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(54) Title: AEROSOL GENERATING SYSTEM WITH SEPARATE CAPSULE AND VAPORIZING UNIT

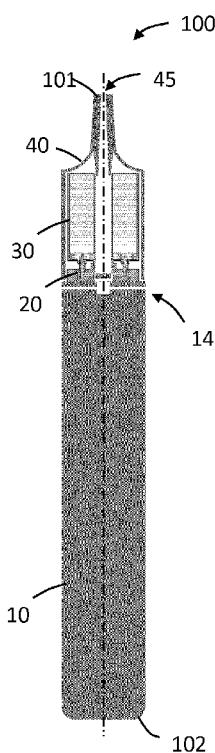


FIG. 1C

(57) Abstract: A system (100) comprises a capsule (30, 30A, 30B) and a vaporizing unit (20) releasably connectable to the capsule (30, 30A, 30B). The capsule (30, 30A, 30B) comprises a reservoir (300) for containing a liquid aerosol-generating substrate, an opening in fluid communication with the reservoir (300), and a valve (380) configured to control flow of the liquid aerosol-generating substrate from the reservoir (300) through the opening. The valve (380) comprises one or more resilient closing members (381, 382) biased towards a closed position. The vaporizing unit (20) comprises a housing (240), a liquid transfer element (210) disposed in the housing (240), and a heating element (220) disposed in the housing (240). The heating element (220) is configured to heat liquid in the liquid transfer element (210). The vaporizing unit (20) also comprises an elongate element extending from a proximal end of the unit (20). The elongate element is configured to be received in the valve (380) to cause the one or more resilient closing members (381, 382) to deflect away from the closed position and to cause the valve (380) to open as a distal end of the capsule (30, 30A, 30B) is moved towards the proximal end of the vaporizing unit (20). The liquid transfer element (210) is placed in fluid connection with the reservoir (300) via the opening when the valve (380) is open.

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AEROSOL GENERATING SYSTEM WITH SEPARATE CAPSULE AND VAPORIZING UNIT

This disclosure relates to multi-part electrically heated aerosol-generating systems and associated devices, articles and methods.

5 One type of aerosol-generating system is an electrically operated handheld aerosol-generating system. Known handheld electrically operated aerosol-generating systems include a device portion comprising a battery and control electronics, a replaceable cartridge portion comprising a supply of aerosol-generating substrate, and an electrically operated vaporizer. A cartridge comprising both a supply of aerosol-generating substrate and a vaporizer is
10 sometimes referred to as a "cartomizer". The vaporizer typically includes a coil of heater wire wound around an elongate wick soaked in liquid aerosol-generating substrate. The cartridge portion often forms a mouthpiece, on which a user may draw to cause aerosol to flow into their mouth.

However, cartridges having this arrangement may be relatively expensive to produce. In
15 part, this is because of the cost of manufacturing the vaporizer assembly. It would be desirable to provide a multi-part aerosol-generating system, such as a handheld electrically operated system, that includes an aerosol generating substrate-containing capsule and a releasably connectable vaporizing unit that has a simple interface to allow the aerosol generating substrate to flow from the capsule to the vaporizing unit when the capsule is connected to the vaporizing
20 unit.

In various aspects of the present invention there is provided a multi-part aerosol-generating system. The system comprises a capsule and a releasably connectable vaporizing unit. The capsule comprises a distal end and a reservoir for containing an aerosol-generating substrate. The vaporizing unit comprises a housing, and a heating element and a liquid transfer
25 element disposed in the housing. The heating element is configured to heat liquid in the liquid transfer element. The housing of the vaporizing unit has a proximal end, and the liquid transfer element extends beyond the proximal end of the housing. The vaporizing unit is configured such that the liquid transfer element is the first portion of the vaporizing unit to penetrate into the reservoir of the capsule as a distal end of the capsule is moved towards a proximal end of the
30 vaporizing unit. The capsule and vaporizing unit are configured such that flow of liquid aerosol-generating substrate out of the capsule can be minimised or eliminated when the capsule is

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disconnected from the vaporizing unit even when the capsule still contains liquid aerosol generating substrate.

The terms "distal," "upstream," "proximal," and "downstream" are used to describe the relative positions of components, or portions of components, of an aerosol generating system.

5 Aerosol generating systems according to the invention have a proximal end through which, in use, an aerosol exits the system for delivery to a user, and have an opposing distal end. The proximal end of the aerosol generating article may also be referred to as the mouth end. In use, a user draws on the proximal end of the aerosol generating article in order to inhale an aerosol generated by the aerosol generating article. The terms upstream and downstream are relative
10 to the direction of aerosol movement through the aerosol generating article when a user draws on the proximal end.

In various aspects of the present invention there is provided a multi-part aerosol-generating system. The system comprises a capsule and a vaporizing unit releasably connectable to the capsule. The capsule comprises a reservoir for containing a liquid aerosol-generating substrate, an opening in fluid communication with the reservoir, and a valve
15 configured to control flow of the liquid aerosol-generating substrate from the reservoir through the opening. The valve comprises one or more resilient closing members biased towards a closed position. The vaporizing unit comprises a housing, a liquid transfer element disposed in the housing, and a heating element disposed in the housing. The heating element is configured
20 to heat liquid in the liquid transfer element. The vaporising unit also comprises an elongate element extending from a proximal end of the unit. The elongate element is configured to be received in the valve to cause the one or more resilient closing members to deflect away from the closed position and to cause the valve to open as a distal end of the capsule is moved towards the proximal end of the vaporizing unit. The liquid transfer element is placed in fluid
25 connection with the reservoir via the opening when the valve is open.

Capsules of aerosol-generating systems of the present invention are configured to contain an aerosol-generating substrate. Preferably the capsules are not refillable by a user. In contrast, the vaporizer unit comprising the heating element and the liquid transfer element preferably may be re-used following multiple capsule replacements. Thus, by providing
30 separate capsules and vaporizing units, the heating element and the transfer element need not be discarded or replaced every time the aerosol-generating substrate is depleted. Further, the

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manufacture of the one-time use aerosol-generating substrate-containing capsule can be simplified by not including the heating element and the transfer element in the capsule.

5 In some examples a separate cover disposable over, and securable in position relative to, the aerosol-generating substrate-containing capsule is provided. This may allow for simplified or reduced cost of manufacture of the aerosol-generating substrate-containing capsule relative to a system in which the liquid-containing portion also includes a mouthpiece portion.

10 Examples of the present invention provide systems, articles and assemblies that use electrical energy to heat a substrate, without combusting the substrate, to form an aerosol that may be inhaled by a user. Preferably, the systems are sufficiently compact to be considered hand-held systems. Some examples of systems of the invention can deliver a nicotine-containing aerosol for inhalation by a user.

15 The term "aerosol generating" article, system or assembly refers to an article, system or assembly comprising an aerosol generating substrate that releases volatile compounds to form an aerosol that may be inhaled by a user. The term "aerosol generating substrate" refers to a substrate capable of releasing, upon heating, volatile compounds, which may form an aerosol.

20 Any suitable aerosol generating substrate may be used with the systems. Suitable aerosol generating substrates may comprise plant-based material. For example, the aerosol generating substrate may comprise tobacco or a tobacco-containing material containing volatile tobacco flavor compounds, which are released from the aerosol generating substrate upon heating. In addition or alternatively, an aerosol generating substrate may comprise a non-tobacco containing material. The aerosol generating substrate may comprise homogenized plant-based material. The aerosol generating substrate may comprise at least one aerosol former. The aerosol generating substrate may comprise other additives and ingredients such as flavorants. Preferably the aerosol generating substrate comprises nicotine. Preferably, the aerosol generating substrate is a liquid at room temperature. For example, the aerosol forming substrate may be a liquid solution, suspension, dispersion or the like. In some preferred embodiments, the aerosol generating substrate comprises glycerol, propylene glycol, water, nicotine and, optionally, one or more flavorant.

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The aerosol generating substrate may be stored in a capsule of examples of a system of the present invention. The capsule comprises a reservoir for containing the aerosol generating substrate. Preferably, at least a portion of the aerosol generating substrate stored in the reservoir is liquid and free-flowing. As used herein, "free-flowing" means that the liquid is not
5 bound or sorbed to a solid substrate. For example, the liquid is preferably not stored in a porous material inside examples of the capsule. In some examples, all of the aerosol generating substrate in a reservoir of a capsule may be a free flowing liquid. Alternatively and by way of further example, from 20% to 100% by volume of the aerosol generating substrate in the reservoir may be a free flowing liquid; such as from about 50% to about 100% or from about
10 75% to about 100%.

The capsule preferably comprises a housing defining the reservoir. Preferably, the housing is a rigid housing. As used herein "rigid housing" means a housing that is self-supporting. The housing may be formed of any suitable material or combination of materials, such as a polymeric material, a metallic material, or a glass. Preferably, the housing is formed
15 by a thermoplastic material. Any suitable thermoplastic material may be used. One suitable thermoplastic material is acrylonitrile butadiene styrene. Preferably the material forming the housing is chemically compatible with the aerosol generating substrate.

The distal end portion of the capsule comprises an opening in communication with the reservoir through which the aerosol generating substrate may be introduced into the reservoir
20 during initial filling by, for example, a manufacturer or removed, such as by flowing, from the reservoir.

The capsule may comprise a port that defines the distal end portion opening of the capsule. The capsule may further comprise a sealing element for example that transversely extends across the port to seal the opening. Preferably, the sealing element is pierceable. Any
25 suitable material may be used to form a pierceable sealing element. For example, a metal foil, such as an aluminium foil, or thermoplastic elastomer may be used to form a pierceable sealing element.

The capsule may comprise an actuatable interface positioned relative to the opening to prevent the aerosol generating material from exiting the reservoir when the capsule is not
30 connected to the vaporizing unit, and to permit fluidic connection between the capsule and the vaporizing unit when the capsule and the vaporizer unit are connected. The interface may

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actuated by penetration of a proximal portion of an elongate element extending proximally from the vaporizing unit into the capsule by the application of force along a longitudinal axis of the device. The interface may comprise a valve, actuatable such that the act of connecting the capsule to the vaporizing unit causes the valve to open and disconnecting the capsule from the vaporizing causes the valve to close. For example, a proximal portion of the elongate element extending from the vaporizing unit may interact with the valve to cause the valve to open when the distal end of the capsule is moved towards a proximal end portion of the vaporizing unit along the longitudinal axis of the device. Any suitable valve may be used. For example, the valve may comprise one or more resilient closing members that are biased in a closed position.

5 The valve may be configured to receive the elongate element such that insertion of the elongate element into the valve may cause deflection of the one or more resilient members away from the biased closed position to open the valve. Withdrawal of the elongate element from the valve results in the one or more resilient members returning to the biased closed position. In some examples of the present invention, the valve comprises two resilient members that interact to close the valve. For example, the resilient members may include flattened portions that are biased to contact one another. Any commercially available one-way valves with adequate size and liquid flows may be used, including mini and micro flutter valves, duckbill valves, check valves.

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Preferably, the valve comprises a duckbill valve that can be opened by insertion of an elongate element, such as the liquid transfer element extending from the vaporizing unit, into the valve to cause the duckbill portion to open and can be caused to close upon withdrawal of the elongate element from the valve. Preferably the elongate element extending proximally from the vaporizing unit that causes the valve to open is the liquid transfer element.

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In addition or alternatively, the capsule may comprise a liquid storage material, positioned in the reservoir across the opening to inhibit free flow of liquid aerosol generating substrate from the reservoir out of the opening when the capsule and vaporizing unit are not connected. Preferably, the liquid storage material substantially or completely prevents free flow of liquid aerosol generating substrate out of the opening. Insertion of the liquid transfer element, such as a wick, of the vaporizing unit into the liquid storage material, results in the transfer by capillary action of the aerosol forming substrate from the liquid storage material through the liquid transfer material into the vaporising unit.

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The distal end of the capsule may define one or more features configured to mate with one or more features of the vaporizing unit when connected. Such an end of the capsule is referred to as a “first mating end.” The end of the vaporizing unit comprising complementary features is referred to as a “second mating end.” Preferably, at least some features of the first and second mating ends are configured to engage via an interference fit. Preferably, at least one or both of the features of the first and second mating ends comprise a friction enhanced surface to facilitate maintenance of secure engagement between the capsule and the vaporizing unit.

The capsule may include a baffle that can move from a first extended position to a second retracted position. In the extended position, the baffle extends distally beyond one or more features of the first mating end of the capsule. When the baffle is in the retracted position, one or more features of the first mating end extend distally beyond the baffle for interaction with one or more features of the second mating end of the vaporizing unit. The baffle may define one or more openings, for example longitudinally aligned with the one or more features of the first mating end, through which the one or more features may extend when the baffle is in the retracted position. The baffle, if present, is preferably biased in the extended position, and application of force to move the first mating end of the capsule towards the second mating end of the vaporizing unit, for example along a longitudinal axis of the device, may cause the baffle to move to the retracted position.

The capsule is releasably connectable to the vaporizing unit. As used herein, “releasably connectable” means that the releasably connectable parts may be connected to, and disconnected from each other, without significantly damaging either part. The capsule may be connected to the vaporizing unit in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like. In some examples, the capsule is connected to the vaporizing unit by rotation, such as with a threaded engagement, but the liquid transfer element of the vaporizing unit is placed in fluid communication with liquid aerosol generating substrate in the reservoir of the capsule by movement in a straight line along an axis, as opposed to rotational movement about the axis, when the capsule and vaporizing unit are connected.

The vaporizing unit preferably comprises a housing, a heating element disposed in the housing, and a liquid transfer element disposed in the housing. The housing may comprise one

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or more parts. The housing may define a second mating end having one or more features configured to engage one or more features of a first mating end of the capsule. The liquid transfer element may extend beyond a proximal end or second mating end of the housing. The liquid transfer element is configured to extend to be in fluid communication with the reservoir.

5 For example, the liquid transfer element may extend into the reservoir beyond the interior surface when the capsule and the vaporizing unit are connected to cause the liquid aerosol-generating substrate to be transferred from the reservoir to the liquid transfer element.

The liquid transfer element may comprise any suitable liquid transfer material. A "liquid transfer material" is a material that conveys liquid from one end of the material to another.

10 Preferably the liquid transfer element actively conveys liquid, for example by capillary action. The liquid transfer material may have a fibrous or spongy structure. Preferably, the liquid transfer material includes a web, mat or bundle of fibers. The fibers may be generally aligned to convey the liquid in the aligned direction. Alternatively, the liquid transfer material may comprise sponge-like or foam-like material. The liquid transfer material may comprise any

15 suitable material or combination of materials. Examples of suitable materials are a sponge or foam material, ceramic- or graphite-based materials in the form of fibers or sintered powders, a fibrous material, for example made of spun or extruded fibers, or ceramic or glass. Preferably, the liquid transfer element that extends beyond the proximal end of the housing of the vaporizing unit comprises a felt material.

20 The liquid transfer element of the vaporizing unit may comprise different liquid transfer materials at different portions of the liquid transfer element. For example, the liquid transfer element may comprise a first portion that extends beyond the proximal end of the housing and a second portion that is in contact with the first portion, where the first and second portions comprise one or more different liquid transfer materials. Alternatively, the liquid transfer

25 element may comprise one liquid transfer material or combination of liquid transfer materials throughout the element. The second liquid transfer material, if present, is preferably suitable for use in contact with a heating element. For example, the second liquid transfer material may comprise a glass or ceramic material, for example fused silica.

In some examples, the liquid transfer element that extends beyond the proximal end of

30 the housing of the vaporizing unit is configured to contact liquid transfer material, or liquid storage material, disposed in the reservoir of the capsule when the capsule and vaporizing unit

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are connected. Liquid aerosol generating substrate may be thus transferred from the liquid storage material in the reservoir to the liquid transfer material of the liquid transfer element of the vaporizing unit. Preferably, the liquid storage material in the reservoir is a layer of high retention material. Preferably, the portion of the liquid transfer element that extends beyond the proximal end of the housing of the vaporizing unit extends into, but preferably not beyond, the layer of high retention material in the reservoir when the capsule and vaporizing unit are connected. Thus, when the capsule and vaporizing unit are disconnected, the layer of high retention material in the reservoir maintains sufficient structural integrity to prevent free flow of liquid aerosol generating substrate out of the reservoir, if any liquid aerosol generating substrate remains in the reservoir.

If the capsule comprises a valve, the vaporizing unit may comprise an element that interacts with the valve or a component operably coupled to the valve to cause the valve to open when the capsule is connected to the vaporizing unit. Preferably the element that interacts with the valve or component is an elongate element, such as the liquid transfer element, that extends beyond the proximal end of the housing of the vaporizing unit. Preferably, the valve comprises one or more resilient closing members biased in a closed position and is configured to receive the elongate member extending from the vaporizing unit to open the valve. Commercially available one-way valves with adequate size and liquid flows may be used, including mini and micro flutter valves, duckbill valves, check valves. Preferably, the valve comprises a resilient member and closes on removal of the elongate member, such as a duckbill valve. Preferably, in the valve embodiments of this invention, no liquid storage material is disposed in the reservoir. Such an arrangement may allow all or substantially all of the liquid aerosol generating substrate to be consumed from the capsule before replacement is necessary.

The vaporizing unit may include a baffle that can move from a first extended position to a second retracted position. In the extended position, the baffle preferably extends proximally beyond one or more features of the second mating end of the vaporizing unit or beyond the liquid transfer element that extends beyond the proximal end of the housing. When the baffle is in the retracted position, one or more features of the second mating end or the liquid transfer element preferably extend proximally beyond the baffle for interaction with one or more features of the first mating end of the capsule or for entry beyond an inner surface of the reservoir of the capsule. The baffle may define one or more openings longitudinally aligned with the one or more features of the second mating end or liquid transfer element through which the one or

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more features or liquid transfer element may extend when the baffle is in the retracted position. The baffle, if present, is preferably biased in the extended position, and application of force to move the first mating end of the capsule towards the second mating end of the vaporizing unit along an axis may cause the baffle to move to the retracted position.

5 In addition or alternatively, the vaporizing unit may comprise a sheath disposed about the liquid transfer element that extends beyond the proximal end of the housing. The sheath may substantially prevent the liquid transfer element from coming into contact with the user during replacement of the capsule. The sheath preferably extends beyond the proximal end of the housing and beyond the proximal end of liquid transfer element. The sheath may be
10 retractable to a position that permits the liquid transfer element to be placed in fluid communication with aerosol generating substrate when the capsule and the vaporizing unit are connected. Preferably, the sheath is biased in an extended configuration and application of force to move the distal end of the capsule towards the proximal end of the vaporizing unit along an axis causes the sheath to adapt the retracted configuration. In some examples, the sheath
15 is the elongate element extending proximally from the vaporizing unit that interacts with a valve of the capsule to cause the valve to open. The sheath may defined a distal opening through which the liquid transfer element may extend when retracted or through which liquid aerosol generating substrate may flow to contact the liquid transfer element retained in the sheath. In some examples an elongate member positioned alongside of the liquid transfer element
20 interacts with the valve to cause the valve to open.

At least a portion of the liquid transfer element is preferably located sufficiently close to the heating element so that liquid aerosol generating substrate carried by the liquid transfer material may be heated by the heating element to generate an aerosol. Preferably, at least a portion of the liquid transfer element is in contact with the heating element.

25 Any suitable heating element may be employed. For example, the heating element may comprise a resistive filament. The term "filament" is an electrical path arranged between two electrical contacts. A filament may arbitrarily branch off and diverge into several paths or filaments, respectively, or may converge from several electrical paths into one path. A filament may have a round, square, flat or any other form of cross-section. A filament may be arranged
30 in a straight or curved manner. One or more resistive filament may form a coil, mesh, array, fabric or the like. Application of an electric current to the heating element results in heating due

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to the resistive nature of the element. In some preferred embodiments, the heating element forms a coil that is wrapped around a portion of the liquid transfer element.

A heating element may comprise any suitable electrically resistive filament. For example, a heating element may comprise a nickel-chromium alloy.

5 The housing of the vaporizing unit is preferably a rigid housing. Preferably, at least a portion of the housing comprises a thermoplastic material, a metallic material, or a thermoplastic material and a metallic material. Preferably the housing comprises material that efficiently conducts thermal energy and thus can act as a heat sink for the aerosolizing unit.

10 The housing may define one or more air inlets to allow air to be drawn into the aerosolizing unit to entrain aerosol resulting from the heating of the aerosol generating substrate. The aerosol containing air may then be guided along the capsule or through a passage in the capsule to the mouth end of the system. Alternatively, or additionally, another part of the system may comprise one or more air inlets in communication with a passage that is in communication with a passage through the vaporizing unit.

15 The vaporizing unit may comprise electrical contacts exterior to, exposed through, or formed from a portion of the housing for electrically coupling the heating element to the power supply or other control electronics in another part of the system. Preferably the contacts are exposed at a distal end portion, such as the distal face of the vaporizing unit for operable connection to another part of the system such as a part comprising the power supply (typically a
20 battery). In some preferred examples of the invention, the housing of the vaporizing unit effectively forms the contacts. The heating element may be electrically coupled to the contacts by any suitable electrical conductor. The contacts may be formed of any suitable electrically conductive material. For example, the contacts may comprise nickel- or chromium-plated brass.

25 The vaporizing unit may be releasably connectable to another part of the system, such as a part that comprises a power supply. The vaporizing unit may be connected to the other part in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like.

30 Aerosol generating systems according to the present invention may comprise a part comprising a power supply. A part comprising a power supply is also referred to as a "battery assembly" in the present disclosure. However, it will be understood that the power supply need

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not be a battery. The battery assembly may comprise a housing in which the power supply disposed. The battery assembly may also comprise electronic circuitry disposed in the housing and electrically coupled to the power supply. The battery assembly may comprise contacts exterior to, exposed through, or formed from a portion of the housing such that the contacts of
5 the battery assembly electrically couple with the contacts of the vaporizing unit when the battery assembly is connected with the vaporizing unit. Preferably the contacts are exposed at a proximal end portion, such as the proximal face of the battery assembly for operable connection to the vaporizing unit. In some preferred examples of the invention, the housing of the battery assembly effectively forms the contacts. The contacts of the battery assembly may be
10 electrically coupled to the electronic circuitry and power supply. Thus, when the battery assembly is connected to the vaporizing unit, the heating element is electrically coupled to the power supply and circuitry of the battery assembly.

Preferably, the electronic circuitry is configured to control delivery of an aerosol resulting from heating of the substrate to a user. Control electronic circuitry can be provided in any
15 suitable form and may, for example, include a controller or a memory and a controller. The controller can include one or more of an Application Specific Integrated Circuit (ASIC) state machine, a digital signal processor, a gate array, a microprocessor, or equivalent discrete or integrated logic circuitry. Control electronic circuitry can include memory that contains instructions that cause one or more components of the circuitry to carry out a function or aspect
20 of the control circuitry. Functions attributable to control circuitry in this disclosure can be embodied as one or more of software, firmware, and hardware.

The electronic circuitry may be configured to monitor the electrical resistance of the heating element or of one or more filaments of the heating element, and to control the supply of power to the heating element dependent on the electrical resistance of the heating element or
25 the one or more filaments.

The electronic circuitry may comprise a microprocessor, which may be a programmable microprocessor. The electronic circuitry may be configured to regulate a supply of power. The power may be supplied to the heater element in the form of pulses of electrical current.

The battery assembly may include a switch to activate the system. For example, the
30 battery assembly may include a button that can be depressed to activate or optionally deactivate the system.

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The power supply is typically a battery, but may be or comprise another form of charge storage device such as a capacitor.

The housing of the battery assembly is a rigid housing. Any suitable material or combination of materials may be used for forming the rigid housing. 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), acrylonitrile butadiene styrene and polyethylene.

The housing of the battery assembly may define one or more air inlets and one or more passages in communication with the inlets. The one or more passages may be in communication with a passage through the vaporizing unit to allow air to flow from the inlets and through the vaporizing unit.

An aerosol generating system of the present invention may include a cover that is disposable over at least the capsule. For example, the cover includes a distal end opening that is configured to receive the capsule. The cover may also extend over at least a portion of the vaporizing unit, and may also extend over at least a portion of the battery assembly. In preferred embodiments, the cover extends over the capsule and the vaporizing unit and abuts a proximal end of the battery assembly. Alternatively, the cover may extend over the capsule and abut a proximal end of the vaporizing unit. The cover is releasably securable in a position relative to at least the capsule. The cover may be releasably connectable to the capsule, the vaporizing unit, or the battery assembly to be retained in a position relative to the capsule. The cover may be connected to the capsule, vaporizing unit or battery assembly in any suitable manner, such as threaded engagement, snap-fit engagement, interference-fit engagement, magnetic engagement, or the like. In some examples, securing of the cover to, for example, the battery assembly may serve to secure the capsule and vaporizing unit in place in the system.

The cover may ensure proper alignment or proper seating of the capsule with the vaporizing unit, and may ensure proper alignment or proper seating of the vaporizing unit with the battery assembly. The cover may define an inner surface configured to engage an outer surface of the capsule when the cover is secured in place relative to the capsule. For example, the cover may comprise a side wall having longitudinal features such as detents or indents that interact with complementary features, such as indents or detents, on the outer surface of the

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capsule. Inner surface features may interact with outer surface features of the vaporizing unit and can thus ensure proper orientation of the capsule and the vaporizing unit. In some examples, the capsule may form an inner shoulder that can contact the capsule at a proximal end portion to press the capsule in place relative to the vaporizing unit, and optionally can press the vaporizing unit into place relative to the battery assembly. In addition or alternatively, a biasing element such as a spring may be disposed in the cover. The biasing element may contact the capsule at a proximal end portion to press the capsule in place relative to the vaporizing unit, and optionally can press the vaporizing unit into place relative to the battery assembly.

10 If the cover extends over air inlets of, for example, the battery assembly or the vaporizing unit, a sidewall of the cover may define one or more air inlets to allow air to enter the inlets of the battery assembly or the inlets of the vaporizing unit.

The cover may define the mouth end of the aerosol generating system. Preferably, the cover is generally cylindrical and tapers inwardly towards the mouth end. The cover preferably comprises a single part. The cover may include a distal part and a releasable connectable proximal part that may serve as a mouthpiece. The cover may define a mouth end opening to allow aerosol resulting from heating of the aerosol-generating substrate to exit the device. The cover may comprise a seal to prevent air other than air containing aerosol from exiting the mouth end of the device.

20 The cover preferably comprises elongate housing. The cover may be substantially rigid. The housing may comprise any suitable material or combination of materials. Examples of suitable materials include metals, alloys, plastics, ceramic, glass, or composite materials containing one or more of those materials, or thermoplastics, for example polypropylene, polyetheretherketone (PEEK) and polyethylene.

25 An aerosol generating system according to the present invention, when all parts are connected, may have any suitable size. For example the system may have a length from about 50 mm to about 200 mm. Preferably, the system has a length from about 100 mm to about 190 mm. More preferably, the system has a length from about 140 mm to about 170 mm.

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All scientific and technical terms used herein have meanings commonly used in the art unless otherwise specified. The definitions provided herein are to facilitate understanding of certain terms used frequently herein.

As used herein, the singular forms “a”, “an”, and “the” encompass embodiments having
5 plural referents, unless the content clearly dictates otherwise.

As used herein, “or” is generally employed in its sense including “and/or” unless the content clearly dictates otherwise. The term “and/or” means one or all of the listed elements or a combination of any two or more of the listed elements.

As used herein, “have”, “having”, “include”, “including”, “comprise”, “comprising” or the
10 like are used in their open ended sense, and generally mean “including, but not limited to”. It will be understood that “consisting essentially of”, “consisting of”, and the like are subsumed in “comprising,” and the like.

The words “preferred” and “preferably” refer to embodiments of the invention that may afford certain benefits, under certain circumstances. However, other embodiments may also be
15 preferred, under the same or other circumstances. Furthermore, the recitation of one or more preferred embodiments does not imply that other embodiments are not useful, and is not intended to exclude other embodiments from the scope of the disclosure, including the claims.

Reference will now be made to the drawings, which depict one or more aspects described in this disclosure. However, it will be understood that other aspects not depicted in
20 the drawings fall within the scope and spirit of this disclosure. Like numbers used in the figures refer to like components, steps and the like. However, it will be understood that the use of a number to refer to a component in a given figure is not intended to limit the component in another figure labeled with the same number. In addition, the use of different numbers to refer to components in different figures is not intended to indicate that the different numbered
25 components cannot be the same or similar to other numbered components.

FIGS. 1A-C are schematic drawings of sectional view of an example of an aerosol generating system according to the present invention in which parts are disconnected (**A**), some

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parts are connected and some are disconnected (**B**), and all parts are connected (**C**).
Electronic components are not shown.

FIG. 2A is a schematic sectional view of an example of a capsule according to the present invention.

5 **FIG. 2B** is a schematic face view of a bottom surface of the capsule depicted in **FIG. 2A**.

FIG. 3A is a schematic sectional view of an example of a vaporizing unit according to the present invention.

FIG. 3B is a schematic face view of a bottom surface of the vaporizing unit depicted in **FIG. 3A**.

10 **FIG. 4** is a schematic sectional view of an example of a capsule connected to a vaporizing unit.

FIGS. 5A-B are schematic sectional views of an example of a vaporizing unit having a longitudinally moveable baffle.

15 **FIGS. 6A-B** are schematic sectional views of an example of a vaporizing unit having retractable sheaths.

FIGS. 7A-B are schematic sectional views of an example of a capsule and a vaporizing unit where the capsule and vaporizing unit are disconnected (**A**) and connected (**B**).

FIGS. 8 is a schematic sectional view of an example of a connected capsule and vaporizing unit.

20 **FIG. 9** is a schematic sectional view of a cover in accordance with examples of the invention.

FIG. 10 is a schematic view of an example of a mechanism for coupling a cover to a battery assembly.

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FIG. 11 is a schematic sectional view of an example of two capsules and a vaporizing unit to which the capsules are connectable.

FIG. 12 is a schematic side view of an aerosol generating system showing some internal components in dashed lines and an aerosol flow path in solid arrows.

5 The schematic drawings are not necessarily to scale and are presented for purposes of illustration and not limitation.

Referring now to **FIGS. 1A-C**, an aerosol generating system **100** includes a battery assembly **10**, a vaporizing unit **20**, a capsule **30**, and a cover **40**. The battery assembly **10** is releasably connectable to the vaporizing unit **20**. The vaporizing unit **20** is releasably connectable to the capsule **30**. The cover **40** is disposable over the vaporizing unit **20** and the capsule **30**. The cover **40** is releasable securable in a position relative to the vaporizing unit **20** and the capsule **30**. In some examples the cover may be releasably connectable to the battery assembly and, when the cover is connected to the battery assembly, the cover aids in retaining the vaporizing unit and capsule in place.

15 The system has a distal end **102** and a mouth end **101**. The battery assembly **10** comprises a housing defining air inlets **14** and a passage in communication with the inlets. When a user draws on the mouth end **101** air may be drawn through air inlets **14** and passage in housing of battery assembly **10**, through a passage in vaporizing unit **20**, through a passage in capsule **30**, through a passage in cover **40**, and out of mouth end opening **45** of cover.

20 The cover **40** in the depicted embodiment has an inwardly extending, elongate annular element **420** that defines a passage for flow of aerosol. The annular element **420** sealingly engages with the capsule **20** to place the passage through the capsule **30** in communication with the passage through the cover **40**.

Referring now to **FIG. 2A**, a capsule **30** may include a housing **310** defining a reservoir **300** for containing liquid aerosol generating substrate and defining a passage **315** for aerosol flow. The capsule may include one or more ports **330** in communication with reservoir **300**, and may include a sealing element **335** sealed across an opening of the port **330**. Preferably, the sealing element **335** is pierceable. The capsule includes a first mating end **340** at its distal end.

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The mating end **340** may include a number of features for cooperating with the vaporizing unit. For example, the capsule **30** includes a longitudinally extending annular member **350** having an outer tapered surface configured to be received by a complementary feature of the vaporizing unit (not shown in **FIG. 2A**). Annular member **350** is preferably tapered at an angle from about 3 degrees to about 4 degrees.

The capsule **30** may include a layer of high retention material **320** disposed across openings in communication with the ports **330**. The high retention material **320** is disposed within the reservoir. In the depicted example, the high retention material **320** is disposed on the bottom interior surface of the reservoir, which bottom surface is indicated by line **A-A**.

Referring now to **FIG. 2B**, a face view of the first mating end **340** of the capsule of **FIG. 2A** is shown. The first mating end **340** includes a plate **311** supporting various features of the first mating end. The plate **311** may be formed from a single piece with the sidewalls of the housing (for example, element **310** in **FIG. 2A**) or may be formed of one or more separate pieces connected to the sidewall of the housing. The plate **311** defines openings around which ports **330** are disposed. The plate **311** defines an opening in communication with passage **315** through which aerosol may flow. The opening is surrounded by the longitudinally extended annular member **350**.

Referring now to **FIG. 3A**, a vaporizing unit **20** may comprise a housing **240** defining a passage **215** through which aerosol may flow. A liquid transfer element **210** and heating element **220** are disposed in the housing **240**. The liquid transfer element **210** is in contact with heating element **220**, which is configured to heat liquid aerosol generating substrate that is carried by the transfer element **210** to form an aerosol. The aerosol may then be carried through passage **215**. The heating element **220** is electrically coupled to electrodes **232**, **234** that extend distally beyond the housing **240** for electrical connection with the battery assembly.

The vaporizing unit **20** has a second mating end **245** that includes features complementary to features of the first mating end of the capsule to ensure proper alignment and connection of the parts. For example, the vaporizing unit **20** includes an annular member **250** having a tapered inner surface configured to receive a corresponding annular member of the capsule **30** (for example, element **350** of the capsule **30** depicted in **FIG. 2A**). The vaporizing unit **20** also includes longitudinally extending annular member **260** through which protruding

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portions **218** of liquid transfer elements extend. Annular members **260** may cooperate with corresponding features of a first mating end of capsule (such as ports **330** depicted in **FIG. 2A**). The protruding portions **218** of liquid transfer elements are in communication with the portion of the liquid transfer element **210** that is in contact with heating element **220**.

5 Referring now to **FIG. 3B**, a face view of the second mating end of the vaporizing unit of **FIG. 3A** is shown. The second mating end includes a plate **241** supporting various features of the second mating end. The plate **241** forms a portion of the housing of the vaporizing unit **20** (for example, element **240** in **FIG. 3A**). The plate **241** defines openings around which annular elements **260** are disposed. The protruding portions **218** of the liquid transfer elements extend
10 through the annular elements **260**. The plate **241** defines an opening in communication with passage **215** through which air or aerosol may flow. The opening is surrounded by the longitudinally extended annular member **250**. Heating element **220** and liquid transfer element **210** are disposed in a flow path through passage **215**.

15 Referring now to **FIG. 4**, an example of a connected capsule **30** and vaporizing unit **20** is shown. The protruding portion **218** of the liquid transfer element extends through the port of the capsule beyond the bottom interior surface (indicated by line **A-A**) of the reservoir **300** and into, but not through, the layer of high retention material **320** in the reservoir **300**. The reservoir **300** contains free-flowing liquid aerosol generating substrate **360** that wets the layer of high retention material **320**. The protruding portion **218** of the liquid transfer element carries liquid
20 substrate **360** to the portion **210** of the liquid transfer element that is in contact with heating element **220**. Heating element **220** heats substrate carried by transfer element **210** to generate an aerosol which may be carried by air through passageways **215**, **315**.

25 Referring now to **FIGS. 5A-B**, a vaporizing unit **20** may include a baffle **50** configured to protect, for example, projecting portions **218** of the liquid transfer elements. The baffle **50** may extend (**FIG. 5A**) and retract (**FIG. 5B**). Preferably, baffle **50** is biased towards the extended position by spring elements **900** (shown schematically) and application of force to move the first mating end of the capsule towards the second mating end of the vaporizing unit causes baffle **50** to retract. Baffle **50** includes openings **501**, **502**, **503** that are aligned with features of the mating end of the vaporizing unit **20**. For example, openings **502** and **503** are aligned with
30 annular members closing **260**, and opening **501** is aligned with central annular member **250**. When the baffle is retracted, features of the mating end of the unit and the protruding elements

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218 extend through the openings **501**, **502**, **503** of the baffle. Baffle **50** may be coupled with, or may be integrally formed with, annular member **60** that may cooperate with the housing of the vaporizing unit to maintain alignment of the openings **501**, **502**, **503** of the baffle **50** with the features of the mating end of the unit while the baffle **50** extends and retracts. For example, a
5 distal portion of the annular member **60** may cooperate with a detent **290** on the housing of the vaporizing unit **20**.

Referring now to **FIGS. 6A-B**, a vaporizing unit may include retractable sheaths **600**, which may protect projecting portions **218** of the liquid transfer element when the vaporizing unit is not connected to the capsule. The sheaths **600** include a biasing element such as a spring
10 **610** and a material **620** attached to the spring **610**. The spring **610** biases the material **620** in an extended position (**FIG. 6A**). Application of force to move the first mating end of the capsule towards the second mating end of the vaporizing unit causes spring **610** and material **620** to retract (**FIG. 6B**).

Referring now to **FIGS. 7A-B**, capsule **30** may include a valve **380** configured to prevent
15 flow of aerosol generating substrate (not shown) from the reservoir through port **330** when the vaporizing unit **20** is not connected to the capsule **30** (**FIG. 7A**) and to allow flow when the vaporizing unit **20** is connected to the capsule **30** (**FIG. 7B**). The valve **380** may be seated in a seal **385** within port **330**. The valve **380** includes first **318** and second **382** resilient closing members biased in a closed position to prevent flow of fluid from the reservoir through the
20 valve. The depicted resilient closing members **381**, **382** each include a flat portion that engages the flat portion of the other member to close the valve. When the vaporizing unit **20** is connected to the capsule **30**, the protruding portion **218** of the liquid transfer element pierces cover **335** disposed over port **330** and extends beyond the inner surface (indicated by line **A-A**) of the reservoir. The protruding portion **218** of the liquid transfer element pierces sealing
25 element **335** disposed across port **330** and inserts into valve **380**, causing resilient closing members **381**, **382** to deflect away from their biased closed positions to cause the valve **380** to open and to place protruding portion **218** of the liquid transfer element in fluid communication with reservoir. The depicted valve **380** is a duckbill valve that is closed when protruding portion
30 **218** of the liquid transfer element is not inserted in the valve **380**. However, any suitable valve may be employed. Preferably the valve is mechanically actuatable and is configured to be

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opened when the vaporizing unit **20** and capsule **30** are connected and is configured to be closed when the vaporizing unit and capsule are not connected.

Referring now to **FIG. 8**, an example of a connected capsule **30** and vaporizing unit **20** are shown. The capsule **30** and vaporizing unit **20** are similar to those depicted in **FIGS. 7A-B**,
5 except that a protective sheath **600** is disposed about the liquid transfer element **218**. The sheath **600** comprises a side wall **610** defining a proximal opening **612**. In the depicted example, the wall **612** of the sheath **600** contacts resilient members **381**, **382** to cause the valve **380** to open. Liquid aerosol generating substrate may flow from the reservoir through opening **612** to the liquid transfer element **218**.

10 Referring now to **FIG. 9**, an example of a cover **40** is shown. A spring **49** is disposed in the cover and may assist in applying pressure to the capsule and vaporizing unit when the cover **40** is connected to the battery assembly. The depicted cover **40** also includes a connection element **47** for connecting the cover **40** to the battery assembly.

15 Referring now to **FIG. 10**, an example of a connection mechanism between a battery assembly **10** and a cover **40** is shown. The connection mechanism may be a quick release-type connection mechanism. For example, a proximal portion **120** of the housing of the battery assembly **10** may be tapered for insertion into a distal portion of the cover **40**, which is also configured to be disposed over vaporizing unit **20** and capsule **30**, which are shown connected to the battery assembly. The housing of the battery assembly includes indents **110** for
20 cooperating with engagement member **420** of connection element **47**. The housing of the battery assembly also includes a rim **130** against which a distal portion of the connection element **47** may abut when the cover is connected with the battery assembly. The connection element **47** includes a slidable annular member **430** that may be retracted to allow disconnection of the cover and the battery assembly. The slidable annular member **430** is
25 biased in an extended position by spring **410** that cooperates with the housing of the cover. The quick release-type connector depicted in **FIG. 9** is shown merely for purposes of illustration, and it will be understood that any suitable connector may be used for connecting battery assembly to cover.

30 Referring now to **FIG. 11**, a system according to the present invention may include more than one capsule **300A**, **300B** releasably coupleable to a vaporizing unit **20**. In the depicted

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embodiment, the vaporizing unit **20** includes a longitudinally extending annular member **290** that forms a passage **295** through which aerosol may flow. The annular member **290** may also serve to guide capsules **300A**, **300B** into proper alignment for connection with vaporizing unit. The capsules **300A**, **300B** may contain the same or different liquids.

5 Referring now to **FIG. 12**, an aerosol generating system **100** of the present invention includes a battery assembly **10**, an vaporizing unit **20** releasably coupleable to the battery assembly **10**, a capsule **30** releasably coupleable to the vaporizing unit **20** and a cover **40** releasably coupleable over the vaporizing unit **20** and the capsule **30**.

The battery assembly **10** comprises a housing **130** in which a power supply **110** and
10 electronic circuitry **120** are disposed. The electronic circuitry **120** is electrically coupled to the power supply **110**. The vaporizing unit **20** comprises a liquid transfer element **210** and a heating element **220**. The liquid transfer element **210** is in thermal connection with the heating element **220**. When the vaporizing unit **20** is connected to the battery assembly **10**, the heating element **220** is electrically coupled with the circuitry **120** and power supply **110**. When the
15 vaporizing unit **20** is connected to the capsule **30**, the liquid transfer element **210** is fluidly coupled with the reservoir **300** suitable to contain an aerosol-generating substrate. When a user draws on the mouth end **101** of the system, which is defined by the cover **40**, air may enter inlets **14** in housing of battery assembly, may flow through a passage in battery assembly **10**, through a passage in vaporizing unit **20** (such as passage **215** depicted in **FIG. 3A**) where
20 aerosol may be entrained in the air, through a passage in the capsule **30** (such as passage **315** depicted in **FIG. 2A**), through a passage in the cover and through a mouth end opening.

Thus, methods, systems, apparatuses, assemblies and articles for aerosol generating systems having separate capsules and vaporizing units are described. Various modifications and variations of the invention will be apparent to those skilled in the art without departing from
25 the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are apparent to those skilled in the mechanical arts, electrical arts, and aerosol generating article manufacturing or related fields
30 are intended to be within the scope of the following claims.

CLAIMS:

1. A capsule for use in an aerosol generating system comprising the capsule for containing a liquid aerosol-generating substrate and a vaporizing unit for heating the liquid aerosol-generating substrate, in which the vaporizing unit is releasably connectable to the capsule, wherein the capsule comprises:
a reservoir for containing the liquid aerosol-generating substrate,
an opening in fluid communication with the reservoir, and
a valve configured to control flow of the liquid aerosol-generating substrate from the reservoir through the opening, wherein the valve comprises one or more resilient closing members biased towards a closed position,
wherein the valve is configured to receive an elongate element of a vaporizing unit to cause the one or more resilient closing members to deflect away from the closed position and to cause the valve to open.
2. A capsule according to claim 1, wherein the valve comprises a first resilient closing member and a second resilient closing member, wherein the first and second resilient closing members contact each other in the closed position.
3. A capsule according to claim 2, wherein the first resilient member comprises a flat portion and the second resilient member comprises a flat portion, and wherein the flat portions of the first and second resilient members contact each other in the closed position.
4. A capsule according to claim 3, wherein the valve comprises a duckbill valve.
5. A capsule according to any one of claims 1 to 4, wherein the capsule comprises a port defining the opening and wherein the valve is seated in the port.
6. A capsule according to any one of claims 1 to 5, wherein the port defines a distal port opening and comprises a sealing element disposed across the distal port opening.

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7. A capsule according to any one of claims 1 to 6, wherein the reservoir of the capsule is configured to be filled entirely with a free-flowing liquid.
8. A capsule according to claim 7, further comprising the free-flowing liquid disposed in the reservoir.
9. A vaporizing unit for use in an aerosol generating system comprising a capsule according to any preceding claim, the capsule having a reservoir for containing a liquid aerosol-generating substrate, and the vaporizing unit for heating the liquid aerosol-generating substrate, in which the vaporizing unit is releasably connectable to the capsule, wherein the vaporizing unit comprises:
a housing,
a liquid transfer element disposed in the housing, and
a heating element disposed in the housing and configured to heat liquid in the liquid transfer element,
wherein the vaporizing unit comprises an elongate element extending from a proximal end of the unit for engagement with a valve of a capsule to form a fluid connection between the liquid transfer and the reservoir of the capsule.
10. A vaporizing unit according to claim 9, wherein a portion of the liquid transfer element extends beyond a proximal end of the housing and is configured to extend into a valve of a capsule, when the vaporizing unit and a capsule are connected.
11. A vaporizing unit according to claim 10, wherein the elongate element extending from the proximal end of the vaporizing unit comprises a sheath disposed about the portion of the liquid transfer element that extends beyond the proximal end of the housing.
12. An aerosol-generating system comprising:
a capsule according to any one of claims 1 to 8, the capsule comprising a reservoir for containing a liquid aerosol-generating substrate, an opening in fluid communication with the reservoir, and a valve configured to control flow of the liquid aerosol-generating substrate from the reservoir through the opening, wherein the valve comprises one or more resilient closing members biased towards a closed position; and

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a vaporizing unit according to any one of claims 9 to 11, the vaporizing unit being releasably connectable to the capsule, and the vaporizing unit comprising a housing, a liquid transfer element disposed in the housing, and a heating element disposed in the housing and configured to heat liquid in the liquid transfer element,

5 wherein the vaporizing unit comprises an elongate element extending from a proximal end of the unit,

wherein the elongate element is configured to be received in the valve to cause the one or more resilient closing members to deflect away from the closed position and to cause the valve to open as a distal end of the capsule is moved towards the proximal end of the vaporizing unit, and

10 wherein the liquid transfer element is placed in fluid connection with the reservoir via the opening when the valve is open.

13. A system according to claim 12, wherein the capsule comprises a port defining the opening, the valve being seated in the port, and the port defining a distal port opening and comprising a sealing element disposed across the distal port opening, and wherein the elongate element extending from the proximal end of the vaporizing unit is configured to pierce the sealing element as the distal end of the capsule is moved towards the proximal end of the vaporizing unit.

20

14. A system according to claims 12 or 13, further comprising a cover disposable over the capsule and the vaporizer unit.

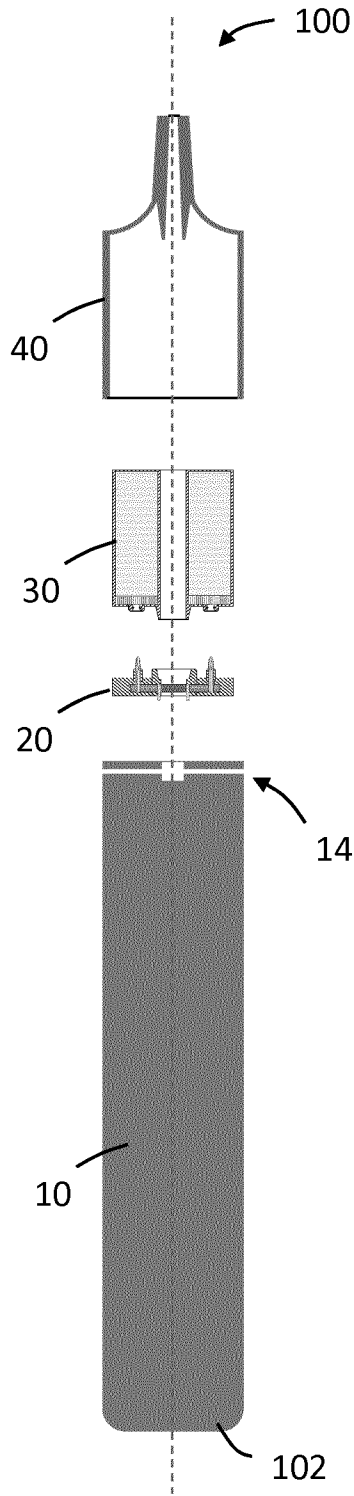


FIG. 1A

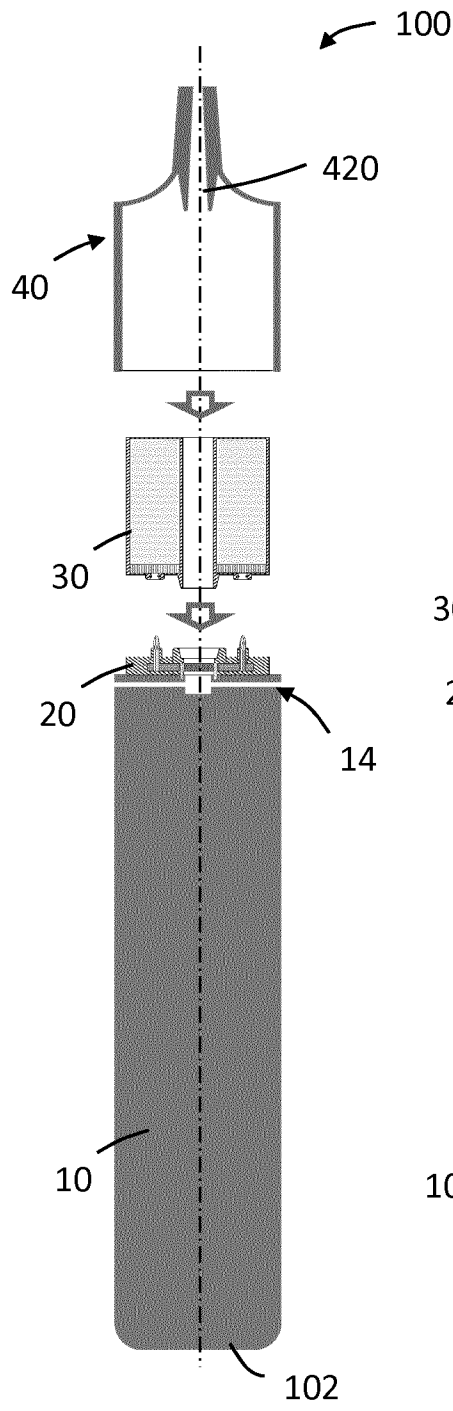


FIG. 1B

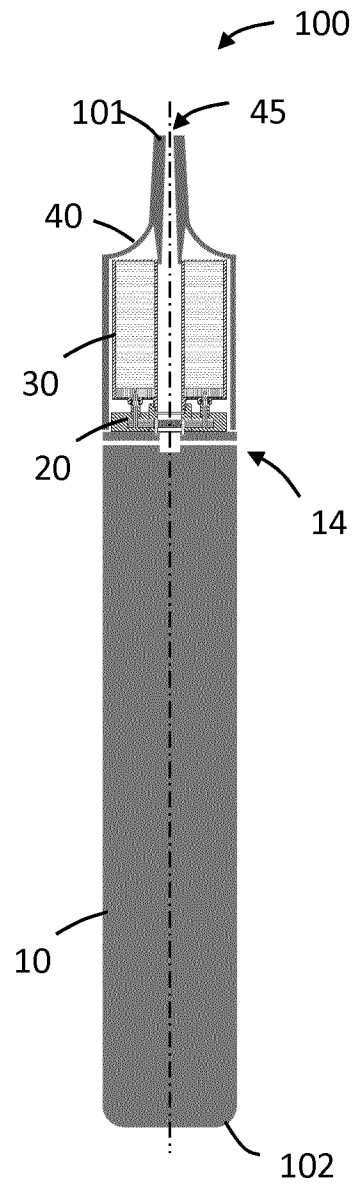


FIG. 1C

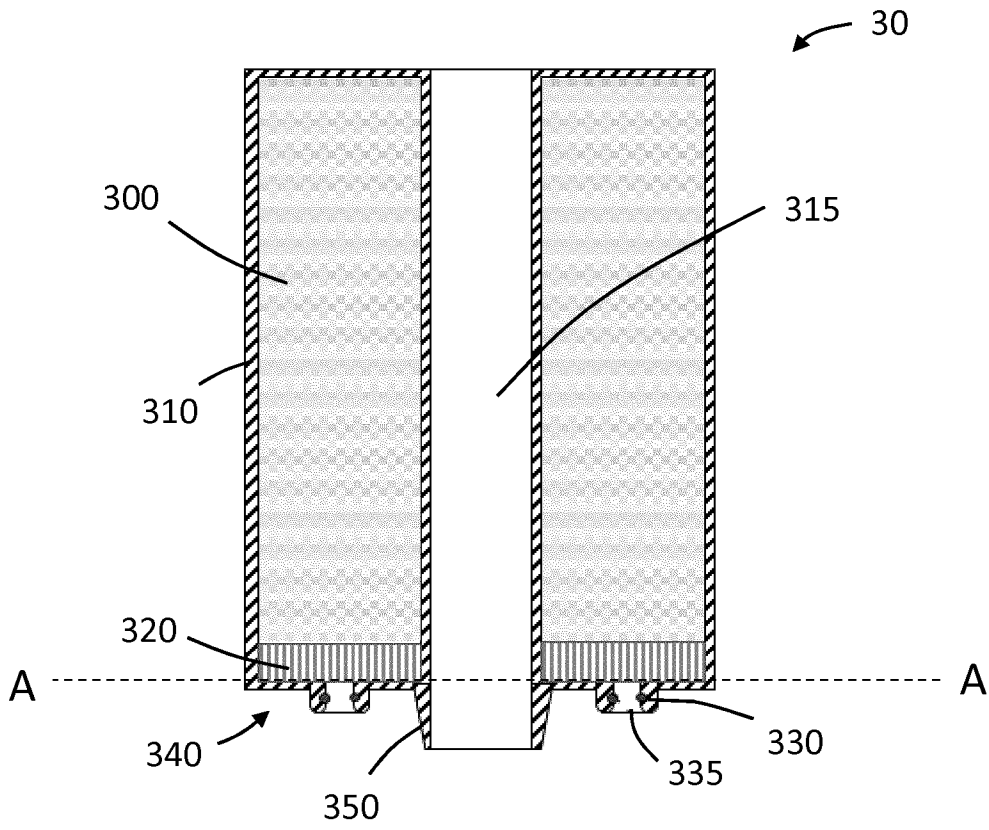


FIG. 2A

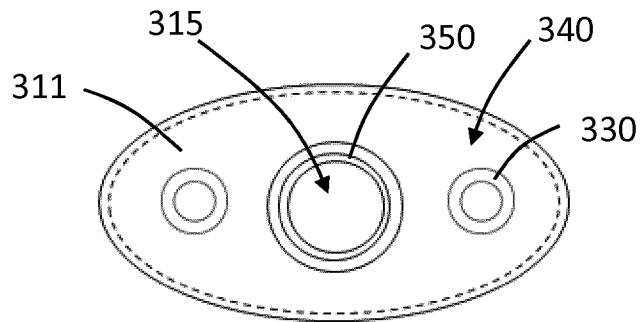


FIG. 2B

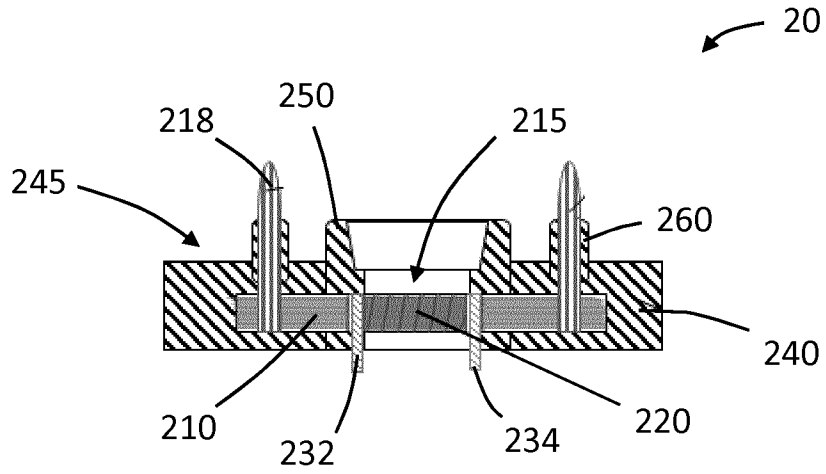


FIG. 3A

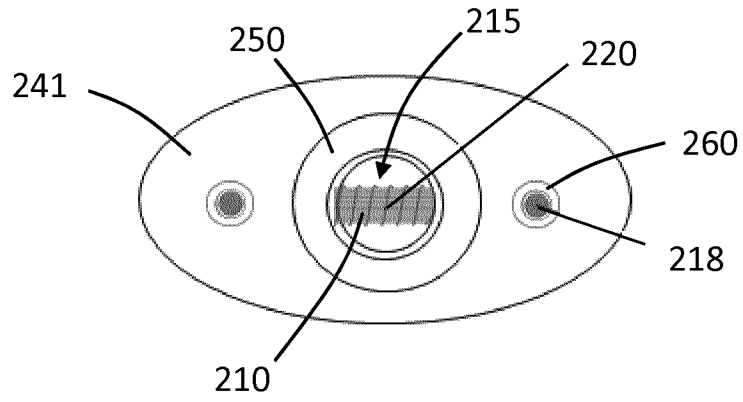


FIG. 3B

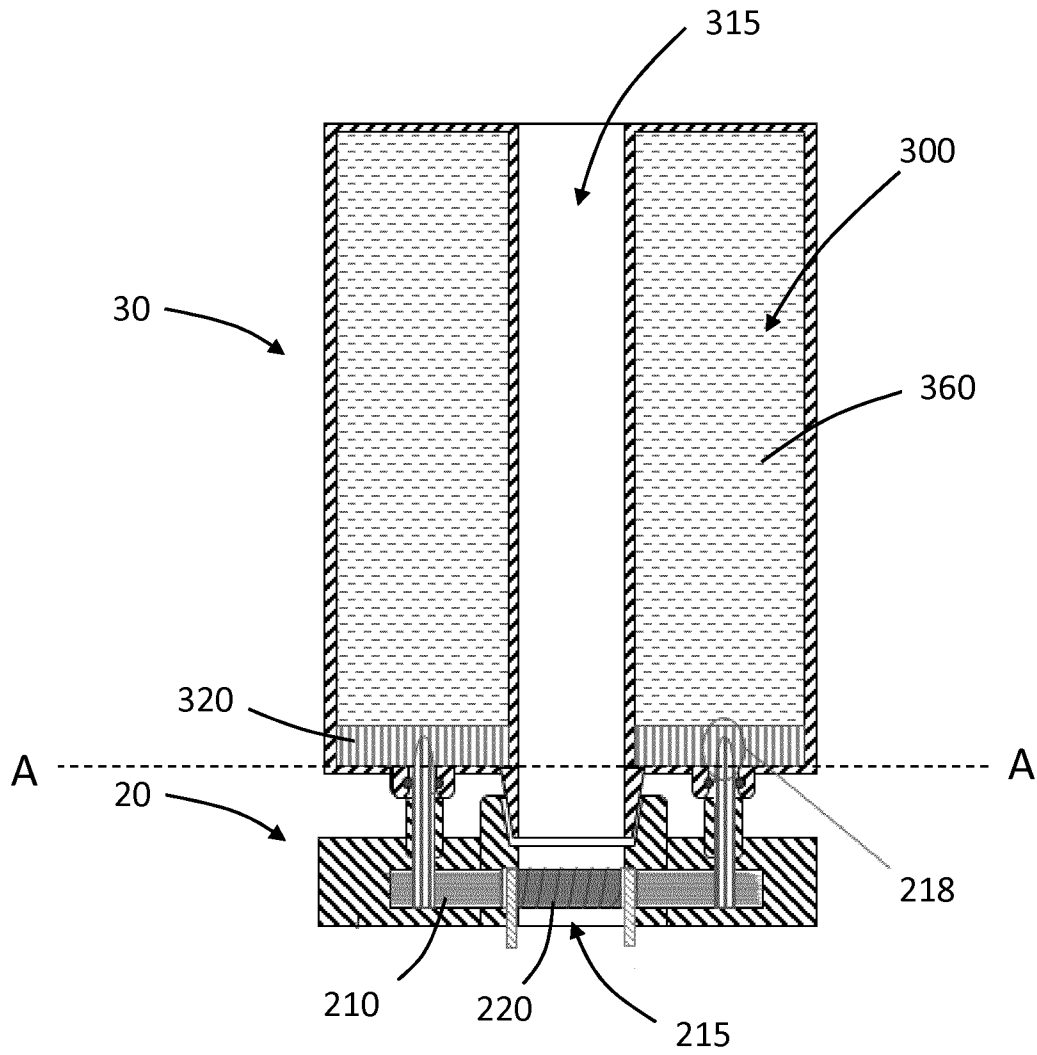


FIG. 4

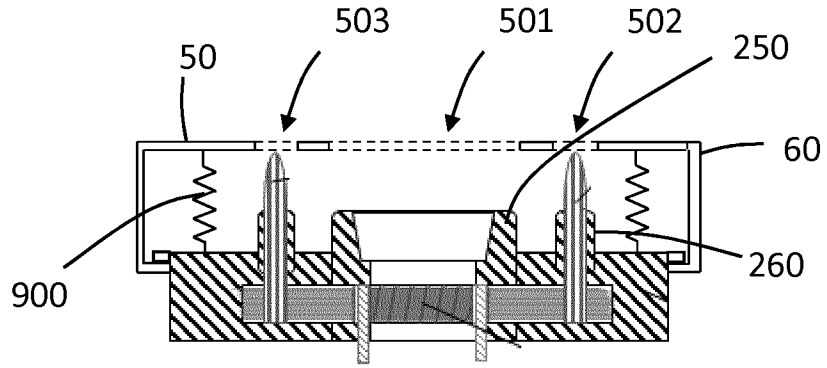


FIG. 5A

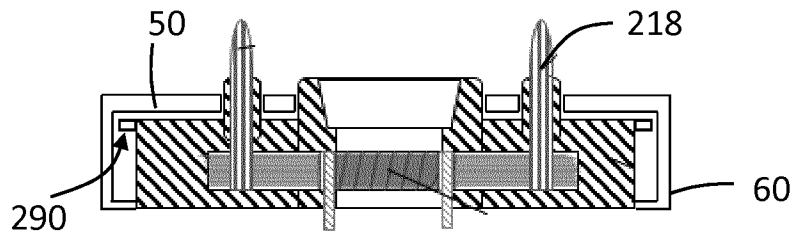


FIG. 5B

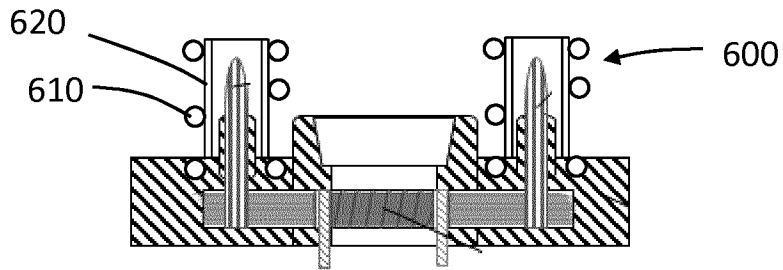


FIG. 6A

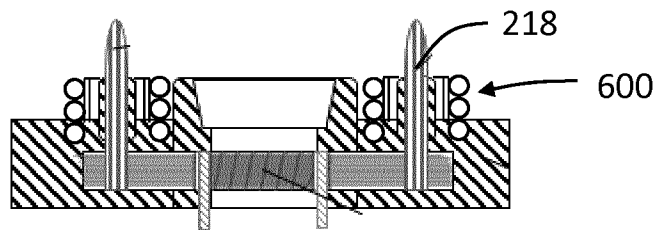


FIG. 6B

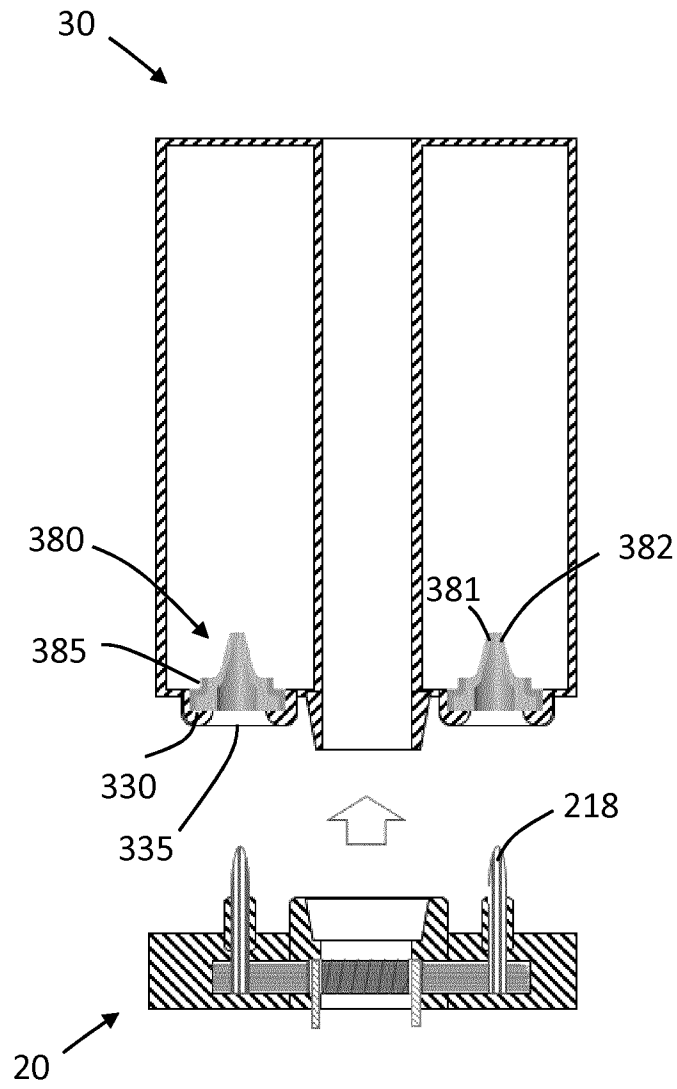


FIG. 7A

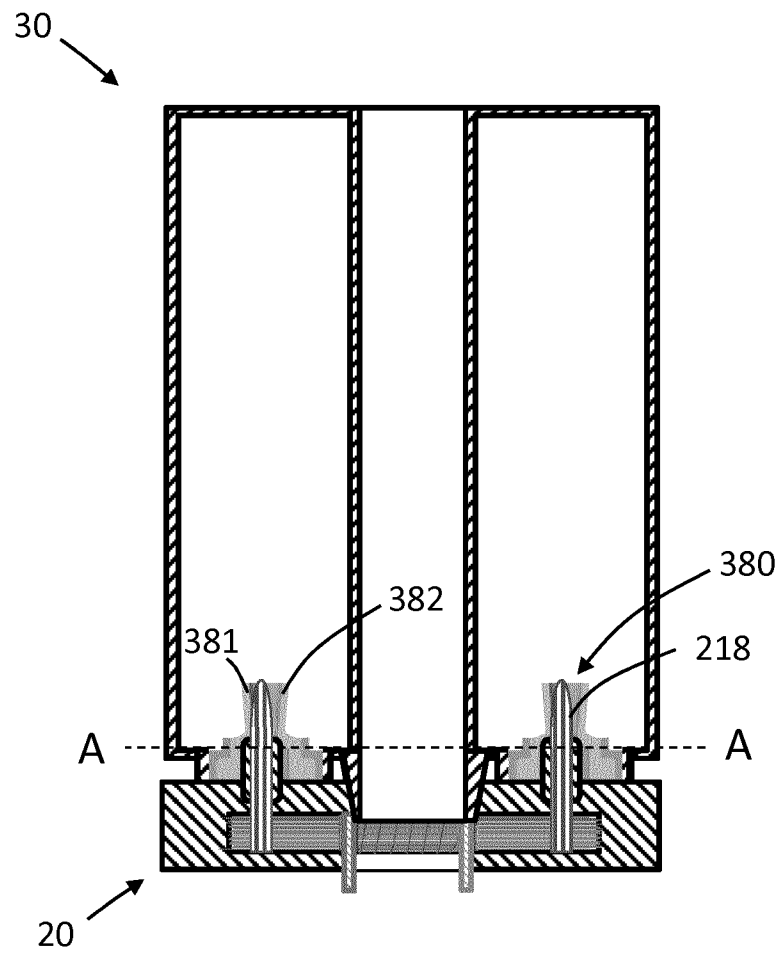


FIG. 7B

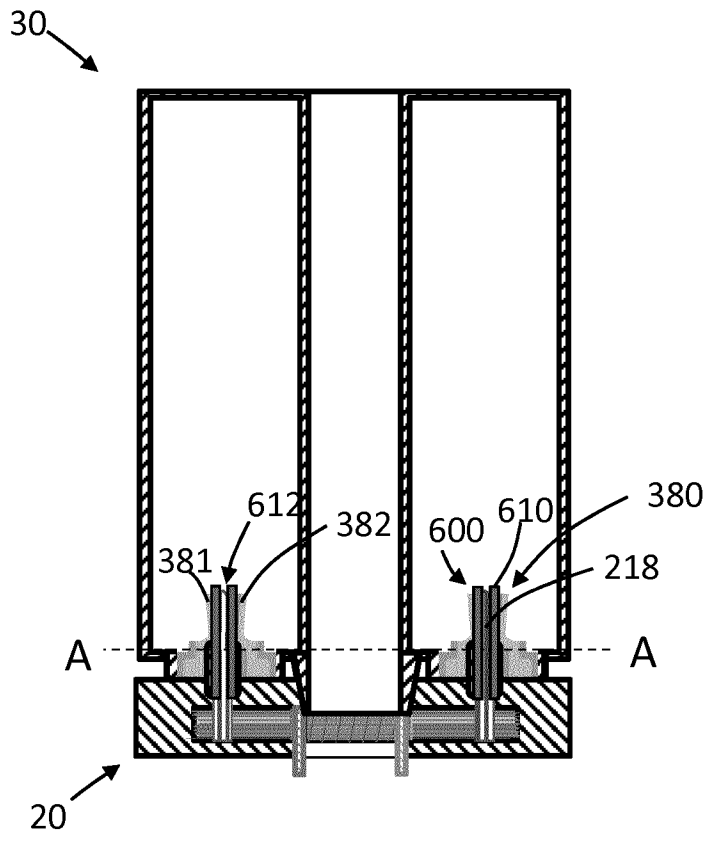


FIG. 8

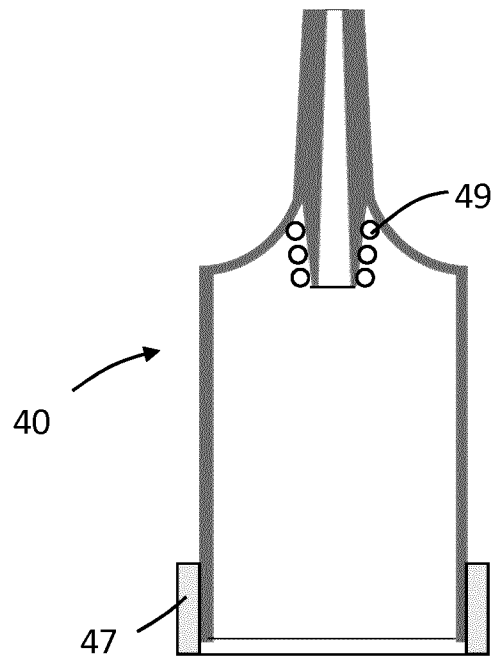


FIG. 9

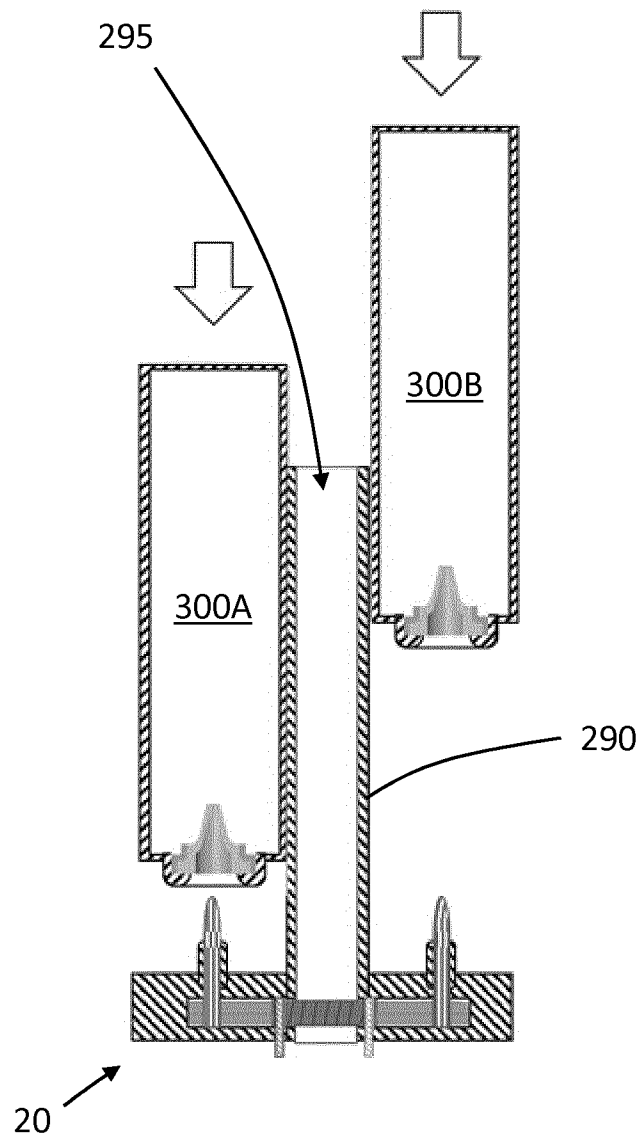


FIG. 11

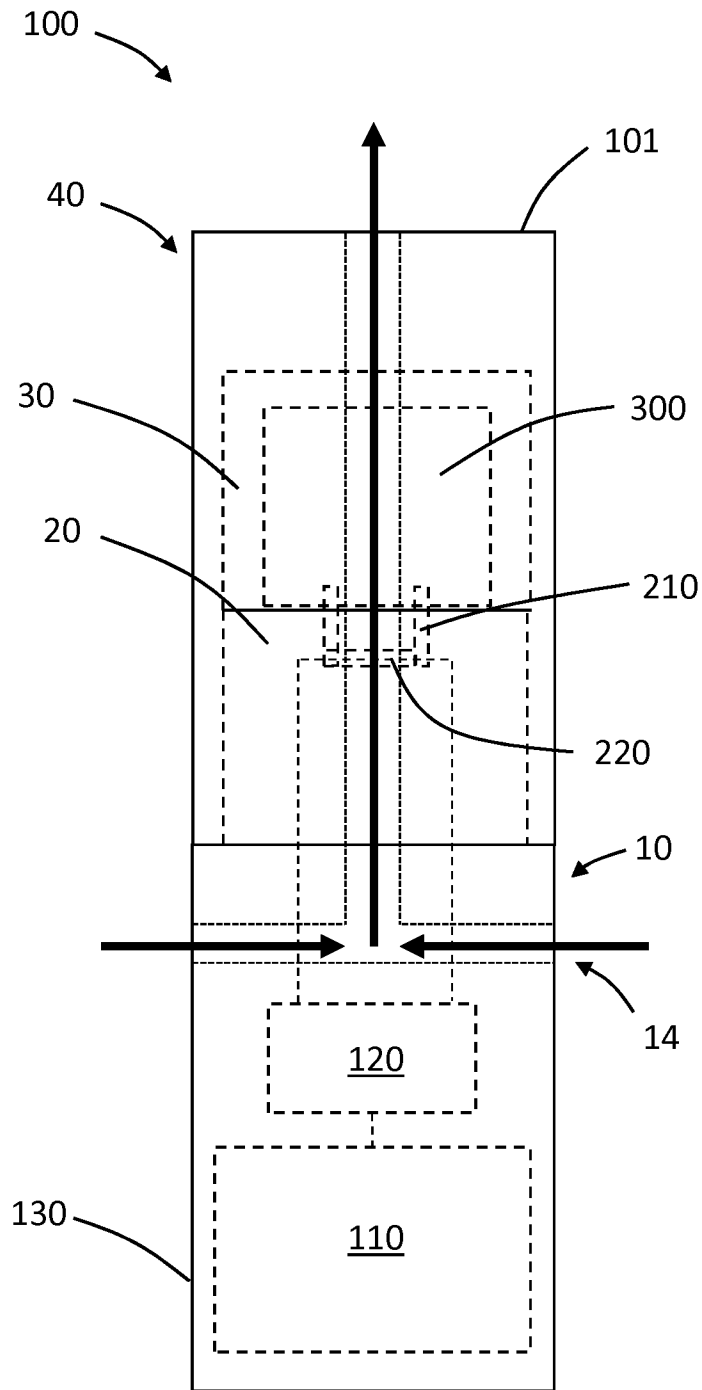


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No PCT/EP2017/054418

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A24F47/00
 ADD.

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)
 A24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2015/245654 A1 (MEMARI KAVEH [GB] ET AL) 3 September 2015 (2015-09-03) the whole document -----	1-14
A	US 2015/173422 A1 (LIU QIUMING [CN]) 25 June 2015 (2015-06-25) the whole document -----	1-14
A	GB 2 502 053 A (NICOVENTURES HOLDINGS LTD [GB]) 20 November 2013 (2013-11-20) the whole document -----	1-14

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

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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

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Date of the actual completion of the international search

25 April 2017

Date of mailing of the international search report

07/06/2017

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2017/054418

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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