4,
wherein the central portion is a concave wall in a spherical shape.

6. The capsule according to claim 4,
wherein said thin-walled region includes a plurality of V-shaped grooves extending radially to an outer circumference of the central portion from said protrusion.

7. The capsule according to claim 1,
wherein the end wall is flat, and
said thin-walled region includes a plurality of V-shaped grooves extending radially to an outer circumference of the end wall from said protrusion.

8. The capsule according to claim 1,
wherein said capsule body has an annular extended portion integrally extending from an outer circumferential edge of the end wall, and
the extended portion and the end wall cooperate with each other to form a distal end portion of the capsule into a concave shape.

9. The capsule according to claim 8,
wherein said thin-walled region includes a plurality of V-shaped grooves extending radially to the extended portion from said protrusion.

10. The capsule according to claim 8,
wherein the end wall is a concave wall in a spherical shape, and
said thin-walled region has an annular shape adjacent to said protrusion and surrounding said protrusion.

11. The capsule according to claim 1, wherein said capsule body further includes a plurality of ribs on the circumferential wall, and these ribs are disposed at intervals in a circumferential direction of said capsule body.

12. The capsule according to any one of claims 1 to 11, wherein said capsule body further includes a flange formed on an outer circumference of the open end, and
said closure wall is a seal member in a sheet shape, said closure wall being connected to the flange to close the open end liquid-tightly.

13. A smoking article, comprising:

the capsule according to any one of claims 1 to 12.

FIG. 1

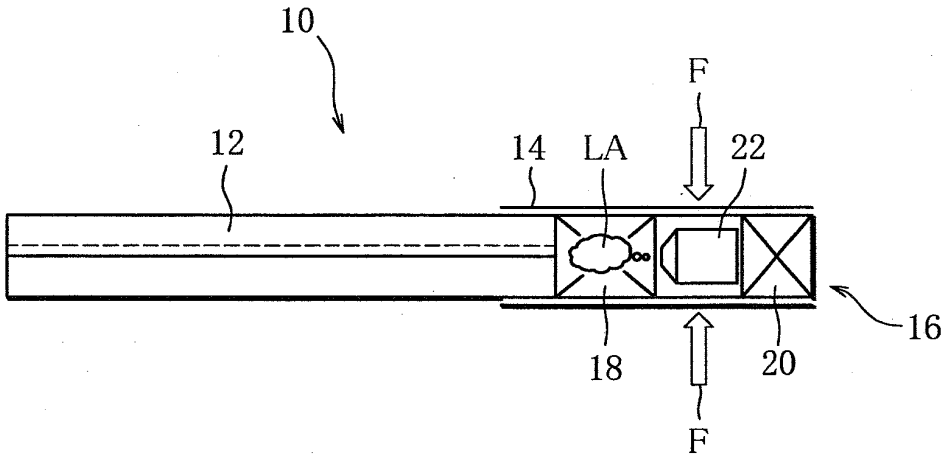


FIG. 2

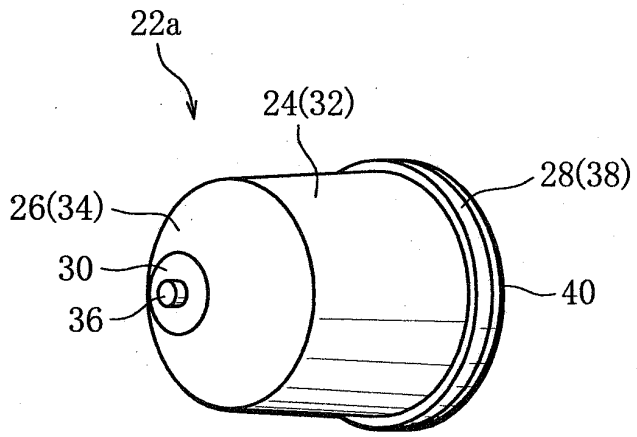


FIG. 3

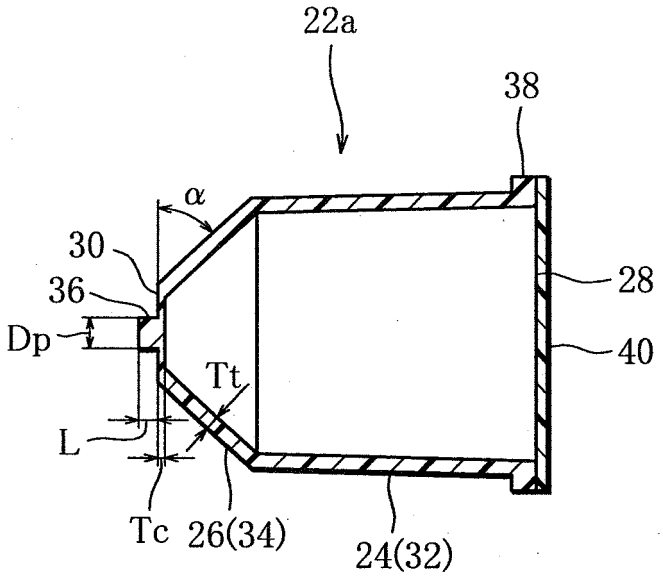


FIG. 4

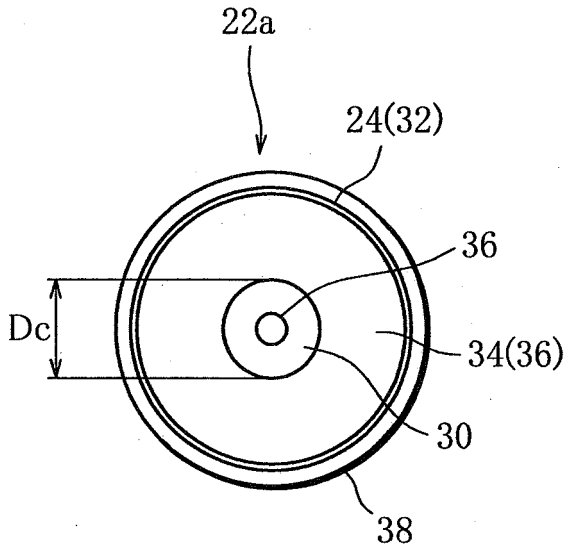


FIG. 5

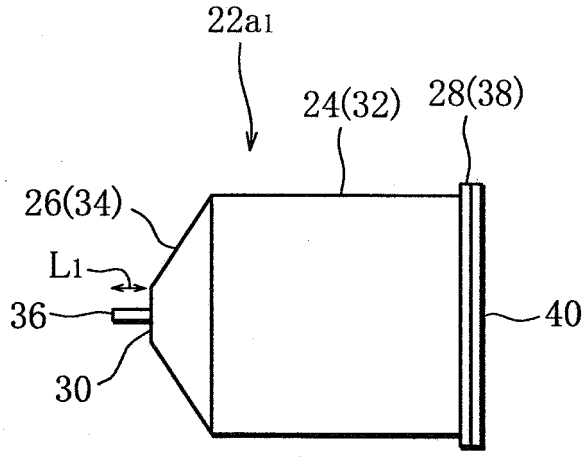


FIG. 6

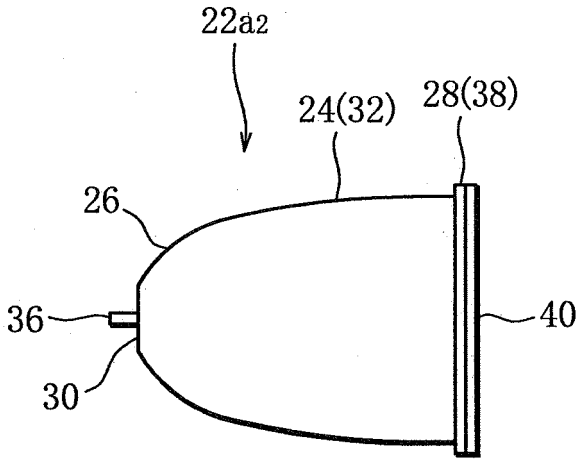


FIG. 7

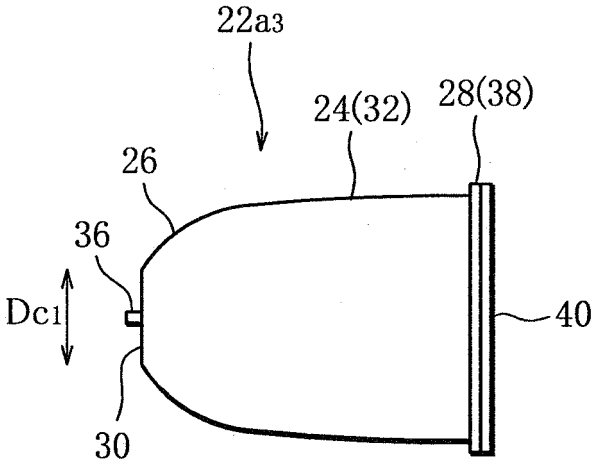


FIG. 8

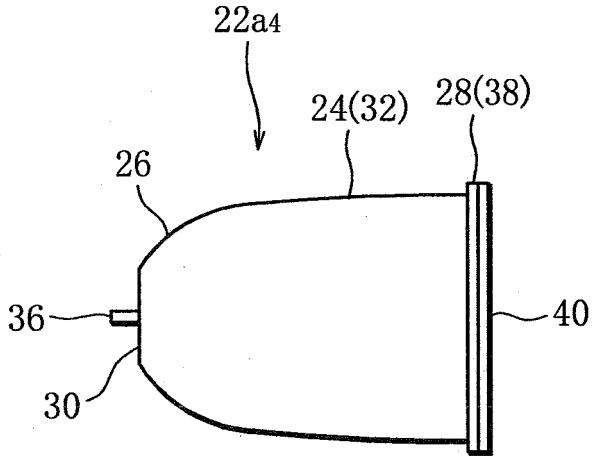


FIG. 9

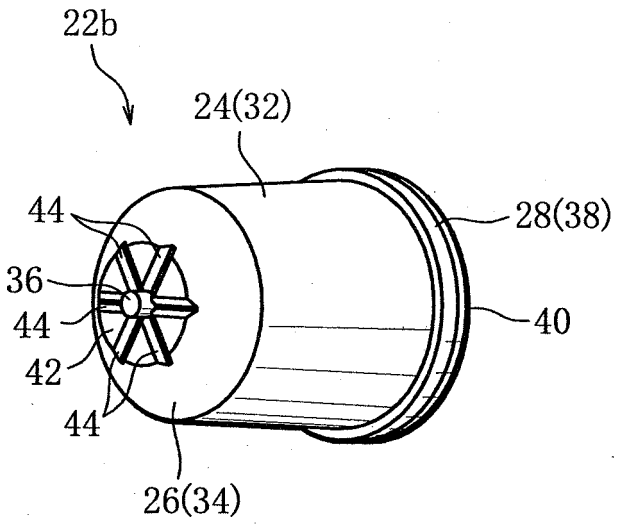

22b
24(32)
44
28(38)
36
44
40
42
44
26(34)

FIG. 10

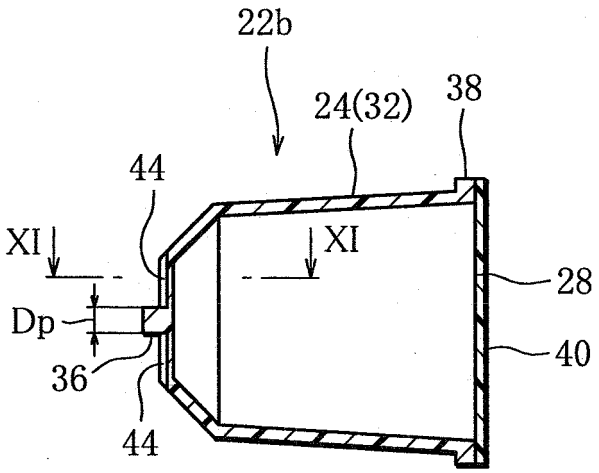
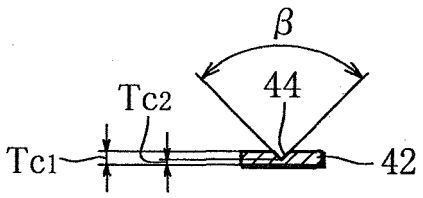

22b
24(32)
38
44
XI
XI
28
Dp
40
36
44

FIG. 11



XI-XI SECTION

FIG. 12

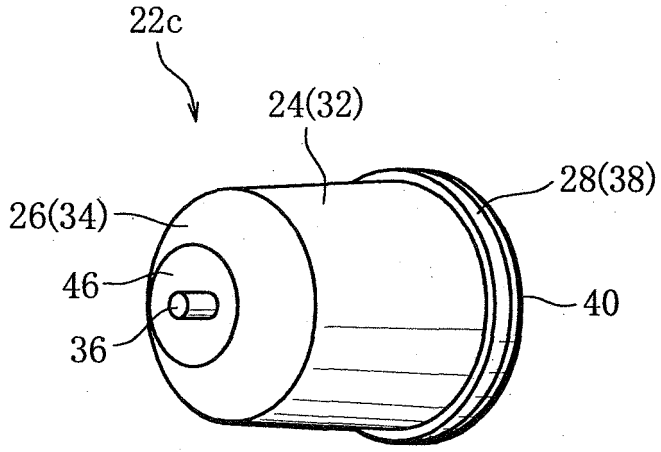


FIG. 13

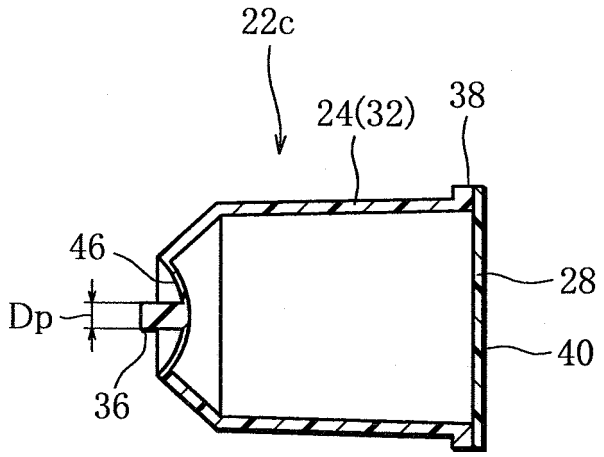


FIG. 14

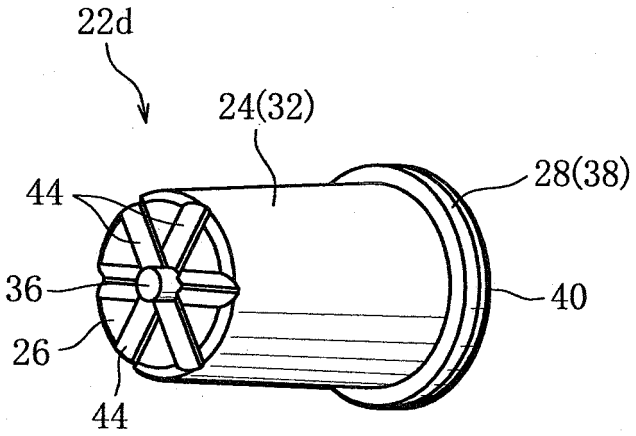


FIG. 15

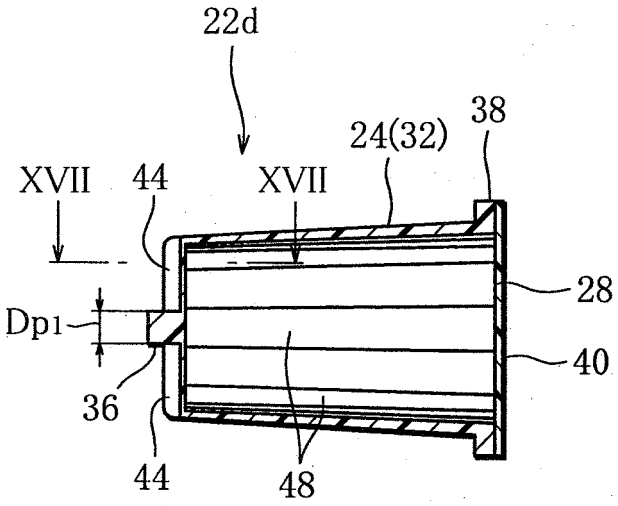


FIG. 16

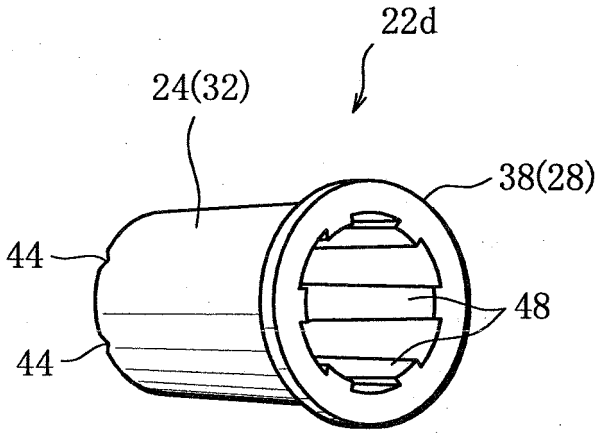
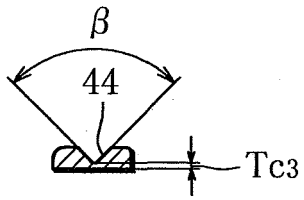


FIG. 17



XVII-XVII SECTION

FIG. 18

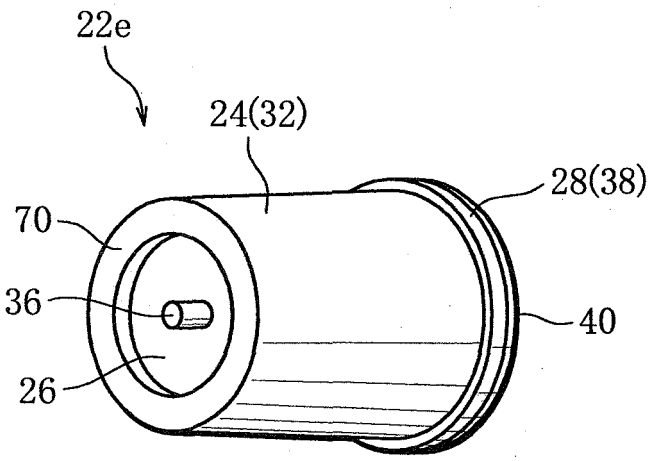


FIG. 19

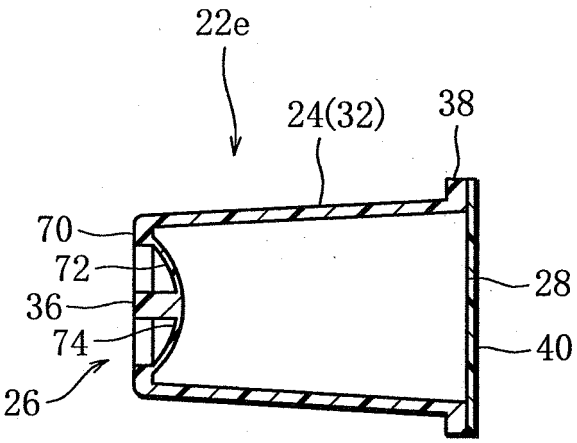


FIG. 20

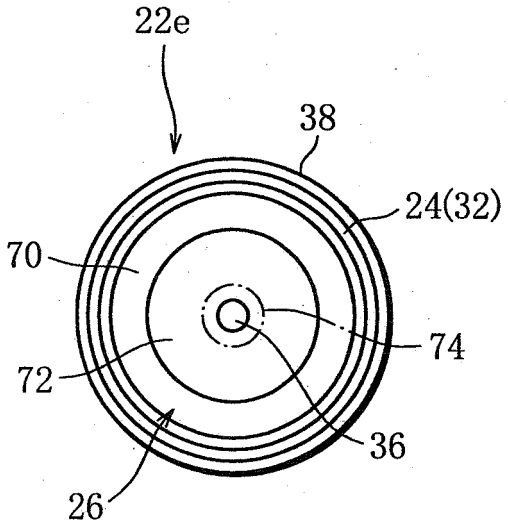


FIG. 21

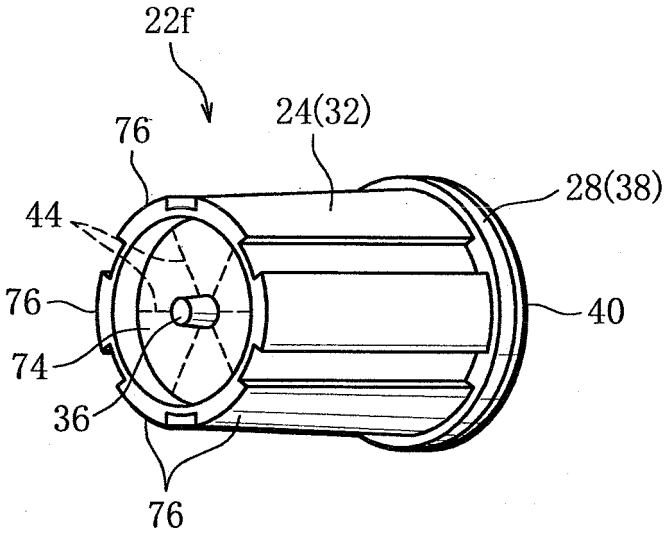

22f
24(32)
76
28(38)
44
76
40
74
36
76

FIG. 22

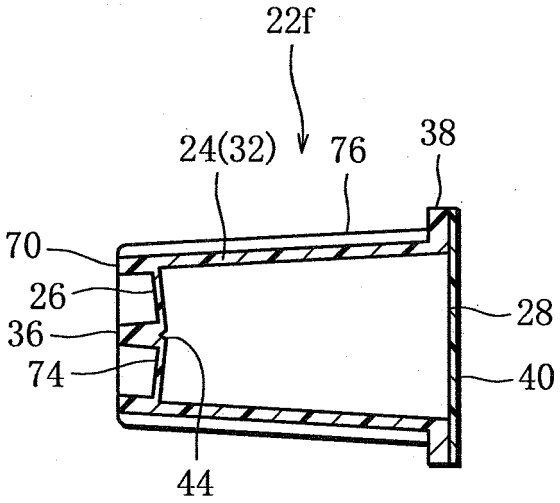

22f
24(32)
76
38
70
26
28
36
74
40
44

FIG. 23

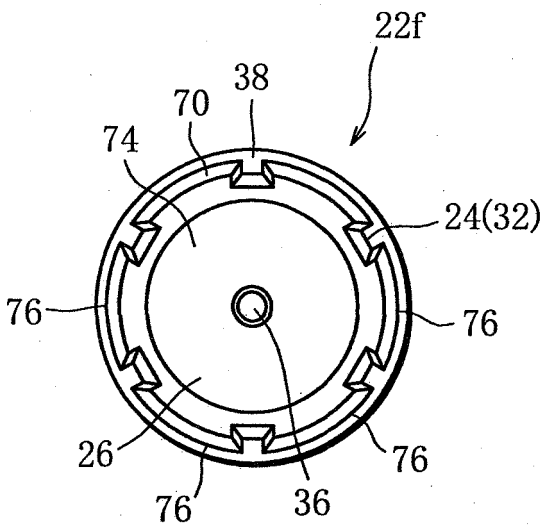

22f
38
70
74
24(32)
76
76
26
76
76
36

FIG. 24

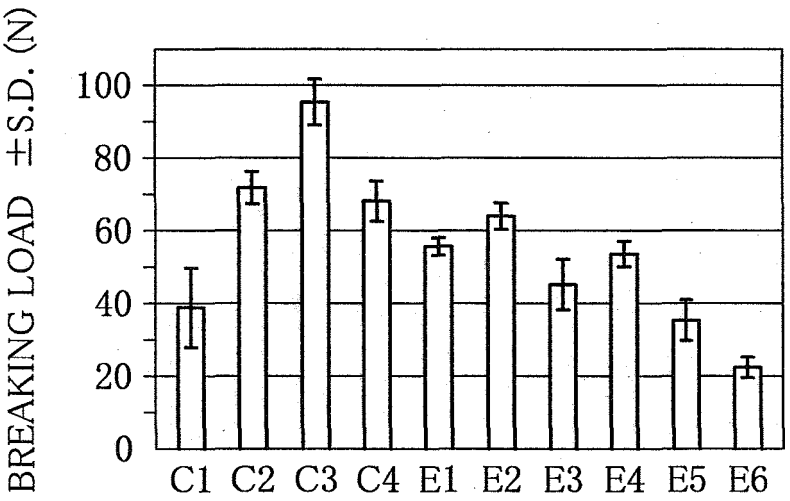

BREAKING LOAD ±S.D. (N)
100
80
60
40
20
0
C1
C2
C3
C4
E1
E2
E3
E4
E5
E6

FIG. 25

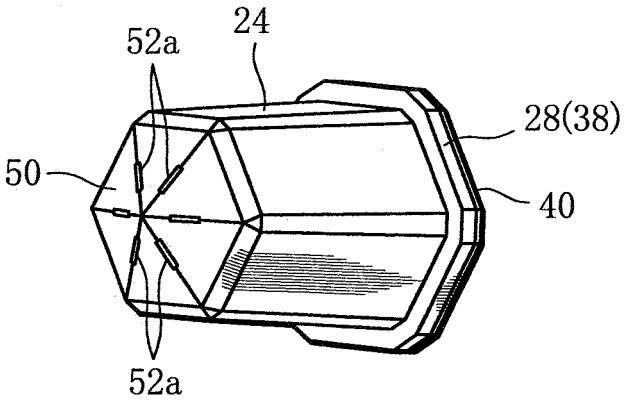


FIG. 26

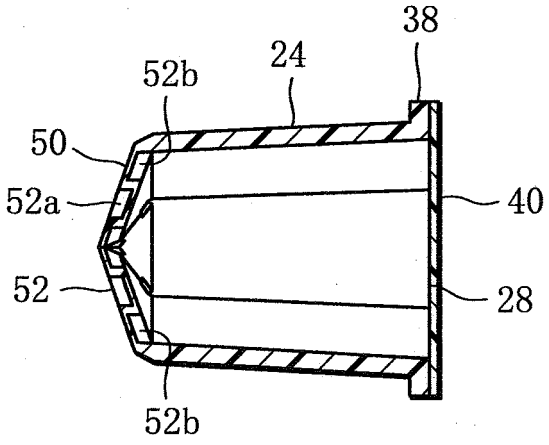


FIG. 27

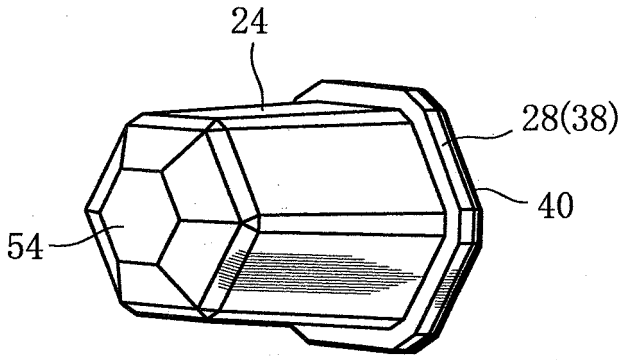


FIG. 28

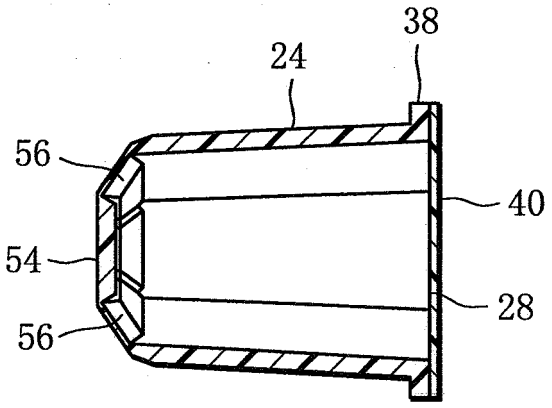


FIG. 29

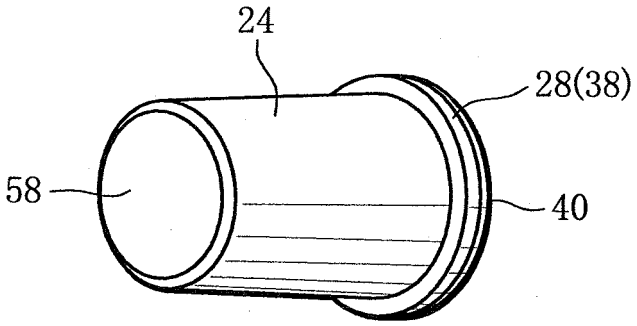


FIG. 30

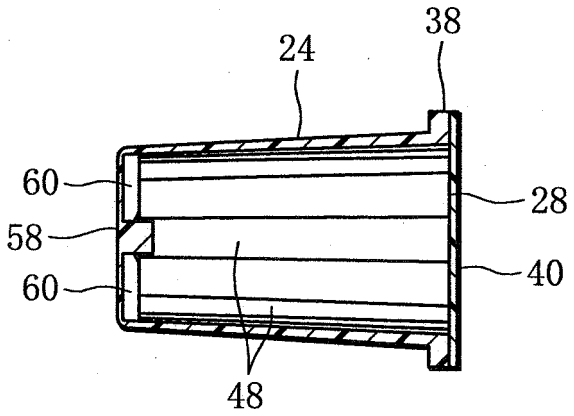


FIG. 31

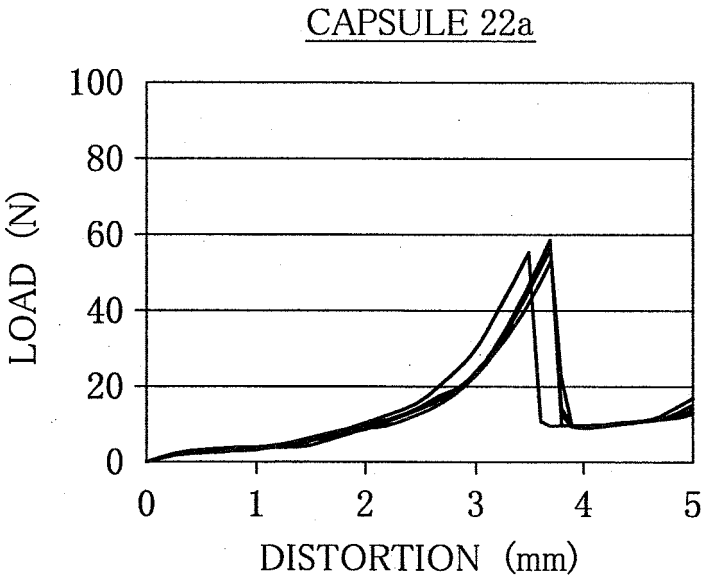

CAPSULE 22a
100
80
60
40
20
0
LOAD (N)
0
1
2
3
4
5
DISTORTION (mm)

FIG. 32

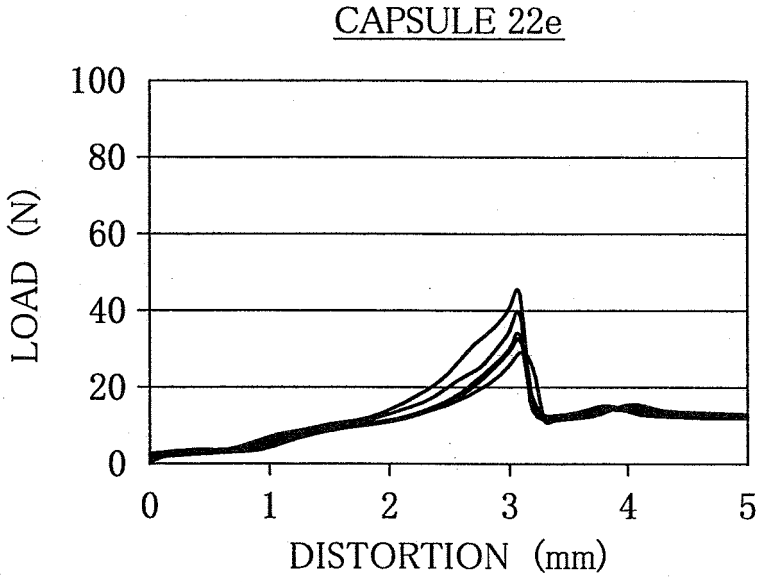
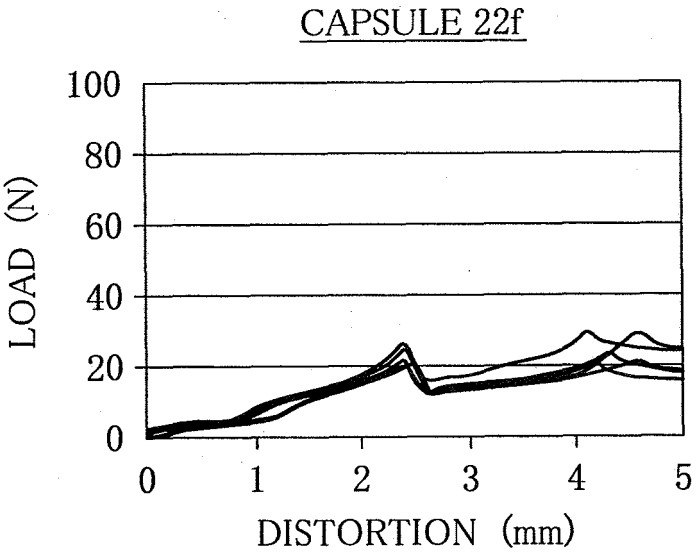

CAPSULE 22e
100
80
60
40
20
0
LOAD (N)
0
1
2
3
4
5
DISTORTION (mm)

FIG. 33



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/062417

A. CLASSIFICATION OF SUBJECT MATTER
A24D3/04(2006.01)i, *A24D3/16*(2006.01)i, *B65D83/00*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24D3/04, A24D3/16, B65D83/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 64-037347 A (Dainippon Printing Co., Ltd.), 08 February 1989 (08.02.1989), entire text; all drawings & JP 2-48067 A & US 4865056 A & EP 276021 A2 & DE 3883017 A & DE 3883017 T & PH 25061 A & HK 84894 A & KR 10-1991-0000804 B & KR 10-1991-0007961 B	1-13
A	JP 06-002164 B1 (Japan Tobacco Inc.), 12 January 1994 (12.01.1994), entire text; fig. 2A to 4 & WO 92/01487 A1	1-13

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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25 July, 2013 (25.07.13)	06 August, 2013 (06.08.13)
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2515794 B2 (Japan Tobacco Inc.), 10 July 1996 (10.07.1996), entire text; all drawings & JP 63-276474 A	1-13
A	JP 2008-528053 A (Philip Morris Products S.A.), 31 July 2008 (31.07.2008), entire text; all drawings & JP 2011-250801 A & JP 5134970 B & JP 2013-55951 A & US 2006/0174901 A1 & EP 1850685 A & EP 2578094 A & EP 2578095 A & WO 2006/082529 A2 & KR 10-2007-0100422 A & CN 101115408 A & BRA PI0606129 & ZA 200705848 A & EA 200701666 A & AU 2006211051 A	1-13
A	JP 2005-318806 A (Isei JO), 17 November 2005 (17.11.2005), entire text; fig. 2 to 4 (Family: none)	1-13
P,A	WO 2013/061888 A1 (Japan Tobacco Inc.), 02 May 2013 (02.05.2013), entire text; all drawings (Family: none)	1-13

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Patent documents cited in the description

- JP 2515794 B **[0006]**
- JP 2008528053 A **[0006]**
- JP 2005318806 A **[0006]**