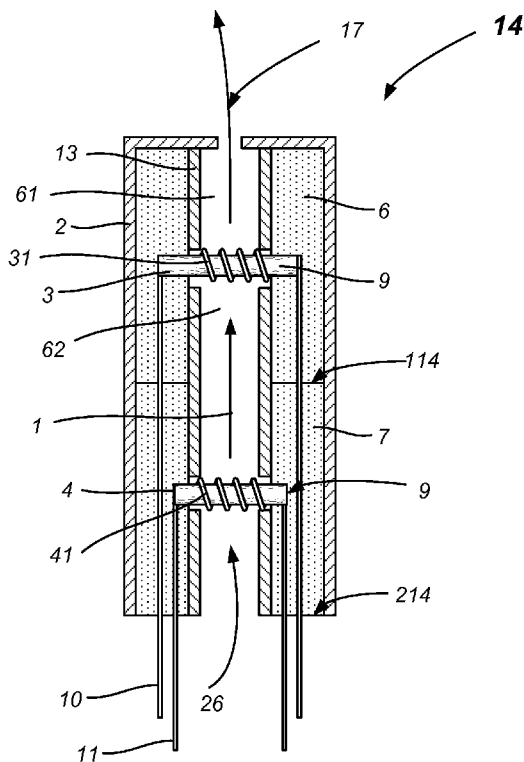




- (51) International Patent Classification:
A24F 47/00 (2006.01) A61M 15/06 (2006.01)
- (21) International Application Number:
PCT/US2014/042425
- (22) International Filing Date:
13 June 2014 (13.06.2014)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/835,458 14 June 2013 (14.06.2013) US
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,

[Continued on next page]

(54) Title: MULTIPLE HEATING ELEMENTS WITH SEPARATE VAPORIZABLE MATERIALS IN AN ELECTRIC VAPORIZATION DEVICE



(57) Abstract: A cartridge for use with a vaporization device comprising a first heating element, a first compartment for containment of a first vaporizable material, and a second compartment for containment of a second vaporizable material, wherein the device generates an aerosol for inhalation by a subject by heating the first vaporizable material or the second vaporizable material.

FIG. 1

WO 2014/201432 A1

EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

**MULTIPLE HEATING ELEMENTS WITH SEPARATE VAPORIZABLE MATERIALS
IN AN ELECTRIC VAPORIZATION DEVICE**

CROSS-REFERENCE

[0001] This application claims the benefit of U.S. Application Serial No. 61/835,458, filed June 14, 2013, which is hereby incorporated by reference in its entirety.

SUMMARY OF THE INVENTION

[0002] Devices and methods for electronic vaporization having a first heating element, a first compartment for containment of a first vaporizable material, and a second compartment for containment of a second vaporizable material wherein the device and methods generate an aerosol for inhalation by a subject by heating the first vaporizable material or the second vaporizable material.

[0003] In some aspects provided herein is a device for generating an inhalable aerosol comprising: a detachable cartridge comprising, a first compartment for containment of a first vaporizable material, a first heating element, and a second compartment for containment of a second vaporizable material, wherein the first vaporizable material in the first compartment is the same or different as the second vaporizable material in the second compartment; and a body having a battery and circuitry for controlling the device, wherein the detachable cartridge and body are coupled by a first connection mechanism and wherein the first heating element is configured to vaporize the first vaporizable material. In some embodiments the device further comprises a second heating element, wherein the second heating element is configured to vaporize the second vaporizable material. In some embodiments, the device is configured so that the first heating element is configured to vaporize the second vaporizable material. In some embodiments, the device is configured so that the first heating element comprises a resistive heater circuit or the second heating element comprises a resistive heater circuit.

[0004] In some embodiments, the device is configured so that the first heating element is configured to heat to a first target temperature, and the second heating element is configured to heat to a second target temperature. Examples of first and second target temperatures include but are not limited to from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C. In some embodiments the first target temperature is different from the second target temperature.

[0005] In some embodiments the device is be configured so that the first heating element comprises a first wire having a first end and a second end, the first wire in contact with the first wicking material, wherein the first wicking material is in fluid communication with the first

vaporizable material. In some embodiments the first heating element is in the first compartment and wherein the first end and the second end of the first wire exit the first compartment and couple electrically to the body. In some embodiments of at least one aspect the second heating element comprises a second wire having a third end and a fourth end, the second wire in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material. In some embodiments the second heating element is in the second compartment and wherein the third end and the fourth end of the second wire exit the second compartment and couple electrically to the body.

[0006] In some embodiments the device is be configured so that the first wicking material and the second wicking material have the same material properties or different material properties, same or different wicking properties, have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material, and the same wicking rate or different wicking rate due to configurations of the circuitry.

[0007] In some embodiments the device is be configured so that the first compartment and the second compartment are in series within the detachable cartridge relative to an airflow path, the first compartment and the second compartment are in parallel within the detachable cartridge relative to an airflow path, and the first compartment and the second compartment share a common axis within the detachable cartridge. In some embodiments the common axis is aligned with a central axis of an airflow path. In some embodiments the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the detachable cartridge.

[0008] In some embodiments the first compartment and the second compartment are removable from the cartridge. In some embodiments the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

[0009] In some embodiments the device is configured so that the connection mechanism comprises: a threaded connection; a tapered connection; a magnetic connection; a spring-loaded connection; a spring detent connection; a snap-fit connection; a compression connection; or any combination thereof.

[0010] In some embodiments the device is configured so that the body further comprises at least one push button for operator control of the circuitry.

[0011] In some embodiments the device is configured so that the first compartment comprises a first airflow path, and the second compartment has a second airflow path that is in communication with the first airflow path. In some embodiments the first compartment comprises a first airflow path, and the second compartment has a second airflow path, wherein

first vapor from the first airflow path is introduced to second vapor from the second airflow path prior to exiting the cartridge. In some embodiments the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor to the second vapor occurs in the second chamber. In some embodiments the cartridge comprises a third chamber and introduction of the first vapor to the second vapor occurs in the chamber. In some embodiments the cartridge further comprises a mouthpiece.

[0012] In some embodiments the device is configured so that the vaporizable material comprises a liquid, a gel, a viscous material, a temperature sensitive mesophase material, or a combination thereof. In some embodiments the first vaporizable material or the second vaporizable material comprise: nicotine; flavorants; humectants; water; or a combination thereof.

[0013] In some embodiments the device is configured so that the circuitry includes an accelerometer. In some embodiments the accelerometer functions comprise: determining if a user is actively using the device; providing a battery power level feedback of the device to the user; providing the user with a mechanism to change a mode of the device; providing an automatic activation mode when the device is picked up by the user; providing a selective pre-heat mode for the resistive heating elements; and providing an automatic sleep mode when the device is inactive for a period of time.

[0014] In some embodiments the device is configured so that the cartridge is available in 2-compartment modules, 3-compartment modules, or multi-compartment modules.

[0015] In some embodiments the device is configured so that the device comprises a first capacitive sensing zone and a second capacitive sensing zone, wherein the first zone is electrically isolated from the second zone, and wherein the first zone comprises a first capacitive sensor and the second zone comprises a second capacitive sensor. In some embodiments the first zone and second zone are configured so that when the first zone and second zone are contacted by a user, the device communicates information to the user, the information comprising, a battery charge level, a vaporizable material level, a pre-heat state, or a combination thereof. In some embodiments the first zone and second zone are configured so that when a user swipes a finger from the first zone to the second zone or from the second zone to the first zone, the device communicates information to the user, the information comprising, a battery charge level, a vaporizable material level, a pre-heat state, or a combination thereof. In some embodiments the first zone and second zone are configured so that when a user swipes a finger from the first zone to the second zone or from the second zone to the first zone, the device is activated.

[0016] In some aspects provided herein is a cartridge for use with a vaporization device comprising: a first vaporizable material, a first compartment that contains the first vaporizable material, a first heating element, a second vaporizable material, and a second compartment that contains the second vaporizable material, wherein the first vaporizable material in the first compartment is the same as or different from the second vaporizable material in the second compartment, wherein the cartridge comprises a first portion of a first connection mechanism for detachable connection to a body of the vaporization device, and wherein the first heating element is configured to vaporize the first vaporizable material. In some embodiments the cartridge is configured so that the second heating element is configured to vaporize the second vaporizable material. In some embodiments the cartridge is configured so that the first heating element is configured to vaporize the second vaporizable material. In some embodiments the cartridge is configured so that the first heating element comprises a resistive heater circuit. In some embodiments the cartridge is configured so that the second heating element comprises a resistive heater circuit. In some embodiments the cartridge is configured so that the first heating element is configured to heat to a first target temperature, and the second heating element is configured to be heated to a second target temperature that is different from the first target temperature, wherein the first heating element material properties are different than the second heating element material properties.

[0017] In some embodiments the cartridge is configured so that the first target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C. In some embodiments the cartridge is configured so that the second target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.

[0018] In some embodiments the cartridge is configured so that a first wicking material, wherein the first heating element comprises a first wire having a first end and a second end in contact with the first wicking material, wherein the first wicking material is in fluid communication with the first vaporizable material. In some embodiments the cartridge is configured so that the first heating element is in the first compartment and wherein the first end and the second end of the first wire exits the first compartment and couple electrically to the body.

[0019] In some embodiments the cartridge is configured so that the second heating element comprises a second wire having a third end and a fourth end in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material. In some embodiments the cartridge is configured so that the second heating

element is in the second compartment and wherein the third end and the fourth end of the second wire exits the second compartment and couple electrically to a battery of the device.

[0020] In some embodiments the cartridge is configured so that the first wicking material and the second wicking material have the same material properties or different material properties. In some embodiments the cartridge is configured so that the first wicking material and the second wicking material have the same wicking properties or different wicking properties. In some embodiments the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material. In some embodiments the cartridge is configured so that the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to differences between the first vaporizable material and the second vaporizable material.

[0021] In some embodiments the cartridge is configured so that the first compartment and the second compartment are in series within the cartridge relative to an airflow path. In some embodiments the cartridge is configured so that the first compartment and the second compartment are in parallel within the cartridge relative to an airflow path. In some embodiments the cartridge is configured so that the first compartment and the second compartment share a common axis within the detachable cartridge. In some embodiments the cartridge is configured so that the common axis is aligned with a central axis of an airflow path. In some embodiments the cartridge is configured so that the first compartment and the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the detachable cartridge.

[0022] The cartridge of claim 34, wherein the first compartment and the second compartment are removable from the cartridge. In some embodiments the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

[0023] In some embodiments the cartridge is configured so that the first connection mechanism comprises: a threaded connection; a tapered connection; a magnetic connection; a spring-loaded connection; a spring detent connection; a snap-fit connection; a compression connection; or any combination thereof.

[0024] In some embodiments the cartridge is configured so that the cartridge further comprises a mouthpiece.

[0025] In some embodiments the cartridge is configured so that the first compartment comprises a first airflow path, and the second compartment has a second airflow path that is in communication with the first airflow path. In some embodiments the first compartment

comprises a first airflow path, and the second compartment has a second airflow path, wherein first vapor from the first airflow path is introduced to second vapor from the second airflow path prior to exiting the cartridge. In some embodiments the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor to the second vapor occurs in the second chamber. In some embodiments the cartridge comprises a third chamber and introduction of the first vapor to the second vapor occurs in the chamber.

[0026] In some embodiments of any aspect the device, cartridge or method comprises a pre-heat temperature for the first heating element or the second heating element is from about 100°C to about 130°C.

[0027] In some embodiments the cartridge is configured so that the vaporizable material comprises a liquid, a gel, a viscous material, a temperature sensitive mesophase material, or a combination thereof. In some embodiments the first vaporizable material or the second vaporizable material comprise: nicotine; flavorants; humectants; water; or a combination thereof. In some embodiments the cartridge is available in 2-compartment modules, 3-compartment modules, or multi-compartment modules.

[0028] In some aspects provided herein is a method of generating an aerosol comprising: providing an aerosol generating device comprising: a cartridge comprising, a first vaporizable material, a first compartment that contains the first vaporizable material, a first heating element, a second vaporizable material, and a second compartment that contains the second vaporizable material, wherein the first vaporizable material in the first compartment is the same or different as the second vaporizable material in the second compartment; and a body having a battery and circuitry for controlling the device, wherein the detachable cartridge and body are coupled by a first connection mechanism and wherein the first heating element is configured to vaporize the first vaporizable material, wherein the device is configured to

- generate a first aerosol in a first airflow path from the first vaporizable material, generate a second aerosol from the second vaporizable material in the first airflow path or a second airflow path, and deliver the first aerosol and the second aerosol to a user, or
 - generate a first vapor in a first airflow path from the first vaporizable material, generate a second vapor from the second vaporizable material in the first airflow path or a second airflow path, and deliver to a user
 - o a third aerosol comprising condensate of the first vapor and the second vapor
- or

- a fourth aerosol generated from a third vapor, the third vapor formed when the first vapor is introduced to the second vapor or condensate thereof, or
- a fifth aerosol generated when the first aerosol is introduced to the second vapor or condensate thereof.

[0029] In some embodiments the first heating element is configured to heat to a first target temperature, and the second heating element is configured to heat to a second target temperature. Examples of first and second target temperatures include but are not limited to from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C. In some embodiments the first target temperature is different from the second target temperature.

[0030] In some embodiments the device is be configured so that the first heating element comprises a first wire having a first end and a second end, the first wire in contact with the first wicking material, wherein the first wicking material is in fluid communication with the first vaporizable material. In some embodiments the first heating element is in the first compartment and wherein the first end and the second end of the first wire exit the first compartment and couple electrically to the body. In some embodiments of at least one aspect the second heating element comprises a second wire having a third end and a fourth end, the second wire in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material. In some embodiments the second heating element is in the second compartment and wherein the third end and the fourth end of the second wire exit the second compartment and couple electrically to the body.

[0031] In some embodiments the device is be configured so that the first wicking material and the second wicking material have the same material properties or different material properties, same or different wicking properties, have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material, and the same wicking rate or different wicking rate due to configurations of the circuitry.

[0032] In some embodiments the device is be configured so that the first compartment and the second compartment are in series within the detachable cartridge relative to an airflow path, the first compartment and the second compartment are in parallel within the detachable cartridge relative to an airflow path, and the first compartment and the second compartment share a common axis within the detachable cartridge. In some embodiments the common axis is aligned with a central axis of an airflow path. In some embodiments the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the detachable cartridge.

[0033] In some embodiments the first compartment and the second compartment are removable from the cartridge. In some embodiments the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

[0034] In some embodiments the connection mechanism comprises: a threaded connection; a tapered connection; a magnetic connection; a spring-loaded connection; a spring detent connection; a snap-fit connection; a compression connection; or any combination thereof.

[0035] In some embodiments the body further comprises at least one push button for operator control of the circuitry.

[0036] In some embodiments the first compartment comprises a first airflow path, and the second compartment has a second airflow path that is in communication with the first airflow path. In some embodiments the first compartment comprises a first airflow path, and the second compartment has a second airflow path, wherein first vapor from the first airflow path is introduced to second vapor from the second airflow path prior to exiting the cartridge. In some embodiments the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor to the second vapor occurs in the second chamber. In some embodiments the cartridge comprises a third chamber and introduction of the first vapor to the second vapor occurs in the chamber. In some embodiments the cartridge further comprises a mouthpiece.

[0037] In some embodiments the vaporizable material comprises a liquid, a gel, a viscous material, a temperature sensitive mesophase material, or a combination thereof. In some embodiments the first vaporizable material or the second vaporizable material comprise: nicotine; flavorants; humectants; water; or a combination thereof.

[0038] In some embodiments the first compartment comprises the first airflow path, and the second compartment comprises the second airflow path that is in communication with the first airflow path.

[0039] In some embodiments the first compartment comprises the first airflow path, and the second compartment comprises the second airflow path, wherein the device is configured to introduce the first vapor or condensate thereof from the first airflow path to second vapor or condensate thereof from the second airflow path prior to exiting the cartridge.

[0040] In some embodiments the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor or condensate thereof to the second vapor or condensate thereof occurs in the second chamber.

[0041] In some embodiments the cartridge comprises a third chamber and introduction of the first vapor or condensate thereof to the second vapor or condensate thereof occurs in the third chamber.

[0042] In some embodiments the cartridge further comprises a mouthpiece.

[0043] In some embodiments the first vaporizable material comprises water.

[0044] In some embodiments the second vaporizable material comprises water.

[0045] In some embodiments the device is configured to heat the first vaporizable material to a lower temperature than a second temperature to which the second vaporizable material is heated.

[0046] In some embodiments the device is configured to heat the second vaporizable material to a lower temperature than a second temperature to which the first vaporizable material is heated.

[0047] In some embodiments of at least one aspect described above the device is configured so the device functions as a water-cooled smoking apparatus.

INCORPORATION BY REFERENCE

[0048] All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference in its entirety.

BRIEF DESCRIPTION OF THE DRAWINGS

[0049] The novel features of the invention are set forth with particularity in the appended claims. A better understanding of the features and advantages of the present invention will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the invention are utilized, and the accompanying drawings of which:

[0050] FIG. 1 illustrates a sectional view of a detachable cartridge having a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material;

[0051] FIG. 2 illustrates a sectional view of a detachable cartridge having a second heating element, a third heating element, a first compartment for containment of vaporizable material, a second compartment for containment of vaporizable material, and a third compartment for containment of vaporizable material;

[0052] FIG. 3 illustrates a sectional view of a detachable cartridge having two heating elements and two compartments for containment of vaporizable material in a parallel or concentric configuration;

[0053] FIG. 4 illustrates an isometric representation of the invention with dimensions and aspect ratio similar to a conventional cigarette.

[0054] FIG. 5 illustrates a representative sectional view of the inventive device described in FIG. 4.

[0055] FIG. 6, 7 & 8 illustrate representative examples of possible connection mechanisms for the inventive device.

DETAILED DESCRIPTION OF THE INVENTION

[0056] The invention described herein has a wide range of applications for inhalation of an active substance as will be appreciated by persons of skill in the art upon reviewing the disclosure. For example, the devices, and cartridges (i.e. pods), such as those disclosed in US application No. 11/485,168, systems, kits and methods could be used, for example, to inhale a tobacco product through the mouth or nose. The devices, systems, kits and methods could be used, for example, to inhale any substance, such as a botanical, pharmaceutical, nutraceutical, or any other substance providing a benefit or sensation to an end user.

[0057] Further, active substances such as those disclosed in US application No. 14/271,071, similar formulations and methods could be used, for example, providing a benefit or sensation to an end user.

[0058] Provided herein is a device for generating an inhalable aerosol comprising; a detachable cartridge having a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material, wherein the vaporizable material in the first compartment is the same or different as the vaporizable material in the second compartment, and a body having a battery and circuitry for controlling the device wherein the cartridge and body are coupled by a first connection mechanism.

[0059] The detachable cartridge comprises multiple compartments with at least one compartment having at least one heating element and at least one vaporizable material. The device is configured such that each compartment containing at least one resistive heating element also comprises a wicking material that is in direct contact with the vaporizable material in the compartment. At least one heating element in at least one compartment is exposed to an air passage in the cartridge.

[0060] At least one resistive heater in the cartridge is designed to reach a closely controlled target temperature, below the pyrolytic temperature of tobacco, and more specifically, a target "vapor temperature", greater than about 100°C, but less than about 300°C, intended to convert

the vaporizable material of at least one compartment to a visible vapor, such as about 170°C for flavorants, about 190°C for nicotine, and about 210°C for humectants.

[0061] In some embodiments, at least one resistive heater comprises wire coil wrapped around a wicking material (e.g. silica) that penetrates a moisture resistant liquid barrier of at least one compartment holding the vaporizable material and allows the vaporizable material to “wick” around the wire and be heated to a controlled temperature when activated. This occurs when the ends of wires traversing the length of the cartridge, exiting the compartment distally and connecting to the body, are activated by a mechanism, optionally a button mechanism, and circuitry connected to the battery in the body. Additionally, different wicking rates of the vaporizable material in the compartment is obtained using different wick materials and/or different arrangements of the heating element and the wick (e.g. heating element wrapped around the wick, heating element passing through the wick). Wicking materials at least comprise silica, cotton, stainless steel mesh, and Ekowool. Wicking properties, which effect wicking rates, include wicking material density, composition, dimension, shape, size, length, width, among others. One of ordinary skill in the art would recognize the relationship between wicking material properties and arrangements of the heating element and the wick and the effects on wicking rates.

[0062] In some embodiments wicking material of the first heating element is the same or different than the wicking material of the second heating element. Heating element material properties include heating element material composition, density, dimension, shape, size, length, width, among others. In some embodiments, the wicking material of the first heating element is the same as the wicking material of the second heating element and the wicking rate of the vaporizable material in the first compartment to at least one heating element is the same or different as the wicking rate of the vaporizable material in the second compartment to at least one heating element. In some embodiments, the wicking material of the first heating element is different than the wicking material of the second heating element, and the wicking rate of the vaporizable material in the first compartment to at least one heating element is the same or different as the wicking rate of the vaporizable material in the second compartment to at least one heating element.

[0063] In some embodiments the vaporizable material in the first compartment is the same as the vaporizable material in the second compartment, and the target temperature for the first heating element is the same or different as the target temperature for the second heating element. In some embodiments, the vaporizable material in the first compartment is different than the vaporizable material in the second compartment, and the target temperature for the first heating

element is the same or different as the target temperature for the second heating element. Target temperatures at least comprise temperatures below the pyrolytic temperature of tobacco, greater than about 100°C but less than about 300°C, about 170°C for flavorants, about 190°C for nicotine, about 210°C for humectants, about 100°C, about 120°C, about 140°C, about 160°C, about 180°C, about 200°C, about 220°C, about 240°C, about 260°C, about 280°C, and about 300°C.

[0064] In some embodiments, the vaporizable material in the first compartment is the same as the vaporizable material in the second compartment, and the temperature range for the first heating element is the same or different than the temperature range for the second heating element. In some embodiments, the vaporizable material in the first compartment is different than the vaporizable material in the second compartment, and the temperature range for the first heating element is the same or different than the temperature range for the second heating element. Temperatures ranges at least comprise temperatures below the pyrolytic temperature of tobacco, greater than about 100°C but less than about 300°C, about 170°C for flavorants, about 190°C for nicotine, about 210°C for humectants, about 125° to about 255°C, about 150° to about 230° C, about 170° to about 210° C.

[0065] In some embodiments, the vaporizable material in the first compartment is the same as the vaporizable material in the second compartment, and the heating parameters for the first heating element is the same or different than the heating parameters for the second heating element. In some embodiments the vaporizable material in the first compartment is different than the vaporizable material in the second compartment, and the heating parameters for the first heating element is the same or different than the heating parameters for the second heating element. Heating parameters at least comprise target temperature, temperature range, heating duration, heating frequency, and heating control. One of ordinary skill in the art would recognize heating parameters that effect function of the aerosol generating devices described herein.

[0066] In some embodiments, the resistive heater elements within at least one compartment for containment of vaporizable material are “breath-activated” when the user puffs on the device. This activation mode is accomplished by vacuum activated contact switches and or solid state pressure sensors and circuitry connected to the battery in the attachable body.

[0067] In still other embodiments, at least one resistive heater element within at least one compartment for containment of vaporizable material is selectively activated when the user picks up the device. This activation mode is accomplished by a button mechanism, an accelerometer, and/or solid state sensors and circuitry connected to the battery in the attachable body. The selective activation cycle has several modes including but not limited to a “preheat” setting for

the resistive heaters that brings the temperature of at least one resistive heater up to a “pre-vaporization” temperature (e.g.: 100°-130°C); a sleep mode where the device deactivates and shuts down after a short period of time; or an “off” mode when no use or movement is detected for a longer period of time, or the user manual changes the mode and/or deactivates the device with the button.

[0068] In some embodiments, at least one resistive heater wire is inserted through or surrounded by wicking material in direct contact with one of the compartments containing vaporizable material. The ends of wires traverse the length and exit the compartment distally where they attach to a first connection mechanism in the distal end of the cartridge that matches a second connection mechanism on the body.

[0069] In some embodiments, the detachable cartridge is a single-unit construction wherein the entire cartridge with all of its components, are replaced en masse.

[0070] In some embodiments, the detachable cartridge is a modular construction wherein the first and/or second compartments containing vaporizable material and a heater, or combinations of multiple compartments, each containing vaporizable material and a heater, are removable. In some embodiments, the individual compartments and heaters are arranged in a stacked- series configuration, a parallel configuration, a concentric configuration, or any combination of series-stacked, parallel or concentric configuration within the detachable cartridge.

[0071] In some embodiments, the individual compartments containing the vaporizable materials and heaters within the cartridge are removable and replaceable. In still other embodiments the individual compartments containing the vaporizable materials and heaters within the cartridge are interchangeable with replacement components. In some embodiments, the individual compartments containing the vaporizable materials and heaters within the cartridge are recyclable and reusable and is refilled by the user.

[0072] In some embodiments, the device comprises different connection mechanisms between the detachable cartridge and the body. In some embodiments, the connection mechanisms comprise; a threaded connection, a tapered connection, a magnetic connection, a spring-loaded connection, a spring detent connection, a snap-fit connection, a compression connection, or any combination thereof.

[0073] In some embodiments, the body also comprises at least one push button for operator control of the circuitry. In some embodiments, the body also comprises at least one LED indicator to apprise the user of a functional operation of the device.

[0074] In some embodiments the battery is not rechargeable. In some embodiments the battery is rechargeable. In some embodiments the battery is a lithium-based rechargeable battery. In some embodiments the attachable body comprises a mechanism for recharging the battery.

[0075] In some embodiments the device is configured to further comprise a detachable mouthpiece, wherein the mouthpiece is the detachable cartridge. In some embodiments the mouthpiece has at least one air passage therethrough and at least one heating element is exposed to the air passage. In some embodiments the detachable mouthpiece cartridge is a single-unit, non-modular construction. In some embodiments the compartments for containment of vaporizable material are aligned in series within the detachable mouthpiece cartridge, are aligned in parallel within the detachable mouthpiece cartridge, are aligned concentrically within the detachable mouthpiece cartridge, and/or are aligned in any combination of series stacking, concentric, and parallel alignment within the detachable mouthpiece cartridge.

[0076] Provided herein is a device for generating an inhalable aerosol comprising; a detachable cartridge having a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material, wherein the vaporizable material in the first compartment is the same or different as the vaporizable material in the second compartment; and an attachable body having a battery and circuitry for controlling the device wherein the detachable cartridge and body are coupled by a first connection mechanism. An exemplary device **100** is illustrated in **FIG. 4** comprising a detachable cartridge **14**, having an air outlet **17**, internal compartments for containment of vaporizable material (not shown), heating elements (not shown), at least one air inlet (not shown), and a first connection mechanism **19**. Also included is a body **18** comprising an activation button **15**, an air inlet **16**, a second connection mechanism **19**, an optional glow indicator LED **20**, a mode indicator LED **21**, an internal battery (not shown), an optional accelerometer (not shown), and internal circuit board and circuitry (not shown). In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0077] As shown in **FIG. 4**, the halves of the exemplary device form a separable, but firm connection **19** and resemble a typical cigarette in appearance. The connection mechanism **19**, also interchangeably referred to as an attachment mechanism, is achieved in numerous ways. As shown in **FIGURES 6, 7, 8**, an attachment mechanism **19** may include and be herein represented by, but are not limited to, a threaded connection **24a, 24b**, a tapered connection **25a, 25b**, a magnetic connection **23a, 23b**, as illustrative examples, or, a spring-loaded connection (not shown), a spring detent connection (not shown), a snap-fit connection (not shown), a

compression connection (not shown), or any combination thereof. In some instances, the device **100** is manufactured as a single-use inseparable outer body. In some embodiments, the single button interface **15** provides the mechanism for on, off and wake from sleep. Alternatively, an accelerometer (not shown), provides the mechanism for on, off and wake from sleep. In some embodiments, the single button interface also provides the mechanism for selection of specific heater activation within the cartridge. In some embodiments, (not shown) additional buttons are included for any of these functions. For example, pressing the single button for 1 second turns the device on. Continuing to hold the button for 5 seconds disables the motion-based low power standby and automatic shut-down. Alternatively, a second button is used to disable the motion-based low power standby and and/or shut-down. In some embodiments, upon power-up, if the single button is depressed for a very long period (>10 seconds), the device turns off again. This is to prevent inadvertent activation while in a purse, etc. While on, pressing the button momentarily turns it off. In some embodiments, a single or more than one button could report battery level (via LED blinks, for instance), change operating temperature of the device, or change the nominal intensity of the LED(s) – if the user is in a dark environment and does not want the light to be distracting. These various features could be triggered with one or more buttons or with the same button by pressing it for a prescribed duration or number of presses.

[0078] Provided herein is a device for generating an inhalable aerosol, comprising; a detachable cartridge having a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material, wherein the vaporizable material in the first compartment is the same or different as the vaporizable material in the second compartment; and a body having a battery, at least one activation button, and circuitry for controlling the device, wherein the device comprises a first capacitive sensor coupled to the circuitry. In some embodiments, a surface or shell of the device triggers the first capacitive sensor upon a user input to the surface or shell of the device. In some embodiments, a capacitive sensing surface of the first capacitive sensor detects when a user is holding the device, causing the device to indicate that the device is in use or a ready state. In some embodiments, the circuitry causes the heating elements to enter a pre-heat state upon activation or triggering of the first capacitive sensor. In some embodiments, the device exits the pre-heat state or turns off when the first capacitive sensor no longer detects movement of the device. In some embodiments, a surface of the device comprises two electrically isolated capacitive sensing zones wherein the first zone comprises a first capacitive sensor, and the second zone comprises a second capacitive sensor. In some embodiments, when a user contacts a first zone, the device indicates to the user that the device is in use or in a ready state. In some

embodiments, the device indicates use or ready state by displaying a pattern of one or more LED(s), displaying a predetermined color of one or more LED(s), or provides an audio signal. In some embodiments, the zones are configured such that when a user touches one of the zones in a predetermined pattern of one or more touches, the device displays a charge level of the battery with a pattern of one or more LED(s) or with a color of one or more LED(s), or with an audio signal. In some embodiments, the zones are configured such that when a user swipes a finger from the first zone to the second zone, or from the second zone to the first zone, the device displays a charge level of the battery with a pattern of one or more LED(s) or with a color of one or more LED(s), or with an audio signal. In some embodiments the device is configured to further comprise a detachable mouthpiece, wherein the mouthpiece is the detachable cartridge. In some embodiments the mouthpiece has at least one air passage therethrough and at least one heating element is exposed to the air passage. In some embodiments the detachable mouthpiece cartridge is a single-unit, non-modular construction. In some embodiments the compartments for containment of vaporizable material are aligned in series within the detachable mouthpiece cartridge, are aligned in parallel within the detachable mouthpiece cartridge, are aligned concentrically within the detachable mouthpiece cartridge, and/or are aligned in any combination of series stacking, concentric, and parallel alignment within the detachable mouthpiece cartridge. In some embodiments, touching the device to lips of a user activates a second capacitive sensor coupled to the circuitry whereby the device heating elements enter a pre-heat state. In some embodiments, when the user inhales the heating elements get fully activated and generate aerosol that is deliverable to the user by such inhalation or by additional inhalation. In some embodiments, inhalation activates a pressure switch to fully activate the heater elements. In some embodiments, the device comprises a button or touch sensor that when pushed or touched fully activates the heater elements and generates aerosol that is deliverable to a user by inhalation thereby.

[0079] As described herein and further shown in **FIG. 1**, one exemplary illustration of the detachable cartridge **14** comprises a shell or outer housing **2**, having a single central airpath **1** therethrough with an air inlet **26** and air outlet, **17**, and a first and second stacked compartments **114**, **214**, respectively, each surrounded by a liquid barrier **13**, and filled with an absorbent batting material **6**, **7** that will absorb and hold a first and second vaporizable material. The vaporizable materials in the stacked compartments **114**, **214** is the same or different. Also within each cartridge, and centered within the central airpath is a first and second resistive heater element **3**, **4**, respectively. One exemplary design of these resistive heater elements **3**, **4** include wire coils **31**, **41** wrapped around a silica wick **9**. The wire coils **31**, **41** are coupled to heater

circuit wires **10, 11** (alternatively called heater wires herein), which deliver energy to the coils **31, 41** which results in the coils heating up and aerosolizing the liquid vaporizable material wicked by the wicking material **9** from their respective compartments **114** or **214**. While the wires **10, 11** are described herein as being coupled to coils **31, 41**, other designs of these heating elements are contemplated herein which would be obvious to one of ordinary skill in the art upon reading the disclosure herein. Further, other wick materials are envisioned and must be capable of withstanding the target temperatures generated by the resistive heating element, without changing the flavor of the vapor or imparting an undesirable taste to the end user. The wicking material **9**, extends through the inner liquid barrier walls **13**, along with the heater circuit wires **10, 11** for the resistive heater elements **3, 4**. This provides a steady and even flow of liquid vaporizable material to the resistive heater elements **3, 4** until the vaporizable material within at least one compartment is exhausted. Immediately proximal to each heater element **3, 4**, and in the central airpath, is an atomizing chamber **61, 62** where the vapor generated from the heating element will form and mix with inlet air and the vapors formed from any previous heating elements in the airpath **1**. In addition, the heater element circuit wires **10, 11** may extend either through, or along side of, adjacent compartments **114, 214** until they reach the first connection mechanism (not shown) at the distal end of the detachable cartridge **14**. The wires then couple to the circuitry of the device which controls the activation and other features of the heater elements, and thus control the timing, delivery, contents, and amount, at least, of the vapor or aerosol deliverable to the user. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0080] In some embodiments of the detachable cartridge **14**, as shown in **FIG. 2**, the cartridge **14** comprises a shell or outer housing **2**, having a single central airpath **1** therethrough, a first, second and third stacked compartments **114, 214, and 314**, respectively, each surrounded by a liquid barrier **13**, and filled with an absorbent batting material **6, 7, and 8** that will absorb and hold a first, second and third vaporizable material. The vaporizable material in the first, second and third compartments is the same or different. Also within each cartridge, and centered within the central airpath is a first, second, and third resistive heater element **3, 4, and 5**, respectively. As described previously, an exemplary design of these resistive heater elements **3, 4, and 5** include wire coils **31, 41, and 51** wrapped around a silica wick **9**. The wicking material **9**, extends through the inner liquid barrier walls **13**, along with the circuit wires **10, 11, and 12** for the resistive heater elements **3, 4 and 5**. This provides a steady and even flow of liquid vaporizable material to the resistive heater elements **3, 4 and 5** until the vaporizable material within at least one compartment **114, 214, 314** is exhausted. Immediately proximal to each

heater coil **31**, **41**, and **51**, and in the central airpath, is an atomizing chamber **61**, **62** and **63** where the vapor generated from the heating element will form and mix with inlet air and the vapors formed from any previous heating elements in the airpath **1**. In addition, the heater element circuit wires **10**, **11**, and **12** may extend either through, or along side of, adjacent compartments **114**, **214**, and **314** until they reach the first connection mechanism (not shown) at the distal end of the detachable cartridge **14**. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0081] Still further, an additional exemplary illustration of the detachable cartridge **14** as shown in **FIG. 3** comprises a shell or outer housing **2**, having multiple air inlets **26a**, **26b**, etc., and compartments, ultimately culminating into a single central airpath **1** at the air outlet, **17**. The illustrative embodiment comprises two parallel or circumferentially located compartments **114**, **214**, respectively, however, one skilled in the art will recognize that there may be multiple circumferentially-located compartments; (e.g.: 3, 4, 5, etc.). The vaporizable material in the first and second compartments is the same or different. The vaporizable material in multiple compartments is the same or different. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0082] The illustrative embodiment in **FIG. 3** comprises two parallel or circumferentially located compartments **114**, **214**, each surrounded by a liquid barrier **13**, and filled with an absorbent batting material **6**, **7** that will absorb and hold a first and second vaporizable material. Also within each cartridge, and centered within the respective airpaths **26a**, **26b** is a first and second resistive heater element **3**, **4**. As described previously, the exemplary design of these resistive heater elements **3**, **4** include wire coils **31**, **41** wrapped around a silica wick **9**. The wicking material **9** extends through the inner liquid barrier walls **13**, along with the circuit wires **10**, **11** for the resistive heater elements **3**, **4**. This provides a steady and even flow of liquid vaporizable material to the resistive heater elements **3**, **4** until the vaporizable material within at least one compartment **114**, **214** is exhausted. Immediately proximal to each coil **31**, **41**, and in the respective airpath, is an atomizing chamber **61**, **62** where the vapor generated from the heating element will form and mix with inlet air from the air inlets **26a**, **26b**. Ultimately, the airpaths converge into a central atomizing chamber **64** within a single airpath **1**, where the vapors mix before exiting through the air outlet **17**. In addition, the heater element circuit wires **10**, **11** extend through or along side of adjacent compartments **114**, **214** until they reach the first connection mechanism (not shown) at the distal end of the detachable cartridge **14**. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0083] As illustrated in **FIGS. 6, 7, and 8** and briefly described previously, a plurality of connection mechanisms are contemplated for the device which comprise threaded connections **24a, 24b**, tapered connections **25a, 25b**, magnetic connections **23a, 23b**, as illustrative examples, or, a spring-loaded connection (not shown), a spring detent connection (not shown), a snap-fit connection (not shown), a compression connection (not shown), or any combination thereof. The connectors shown in **FIGS 6, 7, and 8** could be part of a detachable cartridge and/or a mouthpiece comprising a detachable cartridge.

[0084] **FIGS. 6 and 7** illustrate non-limiting examples for a threaded connection **24a, 24b** and (Morse) taper connection **25a, 25b** respectively where the heater circuit wires **10a, 11a**, (and **12a** in a 3-heater element design), could be inserted along the inner diameters to specific longitudinal locations corresponding to the mating connections **10b, 11b**, (and **12b** in a 3-heater element design), in the attachable body (electronics and battery module). Similarly, **Figure 8** illustrates a simple butted-end connection, with a pair of magnets **23a, 23b**, (or a single magnet **23** and conductive counter-sunk mating endplate. The heater circuit wires **10a, 11a** could be inserted at various aligned point locations on the mating end corresponding to the mating connections **10b, 11b** in the attachable body (electronics and battery module).

[0085] One skilled in the art will quickly recognize that based on the description herein, any combination of cartridge and heater element circuit arrangement as described herein would be possible for alternative cartridge embodiments.

[0086] One skilled in the art will quickly recognize that based on the description herein, any combination of mouthpiece, cartridge and heater element circuit arrangement as described herein would be possible for alternative mouthpiece and/or cartridge embodiments.

[0087] Provided herein is a device **100** as shown in **FIGS. 1, 2, 3 and 5** for generating an inhalable aerosol comprising; a removable cartridge **14** having a proximal end and a distal end, wherein, the removable cartridge **14** comprises; an outer shell **2**, a first connection mechanism **19** at the distal end, at least one air inlet in the distal end **26**, a first heating element **3** with circuitry **10**, a second heating element with circuitry **11**, a first compartment containment of vaporizable material **114**, a second compartment containment of vaporizable material **214**, wherein the vaporizable material in the first compartment **114** is the same or different as the vaporizable material in the second compartment **214**, at least one airpath **1** therethrough having exposure to at least one compartment for containment of vaporizable material **114, 214** and at least one heating element **3, 4**, comprising heating coils **31, 41**, a liquid barrier **13** to isolate the vaporizable materials within at least one compartment and from at least one airpath, an air outlet **17** at the proximal end; and a body **18** having a proximal end and a distal end, coupleable to the cartridge

with a second connection mechanism **19**; wherein, the body comprises; an outer shell **2**, the second connection mechanism **19** at the proximal end, an air inlet in the outer shell **16**, at least one indicator light or mode indicator LED **20, 21**, a battery **70**, circuitry **80, 90** for controlling the device, at least one operator-controlled push-button **15** connected to the circuitry through the outer shell, and an air outlet **27** in the proximal end. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0088] In some embodiments, the device for generating an inhalable aerosol is an electronic cigarette **100**. In some embodiments, the device for generating an inhalable aerosol is an electronic cigar (not shown). In some embodiments, the device for generating an inhalable aerosol is an electronic pipe (not shown). In some embodiments, the device for generating an inhalable aerosol is an electronic water-cooled smoking apparatus (not shown).

[0089] Still further, the removable cartridge **14** comprises at least one atomizing chamber **61, 62, 63, 64** adjacent and proximal to the resistive heating elements **3, 4, 5** and heater coils **31, 41, 51**. In some embodiments a detachable mouthpiece comprises the cartridge **14**. In some embodiments a detachable mouthpiece is the cartridge **14**.

[0090] In some embodiments, the vaporizable material is a liquid, a gel, a viscous material, a temperature sensitive mesophase material.

[0091] As shown in the representative body / electronics and battery module cross-section of **FIG. 5**, in some embodiments of the device, the circuitry controls the selection of the electronic heaters to be activated. This may be accomplished in a number of ways, including but not limited to push button controls **15**, having power supply wires **22** for coupling to the heater wires extending to the first connection mechanism **19**, pressure sensitive or solid state pressure switches (not shown), a circuit board (alternatively called circuitry or control circuitry herein) **80**, or an accelerometer **90** to name a few.

[0092] In some embodiments of the device, the compartments for containment of vaporizable material contain nicotine, flavorants, humectants, or water.

[0093] In some embodiments of the device, the compartments for containment of vaporizable material **114, 214, 314** with individual resistive heating elements **3, 4, 5**, respectively, are prefilled with the same or different vaporizable material. In some embodiments of the device, the compartments for containment of vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5**, respectively, is filled by the user with the same or different vaporizable material. In some embodiments of the device, the compartments for containment of

vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5**, respectively, are recyclable and/or reusable.

[0094] In some embodiments of the device, a mouthpiece comprises the compartments for containment of vaporizable material **114, 214, 314** with individual resistive heating elements **3, 4, 5**, respectively, are prefilled with the same or different vaporizable material. In some embodiments of the device, the compartments for containment of vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5** is filled by the user with the same or different vaporizable material. In some embodiments of the device, the compartments for containment of vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5**, respectively, are recyclable and/or reusable.

[0095] In some embodiments of the device, the compartments for containment of vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5** are replaceable and the housing is reusable.

[0096] In some embodiments of the device, a mouthpiece comprises the compartments for containment of vaporizable material **114, 214, 314**, with individual resistive heating elements **3, 4, 5**, respectively, are replaceable and the mouthpiece is reusable.

[0097] In some embodiments of the device, the cartridge comprising the compartments for containment of vaporizable material are available in 2-element modules **114, 214**; 3-element modules **114, 214, 314**; or multi-element modules **114, 214, 314, ...“x14”**.

[0098] In some embodiments of the device, a detachable mouthpiece comprises a cartridge comprising the compartments for containment of vaporizable material, wherein the mouthpiece is available in 2-element modules **114, 214**; 3-element modules **114, 214, 314**; or multi-element modules **114, 214, 314, ...“x14”**. In some embodiments of the device, a detachable mouthpiece comprises a cartridge comprising the compartments for containment of vaporizable material, wherein the cartridge comprising the compartments for containment of vaporizable material are available in 2-element modules **114, 214**; 3-element modules **114, 214, 314**; or multi-element modules **114, 214, 314, ...“x14”**

[0099] In still other embodiments of the device the target temperatures for the heating elements **3, 4, 5** is below the combustion temperature for tobacco. In still other embodiments of the device the target temperatures for the heating elements **3, 4, 5** is below the pyrolysis temperature for tobacco. More specifically, a target “vapor temperature” is greater than about 100°C, but less than about 300°C, intended to convert the vaporizable material of at least one compartment to a visible vapor. In some embodiments of the device, the target temperature for the heating elements for nicotine is about 190°C. In some embodiments of the device, the target temperature

for the heating elements for flavorants is about 170°C. In some embodiments of the device, the target temperature for the heating elements for humectants is about 210°C.

[00100] Still further, in some embodiments the circuitry includes an accelerometer **90** as previously noted and shown in **FIG 5**. In some embodiments the accelerometer functions comprise; determining if a user is actively using the device, providing a pre-heat condition for the heating elements, providing a battery power level feedback of the device to the user, providing user with a mechanism to change available modes of the device, providing an automatic activation mode when the device is picked up by the user, providing an automatic sleep mode when the device is inactive for a period of time. Direct visual feedback is provided to the user through the use of at least one LED light indicator **20**, or Mode indicator **21**.

[00101] Provided herein is a device for generating an inhalable aerosol, comprising; a detachable cartridge comprising, a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material, wherein the vaporizable material in the first compartment is the same or different as the vaporizable material in the second compartment; and a body having a battery, an activation button, and circuitry for controlling the device, wherein the device generates an aerosol substantially free from at least one Hoffman analyte upon heating the vaporizable material to a target temperature. In some embodiments the device is configured to further comprise a detachable mouthpiece, wherein the mouthpiece is the detachable cartridge. In some embodiments the mouthpiece has at least one air passage therethrough and at least one heating element is exposed to the air passage. In some embodiments the detachable mouthpiece cartridge is a single-unit, non-modular construction. In some embodiments the compartments for containment of vaporizable material are aligned in series within the detachable mouthpiece cartridge, are aligned in parallel within the detachable mouthpiece cartridge, are aligned concentrically within the detachable mouthpiece cartridge, and/or are aligned in any combination of series stacking, concentric, and parallel alignment within the detachable mouthpiece cartridge.

[00102] In some embodiments, the Hoffman analyte is selected from the group consisting of: ammonia, aminonaphthalenes, benzopyrene, formaldehyde, acetaldehyde, acetone, methyl ethyl ketone, butyraldehyde, hydrogen cyanide, nitrous oxides, tobacco-specific nitrosamines (TSNAs), pyridine, quinoline, hydroquinone, phenol, cresols, tar, nicotine, carbon monoxide, 1,3-butadiene, isoprene, acrylonitrile, benzene, toluene, and styrene. In some embodiments, the aerosol comprises particles less than about 2 microns in diameter. In some embodiments, the device generates an aerosol upon heating a vaporizable material to a target temperature with at

least 70% less Hoffman analytes than a common tobacco cigarette. In some embodiments, the device generates an aerosol comprising particles less than about 2 microns in diameter.

[00103] Provided herein is a method of delivering an aerosol substantially free from a Hoffman analyte to a subject comprising; deploying an aerosol generating device a first heating element, a second heating element, a first compartment for containment of vaporizable material, and a second compartment for containment of vaporizable material, wherein the vaporizable material in the first compartment is the same or different as the vaporizable material in the second compartment; and heating the vaporizable materials with at least one heating element of the device to a target temperature to generate an aerosol; and delivering the aerosol to the subject for inhalation.

[00104] In some embodiments of the method, the aerosol comprises particles less than about 2 microns in diameter.

[00105] Provided herein is a device for generating an aerosol from a vaporizable material wherein the aerosol contains at least 70% less Hoffman analytes than a substance generated by burning a tobacco material.

[00106] Provided herein is a device for generating an aerosol from a vaporizable material wherein the device generates an aerosol from a vaporizable material wherein the vapor generated by the device yields a non-mutagenic Ames test result.

[00107] Provided herein is a device for generating an aerosol from a vaporizable material wherein the aerosol vapor scores significantly better on the Ames test than a substance generated by burning a tobacco material.

[00108] Provided herein is a device for generating an aerosol from a vaporizable material wherein the device provides an aerosol for inhalation to a user for at least three non-continuous hours without servicing the device.

[00109] While preferred embodiments of the present invention have been shown and described herein, it will be obvious to those skilled in the art that such embodiments are provided by way of example only. Numerous variations, changes, and substitutions will now occur to those skilled in the art without departing from the invention. It should be understood that various alternatives to the embodiments of the invention described herein may be employed in practicing the invention. It is intended that the following claims define the scope of the invention and that methods and structures within the scope of these claims and their equivalents be covered thereby.

CLAIMS

WHAT IS CLAIMED IS:

1. A device for generating an inhalable aerosol comprising:
 - a) a cartridge comprising, a first vaporizable material, a first compartment for containment of the first vaporizable material, a first heating element, a second vaporizable material, and a second compartment for containment of the second vaporizable material, wherein the first vaporizable material in the first compartment is the same as or different than the second vaporizable material in the second compartment; and
 - b) a body having a battery and circuitry for controlling the device, wherein the cartridge and body are coupled by a first connection mechanism that allows for detachment of the cartridge from the body by a user, and wherein the first heating element is configured to vaporize the first vaporizable material.
2. The device of claim 1, comprising a second heating element, wherein the second heating element is configured to vaporize the second vaporizable material.
3. The device of claim 1, wherein the first heating element is configured to vaporize the second vaporizable material.
4. The device of claim 1, wherein the first heating element comprises a resistive heater circuit.
5. The device of claim 2, wherein the second heating element comprises a resistive heater circuit.
6. The device of claim 2, wherein the first heating element is configured to heat to a first target temperature, and the second heating element is configured to heat to a second target temperature.
7. The device of claim 6, wherein the first target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.
8. The device of claim 6, wherein the second target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.
9. The device of claim 6, wherein the first target temperature is different from the second target temperature.
10. The device of claim 2, comprising a first wicking material, wherein the first heating element comprises a first wire having a first end and a second end, the first wire in contact with

the first wicking material, wherein the first wicking material is in fluid communication with the first vaporizable material.

11. The device of claim 10, wherein the first heating element is in the first compartment and wherein the first end and the second end of the first wire exit the first compartment and couple electrically to the body.

12. The device of claim 2 or 10, comprising a second wicking material, wherein the second heating element comprises a second wire having a third end and a fourth end, the second wire in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material.

13. The device of claim 12, wherein the second heating element is in the second compartment and wherein the third end and the fourth end of the second wire exit the second compartment and couple electrically to the body.

14. The device of claim 12, wherein the first wicking material and the second wicking material have the same material properties or different material properties.

15. The device of claim 12, wherein the first wicking material and the second wicking material have the same wicking properties or different wicking properties.

16. The device of claim 12, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material.

17. The device of claim 12, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to differences between the first vaporizable material and the second vaporizable material.

18. The device of claim 12, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to configurations of the circuitry.

19. The device of claim 2, wherein the first compartment and the second compartment are in series within the detachable cartridge relative to an airflow path.

20. The device of claim 2, wherein the first compartment and the second compartment are in parallel within the detachable cartridge relative to an airflow path.

21. The device of claim 2, wherein the first compartment and the second compartment share a common axis within the detachable cartridge.

22. The device of claim 20, wherein the common axis is aligned with a central axis of an airflow path.

23. The device of claim 2, wherein the first compartment and the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the detachable cartridge.

24. The device of claim 2, wherein the first compartment and the second compartment are removable from the cartridge.

25. The device of claim 2, wherein the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

26. The device of claim 1, wherein the connection mechanism comprises:

- (1) a threaded connection,
- (2) a tapered connection,
- (3) a magnetic connection,
- (4) a spring-loaded connection,
- (5) a spring detent connection,
- (6) a snap-fit connection,
- (7) a compression connection, or
- (8) any combination thereof.

27. The device of claim 1, wherein the body further comprises at least one push button for operator control of the circuitry.

28. The device of claim 2, wherein the first compartment comprises a first airflow path, and the second compartment has a second airflow path that is in communication with the first airflow path.

29. The device of claim 2, wherein the first compartment comprises a first airflow path, and the second compartment has a second airflow path, wherein first vapor from the first airflow path is introduced to second vapor from the second airflow path prior to exiting the cartridge.

30. The device of claim 28, wherein the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor to the second vapor occurs in the second chamber.

31. The device of claim 28, wherein the cartridge comprises a third chamber and introduction of the first vapor to the second vapor occurs in the chamber.

32. The device of claim 1, wherein the cartridge further comprises a mouthpiece.

33. A cartridge for use with a vaporization device comprising: a first vaporizable material, a first compartment that contains the first vaporizable material, a first heating element, a second vaporizable material, and a second compartment that contains the second vaporizable

material, wherein the first vaporizable material in the first compartment is the same as or different from the second vaporizable material in the second compartment, wherein the cartridge comprises a first portion of a first connection mechanism for detachable connection to a body of the vaporization device, and wherein the first heating element is configured to vaporize the first vaporizable material.

34. The cartridge of claim 33, comprising a second heating element, wherein the second heating element is configured to vaporize the second vaporizable material.

35. The cartridge of claim 33, wherein the first heating element is configured to vaporize the second vaporizable material.

36. The cartridge of claim 33, wherein the first heating element comprises a resistive heater circuit.

37. The cartridge of claim 34, wherein the second heating element comprises a resistive heater circuit.

38. The cartridge of claim 34, wherein the first heating element is configured to heat to a first target temperature, and the second heating element is configured to heated to a second target temperature that is different from the first target temperature, wherein the first heating element material properties are different than the second heating element material properties.

39. The cartridge of claim 38, wherein the first target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.

40. The cartridge of claim 38, wherein the second target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.

41. The cartridge of claim 38, comprising a first wicking material, wherein the first heating element comprises a first wire having a first end and a second end in contact with the first wicking material, wherein the first wicking material is in fluid communication with the first vaporizable material.

42. The cartridge of claim 41, wherein the first heating element is in the first compartment and wherein the first end and the second end of the first wire exits the first compartment and couple electrically to the body.

43. The cartridge of claim 34 or 41, comprising a second wicking material, wherein the second heating element comprises a second wire having a third end and a fourth end in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material.

44. The cartridge of claim 43, wherein the second heating element is in the second compartment and wherein the third end and the fourth end of the second wire exits the second compartment and couple electrically to a battery of the device.

45. The cartridge of claim 43, wherein the first wicking material and the second wicking material have the same material properties or different material properties.

46. The cartridge of claim 43, wherein the first wicking material and the second wicking material have the same wicking properties or different wicking properties.

47. The cartridge of claim 43, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material.

48. The cartridge of claim 43, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to differences between the first vaporizable material and the second vaporizable material.

49. The cartridge of claim 34, wherein the first compartment and the second compartment are in series within the cartridge relative to an airflow path.

50. The cartridge of claim 34, wherein the first compartment and the second compartment are in parallel within the cartridge relative to an airflow path.

51. The cartridge of claim 34, wherein the first compartment and the second compartment share a common axis within the detachable cartridge.

52. The cartridge of claim 51, wherein the common axis is aligned with a central axis of an airflow path.

53. The cartridge of claim 34, wherein the first compartment and the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the detachable cartridge.

54. The cartridge of claim 34, wherein the first compartment and the second compartment are removable from the cartridge.

55. The cartridge of claim 34, wherein the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

56. The cartridge of claim 34, wherein the first connection mechanism comprises:

- (1) a threaded connection,
- (2) a tapered connection,
- (3) a magnetic connection,
- (4) a spring-loaded connection,
- (5) a spring detent connection,

- (6) a snap-fit connection,
- (7) a compression connection, or
- (8) any combination thereof.

57. The cartridge of claim 33, wherein the cartridge further comprises a mouthpiece.

58. The cartridge of claim 34, wherein the first compartment comprises a first airflow path, and the second compartment has a second airflow path that is in communication with the first airflow path.

59. The cartridge of claim 34, wherein the first compartment comprises a first airflow path, and the second compartment has a second airflow path, wherein first vapor from the first airflow path is introduced to second vapor from the second airflow path prior to exiting the cartridge.

60. The cartridge of claim 58, wherein the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor to the second vapor occurs in the second chamber.

61. The cartridge of claim 58, wherein the cartridge comprises a third chamber and introduction of the first vapor to the second vapor occurs in the chamber.

62. The device of claim 2 wherein a pre-heat temperature for the first heating element or the second heating element is from about 100°C to about 130°C.

63. The device of claim 1, wherein the circuitry includes an accelerometer.

64. The device of claim 63, wherein the accelerometer functions comprise:

- (i) determining if a user is actively using the device;
- (ii) providing a battery power level feedback of the device to the user;
- (iii) providing the user with a mechanism to change a mode of the device;
- (iv) providing an automatic activation mode when the device is picked up by the user;
- (v) providing a selective pre-heat mode for the resistive heating elements; and
- (vi) providing an automatic sleep mode when the device is inactive for a period of time.

65. The device of claim 1, wherein the vaporizable material comprises a liquid, a gel, a viscous material, a temperature sensitive mesophase material, or a combination thereof.

66. The device of claim 1, wherein the first vaporizable material or the second vaporizable material comprise: nicotine; flavorants; humectants; water; or a combination thereof.

67. The cartridge of claim 33, wherein the vaporizable material comprises a liquid, a gel, a viscous material, a temperature sensitive mesophase material, or a combination thereof.

68. The cartridge of claim 33, wherein the first vaporizable material or the second vaporizable material comprise: nicotine; flavorants; humectants; water; or a combination thereof.

69. The device of claim 1, wherein the cartridge is available in 2-compartment modules, 3-compartment modules, or multi-compartment modules.

70. The cartridge of claim 33, wherein, wherein the cartridge is available in 2-compartment modules, 3-compartment modules, or multi-compartment modules.

71. The device of claim 1, wherein the device comprises a first capacitive sensing zone and a second capacitive sensing zone, wherein the first zone is electrically isolated from the second zone, and wherein the first zone comprises a first capacitive sensor and the second zone comprises a second capacitive sensor.

72. The device of claim 71, wherein the first zone and second zone are configured so that when the first zone and second zone are contacted by a user, the device communicates information to the user, the information comprising, a battery charge level, a vaporizable material level, a pre-heat state, or a combination thereof.

73. The device of claim 71, wherein when the first zone and second zone are configured so that when a user swipes a finger from the first zone to the second zone or from the second zone to the first zone, the device communicates information to the user, the information comprising, a battery charge level, a vaporizable material level, a pre-heat state, or a combination thereof.

74. The device of claim 71, wherein when the first zone and second zone are configured so that when a user swipes a finger from the first zone to the second zone or from the second zone to the first zone, the device is activated.

75. A method of generating an aerosol comprising: providing an aerosol generating device comprising: a cartridge comprising, a first vaporizable material, a first compartment that contains the first vaporizable material, a first heating element, a second vaporizable material, and a second compartment that contains the second vaporizable material, wherein the first vaporizable material in the first compartment is the same or different as the second vaporizable material in the second compartment; and a body having a battery and circuitry for controlling the device, wherein the detachable cartridge and body are coupled by a first connection mechanism and wherein the first heating element is configured to vaporize the first vaporizable material, wherein the device is configured to

- generate a first aerosol in a first airflow path from the first vaporizable material,
- generate a second aerosol from the second vaporizable material in the first airflow

path or a second airflow path, and deliver the first aerosol and the second aerosol to a user, or

- generate a first vapor in a first airflow path from the first vaporizable material, generate a second vapor from the second vaporizable material in the first airflow path or a second airflow path, and deliver to a user
 - o a third aerosol comprising condensate of the first vapor and the second vapor or
 - o a fourth aerosol generated from a third vapor, the third vapor formed when the first vapor is introduced to the second vapor or condensate thereof, or
 - o a fifth aerosol generated when the first aerosol is introduced to the second vapor or condensate thereof.

76. The method of claim 75, comprising a second heating element, wherein the second heating element is configured to vaporize the second vaporizable material

77. The method of claim 75, wherein the first heating element is configured to vaporize the second vaporizable material.

78. The method of claim 75, wherein the first heating element comprises a resistive heater circuit.

79. The method of claim 76, wherein the first heating element is configured to heat to a first target temperature, and the second heating element is configured to heat to a second target temperature.

80. The method of claim 79, wherein the first target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.

81. The method of claim 79, wherein the second target temperature is from about 100° to about 300°C, from about 125° to about 255°C, from about 150° to about 230° C, from about 170° to about 210° C.

82. The method of claim 79, wherein the first target temperature is different from the second target temperature.

83. The method of claim 75, comprising a first wicking material, wherein the first heating element comprises a first wire having a first end and a second end, the first wire in contact with the first wicking material, wherein the first wicking material is in fluid communication with the first vaporizable material.

84. The method of claim 83, wherein the first heating element is in the first compartment and wherein the first end and the second end of the first wire exit the first compartment and couple electrically to the body.

85. The method of claim 76 or 83, comprising a second wicking material, wherein the second heating element comprises a second wire having a third end and a fourth end, the second wire in contact with the second wicking material, wherein the second wicking material is in fluid communication with the second vaporizable material.

86. The method of claim 85, wherein the second heating element is in the second compartment and wherein the third end and the fourth end of the second wire exit the second compartment and couple electrically to the body.

87. The method of claim 85, wherein the first wicking material and the second wicking material have the same material properties or different material properties.

88. The method of claim 85, wherein the first wicking material and the second wicking material have the same wicking properties or different wicking properties.

89. The method of claim 85, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to the wicking properties of the first wicking material and the second wicking material.

90. The method of claim 85, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to differences between the first vaporizable material and the second vaporizable material.

91. The method of claim 85, wherein the first wicking material and the second wicking material have the same wicking rate or different wicking rate due to configurations of the circuitry.

92. The method of claim 85, wherein the first compartment and the second compartment are in series within the detachable cartridge relative to an airflow path.

93. The method of claim 76, wherein the first compartment and the second compartment are in parallel within the cartridge relative to the first airflow path.

94. The method of claim 76, wherein the first compartment and the second compartment share a common axis within the cartridge.

95. The method of claim 94, wherein the common axis is aligned with a central axis of the first airflow path or the second airflow path or both.

96. The method of claim 76, wherein the first compartment and the second compartment are stacked, concentric, aligned around a central axis, or in a parallel alignment within the cartridge.

97. The method of claim 76, wherein the first compartment and the second compartment are removable from the cartridge.

98. The method of claim 76, wherein the first compartment and the second compartment are replaceable with a third compartment or a fourth compartment in the cartridge.

99. The method of claim 75, wherein the connection mechanism comprises:

1. a threaded connection,
2. a tapered connection,
3. a magnetic connection,
4. a spring-loaded connection,
5. a spring detent connection,
6. a snap-fit connection,
7. a compression connection, or
8. any combination thereof.

100. The method of claim 75, wherein the body further comprises at least one push button for operator control of the circuitry.

101. The method of claim 76, wherein the first compartment comprises the first airflow path, and the second compartment comprises the second airflow path that is in communication with the first airflow path.

102. The method of claim 76, wherein the first compartment comprises the first airflow path, and the second compartment comprises the second airflow path, wherein the device is configured to introduce the first vapor or condensate thereof from the first airflow path to second vapor or condensate thereof from the second airflow path prior to exiting the cartridge.

103. The method of claim 76, wherein the first compartment comprises a first chamber comprising the first airflow path, and the second compartment comprises a second chamber comprising the second airflow path, wherein introduction of the first vapor or condensate thereof to the second vapor or condensate thereof occurs in the second chamber.

104. The method of claim 102, wherein the cartridge comprises a third chamber and introduction of the first vapor or condensate thereof to the second vapor or condensate thereof occurs in the third chamber.

105. The method of claim 75, wherein the cartridge further comprises a mouthpiece.

106. The device claim 2, wherein the first vaporizable material comprises water.

107. The device of claim 106, wherein the device is configured to heat the first vaporizable material to a lower temperature than a second temperature to which the second vaporizable material is heated.

108. The device claim 2, wherein the second vaporizable material comprises water.

109. The device of claim 108, wherein the device is configured to heat the second vaporizable material to a lower temperature than a second temperature to which the first vaporizable material is heated.

110. The cartridge claim 34, wherein the first vaporizable material comprises water.

111. The method of claim 110, wherein the device is configured to heat the first vaporizable material to a lower temperature than a second temperature to which the second vaporizable material is heated.

112. The cartridge of claim 34, wherein the second vaporizable material comprises water.

113. The method of claim 112, wherein the device is configured to heat the second vaporizable material to a lower temperature than a second temperature to which the first vaporizable material is heated.

114. The method claim 76, wherein the first vaporizable material comprises water.

115. The method of claim 114, wherein the device is configured to heat the first vaporizable material to a lower temperature than a second temperature to which the second vaporizable material is heated.

116. The method claim 76, wherein the second vaporizable material comprises water.

117. The method of claim 116, wherein the device is configured to heat the second vaporizable material to a lower temperature than a second temperature to which the first vaporizable material is heated.

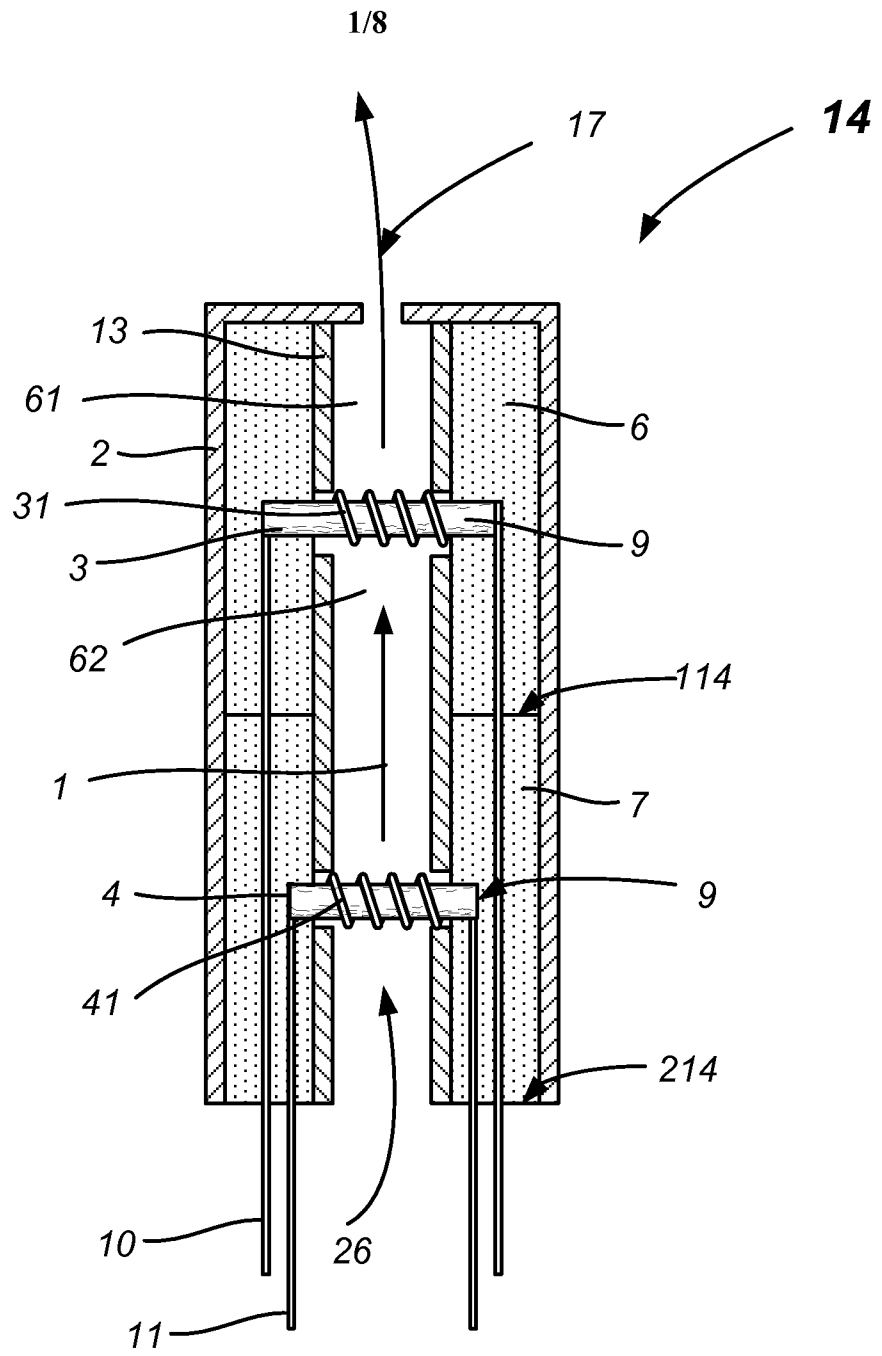


FIG. 1

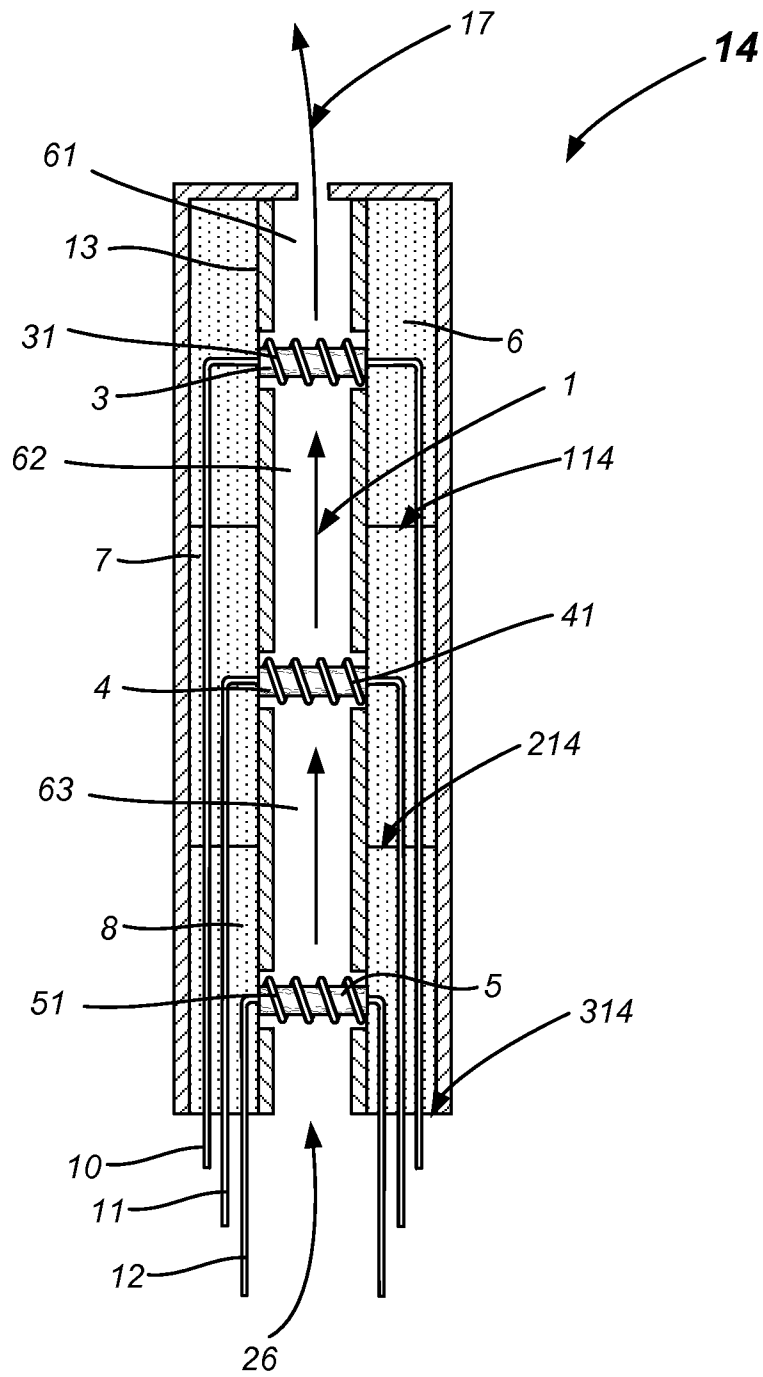


FIG. 2

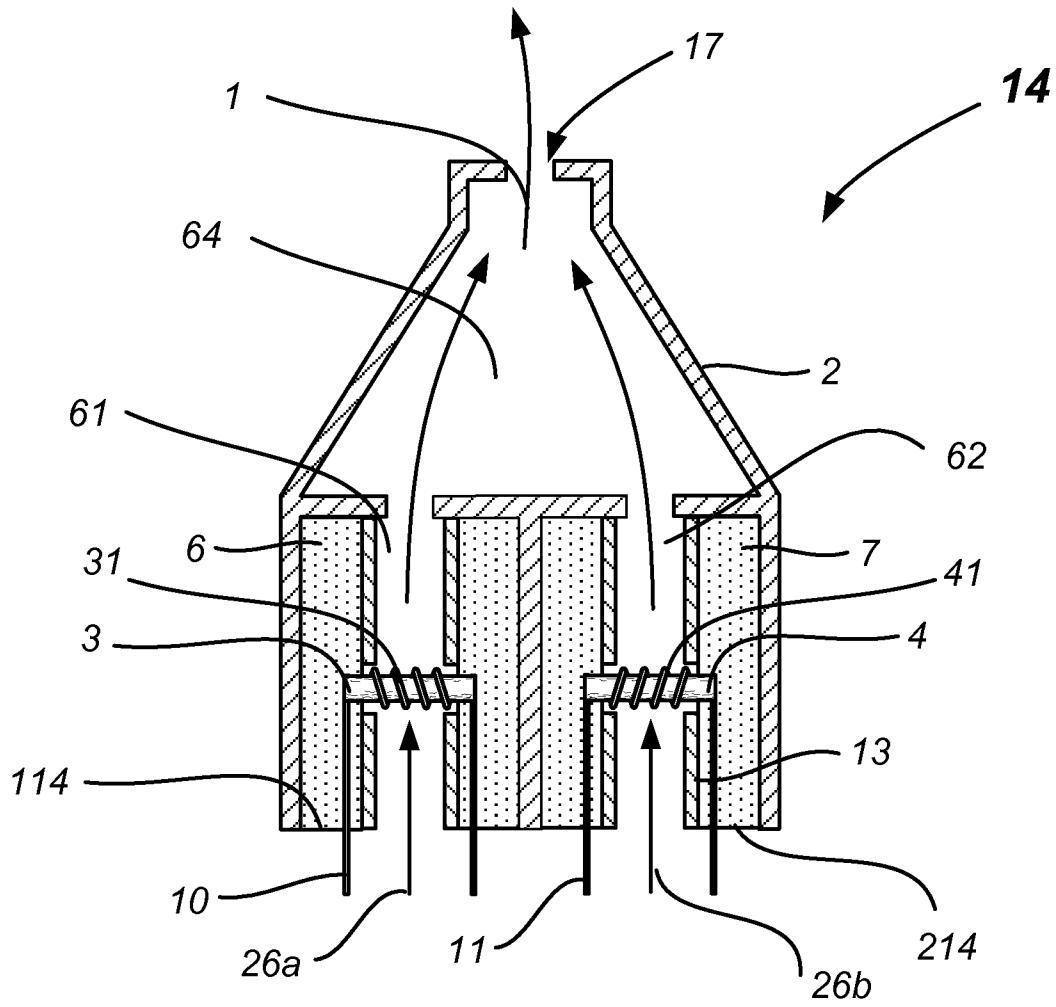


FIG. 3

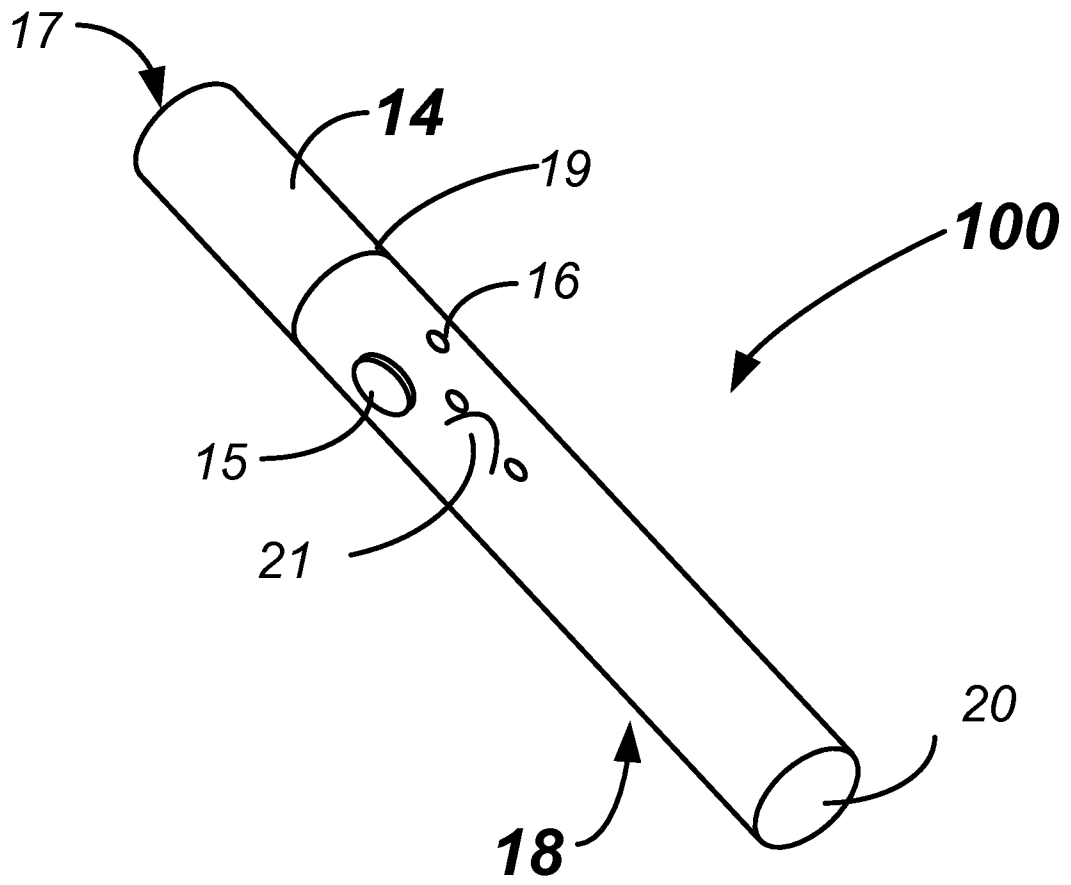


FIG. 4

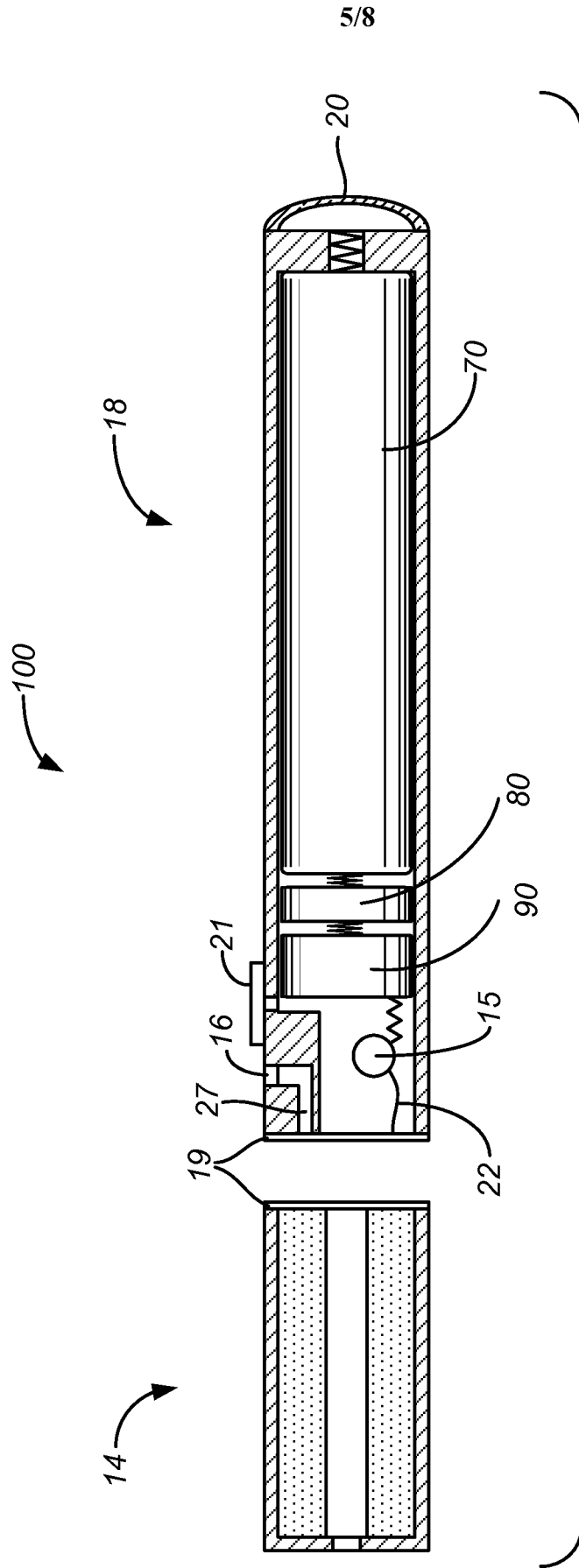
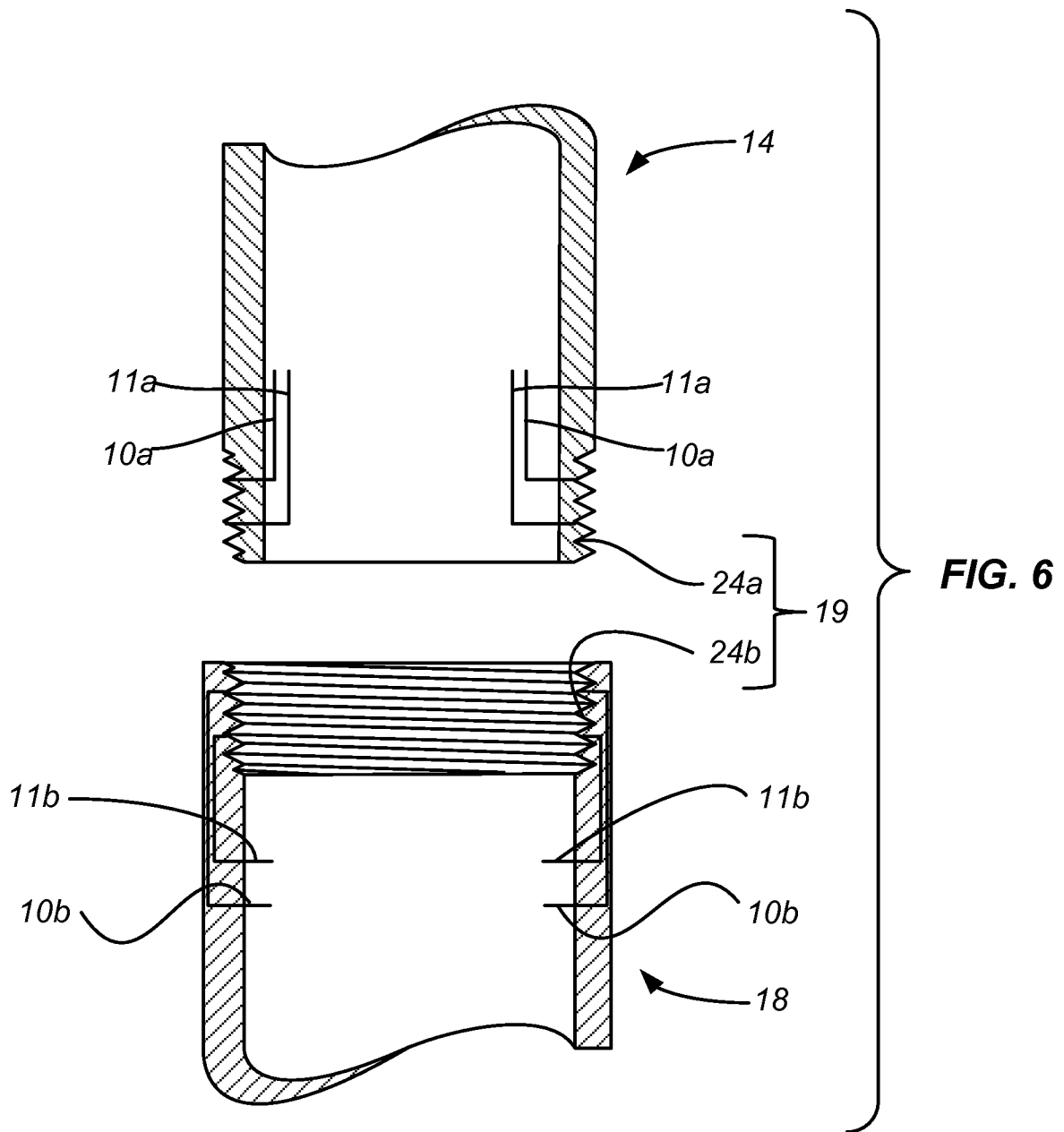
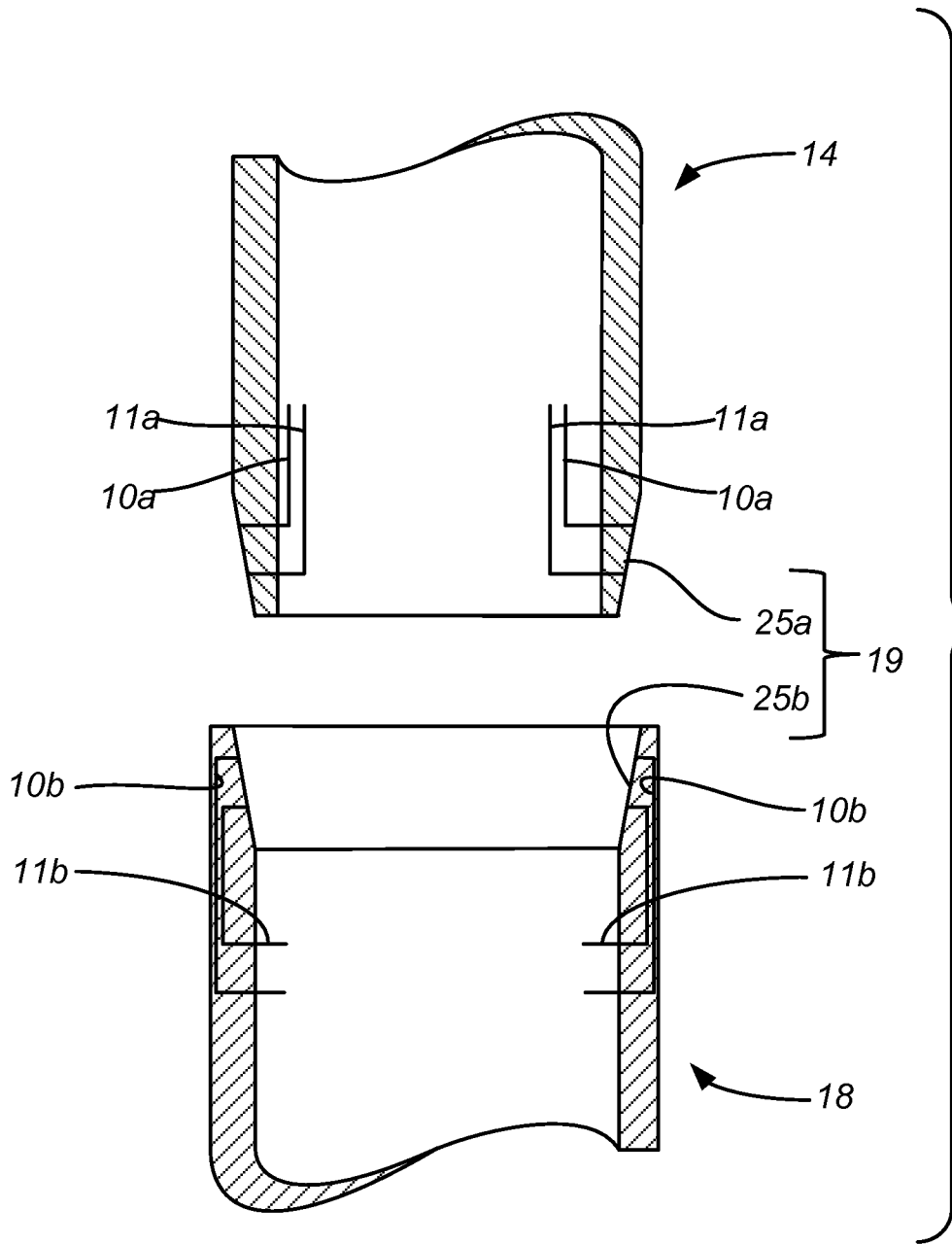


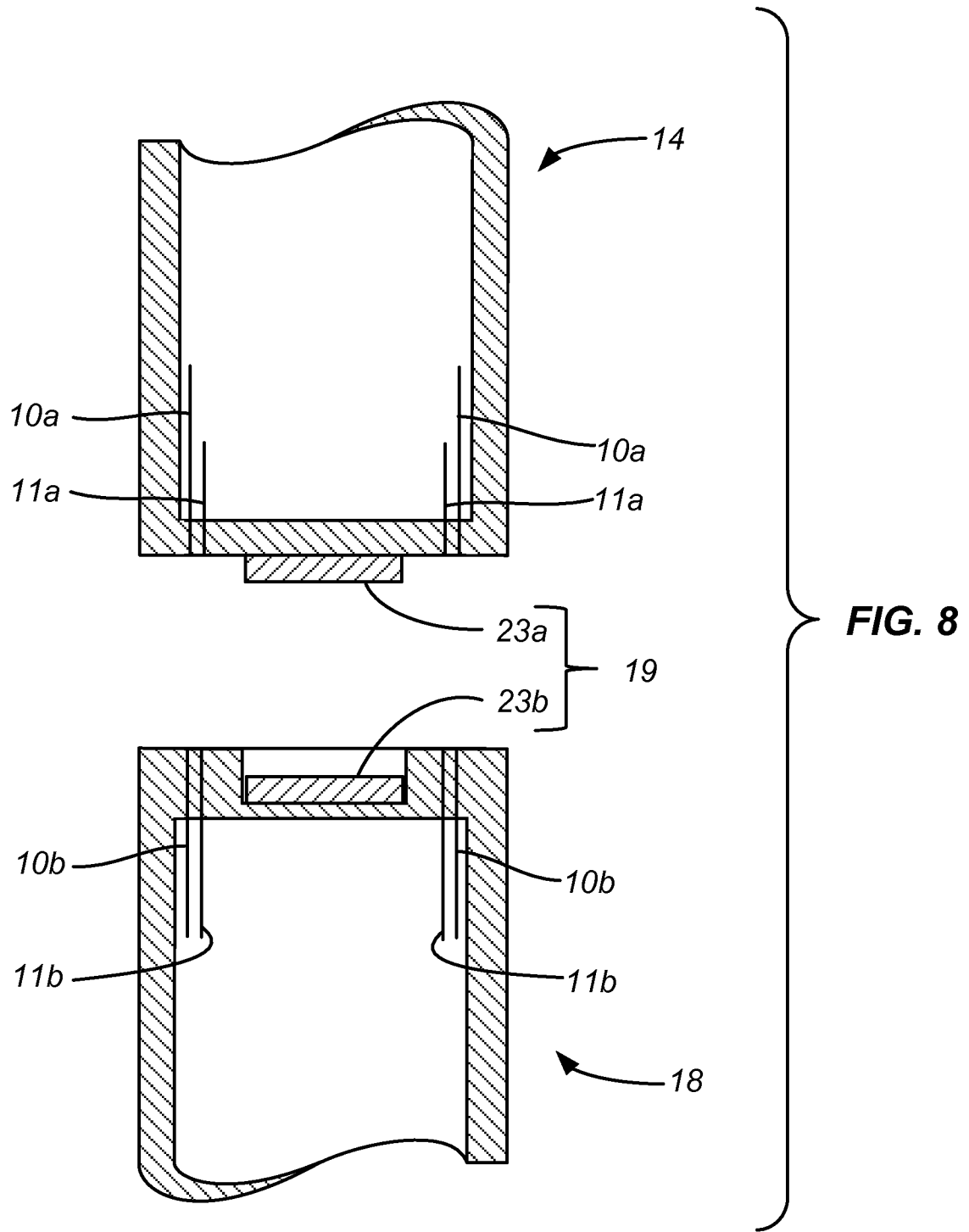
FIG. 5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/042425

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - A24F 47/00; A61M 15/06 (2014.01)
 CPC - A24F 47/008; A61M 15/06 (2014.09)
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC(8) - A24F 25/00, 47/00; A61M 11/00, 11/04, 15/06 (2014.01)
 CPC - A24F 47/00, 47/002, 47/004, 47/008; A61M 15/00, 5/06 (2014.09)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 USPC - 128/202.21, 203.12, 203.26, 203.27; 131/194, 330

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2009/0255534 A1 (PATERNO) 15 October 2009 (15.10.2009) entire document	1-9,19-23,26-30,32-42,49 -53,56-60,65-70,75-82,92 -96,99-117 ----- 10-18,43-48,63,83-85-91
Y	US 2012/0260927 A1 (LIU) 18 October 2012 (18.10.2012) entire document	10-18,43-48,83-91
Y	US 2007/0006889 A1 (KOBAL et al) 11 January 2007 (11.01.2007) entire document	63
A	US 2008/0092912 A1 (ROBINSON et al) 24 April 2008 (24.04.2008) entire document	1-117
A	US 5,708,258 A (COUNTS et al) 13 January 1998 (13.01.1998) entire document	1-117
A	US 2009/0230117 A1 (FERNANDO et al) 17 September 2009 (17.09.2009) entire document	1-117

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
25 September 2014

Date of mailing of the international search report
03 NOV 2014

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