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(71) Applicant: **JT International SA**
1202 Geneva (CH)

(72) Inventors:
- **BOUCHUIGUIR, Layth Sliman**
  1293 Bellevue (SE)
- **MASON, Jon**
  London, W13 8QA (GB)
- **PLEVNIK, Marko**
  London, NW3 2JR (GB)
- **LYELL, Nathan**
  Surrey, GU22 7RN (GB)

(74) Representative: **Serjeants LLP**
Dock
75 Exploration Drive
Leicester, LE4 5NU (GB)

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(54) AEROSOL GENERATION DEVICE HAVING A THERMAL BRIDGE

(57) An aerosol generation device (100) has a heating chamber (102) into which an aerosol substrate is insertable for being heated to generate an aerosol. The heating chamber (102) is housed in a casing (110) and an aperture (103) is provided, through which the aerosol substrate is insertable into the heating chamber (102), e.g. through an open end (114) of the heating chamber (102). Insulation (121) is disposed between the heating chamber (102) and the casing (110) and a thermal bridge (119; 219) is arranged to dissipate heat from the heating chamber (102) to the casing (110), for example in the vicinity of the aperture (103) or from the open end (114) of the heating chamber (102).

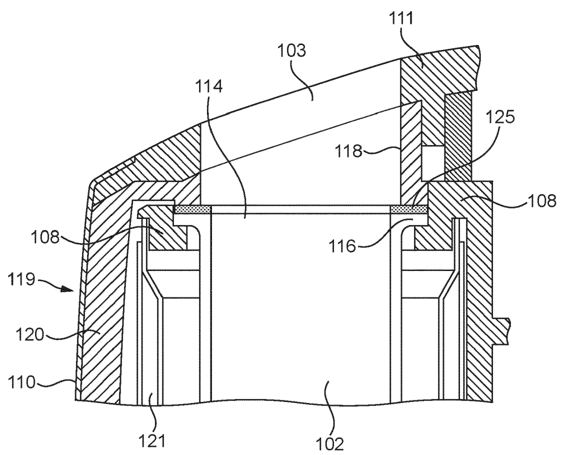

FIG. 7

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Description

Field of the Invention

[0001] The present disclosure relates to an aerosol generation device having a thermal bridge. The thermal bridge may dissipate heat from a heating chamber of the aerosol generation device to a casing of the aerosol generation device or to the exterior of the aerosol generation device. The disclosure is particularly, but not exclusively, applicable to a portable aerosol generation device, which may be self-contained and operate at low temperatures. Such devices may be configured to heat but not burn tobacco or other suitable aerosolisable material by conduction, convection, and/or radiation, to generate an aerosol for inhalation.

Background to the Disclosure

[0002] The popularity and use of reduced-risk or modified-risk devices (also known as vapourisers) has grown rapidly in the past few years as an aid to assist habitual smokers wishing to quit smoking traditional tobacco products such as cigarettes, cigars, cigarillos, and rolling tobacco. Various devices and systems are available that heat or warm aerosolisable substances as opposed to burning tobacco in conventional tobacco products.

[0003] A commonly available reduced-risk or modified-risk device is a heated substrate aerosol generation device or heat-not-burn device. Devices of this type generate an aerosol or vapour by heating an aerosol substrate that typically comprises moist leaf tobacco or other suitable aerosolisable material to a temperature typically in the range of 150°C to 300°C. Heating an aerosol substrate, but not combusting or burning it, releases an aerosol that comprises the components sought by the user but not the toxic and carcinogenic by-products of combustion and burning. Furthermore, the aerosol produced by heating the tobacco or other aersolisable material does not typically comprise the burnt or bitter taste resulting from combustion and burning that can be unpleasant for the user and so the substrate does not therefore require the sugars and other additives that are typically added to such materials to make the smoke and/or vapour more palatable for the user.

[0004] In order to minimise the time between the user first activating the device and the user being able to draw the desired aerosol from the aerosol substrate, it is desirable to heat the aerosol substrate as rapidly as possible to a temperature at which the aerosol may be released. This involves the use of a powerful heater, which inevitably causes the aerosol generation device as a whole to become hot. Moreover, the user may typically use the aerosol generation device over a fairly prolonged period, exacerbating problems associated with heating the overall aerosol generation device. If the aerosol generation device becomes too hot, it may become uncomfortable for the user to hold it in their hand. Worse, if there is any a risk that the user may be injured by the heat, the aerosol generation device would become completely unsuitable for consumer use.

[0005] Existing aerosol generation devices include insulation intended to reduce the transfer of heat from the heating chamber to the outside of the aerosol generation device, with varying degrees of effectiveness. However, aerosol generation devices have an opening or aperture through which the aerosol substrate is inserted into the heating chamber, and heat generated during the heating of the aerosol substrate is inclined to escape out of this opening by radiation, convection and/or conduction. This is hard to mitigate and can be particularly problematic in aerosol generation devices used by the user bringing their mouth and lips into close proximity with the opening during use, e.g. to draw the aerosol from the device.

Summary of the Disclosure

[0006] Aspects of the disclosure are set out in the accompanying claims.

[0007] According to one aspect of the disclosure, there is provided an aerosol generation device comprising: a heating chamber into which an aerosol substrate is insertable for being heated to generate an aerosol; a casing in which the heating chamber is housed; an aperture through which the aerosol substrate is insertable into the heating chamber; insulation disposed at least partially between the heating chamber and the casing; and a thermal bridge arranged to dissipate heat from the heating chamber to the casing.

[0008] The thermal bridge may provide a way to conduct heat away from the heating chamber and around the casing, so it may be dispersed to the surroundings. Effectively, the thermal bridge may act as a heat sink. However, by conducting heat to the casing, the ability of the aerosol generation device to dissipate the heat may be further improved.

[0009] Optionally, wherein the heating chamber comprises a first end and a second end; wherein the first end is opposite the second end; wherein the aperture is located proximal to a first end of the heating chamber wherein the thermal bridge is arranged closer to the aperture than it is to the second end of the heating chamber. In such an arrangement the thermal bridge may provide a way to conduct heat away from the external surface of the aperture of the aerosol generation device, so it may be dispersed to the surroundings.

[0010] Optionally, the thermal bridge at least partly defines the aperture.

[0011] Optionally, the thermal bridge is arranged at least partly between the heating chamber and the aperture.

[0012] Optionally, wherein the thermal bridge comprises a heat dissipation surface facing outward from the aerosol generation device

[0013] Optionally the thermal bridge comprises a heat dissipation surface facing a heat dissipating wall of the casing. Optionally, the heat dissipation surface is in direct contact with the heat dissipating wall of the casing.

[0014] Optionally, the thermal bridge is arranged at least partly to enclose the heating chamber.

[0015] Optionally, the thermal bridge is in contact with the heating chamber, e.g. direct contact.

[0016] Optionally, the thermal bridge comprises a first material and the insulation comprises a second material, the first material having a higher thermal conductivity than the second material. Expressed differently, the thermal bridge is better at conducting heat than the insulation.

[0017] Optionally, the thermal bridge comprises a first material and the casing comprises a second material, the first material having a higher thermal conductivity than the second material. In some other examples, the thermal bridge and the casing comprise the same material. The thermal bridge may comprise metal, and preferably is essentially made of metal. More specifically, the thermal bridge may comprise aluminium, and more preferably is essentially made of aluminium.

[0018] Optionally, the thermal bridge is externally ribbed.

[0019] Optionally, the aerosol generation device further comprises a chassis; both the thermal bridge and chassis complementarily surrounding the heating chamber; the chassis being made of a material having a lower thermal conductivity than the thermal bridge.

[0020] Optionally, the chassis is externally ribbed or the casing is internally ribbed.

[0021] Optionally, the chassis is essentially made of plastic and the thermal bridge is essentially made of metal, preferably aluminium. Optionally, the casing covers the chassis. Optionally the casing comprises metal, and preferably is essentially made of metal.

[0022] Optionally, the thermal bridge comprises a/the first material and the aerosol generation device has an outer trim at least partially defining the aperture, the outer trim comprising a third material, the third material having a lower thermal conductivity than the first material.

[0023] Optionally, the aerosol generation device further comprises a heater, and the insulation is arranged between the heater and the casing. The insulation is also preferably arranged between the heater and the thermal bridge. The heater may be electrically powered.

[0024] Optionally, the aerosol generation device comprises a mounting element which extends from between the heating chamber and the insulation. Optionally, the mounting element cooperates with the chassis and the insulation to secure the insulation and the heating chamber in position in the aerosol generation device.

[0025] Optionally, the heating chamber has a flange and the thermal bridge is located against a surface of the flange. Optionally, the thermal bridge is located against a surface of the flange of the heating chamber opposite to a surface of the flange at which the mounting element is located.

[0026] Optionally, the thermal bridge comprises an aperture part and a casing part; the aperture part being preferably located proximate to the aperture and the casing part being preferably located between a portion of the length of the insulation and the casing.

[0027] Optionally, the aperture part of the thermal bridge at least partially defines the aperture.

[0028] Optionally, the aerosol generation device further comprises a spacing component between the heating chamber and the thermal bridge.

[0029] Optionally, the spacing component comprises a heat resistant polymer material, preferably polyether ether ketone, PEEK.

[0030] According to another aspect of the disclosure, there is provided an aerosol generation device comprising: a heating chamber into which an aerosol substrate is insertable for being heated to generate an aerosol; a casing in which the heating chamber is housed; insulation disposed at least partially between the heating chamber and the casing; an aperture through which the aerosol substrate is insertable into the heating chamber; a thermal bridge arranged in thermal contact with the casing and/or comprising a heat dissipation surface facing outward from the aerosol generation device, the at least part of the thermal bridge defining at least part of the aperture or being at least partly arranged between the heating chamber and the aperture.

[0031] According to yet another aspect of the disclosure, there is provided an aerosol generation device comprising: a heating chamber into which an aerosol substrate is insertable for being heated to generate the an aerosol; a casing in which the heating chamber is housed; an aperture through which the aerosol substrate is insertable into the heating chamber; insulation disposed at least partially between the heating chamber and the casing; and a thermal bridge arranged to dissipate heat from the heating chamber to the exterior of the aerosol generation device.

[0032] Each of the aspects above may comprise any one or more features mentioned in respect of the other aspects above.

[0033] Use of the words "apparatus", "device", and so on are intended to be general rather than specific. Whilst these features of the disclosure may be implemented using an individual component they can equally well be implemented using other suitable components or a combination of components.

[0034] It should be noted that the term "comprising" as used in this document means "consisting at least in part of". So, when interpreting statements in this document that include the term "comprising", features other than that or those prefaced by the term may also be present. Related terms such as "comprise" and "comprises" are to be interpreted in the same manner. As used herein, "(s)" following a noun means the plural and/or singular forms of the noun.

[0035] As used herein, the term "aerosol" shall mean a system of particles dispersed in the air or in a gas, such as mist, fog, or smoke. Accordingly the term "aerosolise" (or "aerosolize") means to make into an aerosol and/or to disperse as an aerosol. Note that the meaning of aerosol/aerosolise is consistent with each of volatilise, atomise and vaporise as defined above. For the avoidance of doubt, aerosol is used to consistently describe mists or droplets comprising atomised, volatilised or vaporised particles. Aerosol also includes mists or droplets comprising any combination of atomised, volatilised or vaporised particles.

[0036] Preferred embodiments are now described, by way of example only, with reference to the accompanying drawings.

Brief Description of the Drawings

[0037]

Figure 1 is a schematic illustration of an aerosol generation device according to a first embodiment, with a closure in a closed position.

Figure 2 is a schematic illustration of the aerosol generation device according to the first embodiment, with a closure in an open position.

Figure 3 is a schematic illustration of the aerosol generation device according to the first embodiment, with an aerosol substrate carrier inserted.

Figure 4 is a schematic illustration of the aerosol generation device according to the first embodiment, with a casing removed.

Figure 5 is a schematic illustration of the aerosol generation device according to the first embodiment, with the casing and part of a chassis removed.

Figure 6 is a schematic illustration of the aerosol generation device according to the first embodiment, with the casing and another part of the chassis removed.

Figure 7 is a schematic cross-sectional illustration of a part of the aerosol generation device according to the first embodiment, in the region of an aperture.

Figure 8 is a schematic illustration of an aerosol generation device according to a second embodiment, with a casing removed.

Figure 9 is a schematic cross-sectional illustration of a part of the aerosol generation device according to the second embodiment, in the region of an aperture.

Detailed Description of Preferred Embodiments

First Embodiment

[0038] Referring to Figures 1 to 7, according to a first embodiment of the disclosure, an aerosol generation device 100 comprises a casing 110 housing various components of the aerosol generation device 100. An aperture 103 is provided through which an aerosol substrate can be inserted into a heating chamber 102. In the present embodiment, the aerosol substrate is provided in a substrate carrier 104. The substrate carrier 104 is generally elongate, and the aerosol substrate is located towards or at a first end of the substrate carrier 104. Between the aerosol substrate and a second end of the substrate carrier 104, the substrate carrier 104 provides a conduit, e.g. in the form of a tube of cardboard or plastics material, optionally with a filter provided along its length, e.g. at the second end of the substrate carrier 104. Aerosol and/or vapour generated from the aerosol substrate as it is heated in the heating chamber 102 can be drawn through the conduit and inhaled by a user from the second end of the substrate carrier 102, which has sufficient length to protrude from the aperture 103 with the aerosol substrate located in the heating chamber 102 (as shown in Figure 3).

[0039] The aerosol generation device 100 may be described as a personal inhaler device, an electronic cigarette (or e-cigarette), vaporiser or vaping device. In the illustrated embodiment, the aerosol generation device 100 is a Heat not Burn (HnB) device. However, aerosol generation devices 100 that are envisaged in the disclosure more generally heat an aerosolisable substance to generate an aerosol for inhalation, as opposed to burning tobacco as in conventional tobacco products.

[0040] The aerosol substrate and substrate carrier 104 may be referred to as a consumable item. In the illustrated embodiment, the consumable item is in the form of a rod that contains processed tobacco material, e.g. a crimped sheet or oriented strips of Reconstituted ToBacco (RTB) paper impregnated with a liquid aerosol former. The liquid aerosol former in the present embodiment comprises Vegetable Glycerin (VG) but may be a mixture of Propylene Glycol (PG) and VG. In the present embodiment, the consumable item uses pure VG, which does not contain any flavourings or nicotine. Instead, volatile flavourings and nicotine derived from the RTB are vapourised at the same time as the aerosol former and is entrained into the resulting condensation aerosol for inhalation by the user. However, in other embodiments, the consumable item has aerosol former containing nicotine and other flavourings. In such cases the consumable item typically contains other solid porous matter to absorb the aerosol former liquid, for example a mousse formed with a gelling agent and a suitable binder which may or may not contain tobacco.

[0041] The casing 110 of the aerosol generation device 100 can be any shape and size suitable to fit the components of the aerosol generation device 100, but it is generally elongate. The aperture 103 is provided at a first end 113 of the aerosol generation device 100, e.g. at one of the ends of the elongate shape of the casing 110. In the drawings, the first end 113 is shown at the top. A second end 115 of the aerosol generation device 100 is an end furthest from the aperture 103, and is shown at the bottom in the drawings. This is how the aerosol generation device 100 is generally oriented during use, so the first end 113 may be referred to as the top end and the second end 115 may be referred to as the bottom end. More specifically, during use, a user typically orients the aerosol generation device 100 with the second end 115 downward and/or in a distal position with respect to the user's mouth and the first end 113 upward and/or in a proximate position with respect to the user's mouth.

[0042] The aerosol generation device 100 has a closure 109 arranged so as to be moveable between at least two positions, in particular between a closed position (as shown in Figure 1) and an open position (as shown in Figure 2). In the closed position, the closure 109 obstructs the aperture 103 so that materials cannot enter the heating chamber 102. In the open position, the aperture 103 is uncovered to allow access to the heating chamber 102 via the aperture 103. In the illustrated embodiment, the closure 109 is arranged to be moveable between the closed position and the open position by sliding. In other embodiments, the closure 109 is arranged to pivot between the closed position and the open position and/or to rotate between the closed position and the open position.

[0043] An indicator 101 is provided on the aerosol generation device 100, for indicating information to the user. In this embodiment, the indicator 101 comprises a light source, e.g. a Light Emitting Diode (LED) or (as in the present embodiment) a strip of LEDs, and the indicator 101 is provided on a side of the casing 110, e.g. between the first end 113 and the second end 115. The information indicated to the user by the indicator 101 may include a status of the aerosol generation device 100, e.g. whether the aerosol generation device 100 is turned off, in a stand-by mode or turned on, a battery level, a temperature of the heating chamber 102 or an indication of a session time.

[0044] As can be seen most clearly in Figure 4, in which the aerosol generation device 100 is shown with the casing 110 removed, the aerosol generation device 100 comprises a chassis 107. The chassis 107 provides the aerosol generation device 100 with structural integrity. It also allows components of the aerosol generation device 100 to be mounted using visible mountings, such as screws or snap fit connections, without taking significant account of impact upon the appearance of the chassis 107. Rather, the casing 110 fits around, e.g. covers, the chassis 107 and hence provides an outer or exterior surface of the aerosol generation device 100. This means that the casing 110 provides at least the majority of the visible surface of the aerosol generation device 100.

[0045] In this embodiment, the chassis 107 comprises a plastics material and the casing 110 comprises a metal. The chassis 107 being plastics material means it can be easily and cheaply formed by moulding. Plastics materials also tend to have much lower thermal conductivity than metals, meaning that the chassis 107 is generally more thermally insulating than the casing 110. The casing 110 being metal allows the outer casing 110 to be pleasant for a user to hold. It can also be anodised, treated or coated, e.g. by powder coating, to have an attractive appearance and to resist scratches, wear, tarnishing or other deterioration. The higher thermal conductivity of the metal of the outer casing 110 in comparison to the plastics material of the chassis 107 allows any heat leaking out of the heating chamber 102 to the casing 110 to be distributed around the casing 110 more freely, so reducing localised hotspots. However, it should be noted that the chassis 107 being a plastics material and the casing 110 being a metal is not essential, and in other embodiments the chassis 107 and casing 110 are formed of other materials.

[0046] The chassis 107 comprises two parts. With the aerosol generation device 100 oriented with the aperture 103 facing towards the viewer, a left part 107a is on the left hand side and a right part 107b is on the right hand side. The left part 107a and the right 107b fit together at a plane that bisects the aerosol generation device 100. The plane is parallel to the length of the aerosol generation device 100, that length being in a direction between the first end 113 and the second end 115, and extending from front to back of the aerosol generation device 100 in the orientation described here. Effectively, the chassis 107 is split into two generally equal portions that are mirror images of one another, aside from minor differences, e.g. to accommodate small asymmetric features such as the indicator 101 being located on the right hand part 107b.

[0047] An outer surface of the chassis 107 is ribbed. That is, the chassis 107 comprises a wall 117 that has a generally uniform thickness over the majority of its extent, with ribs 124 provided on an outwardly facing surface of the wall 117. The ribs are upstanding from the outwardly facing surface. In the illustrated embodiment, most of the ribs 124 extend around the casing 110 generally circumferentially with respect to the length of the aerosol generation device 100. However, at least one of the ribs 124 extends along the length of the aerosol generation device 100, generally perpendicularly to the other ribs 124. In other words, the chassis 107 has ribs 124 that cross one another, e.g. perpendicularly. The ribs 124 increase the structural integrity of the chassis 107 in comparison to the wall 117 alone, without adding as much weight as may be added by making the wall 117 itself thicker.

[0048] The casing 110 fits directly to the chassis 107. Like the chassis 107, in the illustrated embodiment, the casing 110 comprises two parts. With the aerosol generation device 100 oriented with the aperture 103 facing towards the viewer, a left part 110a is on the left hand side and a right part 110b is on the right hand side. The left part 110a and the right 110b fit together at the same plane as the plane that the left part 107a and right part 107b of the chassis 107 fit together. So, similarly to the chassis 107, the casing 110 is split into two generally equal portions that are mirror images of one another, aside from minor differences, e.g. to accommodate small asymmetric features such as the indicator 101 being located on the right hand part 110b.

[0049] In this embodiment, both the inwardly facing and the outwardly facing surfaces of the casing 110 are smooth. The inwardly facing surface is contoured to follow the outer extent of the chassis 107, e.g. in the illustrated embodiment the outer extent of the ribs 124. The inwardly facing surface of the casing 110 fits flush with the outer extent of the chassis 107. This allows the casing 110 to be bonded to the chassis 107 securely, e.g. by glue. Advantageously, spaces between the ribs 124 of the chassis 107 provide gaps between the wall of the chassis 107 and the inwardly facing surface of the casing 110. These gaps may be simply filled with air, which itself is a good insulator, having a thermal conductivity at atmospheric pressure lower than many plastics materials. The ribs 124 of the chassis 107 therefore advantageously improve the insulating properties of the aerosol generation device 100 between the heating chamber 102 and the casing 110. In a variant of this embodiment, the internal surface of the casing has the ribs 124 and the chassis is externally smooth. In another variants, both the internal surface of the casing and external surface of the chassis are ribbed.

[0050] In the first embodiment, the casing 110 does not extend over the entirety of the first end 113 of the aerosol generation device 100, where the aperture 103 and the closure 109 are provided. Rather, the aerosol generation device 100 has a trim 111 at the first end 113. The trim 111 extends at least partially, and in the illustrated embodiment entirely, around the aperture 103. In other words, the trim 111 at least partly defines the aperture 103. It also extends under the closure 109, that is between the closure 109 and the rest of the aerosol generation device 100. In this first embodiment, the trim 111 comprises a plastics material, e.g. the same material as the chassis 107. It is retained between the left part 107a and the right part 107b of the chassis 107. The trim 111 is the part of the aerosol generation device 100 that is in closest proximity to the mouth of the user during use.

[0051] The internal components of the aerosol generation device 100 can be seen most clearly in Figure 5, in which the casing 110 and the right part 107b of the chassis 107 are removed, and in Figure 6, in which the casing 110 and the entire chassis 107 are removed. It can be seen that the heating chamber 102 (or oven) is surrounded by insulation 121. The indicator 101 is also more visible, along with an electrical power source 112, e.g. cell or battery, of the aerosol generation device 100. One point of note is that the insulation 121 and electrical power source 112, which are both generally cylindrical, are arranged side by side so as to package them inside the chassis 107 and casing 110 compactly.

[0052] In more detail, the heating chamber 102 is located towards the first end 113 of the aerosol generation device 101. The heating chamber 102 is generally cup shaped, with an open end 114 located towards the first end 113 of the aerosol generation device 100 through which open end 114 the aerosol substrate can pass into the heating chamber 102 (see Figure 7). The aperture 103 of the aerosol generation device 100 coincides with the open end 114 of the heating chamber 102. In the illustrated embodiment, the aperture 103 is substantially circular, having a diameter slightly greater than that of the inner diameter of the heating chamber 102. The aerosol substrate carrier 104 is substantially cylindrical, with a similar diameter to that of the inner diameter of the heating chamber 102, and can therefore pass through the aperture 103 and the open end 114 of the heating chamber 102 without difficulty. However, the aperture 103 and aerosol substrate carrier 104 may be any shape or size so long as at least part of the aerosol substrate carrier 104 can be received through the aperture 103 into the heating chamber 102 so as to allow the aerosol substrate to be heated within the heating chamber 102.

[0053] The heating chamber 102 is mounted within the insulation 121. As can be seen most clearly in Figure 7, the heating chamber 102 has a flange 116 protruding outwardly at the open end 114. The flange 116 is annular, e.g. it extends all the way around the open end 114 of the heating chamber 102. The flange 116 extends radially outward from a side wall of the heating chamber 102. In the illustrated embodiment, the flange 116 extends perpendicularly to the side wall, e.g. in a plane having a central axis of the heating chamber 102 as a normal to it.

[0054] A mounting element 108 is provided for mounting the heating chamber 102 in the insulation 121 and mounting the combination of the heating chamber 102 and the insulation 121 in the aerosol generation device, or more specifically to the chassis 107. The mounting element 108 is generally annular, e.g. it extends around an outer periphery of the heating chamber 102 and the insulation 121 at the open end 114 of the heating chamber 102. The mounting element 108 spaces the heating chamber 102 from the insulation 121. More specifically, the mounting element 108 is located between the heating chamber 102 and the insulation 121, at the open end 114 of the heating chamber 102. The dimensions of the heating chamber 102 and the insulation 121 are such that the heating chamber 102 fits within a void defined by an internal wall of the insulation 121. With the heating chamber inserted into the void of the insulation, the only contact between the heating chamber 102 and the insulation 121 is via the mounting element 108. Space elsewhere between the heating chamber 102 and the insulation 121 is filled with air, thus improving thermal isolation between the heating chamber 102 and the insulation 121 in comparison to an arrangement in which the heating chamber 102 and insulation 121 are in greater contact with one another. In the illustrated embodiment, the mounting element 108 comprises polyether ether ketone (PEEK). PEEK is used because it is highly resistant to thermal degradation and has low thermal conductivity. Other materials could be used, such as other thermoplastics.

[0055] The insulation 121 surrounds the heating chamber 102 except at the open end 114 of the heating chamber 102. In some embodiments, the insulation 121 is fibrous or foam material, such as wool. In the illustrated embodiment, the insulation 121 comprises a pair of nested tubes or cups enclosing a cavity therebetween. The cavity may be filled with a thermally insulating material, for example fibres, foams, gels or gases (e.g. at low pressure) and/or the cavity may comprise a vacuum. Advantageously, a vacuum requires very little thickness to achieve high thermal insulation. It will be appreciated that the insulation 121 surrounds the heating chamber 102 except at the open end 114. It therefore inhibits or restricts the flow of heat from the heating chamber 102 to the casing 110. Moreover, a heater (not shown) is typically located on an outside surface of the heating chamber 102, and the insulation 121 also surrounds this heater in a similar way.

[0056] The mounting element 108 extends from between the heating chamber 102 and the insulation 121, around an end of the insulation 121 proximate to the open end 114 of the heating chamber 102 to an outer surface of the insulation 121. The mounting element 108 cooperates with the chassis 107 and the outer surface of the insulation 121 to secure the insulation 121 and the heating chamber 102 in position in the aerosol generation device 100. In much the same way as the heating chamber 102 is nested inside the insulation 121, there is a void within the chassis 107 for accommodating the insulation 121 with space between the insulation 121 and the chassis 107.

[0057] An additional mounting element (not shown) is provided at an end of the insulation 121 opposite to the end proximate to the open end 114 of the heating chamber 102. However, the insulation 121 is only in contact with the chassis 107 via the mounting element 108 and additional mounting element, and not elsewhere. This again improves thermal isolation of the heating chamber 102 with respect to the exterior of the aerosol generation device 100, e.g. the casing 110.

[0058] The heating chamber 102 and the insulation 121 are further held in position within the aerosol generation device 100 by a thermal bridge 119. The thermal bridge 119 is located against a surface of the flange 116 of the heating chamber 102 opposite to a surface of the flange 116 at which the mounting element 108 is located. The flange 116 is thus held between the thermal bridge 119 and the mounting element 108. In the illustrated embodiment, there is a gasket 125 between the thermal bridge 119 and the flange 116 to improve the fit, but this is inessential. The thermal bridge 119 is itself mounted to the chassis 107 in the vicinity of the aperture 103, and acts to prevent movement of the heating chamber 102 and insulation 121 towards the first end 113 of the aerosol generation device 100.

[0059] In the illustrated embodiment, the thermal bridge 119 comprises an aperture part 118 and a casing part 120. The aperture part 118 of the thermal bridge 119 is located proximate to the aperture 103 and the casing part 120 is located between a portion of the length of the insulation 121 and the casing 110. The aperture part 118 of the thermal bridge 119 at least partly defines the aperture 103, in particular an internal part of the aperture 103, of the aerosol generation device 100. In more detail, the aperture part 118 of the thermal bridge 119 extends all the way around the aperture 103 in this embodiment, although in other embodiments it extends only part of the way around the aperture 103. In the illustrated embodiment, aperture part 118 of the thermal bridge 119 has a hole therethrough that provides the aerosol generation device 100 with the aperture 103. The casing part 120 of the thermal bridge 119 comprises a wall 123 with exterior ribs 124 that protrude from a surface of the wall 123 that faces outwardly with respect to the heating chamber 102. The ribs 124 serve to increase the surface area of the casing part 120 of the thermal bridge 119.

[0060] In the illustrated embodiment, the aperture part 118 and the casing part 120 of the thermal bridge 119 are a single contiguous piece. The thermal bridge 119 comprises metal. In this embodiment, the metal is aluminium. Aluminium is used for its high thermal conductivity and because it is relatively lightweight and provides for easy manufacturing in comparison to other metals. In other embodiments, the thermal bridge 119 comprises an alloy of aluminium or some other metal or material, such as copper, iron, steel or any alloys thereof.

[0061] In this first embodiment, an outwardly facing surface of the casing part 120 of the thermal bridge 119 is in good thermal contact with the casing 110. This may be achieved by using a thermal paste or other suitable material between the casing part 120 of the thermal bridge 119 and the casing 110. In other embodiment, it is achieved only be ensuring close physical contact between the thermal bridge 119 and the casing 110.

[0062] The thermal bridge 119 is arranged to provide a path for heat to flow from the open end 114 of the heating chamber to the casing 110. As the casing 110 itself has relatively high thermal conductivity, e.g. because it comprises metal, heat flowing to the casing 110 from the open end 114 of the heating chamber via the thermal bridge 119 is conducted by the casing 110, and thereby spreads around the casing 110. As the casing 110 provides the exterior surface of the aerosol generation device 100, heat can then radiate away from the aerosol generation device 100 effectively. Counterintuitively, rather than seeking to further trap heat within the heating chamber 102, this arrangement recognises that it is better to allow heat that escapes from the heating chamber 102 at the open end 114 to move away from the aperture 103 of the aerosol generation device 100. This prevents the aerosol generation device 100 becoming undesirably hot in the vicinity of the aperture 103 more effectively than arrangements the further attempt to trap heat in the heating chamber 102 at the open end 114.

[0063] As mentioned above, the trim 111 covers the thermal bridge 119 at the first end 113 of the aerosol generation device 100. As the trim 111 comprises a material of lower thermal conductivity than the thermal bridge 119, heat from the open end 114 of the heating chamber is inhibited or restricted from flowing to the trim and hence to the exterior surface of the aerosol generation device 100 at the first end 113.

[0064] In experimental analysis of a sample aerosol generation device based on the first embodiment, the heating chamber 102 of the aerosol generation device 100 was used in repeated cycles to heat an aerosol substrate in a room temperature environment so that the temperature of the aerosol generation device 100 reached an approximate steady state. It was found that, at point A shown in Figure 3, the temperature of the outer surface of the aerosol generation device 100 reached approximately 37°C, point B of the outer surface of the aerosol generation device 100 reached approximately 35°C, point C of the outer surface of the aerosol generation device 100 reached approximately 33°C, point D of the outer surface of the aerosol generation device 100 reached approximately 29°C and point E of an inside surface of the chassis 107 reached approximately 46°C.

Second Embodiment

[0065] Referring to Figures 8 and 9, an aerosol generation device 100 according to a second embodiment of the disclosure is identical to the aerosol generation device 100 of the first embodiment, except that the thermal bridge 219 of the second embodiment is located in the position of the trim 111 and has a different form.

[0066] In more detail, the thermal bridge 219 of the second embodiment does not extend around the insulation 121. Effectively, the casing part 120 of the thermal bridge 119 of the first embodiment is omitted, and the aperture part 118 of the thermal bridge 119 of the first embodiment is adapted to replace the trim 111 of the first embodiment. The thermal bridge 219 of the second embodiment defines the aperture 103, at least in part. More specifically, the thermal bridge 219 extends all the way around the aperture 103 in this embodiment, although in other embodiments it extends only part of the way around the aperture 103. In the illustrated embodiment, the thermal bridge 219 has a hole therethrough that provides the aerosol generation device 100 with the aperture 103. The thermal bridge 219 is held in position by the casing 110, that is the periphery of the thermal bridge 219 is in contact with the casing 110, e.g. between the left part 110a and the right part 110b of the casing 110.

[0067] A spacer 220 extends between the thermal bridge 219 and the flange 116 of the heating chamber 102. In the illustrated embodiment, there is also a gasket 125 between the spacer 220 and the flange 116 to improve the fit. The spacer 220 has a hole through it of similar dimensions to that of the thermal bridge 219, and the two holes are aligned so that they together further define the aperture 103. The spacer 220 is generally tubular. In this embodiment, the spacer 220 comprises PEEK. PEEK is useful as it inhibits or restricts transfer of heat from the flange 116 of the heating chamber 102 to the thermal bridge 219 by conduction. The thermal bridge 219 comprises metal, in this embodiment aluminium. The thermal bridge 219 may alternatively comprise an alloy of aluminium. Other materials may also be used, such as copper, iron, steel or any alloy thereof.

[0068] Similarly to the first embodiment, rather than seeking to further trap heat within the heating chamber 102, the thermal bridge 219 of the second embodiment again seeks to allow heat escaping from the heating chamber 102 at the open end 114 to move away from the aperture 103 of the aerosol generation device 100. This is achieved by the thermal bridge 219 conducting heat away from the periphery of the aperture 103 towards the casing 110. Specifically, the thermal bridge 219 extends over the first end 113 of the aerosol generation device, around the aperture 103. It also extends under the closure 109, that is between the closure 109 and the rest of the aerosol generation device 100. It is retained between the left part 110a and the right part 110b of the casing 110. The periphery of the thermal bridge 219 is in direct contact with the casing 110. The location of the thermal bridge 219, e.g. on the outer or exterior surface of the aerosol generation device 100 at the first end 113, allows the thermal bridge 219 to radiate heat away from the aperture 103 into the surroundings. Moreover, by being in thermal contact with the casing 110, heat can flow to the casing 110 from the thermal bridge 219 and spread around the casing 110, where it can be radiated away into the surroundings. Surfaces of the thermal bridge 219 and casing 110 that are in contact with one another can be a tight fit and/or thermal paste or some other heat conductive medium can be applied between the surfaces, to ensure good thermal conduction from the thermal bridge 219 to the casing 110.

[0069] In experimental analysis of a sample aerosol generation device based on the second embodiment, the heating chamber 102 of the aerosol generation device 100 was used in repeated cycles to heat an aerosol substrate in a room temperature environment so that the temperature of the aerosol generation device 100 reached an approximate steady state. It was found that, at point A shown in Figure 3, the temperature of the outer surface of the aerosol generation device 100 reached approximately 36°C, point B of the outer surface of the aerosol generation device 100 reached approximately 33°C, point C of the outer surface of the aerosol generation device 100 reached approximately 32°C, point D of the outer surface of the aerosol generation device 100 reached approximately 29°C and point E of an inside surface of the chassis 107 reached approximately 49°C. It will be appreciated that these temperatures are marginally cooler than those achieved by the aerosol generation device based on the first embodiment, at least as far as the outer surface of the casing 110 is concerned. However, counterbalancing this, it was found that the presence of metal surrounding the aperture 103 (i.e. the metal surface of the thermal bridge 219) in the second embodiment caused more heat to radiate from the aerosol generation device 100 in that vicinity than in the first embodiment, where this trim 111 of plastics material in present on the surface surrounding the aperture 103. Given the proximity of the users mouth to this part of the aerosol generation device 100 during use, this caused a noticeable difference to the user experience, with the perception being that the temperature of the surface surrounding the aperture 103 being hotter in the second embodiment than in the first embodiment, despite the measurements demonstrating the opposite.

Definitions and Alternative Embodiments

[0070] It will be appreciated from the description above that many features of the different embodiments are interchangeable with one another. The disclosure extends to further embodiments comprising features from different embodiments combined together in ways not specifically mentioned.

[0071] As used herein, the term "vapour" (or "vapor") means: (i) the form into which liquids are naturally converted by the action of a sufficient degree of heat; or (ii) particles of liquid/moisture that are suspended in the atmosphere and visible as clouds of steam/smoke; or (iii) a fluid that fills a space like a gas but, being below its critical temperature, can be liquefied by pressure alone.

[0072] Consistently with this definition the term "vaporise" (or "vaporize") means: (i) to change, or cause the change into vapour; and (ii) where the particles change physical state (i.e. from liquid or solid into the gaseous state).

[0073] As used herein, the term "aerosol" shall mean a system of particles dispersed in the air or in a gas, such as mist, fog, or smoke. Accordingly the term "aerosolise" (or "aerosolize") means to make into an aerosol and/or to disperse as an aerosol. Note that the meaning of aerosol/aerosolise is consistent with each of volatilise, atomise and vaporise as defined above. For the avoidance of doubt, aerosol is used to consistently describe mists or droplets comprising atomised, volatilised or vaporised particles. Aerosol also includes mists or droplets comprising any combination of atomised, volatilised or vaporised particles.

Claims

1. An aerosol generation device (100) comprising:

   a heating chamber (102) into which an aerosol substrate is insertable for being heated to generate an aerosol;
   a casing (110) in which the heating chamber (102) is housed;
   an aperture (103) through which the aerosol substrate is insertable into the heating chamber (102);
   insulation (121) disposed at least partially between the heating chamber (102) and the casing (110); and
   a thermal bridge (119; 219) arranged to dissipate heat from the heating chamber (102) to the casing (110).

2. The aerosol generation device (100) of claim 1, wherein the thermal bridge (119, 219) comprises a heat dissipation surface facing a heat dissipating wall of the casing (110).

3. The aerosol generation device (100) of claim 2, wherein the heat dissipation surface is in direct contact with the heat dissipating wall of the casing (110).

4. The aerosol generation device (100) of any one of the preceding claims, wherein the thermal bridge (119; 219) comprises a first material and the insulation (121) comprises a second material, the first material having a higher thermal conductivity than the second material.

5. The aerosol generation device (100) of any one of the preceding claims, wherein the thermal bridge (119; 219) comprises a first material and the casing (110) comprises a second material, the first material having a higher thermal conductivity than the second material.

6. The aerosol generation device (100) of any one of the preceding claims, wherein the thermal bridge (119; 219) comprises metal, preferably wherein the thermal bridge (119; 219) comprises aluminium.

7. The aerosol generation device (100) of any one of the preceding claims, wherein the aerosol generation device (100) further comprises a chassis (107); both the thermal bridge (119; 219) and chassis (107) complementarily surrounding the heating chamber (102); the chassis (107) being made of a material having a lower thermal conductivity than the thermal bridge (119; 219).

8. The aerosol generation device (100) of claim 7, wherein the chassis (107) is externally ribbed or the casing (110) is externally or internally ribbed.

9. The aerosol generation device (100) of claim 7 or claim 8, wherein the chassis is essentially made of plastic and the thermal bridge (119; 219) is essentially made of metal.

10. The aerosol generation device (100) of any one of claims 7 to 9, wherein the casing (110) covers the chassis (107).

11. The aerosol generation device (100) of any one of claims 7 to 10, wherein the casing (110) comprises metal, and preferably wherein the casing (110) is essentially made of metal.

12. The aerosol generation device (100) of any one of claims 7 to 11, further comprising a mounting element (108) which extends between the heating

chamber (102) and the insulation (121).

13. The aerosol generation device (100) of claim 12, wherein the mounting element (108) cooperates with the chassis (107) and the insulation (121) to secure the insulation (121) and the heating chamber in position in the aerosol generation device (100).

14. The aerosol generation device (100) of any one of claims 7 to 13, wherein the heating chamber (102) has a flange (116) and the thermal bridge (119; 219) is located against a surface of the flange (116).

15. The aerosol generation device (100) of claim 14 as dependent on claim 12 or claim 13, wherein the thermal bridge (119; 219) is located against a surface of the flange (116) of the heating chamber (102) opposite to a surface of the flange (116) at which the mounting element (108) is located.

16. The aerosol generation device (100) of any one of the preceding claims, further comprising a heater, and the insulation (121) is arranged between the heater and the casing (110), wherein the heater is preferably electrically powered and wherein the insulation (121) is preferably arranged between the heater and the thermal bridge (119; 219).

17. The aerosol generation device (100) of any one of the preceding claims, wherein the thermal bridge (119; 219) comprises an aperture part (118) and a casing part (120); the aperture part (118) being preferably located proximate to the aperture (103) and the casing part (120) being preferably located between a portion of the length of the insulation (121) and the casing (110), preferably wherein the aperture part (118) of the thermal bridge (119; 219) at least partially defines the aperture (103).

18. The aerosol generation device (100) of any one of the preceding claims, further comprising a spacing component (220) between the heating chamber (102) and the thermal bridge (119; 219), preferably wherein the spacing component (220) comprises a heat resistant polymer material, preferably selected from at least one of silicon, polyurethane or polyether ether ketone, PEEK.

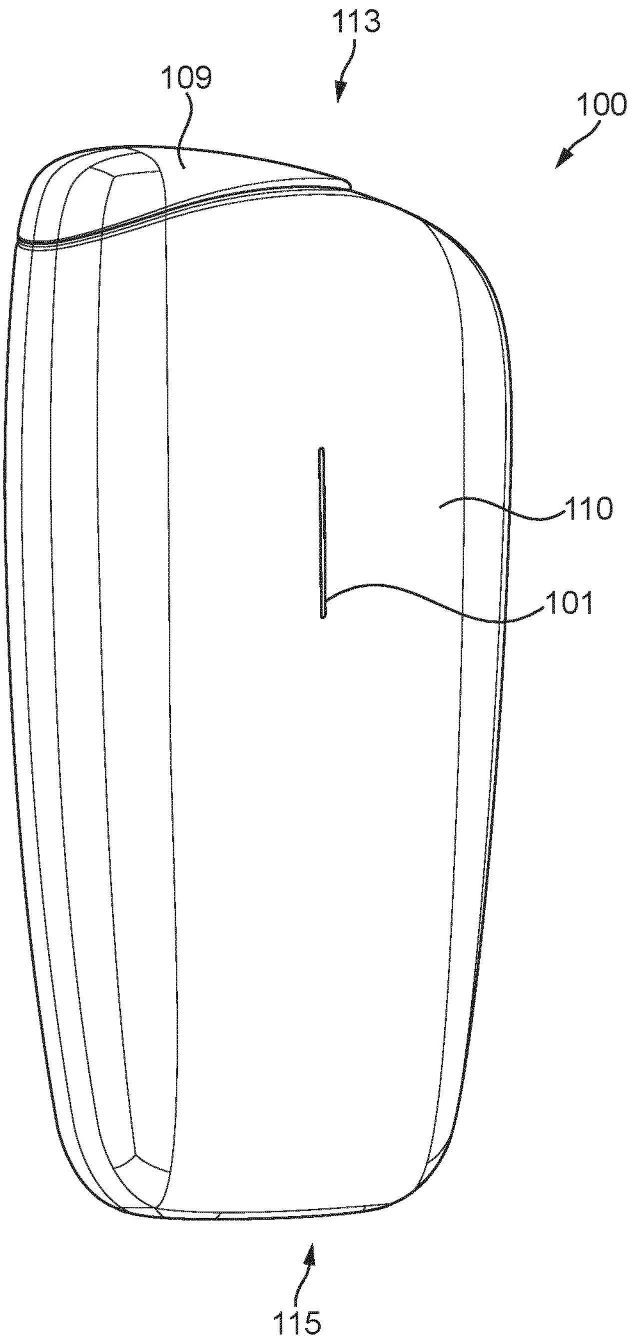

FIG. 1

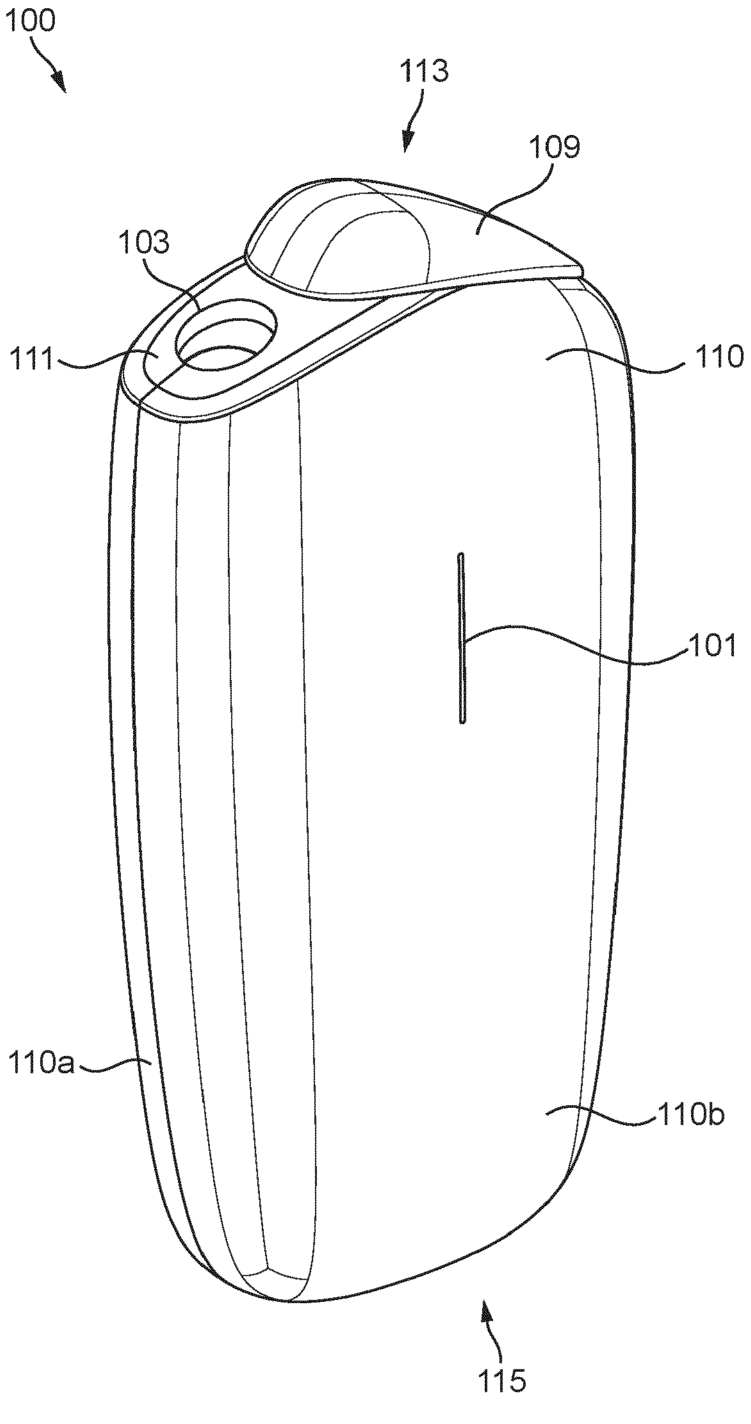

FIG. 2

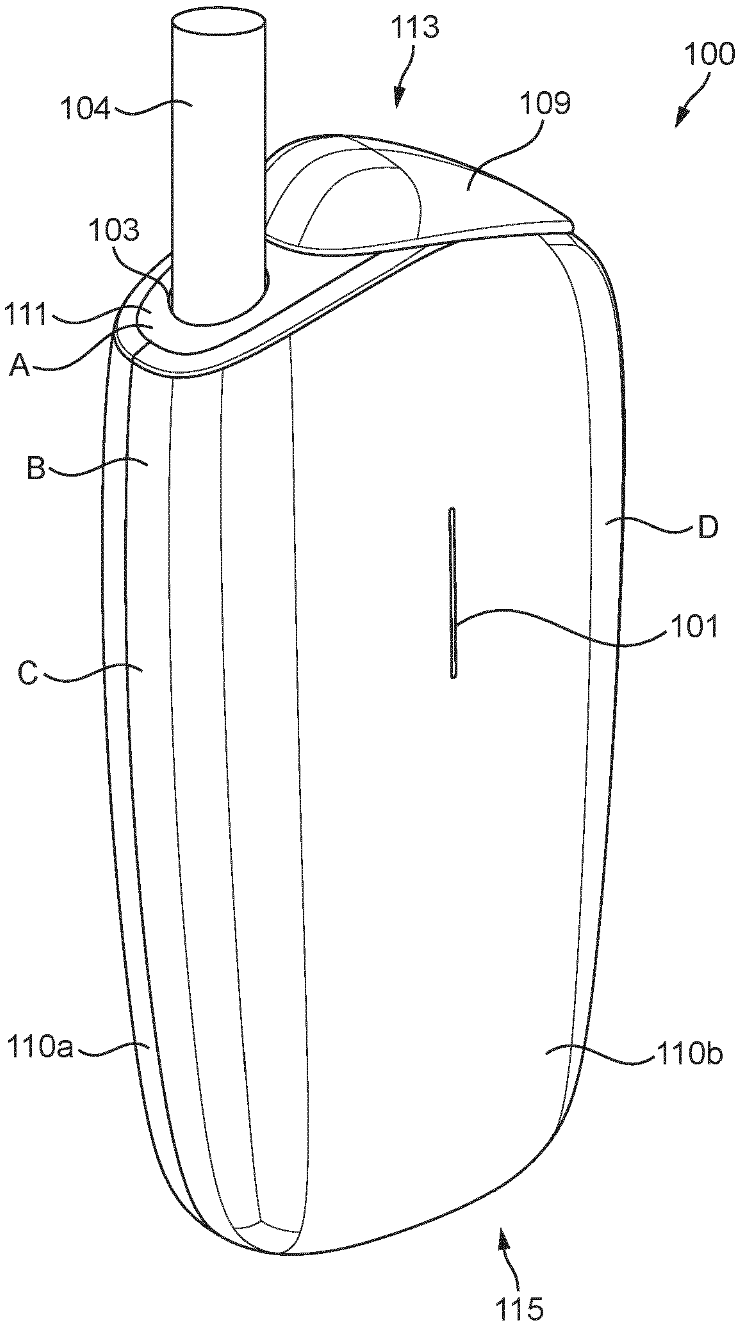

FIG. 3

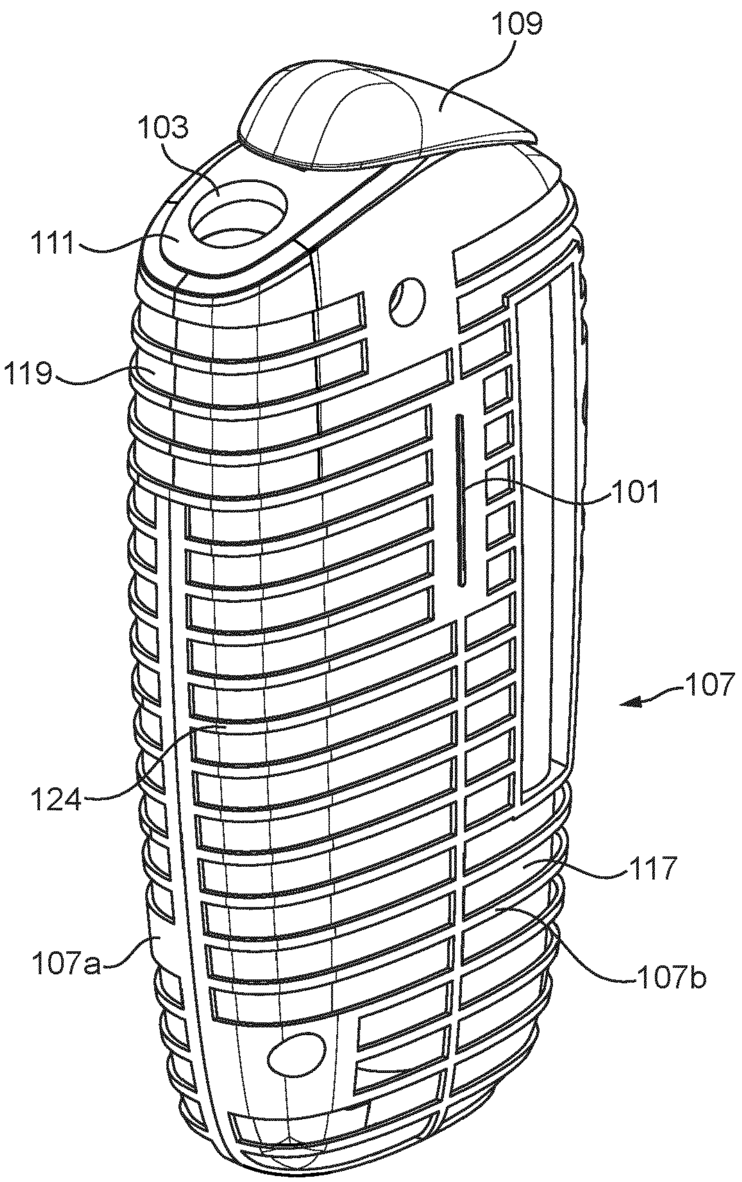

FIG. 4

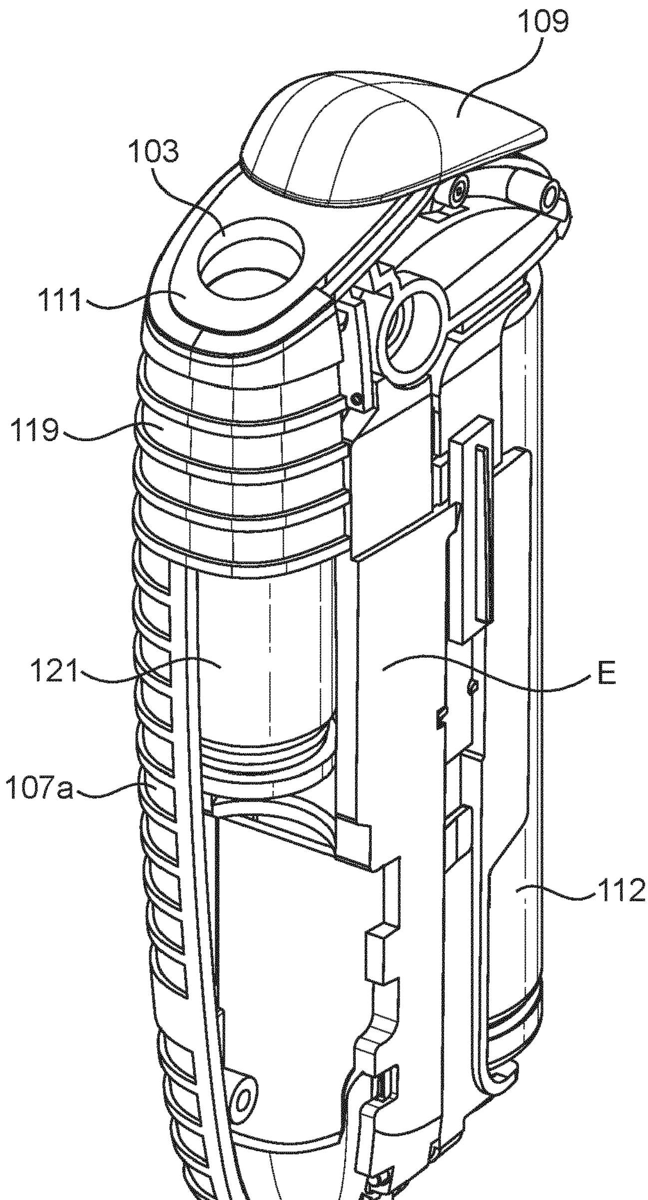

FIG. 5

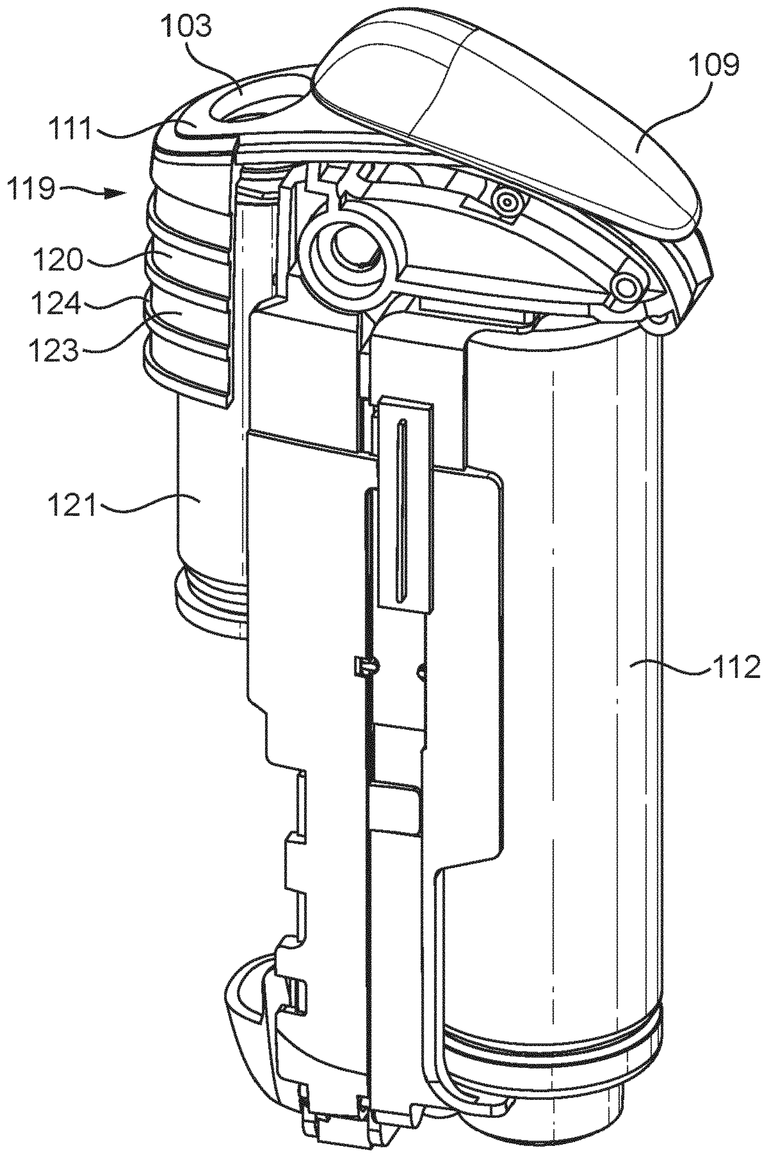

FIG. 6

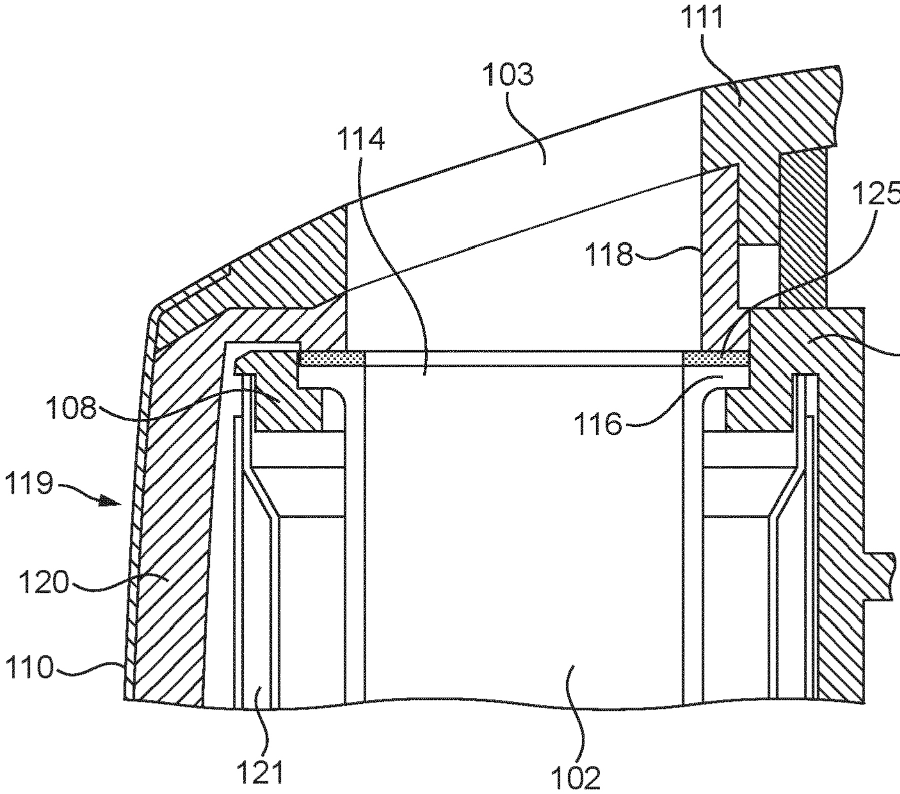

FIG. 7

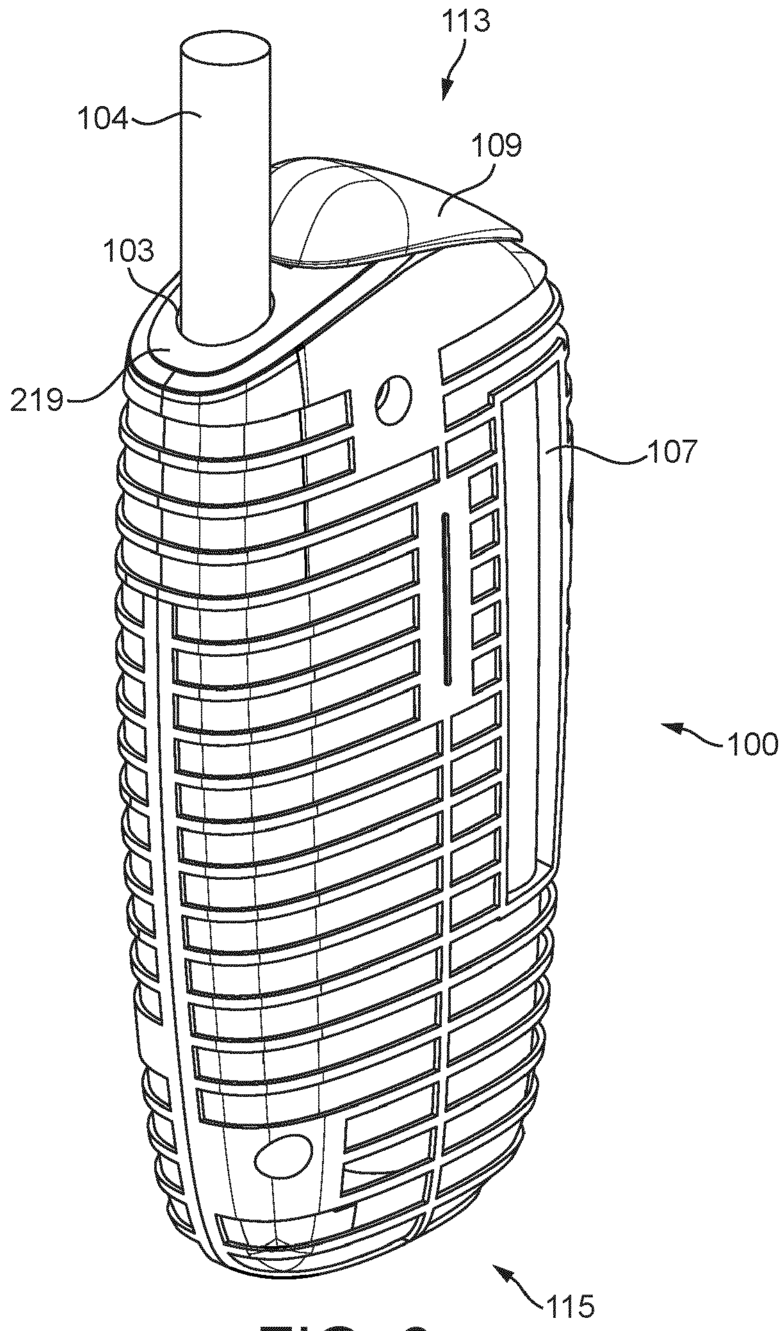

FIG. 8

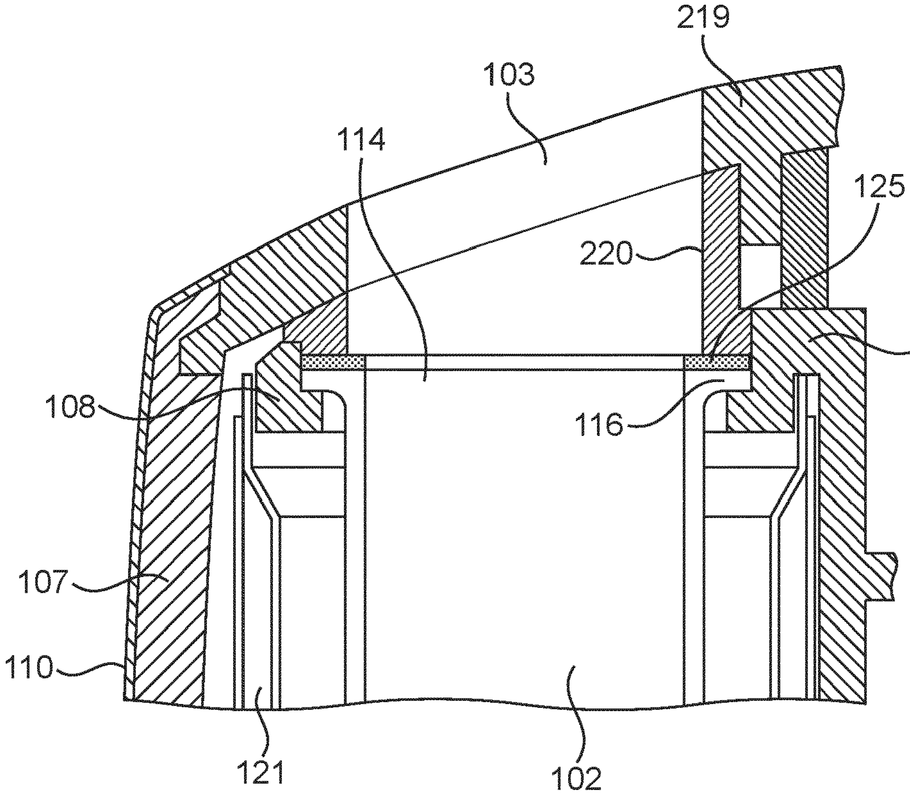

FIG. 9

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Application Number
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A24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 March 2023	Schnitzhofer, Markus

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CATEGORY OF CITED DOCUMENTS

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