(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 520 204 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
**12.03.2025 Bulletin 2025/11**

(21) Application number: **25152553.1**

(22) Date of filing: **18.03.2022**

(51) International Patent Classification (IPC):
***A24F 40/485*** *(2020.01)*

(52) Cooperative Patent Classification (CPC):
**A24F 40/485; A24F 40/40;** A24F 40/20

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priority: **19.03.2021 EP 21163745**

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
**22716389.6 / 4 307 941**

(71) Applicant: **Philip Morris Products S.A.**
**2000 Neuchâtel (CH)**

(72) Inventors:
- **MÄÄTTÄNEN, Teemu Henrik**
  **2000 Quai Jeanrenaud 3 (CH)**
- **AW, Sze Chiek**
  **569873 Singapore (SG)**
- **CHONG, Khai Shin**
  **569873 Singapore (SG)**
- **EOW, Yeong Taur**
  **569873 Singapore (SG)**

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
**PartG mbB**
**Leopoldstraße 4**
**80802 München (DE)**

Remarks:
This application was filed on 17-01-2025 as a divisional application to the application mentioned under INID code 62.

# (54) AEROSOL-GENERATING DEVICE WITH VENTING MEANS

(57) The present invention relates to an aerosol-generating system, comprising an aerosol-generating article comprising an aerosol-generating substrate, and an aerosol-generating device (1), comprising a heating chamber (4) adapted to receive an aerosol-generating article, a heating element (5), a sealed housing compartment (8), a venting means (10) adapted to allow gas flow from the sealed housing compartment (8) to the outside of the aerosol-generating device (1) to compensate for heat expansion of gas inside the housing compartment (8) due to heating operation of the heating element (5). The invention further relates to a method for operating an aerosol-generating system and a use of a venting membrane (10) in an aerosol-generating device (1).

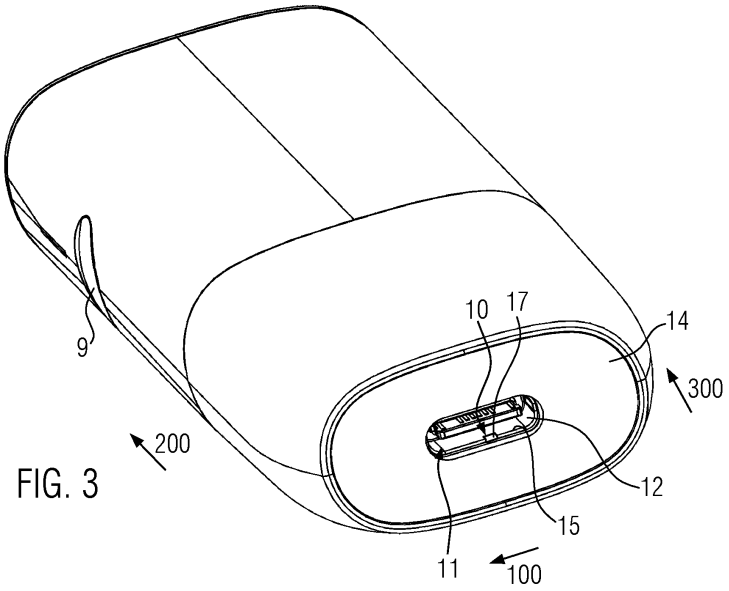


FIG. 3

EP 4 520 204 A2

## Description

**[0001]** The present invention relates to an aerosol-generating system with a device having a sealed housing compartment. The present invention also relates to a method for operating an aerosol-generating system and a use of a venting membrane in an aerosol-generating device.

**[0002]** One type of aerosol-generating system is an electrically operated smoking system. Known handheld electrically operated smoking systems typically comprise an aerosol-generating device comprising a battery, control electronics and an electric heater for heating an aerosol-generating article designed specifically for use with the aerosol-generating device. In some examples, the aerosol-generating article comprises an aerosol-forming substrate, such as a tobacco rod or a tobacco plug, and the heater contained within the aerosol-generating device is inserted into or located around the aerosol-forming substrate when the aerosol-generating article is inserted into the aerosol-generating device. In an alternative electrically operated smoking system, the aerosol-generating article may comprise a capsule containing an aerosol-forming substrate, such as loose tobacco.

**[0003]** According to a first aspect of the invention, there is provided an aerosol-generating device, comprising a heating chamber adapted to receive an aerosol-generating article, a heating element, a sealed housing compartment, and a venting means adapted to allow gas flow from the sealed housing compartment to the outside of the aerosol-generating device to compensate for heat expansion of gas inside the housing compartment due to heating operation of the heating element.

**[0004]** The transverse direction of the aerosol-generating device may be perpendicular to a longitudinal direction of the aerosol-generating device. The longitudinal direction may be the main extension direction of the aerosol-generating device, namely the direction in which the aerosol-generating device has its greatest length. In an upright orientation of the aerosol-generating device, the longitudinal direction is the height direction and the transversal direction may be a horizontal direction. The transversal direction may be perpendicular to a width direction of the aerosol-generating device. Any indications in the following regarding "upper" and "lower" are with respect to the longitudinal direction being the height direction.

**[0005]** An aerosol-generating article may be inserted in the heating chamber of the aerosol-generating device in the longitudinal direction, such that the aerosol-generating article is at least partially arranged in a heating chamber. When the aerosol-generating article abuts against a stop element or end surface of the heating chamber, a mouth-end portion of the aerosol-generating article may protrude from the heating chamber in the longitudinal direction.

**[0006]** The housing compartment is sealed to prevent the ingress of dust or ingress of dust and water. The housing compartment may comprise a bottom plate. The bottom plate may sealingly close the lower side of the housing compartment. At least one of the heating element, control electronics and a battery are arranged in the housing compartment.

**[0007]** The heating element may be provided in or adjacent to the sealed housing compartment.

**[0008]** The heating element may be an electrical resistance heating element, or an inductive heating element, such as an inductor, for example a coil. Control electronics may be provided, which are adapted to control the heating element to swiftly heat the aerosol-generating article in the heating chamber. The heating element and the control electronics of the device may be adapted, such that the temperature of the heating element is in between 70 degrees Celsius and 130 degrees Celsius, or in between 80 degrees Celsius and 120 degrees Celsius, or in between 80 degrees Celsius and 100 degrees Celsius. The heating element and the control electronics may be adapted, such that the heating time for heating the heating element from ambient temperature to at least 80 degrees Celsius is less than 5 seconds or less than 3 seconds.

**[0009]** The heating element and the control electronics of the device may be adapted, such that the aerosol-generating article is heated to a temperature between 70 degrees Celsius and 130 degrees Celsius, or in between 80 degrees Celsius and 120 degrees Celsius, or in between 80 degrees Celsius and 100 degrees Celsius. The heating element and the control electronics may be adapted, such that the heating time for heating the aerosol-generating article from ambient temperature to at least 80 degrees Celsius is less than 5 seconds or less than 3 seconds.

**[0010]** The heating element and the control electronics of the device may be adapted, such that the aerosol-generating article is heated to a temperature between 250 degrees Celsius and 400 degrees Celsius, or in between 300 degrees Celsius and 350 degrees Celsius. The heating element and the control electronics may be adapted, such that the heating time for the aerosol-generating article from ambient temperature to at least 300 degrees Celsius is less than 60 seconds or less than 30 seconds.

**[0011]** The heating element and the control electronics may be adapted to heat in several consecutive heating cycles during the consumption of one aerosol-generating article, with a temperature variation in the heating element of at least 10 degrees Celsius, or at least 20 degrees Celsius.

**[0012]** Due to the temperature change of gas in the housing compartment, pressure may build up in the housing compartment. The venting means allows gas to flow from the sealed housing compartment to the outside to prevent excess pressures in the sealed housing compartment. The venting means may be adapted to allow gas to flow from the outside into the sealed housing

compartment, to compensate negative, below-ambient pressures during cooling or in the low temperature phases during aerosol generation.

**[0013]** The venting means may be permeable for gases and impermeable for water. Thus, the aerosol-generating device may be waterproof.

**[0014]** The venting means may have a water entry pressure of at least 5 Kilopascal, preferably of at least 10 Kilopascal, in particular of about 12 Kilopascal. This enables, that the device is increasingly waterproof.

**[0015]** The venting means may have an airflow capacity of 3000 to 7000 milliliter per square centimeter and minute at 7 Kilopascal, preferably of 5000 to 5200 milliliter per square centimeter and minute at 7 Kilopascal. The airflow capacity allows for rapidly compensating for temperature changes in the aerosol-generating device.

**[0016]** The venting means may be operational in a temperature range of - 40 degrees Celsius to 150 degrees Celsius. In another embodiment, the venting means may be operational in a temperature range of -20 degrees Celsius to 90 degrees Celsius. The venting means may have the aforementioned airflow capacity over this entire temperature range. The venting means may have the aforementioned water entry pressure over this entire temperature range.

**[0017]** The venting means may comprise a membrane. The membrane may be adapted such that gas may flow through the membrane. The area of the membrane may define the possible gas flow. The membrane may be adapted such that liquids, in particular water, may not flow through the membrane.

**[0018]** The venting means may comprise a membrane with expanded Polytetrafluoroethylene. This allows a preferable implementation of a waterproof, gas-permeable membrane.

**[0019]** The venting means may comprise expanded Polytetrafluoroethylene applied on a backing layer. The backing layer may be both gas and water permeable, and may provide structural stability.

**[0020]** The venting means may comprise a hydrophobic and oleophobic membrane. This enables to protect the inside of the sealed housing compartment from polar liquids, such as water, and non-polar liquids, such as oil.

**[0021]** The venting means may comprise an inert and UV-resistant membrane. Thus, the durability of the membrane may be improved when the membrane comes in contact with potentially reactive substances from the environment.

**[0022]** The membrane may be connected to a carrier substrate having a central opening with a size of at least 0.5 square millimeters, of at least 1 square millimeter or of at least 2 square millimeters. The carrier substrate may be of a flat rectangular form with a central opening. Alternatively, the carrier substrate may be of a flat circular form with a central opening.

**[0023]** The carrier substrate may improve the sealing properties of the membrane and the fluid-tight connection of the membrane to the sealed housing compartment. The size of the opening determines the potential gas flow at a given relative pressure on opposite sides of the membrane.

**[0024]** The carrier substrate may be a double-sided adhesive layer, connecting the membrane to the housing compartment. Thus, the double function of sealing and connecting is provided.

**[0025]** The membrane may have a thickness of 0.05 to 0.5 millimeters, preferably of 0.1 to 0.2 millimeters, in particular about 0.15 millimeters. This thickness range provides a structurally stable, yet sufficiently permeable membrane.

**[0026]** The membrane is overlappingly arranged on an opening of the housing compartment. This allows sealing the opening of the housing compartment, while still allowing venting through the membrane. The opening may be a through-hole in a wall of the housing compartment.

**[0027]** The venting means may comprise an opening in the housing compartment and a channel extending into a housing compartment wall. The housing compartment wall may be formed by a bottom plate. The extension direction of the channel may be in a different direction than the opening direction of the housing opening. Thus, the venting means, and in particular a membrane of the venting means, may be protected from contact with outside objects. The fluid flow may be improved, since gas flow may be less restricted by this geometry than liquid flow. The channel and opening geometry may be particularly preferable regarding polar liquids, such as water, preventing same from reaching the membrane due to their surface tension. The extension direction of the channel may be at an angle of at least 45 degrees, preferably at least 60 degrees, and in particular perpendicular to the opening direction of the housing opening.

**[0028]** The housing opening may have a cross-sectional area greater than the cross-sectional area of the channel. Thus, a sufficiently high flow through the opening in the housing may be obtained, despite a membrane being arranged therein.

**[0029]** The channel may have a cross-sectional area of in between 0.5 square millimeters and 2 square millimeters. This provides for a sufficient gas flow, yet making it difficult for liquids to enter in the channel.

**[0030]** The channel may be a recess extending into a housing compartment wall. Thus, gas may flow out of the channel at any point of its length extension. Alternatively, the channel may be a closed channel with walls on all sides along the flow direction.

**[0031]** The channel may connect the venting means to a recessed area in the housing compartment wall. The recessed area may have a larger opening towards the outside than the channel, facilitating gas outflow.

**[0032]** The bottom plate may be fixed by means of screws. Arranging the venting means close to a screw enables that it is provided in a region of the aerosol-generating device, which is unlikely to deform during normal handling, in particular due to the tensioning force of the screw. Thus, it is less likely that involuntary relative

movement of parts of the aerosol-generating device, block channels or openings of the venting means.

**[0033]** A screw head may be arranged in the recessed area. Thus, the recess required for the screw head accommodation, may provide a double function for venting gas flow.

**[0034]** An electrical connector may be arranged in the recessed area. Thus, an electrical connector opening may be used for venting.

**[0035]** A cover panel may be arranged outside of the venting means, wherein a gap is provided in between the cover panel and the venting means, such that the venting means is arranged in a distance of 0.3 millimeters to 1 millimeter from the cover panel. Thus, venting gas flow in between the cover panel and venting means is possible. Furthermore, the venting means may be protected from mechanical damage.

**[0036]** The bottom plate may comprise a protruding side wall in the transversal direction. The cover panel may be fixed to the inside of the protruding side wall. The cover panel may be clipped in or fixed by means of adhesive to the bottom plate.

**[0037]** The sealed housing compartment may comprise electronic components. The sealed housing compartment may protect the electronic components from damage by liquids.

**[0038]** The sealed housing compartment comprises a button adapted to interact with control electronics in the sealed housing compartment, wherein movement of the button alters the inside volume of the sealed housing compartment. Since the housing compartment is sealed, a change in temperature changes the pressure inside the housing compartment, which may alter the position or responsive force of the button. The venting means enables that the pressure inside the sealed housing compartment is not significantly altered even during heating by means of the heating element, and ensures that the button may be operated with the same haptic properties at any time. The button may be overmolded with elastic material to enable sealing of the housing compartment. The button may be attached with double adhesive tape to enable sealing of the housing compartment.

**[0039]** The venting means may comprise a membrane, which is arranged on the outer side of a housing compartment wall, in particular in the form of a bottom plate.

**[0040]** The venting means may comprise a membrane, which is arranged on the inner side of a housing compartment wall, in particular in the form of a bottom plate.

**[0041]** The membrane may be arranged in a recess in the housing compartment wall. This allows for protection of the membrane. The membrane may deform due to pressure.

**[0042]** According to a second aspect of the present invention there is provided an aerosol-generating system comprising an aerosol-generating device according to the first aspect of the present invention in accordance with any of the embodiments described herein. The aerosol-generating system also comprises an aerosol-generating article comprising an aerosol-forming substrate. As used herein, the term "aerosol-generating article" refers to an article comprising an aerosol-forming substrate that, when heated, releases volatile compounds that can form an aerosol.

**[0043]** The aerosol-forming substrate may comprise a plug of tobacco. The tobacco plug may comprise one or more of: powder, granules, pellets, shreds, spaghettis, strips or sheets containing one or more of: tobacco leaf, fragments of tobacco ribs, reconstituted tobacco, homogenised tobacco, extruded tobacco and expanded tobacco. Optionally, the tobacco plug may contain additional tobacco or non-tobacco volatile flavour compounds, to be released upon heating of the tobacco plug. Optionally, the tobacco plug may also contain capsules that, for example, include the additional tobacco or non-tobacco volatile flavour compounds. Such capsules may melt during heating of the tobacco plug. Alternatively, or in addition, such capsules may be crushed prior to, during, or after heating of the tobacco plug.

**[0044]** Where the tobacco plug comprises homogenised tobacco material, the homogenised tobacco material may be formed by agglomerating particulate tobacco. The homogenised tobacco material may be in the form of a sheet. The homogenised tobacco material may have an aerosol-former content of greater than 5 percent on a dry weight basis. The homogenised tobacco material may alternatively have an aerosol former content of between 5 percent and 30 percent by weight on a dry weight basis. Sheets of homogenised tobacco material may be formed by agglomerating particulate tobacco obtained by grinding or otherwise comminuting one or both of tobacco leaf lamina and tobacco leaf stems; alternatively, or in addition, sheets of homogenised tobacco material may comprise one or more of tobacco dust, tobacco fines and other particulate tobacco byproducts formed during, for example, the treating, handling and shipping of tobacco. Sheets of homogenised tobacco material may comprise one or more intrinsic binders, that is tobacco endogenous binders, one or more extrinsic binders, that is tobacco exogenous binders, or a combination thereof to help agglomerate the particulate tobacco. Alternatively, or in addition, sheets of homogenised tobacco material may comprise other additives including, but not limited to, tobacco and non-tobacco fibres, aerosol-formers, humectants, plasticisers, flavourants, fillers, aqueous and non-aqueous solvents and combinations thereof. Sheets of homogenised tobacco material are preferably formed by a casting process of the type generally comprising casting a slurry comprising particulate tobacco and one or more binders onto a conveyor belt or other support surface, drying the cast slurry to form a sheet of homogenised tobacco material and removing the sheet of homogenised tobacco material from the support surface.

**[0045]** The aerosol-generating article may have a total length of between approximately 30 millimetres and approximately 100 millimetres. The aerosol-generating ar-

ticle may have an external diameter of between approximately 5 millimetres and approximately 13 millimetres.

**[0046]** The aerosol-generating article may comprise a mouthpiece positioned downstream of the tobacco plug. The mouthpiece may be located at a downstream end of the aerosol-generating article. The mouthpiece may be a cellulose acetate filter plug. Preferably, the mouthpiece is approximately 7 millimetres in length, but can have a length of between approximately 5 millimetres to approximately 10 millimetres.

**[0047]** The tobacco plug may have a length of approximately 10 millimetres. The tobacco plug may have a length of approximately 12 millimetres.

**[0048]** The diameter of the tobacco plug may be between approximately 5 millimetres and approximately 12 millimetres.

**[0049]** In a preferred embodiment, the aerosol-generating article has a total length of between approximately 40 millimetres and approximately 50 millimetres. Preferably, the aerosol- generating article has a total length of approximately 45 millimetres. Preferably, the aerosol-generating article has an external diameter of approximately 7.2 millimetres.

**[0050]** According to a third aspect of the present invention there is provided a method for operating an aerosol-generating system, comprising the steps of inserting an aerosol-generating article in a heating chamber of an aerosol-generating device, heating the aerosol-generating article to generate aerosol, allowing heated gas to flow from a sealed housing compartment of the aerosol-generating device to the outside through a venting means. Thus, despite the heating, the pressure inside the sealed housing compartment is not significantly altered. The inside of the sealed housing compartment may be at substantially ambient pressure, despite the heating.

**[0051]** Water may be prevented to flow from the outside through the venting means into the housing compartment. Thus, control electronics inside the sealed housing compartment are protected.

**[0052]** The venting gas may flow through a recess for a screw head. Thus, the volume in between the walls of the screw head recess and the screw head may be used as a venting channel or outlet.

**[0053]** The venting gas may flow through an electrical connector opening. Thus, the electrical connector opening may be used as a venting outlet.

**[0054]** The venting gas may flow under a cover panel. Thus, the venting means may be protected. The flow of heating gas may be distributed to one or several outlet locations in or at the cover panel.

**[0055]** According to a fourth aspect of the present invention there is provided a use of a venting membrane in an aerosol-generating device to compensate heat expansion of gas due to heat produced in a heating chamber receiving an aerosol-generating article. Thus, it is possible to prevent pressure build-up in the aerosol-generating device due to heat expansion of the gas therein.

**[0056]** The device according to the first aspect of the invention may be used according to the method of the third aspect of the invention in any of its embodiments. The method according to the third aspect of the invention may be performed by using the device according to the first aspect of the invention in any of its embodiments or the system according to the second aspect of the invention in any of its embodiments. The use of the venting membrane according to the fourth aspect of the invention may be performed with the device according to the first aspect of the invention in any of its embodiments and by using method steps from the method according to the third aspect of the invention in any of its embodiments.

**[0057]** The invention is defined in the claims. However, below there is provided a non-exhaustive list of non-limiting examples. Any one or more of the features of these examples may be combined with any one or more features of another example, embodiment, or aspect described herein.

**[0058]** Example Ex1: An aerosol-generating device, comprising a heating chamber adapted to receive an aerosol-generating article, a heating element, a sealed housing compartment and a venting means adapted to allow gas flow from the sealed housing compartment to the outside of the aerosol-generating device to compensate for heat expansion of gas inside the housing compartment due to heating operation of the heating element.

**[0059]** Example Ex2: An aerosol-generating device according to example Ex1, wherein the venting means is permeable for gases and impermeable for water.

**[0060]** Example Ex3: An aerosol-generating device according to example Ex1 or example Ex2, wherein the venting means has a water entry pressure of at least 5 Kilopascal, preferably of at least 10 Kilopascal, in particular of about 12 Kilopascal.

**[0061]** Example Ex4: An aerosol-generating device according to any one of examples Ex1 to Ex3, wherein the venting means has an airflow capacity of 3000 to 7000 milliliter per square centimeter and minute at 7 Kilopascal, preferably of 5000 to 5200 milliliter per square centimeter and minute at 7 Kilopascal.

**[0062]** Example Ex5: An aerosol-generating device according to any one of examples Ex1 to Ex4, wherein the venting means is operational in a temperature range of -40 degrees Celsius to 150 degrees Celsius.

**[0063]** Example Ex6: An aerosol-generating device according to any one of examples Ex1 to Ex5, wherein the venting means comprises a membrane.

**[0064]** Example Ex7: An aerosol-generating device according to any one of examples Ex1 to Ex6, wherein the venting means comprises a membrane with expanded Polytetrafluoroethylene.

**[0065]** Example Ex8: An aerosol-generating device according to any one of examples Ex1 to Ex7, wherein the venting means comprises expanded Polytetrafluoroethylene applied on a backing layer.

**[0066]** Example Ex9: An aerosol-generating device

according to any one of examples Ex1 to Ex8, wherein the venting means comprises a hydrophobic and oleophobic membrane.

**[0067]** Example Ex10: An aerosol-generating device according to any one of examples Ex1 to Ex9, wherein the venting means comprises an inert and UV-resistant membrane.

**[0068]** Example Ex11: An aerosol-generating device according to any one of examples Ex1 to Ex10, wherein the venting means comprises a membrane, wherein the membrane is connected to a carrier substrate having a central opening with a size of at least 0.5 square millimeters, of at least 1 square millimeter or of at least 2 square millimeters.

**[0069]** Example Ex12: An aerosol-generating device according to examples Ex11, wherein the carrier substrate is a double-sided adhesive layer, connecting the membrane to the housing compartment.

**[0070]** Example Ex13: An aerosol-generating device according to any one of examples Ex6 to Ex12, wherein the membrane has a thickness of 0.05 to 0.5 millimeters, preferably of 0.1 to 0.2 millimeters, in particular about 0.15 millimeters.

**[0071]** Example Ex14: An aerosol-generating device according to any one of examples Ex6 to Ex13, wherein the membrane is overlappingly arranged on an opening of the housing compartment.

**[0072]** Example Ex15: An aerosol-generating device according to any one of examples Ex1 to Ex14, wherein the venting means comprises a housing opening in the housing compartment and a channel extending in a housing compartment wall, wherein the extension direction of the channel is in a different direction than the opening direction of the housing opening.

**[0073]** Example Ex16: An aerosol-generating device according to example Ex15, wherein the housing opening has a cross-sectional area greater than the cross-sectional area of the channel.

**[0074]** Example Ex17: An aerosol-generating device according to example Ex15 or Ex16, wherein the channel has a cross-sectional area of in between 0.5 square millimeters and 2 square millimeters.

**[0075]** Example Ex18: An aerosol-generating device according to any one of examples Ex15 to Ex17, wherein the channel is a recess extending in a housing compartment wall.

**[0076]** Example Ex19: An aerosol-generating device according to any one of examples Ex15 to Ex18, wherein the channel connects the venting means to a recessed area in the housing compartment wall.

**[0077]** Example Ex20: An aerosol-generating device according to example Ex19, wherein a screw head is arranged in the recessed area.

**[0078]** Example Ex21: An aerosol-generating device according to example Ex19 or Ex20, wherein an electrical connector is arranged in the recessed area.

**[0079]** Example Ex22: An aerosol-generating device according to any one of examples Ex1 to Ex21, wherein a cover panel is arranged outside of the venting means, wherein a gap is provided in between the cover panel and the venting means, such that the venting means is arranged in a distance of 0.3 millimeters to 1 millimeter to the cover panel.

**[0080]** Example Ex23: An aerosol-generating device according to any one of examples Ex1 to Ex22, wherein the sealed housing compartment comprises electronic components.

**[0081]** Example Ex24: An aerosol-generating device according to any one of examples Ex1 to Ex23, wherein the sealed housing compartment comprises a button adapted to interact with control electronics in the sealed housing compartment, wherein movement of the button alters the inside volume of the sealed housing compartment.

**[0082]** Example Ex25: An aerosol-generating device according to any one of examples Ex1 to Ex24, wherein the venting means comprises a membrane, which is arranged on the outer side of a housing compartment wall.

**[0083]** Example Ex26: An aerosol-generating device according to any one of examples Ex1 to Ex25, wherein the venting means comprises a membrane, which is arranged on the inner side a housing compartment wall.

**[0084]** Example Ex27: An aerosol-generating device according to examples Ex25 to Ex26, wherein the membrane is arranged in a recess in the housing compartment wall.

**[0085]** Example Ex28: A method for operating an aerosol-generating system, comprising the steps of:

- inserting an aerosol-generating article in a heating chamber of an aerosol-generating device,
- heating the aerosol-generating article to generate aerosol,
- allowing heated gas to flow from a sealed housing compartment of the aerosol-generating device to the outside through a venting means.

**[0086]** Example Ex29: A method according to example Ex28, further comprising the step of preventing water to flow from the outside through the venting means into the housing compartment.

**[0087]** Example Ex30: A method according to example Ex28 or Ex29, wherein the venting gas flows through a recess for a screw head.

**[0088]** Example Ex31: A method according to any one of examples Ex28 to Ex30, wherein the venting gas flows through an electrical connector opening.

**[0089]** Example Ex32: A method according to any one of examples Ex28 to Ex31, wherein the venting gas flows under a cover panel.

**[0090]** Example Ex33: Use of a venting membrane in an aerosol-generating device to compensate heat expansion of gas due to heat produced in a heating chamber receiving an aerosol-generating article.

**[0091]** Example Ex34: An aerosol-generating system

comprising an aerosol-generating device according to any one of the previous examples Ex1 to Ex26 and an aerosol-generating article, wherein the aerosol-generating article comprises an aerosol-forming substrate.

**[0092]** Examples will now be further described with reference to the figures.

Fig. 1 shows a perspective view of an aerosol-generating device.

Fig. 2 shows a cross-section through the aerosol-generating device of Fig. 1.

Fig. 3 shows a perspective view of the aerosol-generating device of Fig. 1 from below.

Fig. 4 shows a partial perspective view of the aerosol-generating device of Fig. 1 from below without the cover panel.

Fig. 5 shows a partial cross-sectional view of the lower region of the aerosol-generating device of Fig. 1.

Fig. 6 shows a partial cross-sectional view of the lower region of the aerosol-generating device of Fig. 1 with an inner holder removed.

Fig. 7 shows a partial cross-sectional view of the lower region of the aerosol-generating device of Fig. 1.

Fig. 8 shows a partial perspective view of the aerosol-generating device according to a second embodiment of the invention from below without the cover panel.

Fig. 9 shows a perspective view of the bottom plate in the second embodiment.

**[0093]** An aerosol-generating device 1 according to a first embodiment of the invention is shown in an upright orientation in Fig. 1. The aerosol-generating device 1 comprises a housing 2 and a cover element 3 slidably arranged on the housing 2 in the transverse direction 100. The housing 2 extends predominantly in a longitudinal height direction 200, and has its comparatively smallest extension in the width direction 300. The cover element 3 is shown in the closed position in Figs. 1 and 2, covering the aperture of a heating chamber 4.

**[0094]** When the cover element 3 is in an open position, the heating chamber 4 is adapted to receive a rod-shaped aerosol-generating article and heat same by means of a heating element 5. The heating element 5 is an inductive coil module, which is adapted to heat a susceptor, which may be part of the rod-shaped aerosol-generating article. The heating element 5, control electronics 6 and a battery 7 are arranged in a housing compartment 8 of the housing 2.

**[0095]** The housing compartment 8 is sealed, to prevent water or dust from entering the housing compartment 8. The housing compartment 8 may comprise a button 9, which is overmolded to be sealed.

**[0096]** When the aerosol-generating article is heated, aerosol is generated, which may be consumed in a similar manner as a cigarette, with the mouth end of the rod-shaped article protruding from the heating chamber. For a beneficial consumer experience, a sufficient and swift aerosol delivery is desired. This requires a sufficient and swift heating of the aerosol-generating article. Thus, heating of the aerosol-generating article is performed at comparatively high power. This means, that not only the aerosol-generating article but also the heating element 5 and the control electronics 6 and the battery 7 will generate heat and heat the gas, namely air, inside the housing compartment 8.

**[0097]** During aerosol-generation, the gas inside the housing compartment 8 is heated and expands rapidly. This would increase the pressure inside the sealed housing compartment 8 and this pressure would also act against the inside of the button 9, altering the appearance or user activation experience of the button 9.

**[0098]** To avoid such a pressure increase inside the housing compartment 8, a venting means 10 is provided in the lower region of the aerosol-generating device 1. The venting means 10 is provided next to an electrical connector opening 11.

**[0099]** The venting means 10 is at least partially arranged in a bottom plate 12 of the housing compartment 8. The bottom plate 12 is connected by means of screws 13, to close the housing compartment 8. A cover panel 14 is connected to the bottom plate and covers the screws 13. A gap 15 is provided in between the bottom plate 12 and the cover panel 14. The gap 15 enables that gas flows in between the bottom plate 12 and the cover panel 14. The bottom plate 12 comprises a protruding side wall 16, as can be seen in Fig. 4. The cover panel 14 is connected by means of adhesive to the protruding side wall 16.

**[0100]** In Fig. 3, an electrical connector, such as a USB-C connector, is provided in the electrical connector opening 11. A channel 17 of the venting means 10 opens to the electrical connector opening 11. The channel 17 allows gas flow through the venting means 10.

**[0101]** In Fig. 4, the cover panel 14 is removed, such that the channel 17 may be fully seen. The channel 17 leads to an opening 18 in the bottom plate 12.

**[0102]** The channel 17 extends in the width direction 300, while the opening 18 extends in the transversal direction 100. To enable a constant wall thickness of the bottom plate 12, a recessed area 19 is provided in the bottom plate 12 next to the opening 18 and channel 17 of the venting means 10. This facilitates the production of the bottom plate by means of injection molding and enables the beneficial channel 17 and opening 18 geometry.

**[0103]** As shown in Fig. 5, an optional spacer 20 is arranged on the inside of the bottom plate 12. The spacer 20 may be elastic. The bottom plate 12 comprises protrusions 21, which engage into recesses 22 of the spacer 20. The spacer 20 is arranged in between and in contact with both a holder 23 and the bottom plate 12. In particular, the holder 23 may be part of or connected to a battery holder 24. The spacer 20 has a central spacer

opening 25 and the holder 23 has a central holder opening 26. The spacer opening 25 and the holder opening 26 extend in the transverse direction and are substantially aligned. In between the holder 23 and the spacer 20, a membrane 27 is arranged, such that the membrane covers the openings 25, 26. The membrane 27 may be connected to a carrier substrate 28. The carrier substrate 28 may be a double adhesive tape. The carrier substrate 28 may connect the membrane 27 to the holder 23. The carrier substrate 28 has a central opening 29, which is substantially aligned with the openings 25 and 26 of the spacer 20 and holder 23. The membrane 27 allows flow of gas, but prevents flow of liquid.

**[0104]** In Fig. 8, a second embodiment of the aerosol-generating device 1 according to the invention is shown. For the purpose of illustration, the bottom plate 12, which corresponds to the bottom plate 12 of the first embodiment, is removed. A venting means 30 is arranged in between a recess 31 for the head 32 of the screw 13 and the electrical connector opening 11. The venting means 30 comprises a first channel 33 leading to the electrical connector opening 11. The venting means 30 comprises a second channel 34 leading to the screw recess 31. Thus, during venting, air from the inside of the housing compartment 8 may flow through the channels 33, 34 to the electrical connector opening 11 and the screw recess 31 and subsequently to the outside. The venting means 30 comprises a membrane 35 which is permeable to gas but not to liquids. The membrane 35 is arranged on a carrier substrate 36, which may be in the form of double adhesive tape connecting the membrane 35 to the bottom plate 12. In the second embodiment, the membrane 35 is arranged on the outer side of the bottom plate 12, while in the first embodiment the membrane is arranged on the inner side of the button plate 12.

**[0105]** The bottom plate 12 of the second embodiment is shown in Fig. 9 in isolation. A recess 37 for receiving the membrane 35 and carrier substrate 36 is provided. The membrane 35 covers an opening 38, which is centrally provided in the recess 37.

**[0106]** In an embodiment of the method according to the invention, an aerosol-generating rod is inserted into the heating chamber 4 and heated therein. The gas inside the housing compartment 8 of the aerosol-generating device 1 is heated, and thus, through heat expansion of the gas, the pressure increases. Since the venting means 10 or 30 is provided, gas will flow through the membrane 35 and channel 17 in the first embodiment, or membrane 35 and channels 33 and 34 in the second embodiment, and then to the outside. Thus, to compensate heat-generated pressure differences, gas may flow in and out of the housing compartment 8. However, due to the arrangement of the channels 17, 33, 34 and opening 18, 28 of the venting means 10, 30, and due to the membrane 27, 25, intake of water or dust in the device may be prevented.

**[0107]** The channels 17, 33, 34 may be in the form of recesses in the bottom plate 12, forming a tubular channel when being closed by means of the cover panel 14. Preferably, the cover panel is arranged in a distance from the venting membrane, such that a gap is provided in between the cover panel 14 and the venting means 10, 30.

**[0108]** The venting means 10 may be located in the middle along the transverse direction 100 of the aerosol-generating device 1. The opening 18, 28 in the bottom plate 12 may be in the form of a through-hole. The gap 15 in between the bottom plate 12 and the cover panel 14 has a height which anticipates the potential deformation of the membrane 35 due to pressure. The venting air in the screw recess 31 may escape to the outside along a flow path in between the cover panel 14 and the side wall 16 of the bottom plate 12.

**[0109]** For the purpose of the present description and of the appended claims, except where otherwise indicated, all numbers expressing amounts, quantities, percentages, and so forth, are to be understood as being modified in all instances by the term "about". Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein. In this context, therefore, a number A is understood as A $\pm$ 10% of A. Within this context, a number A may be considered to include numerical values that are within general standard error for the measurement of the property that the number A modifies. The number A, in some instances as used in the appended claims, may deviate by the percentages enumerated above provided that the amount by which A deviates does not materially affect the basic and novel characteristic(s) of the claimed invention. Also, all ranges include the maximum and minimum points disclosed and include any intermediate ranges therein, which may or may not be specifically enumerated herein.

## Claims

**1.** An aerosol-generating system, comprising

an aerosol-generating article comprising an aerosol-generating substrate, and
an aerosol-generating device (1),
wherein the aerosol-generating device (1) comprises
a heating chamber (4) adapted to receive the aerosol-generating article,
a heating element (5),
a sealed housing compartment (8),
a venting means (10) adapted to allow gas flow from the sealed housing compartment (8) to the outside of the aerosol-generating device (1) to compensate for heat expansion of gas inside the housing compartment (8) due to heating operation of the heating element (5).

2. The aerosol-generating system according to claim 1, wherein a cover panel (14) is arranged outside of the venting means (10), wherein a gap (15) is provided in between the cover panel (14) and the venting means (10), wherein preferably the venting means (10) is arranged in a distance of 0.3 millimeters to 1 millimeter to the cover panel (14).

3. The aerosol-generating system according to claim 1 or 2, wherein the sealed housing compartment (8) comprises a button (9) adapted to interact with control electronics in the sealed housing compartment (8), wherein movement of the button (9) alters the inside volume of the sealed housing compartment (8).

4. The aerosol-generating system according to any one of the preceding claims, wherein the venting means (10) comprises an opening (18) in the housing compartment (8) and a channel (17) extending in a housing compartment wall, wherein the extension direction of the channel (17) is in a different direction than the opening direction of the housing opening (18).

5. The aerosol-generating system according to claim 4, wherein the channel (17) is a recess extending in a housing compartment wall.

6. The aerosol-generating system according to claim 4 or 5, wherein the channel (17) connects the venting means (10) to a recessed area (19) in the housing compartment wall.

7. The aerosol-generating system according to claim 6, wherein a screw head is arranged in the recessed area (19) and/or wherein an electrical connector is arranged in the recessed area (19).

8. The aerosol-generating system according to any one of the preceding claims, wherein the venting means (10) has a water entry pressure of at least 5 Kilopascal, preferably of at least 10 Kilopascal, in particular of about 12 Kilopascal.

9. The aerosol-generating system according to any one of the preceding claims, wherein the venting means (10) has an airflow capacity of 3000 to 7000 milliliter per square centimeter and minute at 7 Kilopascal, preferably of 5000 to 5200 milliliter per square centimeter and minute at 7 Kilopascal.

10. The aerosol-generating system according to any one of the preceding claims, wherein the venting means (10) comprises a membrane (27), wherein the membrane (27) is connected to a carrier substrate (28) having a central opening (29) with a size of at least 0.5 square millimeters, of at least 1 square millimeter or of at least 2 square millimeters.

11. The aerosol-generating system according to claim 10, wherein the membrane (27) has a thickness of 0.05 to 0.5 millimeters, preferably of 0.1 to 0.2 millimeters, in particular about 0.15 millimeters.

12. The aerosol-generating system according to any one of the preceding claims, wherein the venting means (10) comprises expanded Polytetrafluoroethylene applied on a backing layer.

13. The aerosol-generating system according to any one of the preceding claims, without the aerosol-generating article.

14. A method for operating an aerosol-generating system, comprising the steps of:

    - inserting an aerosol-generating article in a heating chamber (4) of an aerosol-generating device (1),
    - heating the aerosol-generating article to generate aerosol, and
    - allowing heated gas to flow from a sealed housing compartment (8) of the aerosol-generating device (1) to the outside through a venting means (10).

15. Use of a venting membrane (27) in an aerosol-generating device (1) to compensate heat expansion of gas due to heat produced in a heating chamber (4) receiving an aerosol-generating article.

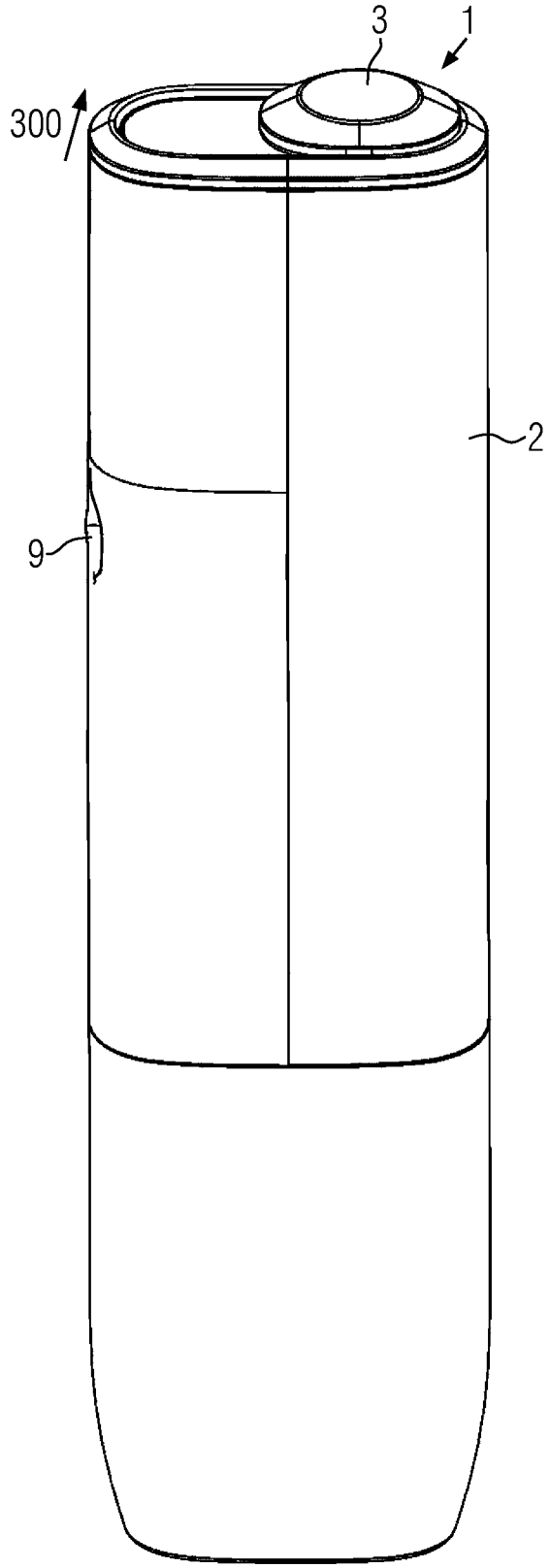


FIG. 1

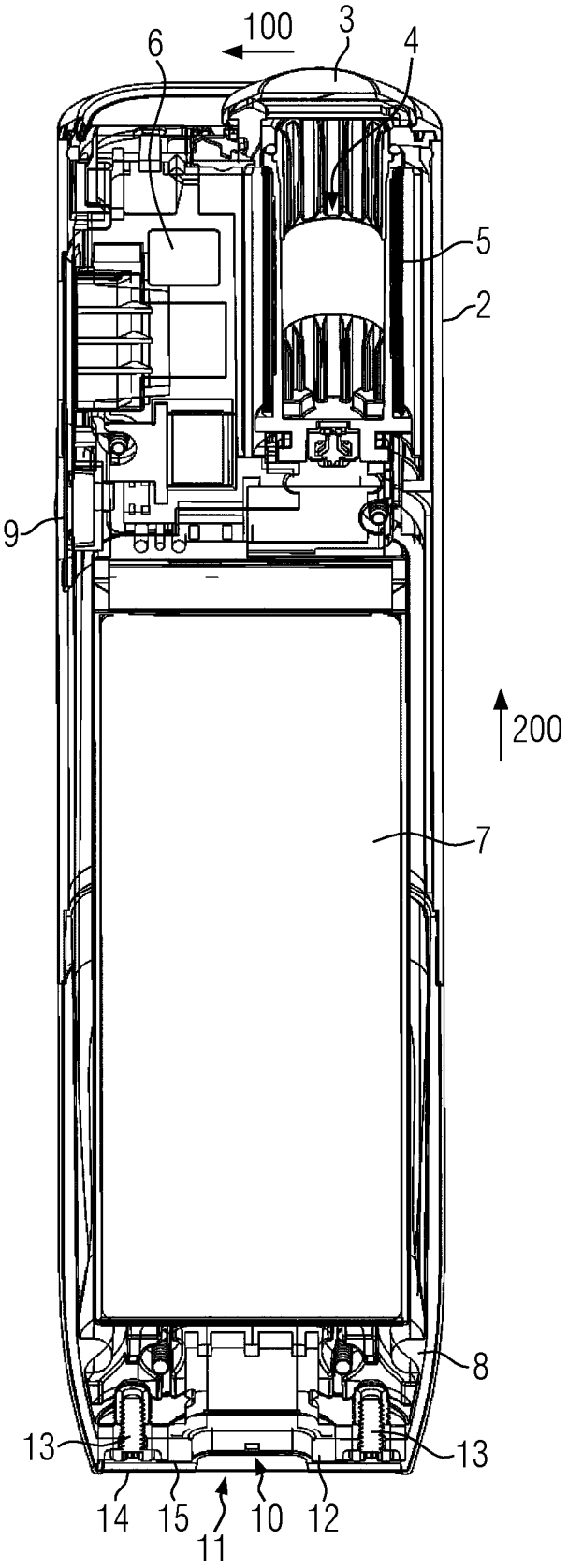


FIG. 2

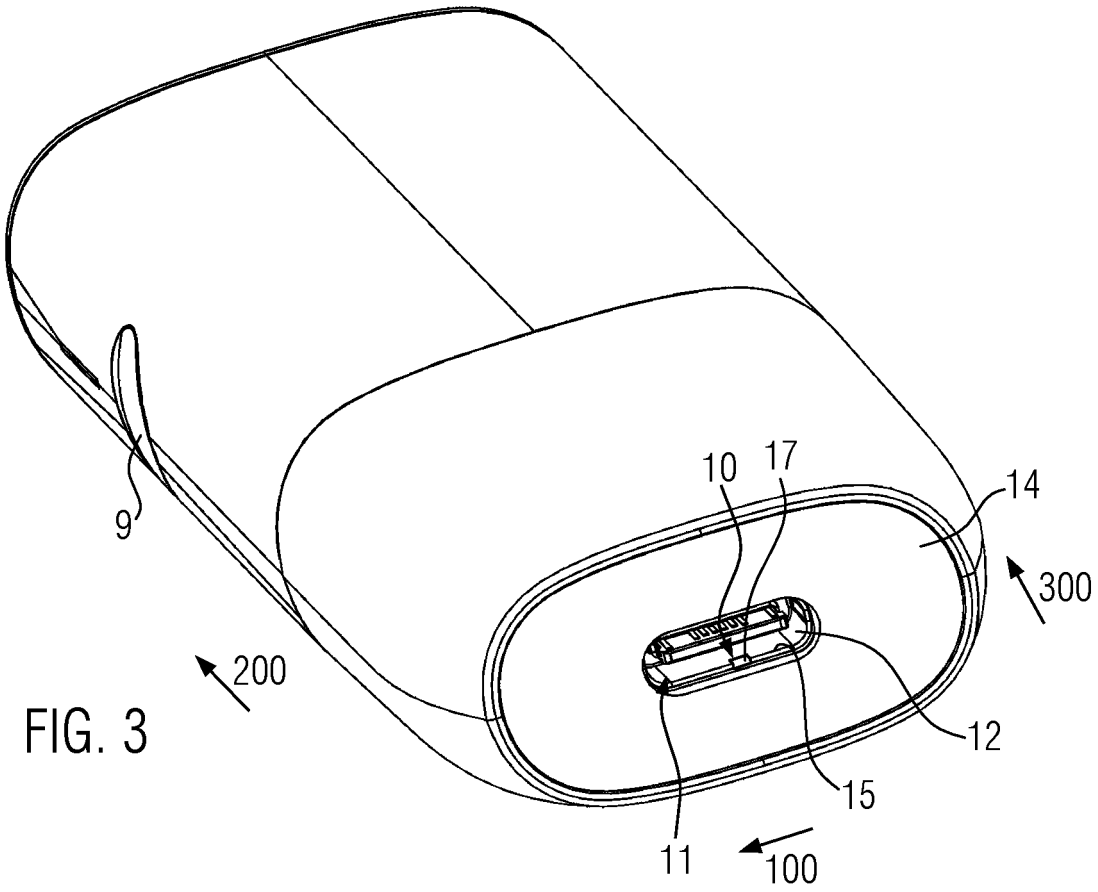


FIG. 3

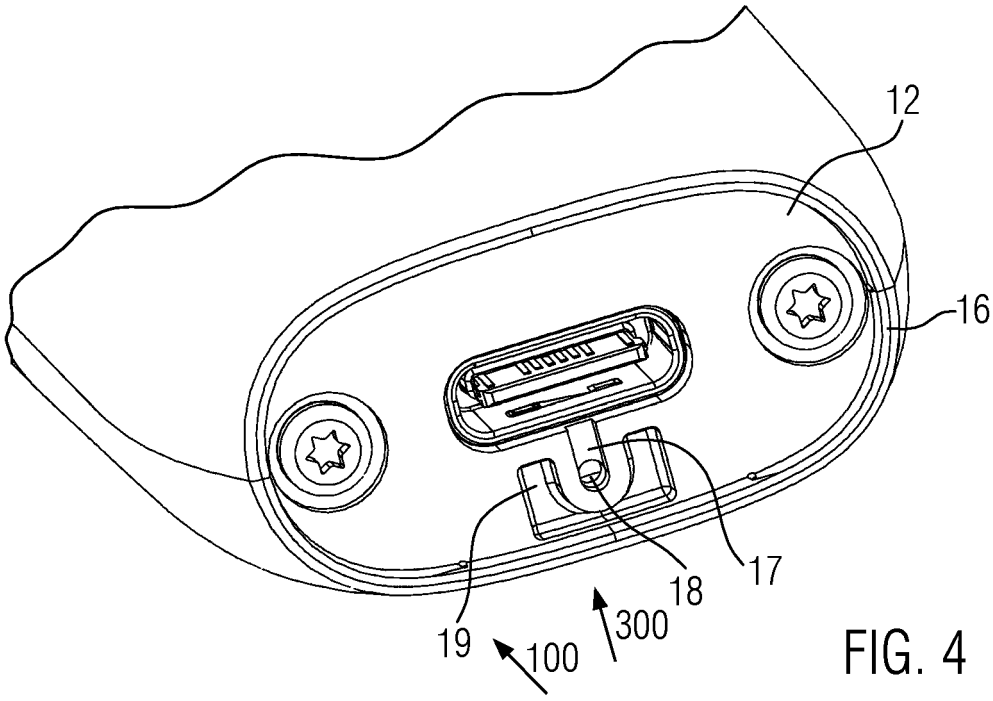


FIG. 4

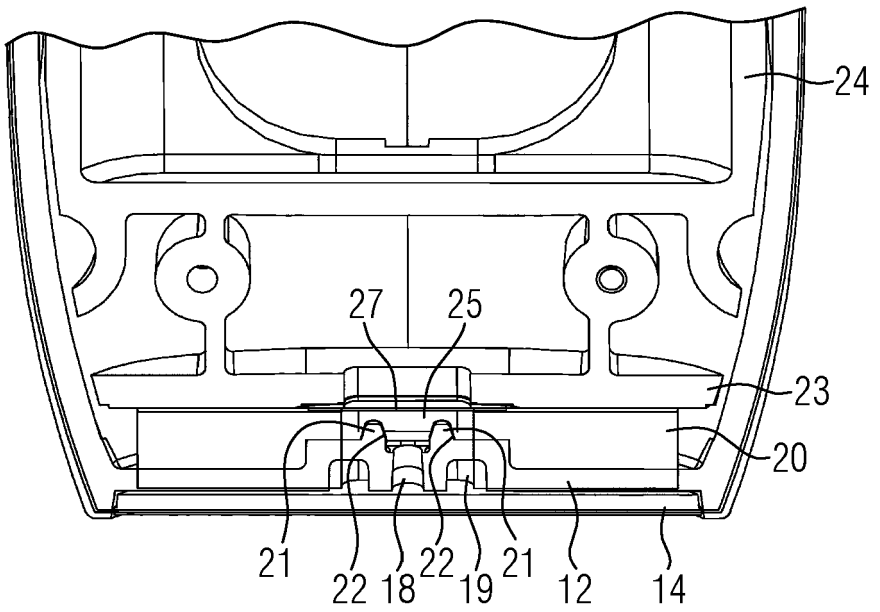


FIG. 5

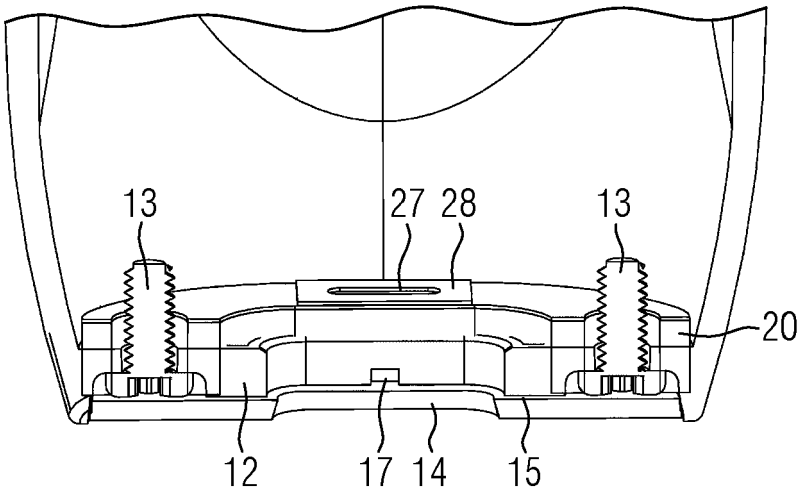


FIG. 6

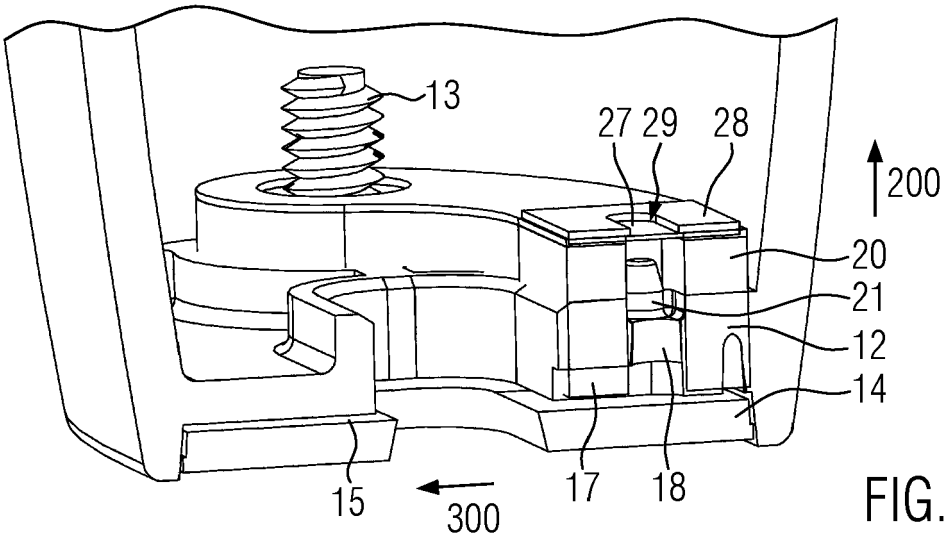


FIG. 7

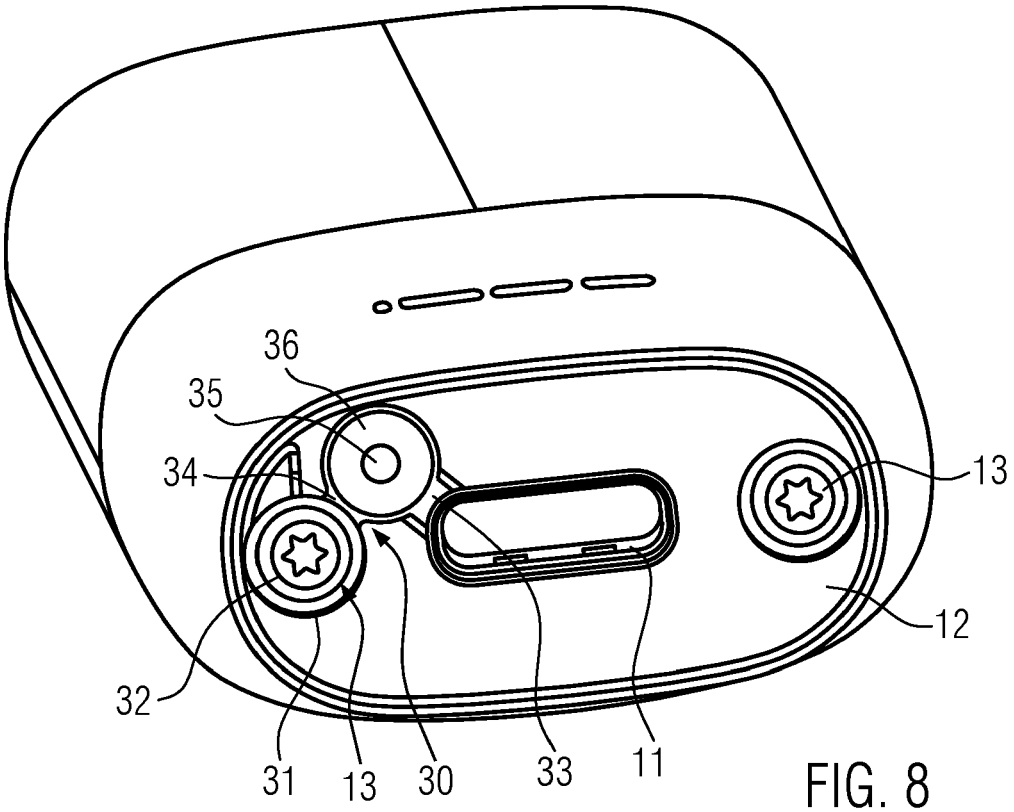


FIG. 8

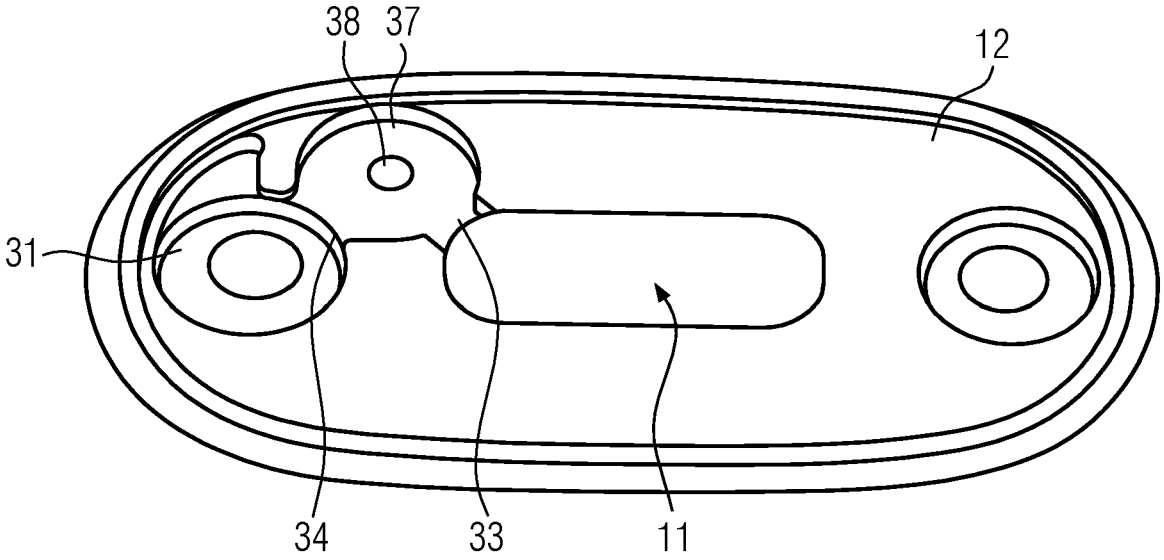


FIG. 9