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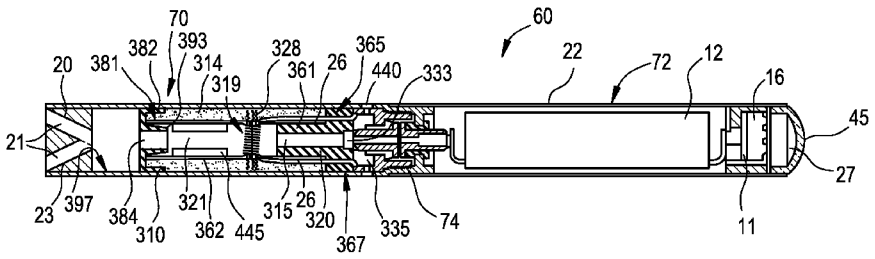
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FIG. 2



(57) Abstract: An electronic vaping device includes an outer tube extending in a longitudinal direction, an inner tube within the outer tube, a reservoir comprising a pre-vapor formulation, a wick in communication with the reservoir, and a heater in communication with the wick. The electronic vaping device may also include at least one of a mouth-end insert including four outlets and a flow constriction in the inner tube. Each outlet is at an end of an off-axis passage that extends from an inlet to the outlet. Each off-axis passage extends tangentially to a circumference surrounding a central, longitudinally extending axis of the electronic vaping device.

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ELECTRONIC VAPING DEVICE

PRIORITY STATEMENT

[0001] This application is a non-provisional application that claims priority to U.S. provisional app. no. 62/075,417, filed on November 5, 2014, the entire contents of which is incorporated by reference in its entirety.

BACKGROUND

Field

[0002] The present disclosure relates to an electronic vaping device and a method of forming an electronic vaping device that produces a vapor having two distinct particle size distributions.

Description of Related Art

[0003] An electronic vaping device includes a heater element, which vaporizes a pre-vapor formulation to produce a vapor. The heater element may include a resistive heater coil, with a wick extending there through.

SUMMARY

[0004] At least one example embodiment relates to a cartridge of an electronic vaping device.

[0005] In at least one example embodiment, a cartridge of an electronic vaping device includes an outer tube extending in a longitudinal direction, an inner tube within the outer tube, the inner tube including a flow constriction along a portion of a length of the inner tube, a reservoir containing a pre-vapor formulation, a wick in communication with the reservoir, and a heater in communication with the wick. The heater is configured to heat the pre-vapor formulation to a temperature sufficient to form a vapor. The flow constriction is configured to reduce a temperature of the vapor, and the flow constriction positioned about 1 mm to about 5 mm from the heater.

[0006] In at least one example embodiment, the flow constriction comprises an insert friction fit in the inner tube. The insert is formed of at least one of a metal, an alloy, a plastic, and a thermoplastic. The material is at least one of polypropylene, polyetheretherketone (PEEK), ceramic, fiberglass, and polyethylene.

[0007] In at least one example embodiment, the cartridge also includes a mouth-end insert including four outlets. Each of the four outlets is at an end of an off-axis passage and each off-axis passage extending generally perpendicularly to adjacent off-axis passages. The inner tube has an inner diameter ranging from about 3 mm to about 4 mm. The flow constriction has an inner diameter ranging from about 1

mm to about 2.5 mm. The flow constriction has a length ranging from about 3 mm to about 8 mm.

[0008] In at least one example embodiment, a cartridge of an electronic vaping device includes an outer tube extending in a longitudinal direction, an inner tube within the outer tube, a reservoir comprising a pre-vapor formulation, a wick in communication with the reservoir, a heater in communication with the wick, the heater configured to heat the pre-vapor formulation, and a mouth-end insert. The mouth-end insert includes a first outlet at an end of a first off-axis passage, and a second outlet at an end of a second off-axis passage. The first off-axis passage and the second off-axis passage each have a central axis extending from an inlet to the outlet, and the first off-axis passage and the second off-axis passage extend tangentially to a circumference surrounding a central, longitudinally extending axis of the electronic vaping device.

[0009] In at least one example embodiment, the mouth-end insert includes four outlets, each of the four outlets being at an end of an off-axis passage.

[0010] In at least one example embodiment, A cartridge of an electronic vaping device includes an outer tube extending in a longitudinal direction, an inner tube within the outer tube, the inner tube including a flow constriction along a portion of a length of the inner

tube, a reservoir comprising a pre-vapor formulation, a wick in communication with the reservoir, a heater in communication with the wick, the heater configured to heat the pre-vapor formulation to form a vapor, and a mouth-end insert. The mouth-end insert includes four outlets. Each of the four outlets is at an end of one of four off-axis passages. The four off-axis passages each have a central axis extending from an inlet to the outlet, and the four off-axis passages each extend tangentially to a circumference surrounding a central, longitudinally extending axis of the electronic vaping device. The flow constriction is between the mouth-end insert and the heater.

[0011] In at least one example embodiment, the flow constriction is an insert friction fit in the inner tube. The insert is formed of at least one of a metal, an alloy, a plastic, and a thermoplastic. The material is at least one of polypropylene, polyetheretherketone (PEEK), ceramic, fiberglass, and polyethylene. The flow constriction is about 1 mm to about 5 mm from the heater. The flow constriction has an inner diameter ranging from about 1 mm to about 2.5 mm. The flow constriction has a length ranging from about 3 mm to about 8 mm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The various features and advantages of the non-limiting embodiments herein may become more apparent upon review of the

detailed description in conjunction with the accompanying drawings. The accompanying drawings are merely provided for illustrative purposes and should not be interpreted to limit the scope of the claims. The accompanying drawings are not to be considered as drawn to scale unless explicitly noted. For purposes of clarity, various dimensions of the drawings may have been exaggerated.

[0013] Figure 1 is a top planar view of an electronic vaping device according to at least one example embodiment.

[0014] Figure 2 is a side, cross-sectional view of at least one example embodiment of an electronic vaping device.

[0015] Figure 3 is a bottom view of a mouth-end insert according to at least one example embodiment.

[0016] Figure 4 is a top view of a mouth-end insert according to at least one example embodiment.

[0017] Figure 5 is a side, cross-sectional view of at least one example embodiment of an electrical vaping device as described herein.

[0018] Figure 6 is a truncated side, cross-sectional view of a first section of an electrical vaping device according to at least one example embodiment.

[0019] Figure 7 is a perspective view of an inner tube (chimney) according to at least one example embodiment.

[0020] Figure 8 is a perspective view of an inner tube (chimney) according to at least one example embodiment.

[0021] Figure 9 is a perspective view of a bottom of a mouth-end insert according to at least one example embodiment.

DETAILED DESCRIPTION

[0022] Some detailed example embodiments are disclosed herein. However, specific structural and functional details disclosed herein are merely representative for purposes of describing example embodiments. Example embodiments may, however, be embodied in many alternate forms and should not be construed as limited to only the example embodiments set forth herein.

[0023] Accordingly, while example embodiments are capable of various modifications and alternative forms, example embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that there is no intent to limit example embodiments to the particular forms disclosed, but to the contrary, example embodiments are to cover all modifications, equivalents, and alternatives falling within the scope of example embodiments. Like numbers refer to like elements throughout the description of the figures.

[0024] It should be understood that when an element or layer is referred to as being "on," "connected to," "coupled to," or “covering” another element or layer, it may be directly on, connected to, coupled to, or covering the other element or layer or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly connected to," or "directly coupled to" another element or layer, there are no intervening elements or layers present. Like numbers refer to like elements throughout the specification. As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0025] It should be understood that, although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers, and/or sections should not be limited by these terms. These terms are only used to distinguish one element, component, region, layer, or section from another region, layer, or section. Thus, a first element, component, region, layer, or section discussed below could be termed a second element, component, region, layer, or section without departing from the teachings of example embodiments.

[0026] Spatially relative terms (e.g., "beneath," "below," "lower," "above," "upper," and the like) may be used herein for ease of description to describe one element or feature's relationship to another element(s) or

feature(s) as illustrated in the figures. It should be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the term "below" may encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0027] The terminology used herein is for the purpose of describing various example embodiments only and is not intended to be limiting of example embodiments. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “includes,” “including,” "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0028] Example embodiments are described herein with reference to cross-sectional illustrations that are schematic illustrations of idealized

embodiments (and intermediate structures) of example embodiments. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, example embodiments should not be construed as limited to the shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

[0029] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which example embodiments belong. It will be further understood that terms, including those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0030] At least one example embodiment is related to an electronic vaping device, which may include at least one of mouth-end insert and a flow constriction. The flow constriction may be between a heater and the mouth-end insert. The mouth-end insert may include two or more holes that are rotationally and radially angled so as to distribute vapor in a diverging and swirling pattern as the vapor exits the electronic vaping device. Moreover, the diverging and swirling pattern reduces vapor temperature before exiting the electronic vaping device. The flow

constriction downstream of the heater may reduce vapor temperature before exiting the electronic vaping device.

[0031] In at least one example embodiment, the electronic vaping device produces a vapor upon heating a pre-vapor formulation.

[0032] In at least one example embodiment, the pre-vapor formulation may be a material or combination of materials that may be transformed into a vapor. For example, the pre-vapor formulation may be a liquid, solid and/or gel formulation including, but not limited to, water, beads, solvents, active ingredients, ethanol, plant extracts, natural or artificial flavors, and/or vapor formers, such as glycerin and propylene glycol.

[0033] Figure 1 is a top planar view of an electronic vaping device according to at least one example embodiment. Figure 2 is a side, cross-sectional view of an electronic vaping device according to at least one example embodiment.

[0034] As shown in Figures 1 and 2, the electronic vaping device 60 comprises a cartridge (or first section) 70 and a fixture (or second section) 72, which are coupled together at a threaded joint 74 or by other connector or mechanism such as a snug-fit, snap-fit, detent, clamp and/or clasp. The first section 70 may house a mouth-end insert 20, a heater 319, a flexible, filamentary wick 328, and a reservoir 314. The second section 72 may house a power supply 12, a control circuit 11,

and optionally a puff sensor 16. The first section 70 and the second section 72 include an outer housing 22 extending in a longitudinal direction along a length of the electronic vaping device 60. In at least one example embodiment, the electronic vaping device 60 may be disposable and includes only one section (not shown). In at least one example embodiment, the first section 70 may include a refillable reservoir 314 or the first section 70 may be disposable and the second section 72 may include a rechargeable battery.

[0035] In at least one example embodiment, as shown in Figure 2, the electronic vaping device 60 includes a heater 319 and a filamentary wick 328. The first section 70 includes the outer housing 22 extending in a longitudinal direction and an inner tube (or chimney) 362 coaxially positioned within the outer housing 22. A nose portion 361 of an upstream gasket (or seal) 320 is fitted into a first end portion 365 of the inner tube 362, such that an outer perimeter 367 of the gasket 320 provides a liquid-tight seal with an interior surface 397 of the outer housing 22. The gasket 320 also includes a central, longitudinal air passage 315, which opens into an interior of the inner tube 362 that defines a central channel 321. A transverse channel 333 at a portion of the gasket 320 intersects and communicates with the central, longitudinal air passage 315 of the gasket 320. This channel 333 assures

communication between the central, longitudinal air passage 315 and a space 335 defined between the gasket 320 and a threaded connection 74.

[0036] A nose portion 393 of a second gasket 310 is fitted into a second end portion 381 of the inner tube 362. An outer perimeter 382 of the second gasket 310 provides a seal with an interior surface 397 of the outer housing 22. The second gasket 310 includes a central channel 384 disposed between the central passage 321 of the inner tube 362 and the mouth-end insert 20.

[0037] In at least one example embodiment, the reservoir 314 is contained in an annulus between the inner tube 362 and the outer housing 22 and between the first gasket 320 and the second gasket 310. Thus, the reservoir 314 at least partially surrounds the central air passage 321. The reservoir 314 comprises a pre-vapor formulation and optionally a storage medium (not shown) configured to store the pre-vapor formulation therein.

[0038] In at least one example embodiment, the heater 319 extends through the central air passage 321 of the inner tube 362. The heater 319 is in contact with the filamentary wick 328, which extends between opposing sections of the reservoir 314 so as to deliver the pre-vapor formulation from the reservoir 314 to the heater 319. The electronic vaping device 60 may include at least one air inlet 440 arranged at the

threaded joint 74 and/or between the threaded joint 74 and the heater 319.

[0039] In at least one example embodiment, the power supply 12 may include a battery arranged in the electronic vaping device 60. The power supply 12 is configured to apply voltage across the heater 319 associated with the filamentary wick 328. Thus, the heater 319 vaporizes the pre-vapor formulation according to a power cycle of a desired (or, alternatively a predetermined) time period, such as a 2 to 10 second period of time. The battery may be disposable or rechargeable.

[0040] In at least one example embodiment, the electronic vaping device 60 may include the control circuit 11, which may be on a printed circuit board. The control circuit 11 may also include a heater activation light 27 that is configured to glow when the heater 319 is activated. An end cap 45 may be positioned at an end or along the housing 22 of the electronic vaping device 60.

[0041] In at least one example embodiment, the outer housing 22 of the electronic vaping device 60 may be formed of any suitable material or combination of materials. The outer housing 22 may be generally cylindrical and may be formed at least partially of metal. Although the housing 22 is described herein as cylindrical, other forms and shapes are contemplated.

[0042] In at least one example embodiment, as shown in Figure 2, a mouth-end insert 20 includes two or more, for example four outlets (holes) 21, that are rotationally and radially angled about a circumference of a downstream face of the mouth-end insert 20. As vapor exits the electronic vaping device 60 through the mouth-end insert 20, the vapor passes through the four outlets 21 so that the vapor expands outwardly when in use. Each of the outlets may be located at an end off a corresponding off-axis passage 23 that is angled with respect to the longitudinal axis of the electronic vaping device 60. Moreover, each off-axis passage 23 extends generally perpendicular to each adjacent off-axis passage 23.

[0043] In at least one example embodiment, the outlets 21 are substantially uniformly distributed about the perimeter of mouth-end insert 20 so as to substantially uniformly distribute vapor during vaping and create a greater perception of fullness in the mouth. Thus, the vapor enters the mouth and moves in different directions so as to provide a full mouth feel.

[0044] In contrast, electronic vaping devices having a single, on-axis orifice tend to direct vapor as single jet of greater velocity toward a more concentrated location when exiting the electronic vaping device.

[0045] In at least one example embodiment, the off-axis passages 23 are angled at about 5° to about 60° with respect to the central,

longitudinal axis of the outer housing 22 so as to more completely distribute vapor during vaping and to remove droplets. In at least one example embodiment, there are four off-axis passages 23, each at an angle of about 40° to about 50° with respect to the central, longitudinal axis of the outer housing 22, or about 40° to about 45°, or about 42°.

[0046] In at least one example embodiment, each of the off-axis passages 23, each inlet 3, and each outlet 21 has a diameter ranging from about 0.015 inch to about 0.090 inch (e.g., about 0.020 inch to about 0.040 inch or about 0.028 inch to about 0.038 inch). The size of the off-axis passages 23 and outlets 21 and the number of off-axis passages 23 and outlets 21 may be selected to adjust the resistance to draw (RTD) of the electronic vaping article 60, if desired.

[0047] In at least one example embodiment, the mouth-end insert 20 may be integrally affixed within the outer housing 22 of the first section 70. Moreover, the mouth-end insert 20 may be formed of a polymer, such as low-density polyethylene, high-density polyethylene, polypropylene, polyvinylchloride, polyetheretherketone (PEEK), and/or combinations of polymers. The mouth-end insert 20 may also be colored if desired.

[0048] In at least one example embodiment, the mouth-end insert 20 disperses and changes the direction of the vapor as it is drawn from the electronic vaping device 60 so as to provide a fuller mouth feel. As vapor

is formed, it passes through the central channel 321 in the inner tube 362 and through the central channel 384 in the second gasket 310. In at least one example embodiment, the inner tube 362 has an inner diameter ranging from about 3 mm to about 4 mm, or about 3.5 mm.

[0049] Figure 3 is a bottom view of a mouth-end insert according to at least one example embodiment. Figure 4 is a top view of a mouth-end insert according to at least one example embodiment.

[0050] In at least one example embodiment, as shown in Figures 3 and 4, each off-axis passage 23 has a central axis extending from an inlet 3 to the outlet 21. Each off-axis passage extends tangentially with respect to a concentric arc or a circumference "C" about a longitudinally extending, central axis of the mouth-end insert, which may coincide with a central, longitudinal axis of the electronic vaping device 60. Thus, the off-axis passages 23 are both rotationally and radially positioned about the mouth-end insert 20 as shown, and the passages 23 do not intersect the longitudinally extending, central axis. When exiting the electronic vaping device 60, the vapor exits in a swirling pattern.

[0051] In at least one example embodiment, as shown in Figure 2, the electronic vaping device 60 may also include a flow constriction 445 positioned between the heater 319 the second gasket 310 within the inner tube 362. As shown, the flow constriction 445 may be a separate insert that is friction fit in the inner tube 362. The inner diameter may

be decreased at a portion of the inner tube 362 into which the flow constriction 445 is inserted.

[0052] In at least one example embodiment, the flow constriction 445 and/or the inner tube 362 may be formed of any suitable material or combination of materials. Examples of suitable materials include metals, alloys, plastics or composite materials containing one or more of those materials, or thermoplastics that are suitable for food or pharmaceutical applications, for example polypropylene, polyetheretherketone (PEEK), ceramic, fiberglass, and polyethylene. The material is light and non-brittle.

[0053] In at least one example embodiment, when included, the flow constriction 445 is about 3 mm to about 8 mm in length, or about 3 mm to about 7 mm (e.g., about 4 mm to about 6 mm). The flow constriction 445 may be positioned about 1 mm to about 5 mm from the heater (e.g., about 1 mm to about 3 mm or about 2 mm to about 4 mm).

[0054] In at least one example embodiment, the flow constriction 445 may have an inner diameter of about 1 mm to about 2.5 mm, or about 2 mm. The inner diameter of the inner tube 362 adjacent the flow constriction 445 and along the remaining length of the inner tube 362 not including the flow constriction 445 may range from about 3 mm to about 4 mm, or about 3.5 mm.

[0055] In at least one example embodiment, the flow constriction 445 is about 1 mm to about 5 mm from the heater 319 (e.g., about 1.5 mm to about 4.5 mm, about 2 mm to about 4 mm, or about 2.5 mm to about 3.5 mm).

[0056] Figure 7 is a perspective view of an inner tube for use in the electronic vaping device 60 of Figure 2 according to at least one example embodiment.

[0057] In at least one example embodiment, as shown in Figure 7, the inner tube 362 may have a same diameter along an outer surface.

[0058] Figure 3 is a bottom view of a mouth-end insert according to at least one example embodiment. Figure 4 is a top view of a mouth-end insert according to at least one example embodiment.

[0059] In at least one example embodiment, as shown in Figures 3 and 4, there are four off-axis passages 23, which are oriented orthogonally to one another so as to provide a substantially uniform distribution of vapor. For each passage 23, its inlet 3 and its outlet 21 are mutually spaced along a tangent of a concentric arc "C" and the passages 23 are equally spaced about the arc "C" orthogonal or 90° from one another.

[0060] In at least one example embodiment, the mouth-end insert may include three holes instead of four, and the same relationships would apply: for each passage 23, the inlet 3 and outlet 21 would be mutually spaced along a tangent along a concentric arc "C" and the passages 23

would be equally spaced about the arc "C", for example about 120° from one another.

[0061] In at least one example embodiment, as shown in Figure 10, an interior surface 2 of the mouth-end insert 20 is generally dome-shaped.

[0062] In at least one example embodiment, the off-axis passages 23 are arranged and include interior surfaces 2, such that droplets of unvaporized pre-vapor formulation, if any, that may be entrained in the vapor impact the interior surfaces 2 of the mouth-end insert 20. As a result, such droplets are substantially removed or broken apart so as to enhance the vapor.

[0063] Figure 5 is a side, cross-sectional view of at least one example embodiment of an electrical vaping device as described herein.

[0064] In at least one example embodiment, as shown in Figure 5, the electronic vaping device 60 is generally the same as the electronic vaping device of Figure 2, except that the flow constriction 445 is integrally formed with the inner tube 362, such that the inner tube 362 has contoured walls, which cause the central air channel 321 to have a reduced diameter downstream of the heater 319.

[0065] Figure 6 is a truncated side, cross-sectional view of a first section of an electrical vaping device according to at least one example embodiment.

[0066] In at least one example embodiment, as shown in Figure 6, the reservoir 314 has an increased size due to the narrowed diameter of the inner tube 362 along the flow constriction 445, which allows for a larger volume of pre-vapor formulation to be contained in the electronic vaping device 60.

[0067] Figure 8 is a perspective view of an inner tube (chimney) according to at least one example embodiment. As shown, the inner tube 362 can include a narrowed portion that acts as the flow constriction 445.

[0068] In at least one example embodiment, the electronic vaping device 60 may include only the mouth-end insert 20, as described herein, or only the flow constriction 445.

[0069] In at least one example embodiment, both the mouth-end insert 20, as described herein, and the flow constriction 445 are effective to reduce the temperature of vapor before exiting the electronic vaping device 60 when included individually in the electronic vaping device 60. Moreover, when used in combination, the mouth-end insert 20 and the flow constriction 445 reduce the temperature of the vapor even more than when only the mouth-end insert 20 or only the flow constriction 445 is included in the electronic vaping device 60.

[0070] When the word "about" is used in this specification in connection with a numerical value, it is intended that the associated

numerical value include a tolerance of ±10% around the stated numerical value. Moreover, when reference is made to percentages in this specification, it is intended that those percentages are based on weight, i.e., weight percentages. The expression “up to” includes amounts of zero to the expressed upper limit and all values therebetween. When ranges are specified, the range includes all values therebetween such as increments of 0.1%.

[0071] Moreover, when the words "generally" and "substantially" are used in connection with geometric shapes, it is intended that precision of the geometric shape is not required but that latitude for the shape is within the scope of the disclosure. When used with geometric terms, the words "generally" and "substantially" are intended to encompass not only features which meet the strict definitions but also features which fairly approximate the strict definitions.

[0072] It will now be apparent that a new, improved, and nonobvious electronic vaping device has been described in this specification with sufficient particularity as to be understood by one of ordinary skill in the art. Moreover, it will be apparent to those skilled in the art that numerous modifications, variations, substitutions, and equivalents exist for features of the electronic vaping device, which do not materially depart from the spirit and scope of the invention. Accordingly, it is expressly intended that all such modifications, variations, substitutions,

and equivalents which fall within the spirit and scope of the invention as defined by the appended claims shall be embraced by the appended claims.

We Claim:

1. A cartridge of an electronic vaping device, the cartridge comprising:

an outer tube extending in a longitudinal direction;

an inner tube within the outer tube, the inner tube including a flow constriction along a portion of a length of the inner tube;

a reservoir containing a pre-vapor formulation;

a wick in communication with the reservoir; and

a heater in communication with the wick, the heater configured to heat the pre-vapor formulation to a temperature sufficient to form a vapor, the flow constriction configured to reduce a temperature of the vapor, and the flow constriction positioned about 1 mm to about 5 mm from the heater.

2. The cartridge of claim 1, wherein the flow constriction comprises an insert friction fit in the inner tube.

3. The cartridge of claim 2, wherein the insert is formed of at least one of a metal, an alloy, a plastic, and a thermoplastic

4. The cartridge of claim 3, wherein the material is at least one of polypropylene, polyetheretherketone (PEEK), ceramic, fiberglass, and polyethylene.

5. The cartridge of claim 1, further comprising:

a mouth-end insert including four outlets, each of the four outlets being at an end of an off-axis passage and each off-axis passage extending generally perpendicularly to adjacent off-axis passages.

6. The cartridge of claim 1, wherein the inner tube has an inner diameter ranging from about 3 mm to about 4 mm.

7. The cartridge of claim 1, wherein the flow constriction has an inner diameter ranging from about 1 mm to about 2.5 mm.

8. The cartridge of claim 1, wherein the flow constriction has a length ranging from about 3 mm to about 8 mm.

9. A cartridge of an electronic vaping device, the cartridge comprising:

an outer tube extending in a longitudinal direction;

an inner tube within the outer tube;

a reservoir comprising a pre-vapor formulation;

a wick in communication with the reservoir;

a heater in communication with the wick, the heater configured to heat the pre-vapor formulation; and

a mouth-end insert including,

a first outlet at an end of a first off-axis passage, and

a second outlet at an end of a second off-axis passage, the first off-axis passage and the second off-axis passage each having a central axis extending from an inlet to the outlet, and the first off-axis passage and the second off-axis passage extending tangentially to a circumference surrounding a central, longitudinally extending axis of the electronic vaping device.

10. The electronic vaping device of claim 9, wherein the mouth-end insert includes four outlets, each of the four outlets being at an end of an off-axis passage.

11. A cartridge of an electronic vaping device, the cartridge comprising:

an outer tube extending in a longitudinal direction;

an inner tube within the outer tube, the inner tube including a flow constriction along a portion of a length of the inner tube;

a reservoir comprising a pre-vapor formulation;

a wick in communication with the reservoir;

a heater in communication with the wick, the heater configured to heat the pre-vapor formulation to form a vapor; and

a mouth-end insert including,

four outlets, each of the four outlets being at an end of one of four off-axis passages, the four off-axis passages each having a central axis extending from an inlet to the outlet, and the four off-axis passages each extending tangentially to a circumference surrounding a central, longitudinally extending axis of the electronic vaping device, the flow constriction between the mouth-end insert and the heater.

12. The cartridge of claim 11, wherein the flow constriction is an insert friction fit in the inner tube.

13. The cartridge of claim 11, wherein the insert is formed of at least one of a metal, an alloy, a plastic, and a thermoplastic.

14. The cartridge of claim 13, wherein the material is at least one of polypropylene, polyetheretherketone (PEEK), ceramic, fiberglass, and polyethylene.

15. The cartridge of claim 11, wherein the flow constriction is about 1 mm to about 5 mm from the heater.

16. The cartridge of claim 11, wherein the flow constriction has an inner diameter ranging from about 1 mm to about 2.5 mm.

17. The cartridge of claim 11, wherein the flow constriction has a length ranging from about 3 mm to about 8 mm.

FIG. 1

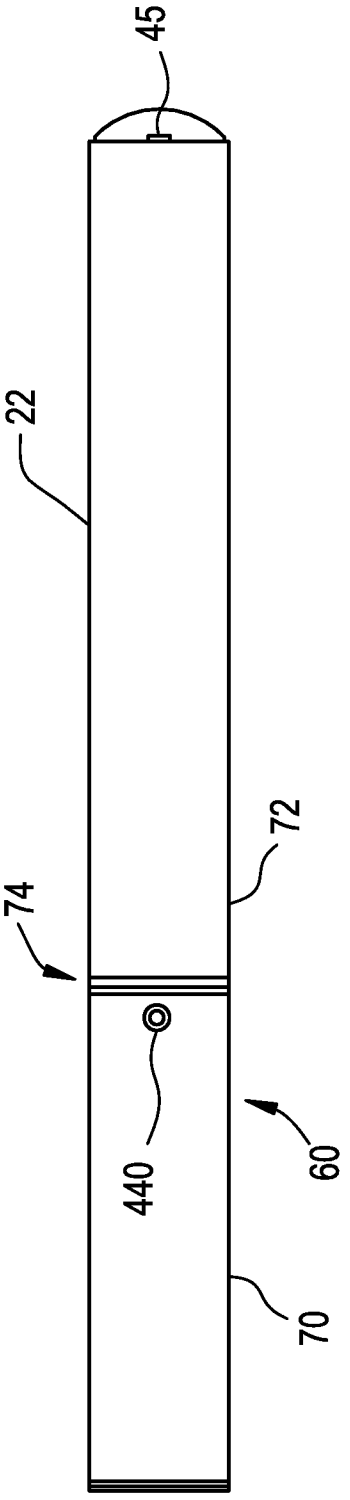

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FIG. 2

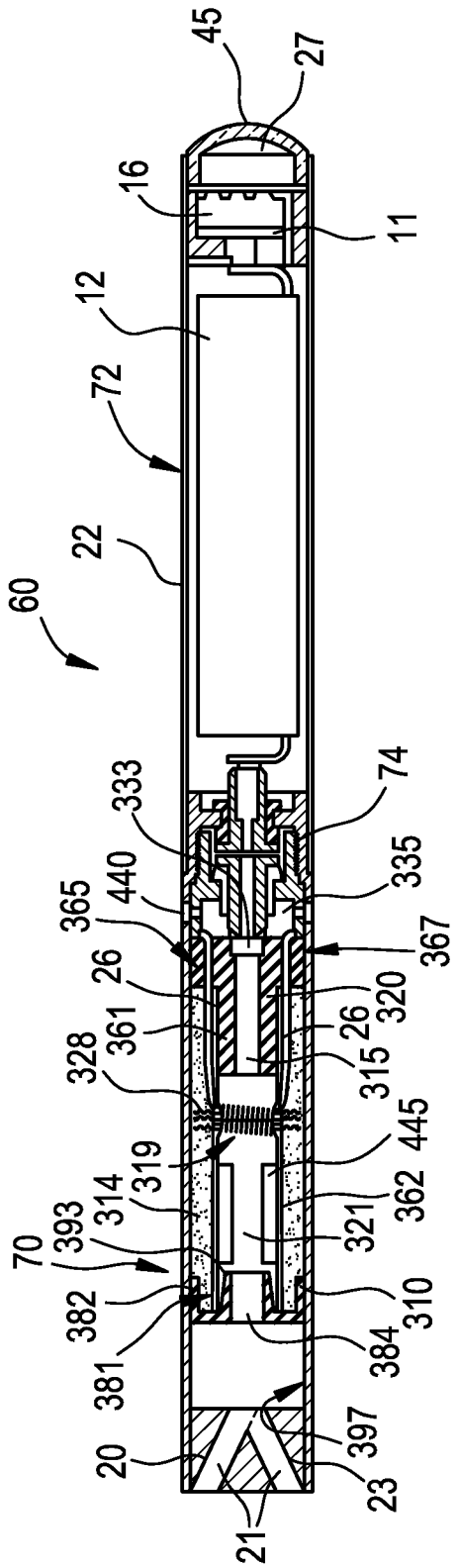

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FIG. 3

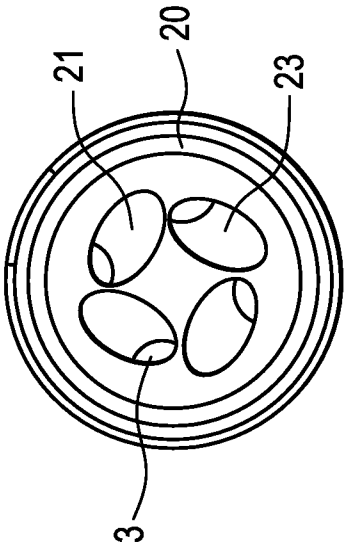


FIG. 4

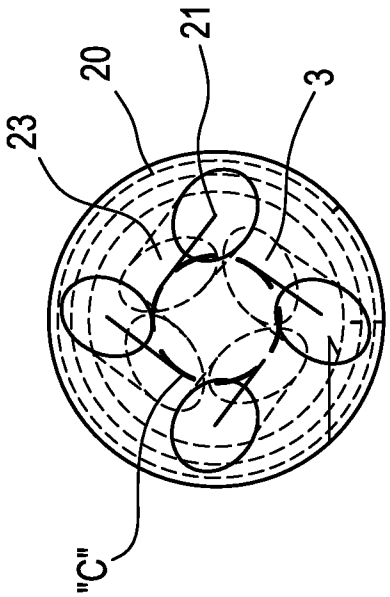


FIG. 5

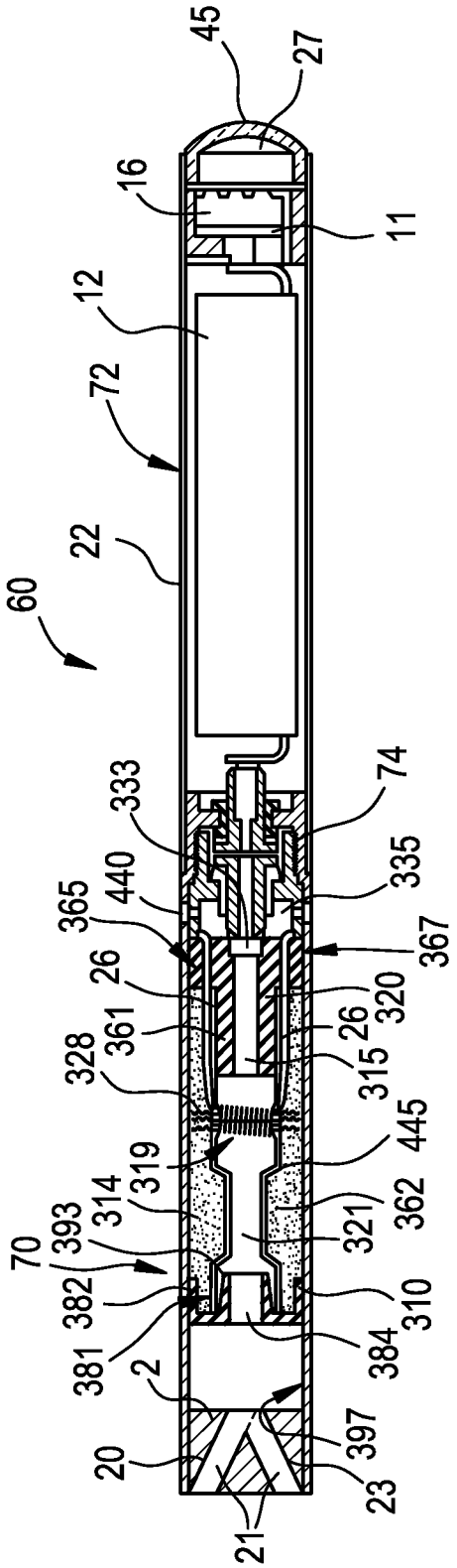


FIG. 6

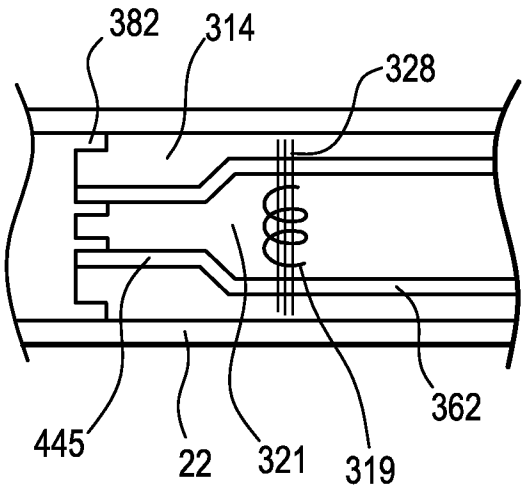


FIG. 7

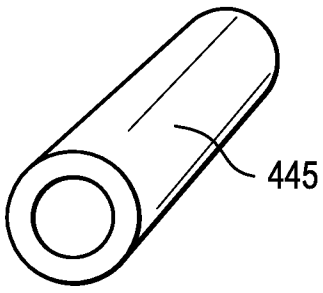


FIG. 8

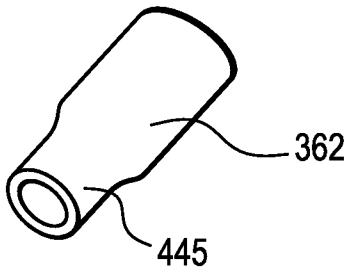
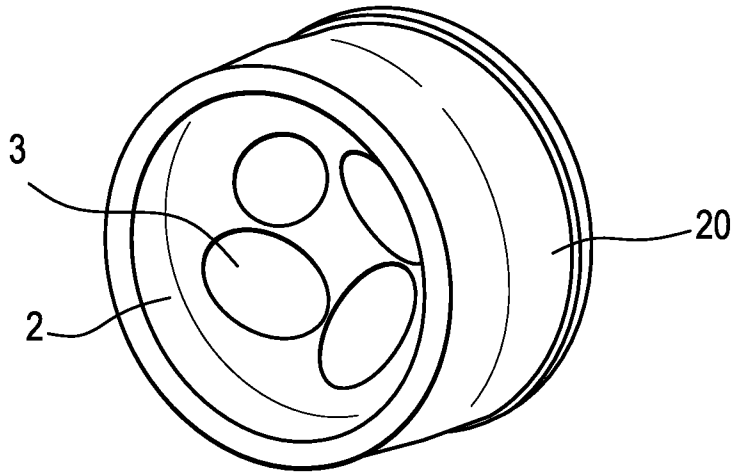


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/059223

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A24F 25/00 (2015.01)
CPC - A24F 25/02 (2015.12)
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 1/10, 13/00, 25/00 (2015.01)
CPC - A24F 1/00, 13/00, 25/02 (2015.12)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 131/329, 330, 347, 359, 360; 392/404 (Keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatBase, Google Patents, Google Scholar, Google.
Search terms used: e-cigarette, atomizer, vaporizer, reservoir, wick, heater, mouth insert, vapor, temperature, cooling, heating, flow, restrictor.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/0192623 A1 (ALTRIA CLIENT SERVICES INC) 01 August 2013 (01.08.2013) entire document	1-17
A	US 8,511,318 B2 (HON) 20 August 2013 (20.08.2013) entire document	1-17
A	US 2013/0081642 A1 (SAFARI) 04 April 2013 (04.04.2013) entire document	1-17

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"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
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 December 2015	04 FEB 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)