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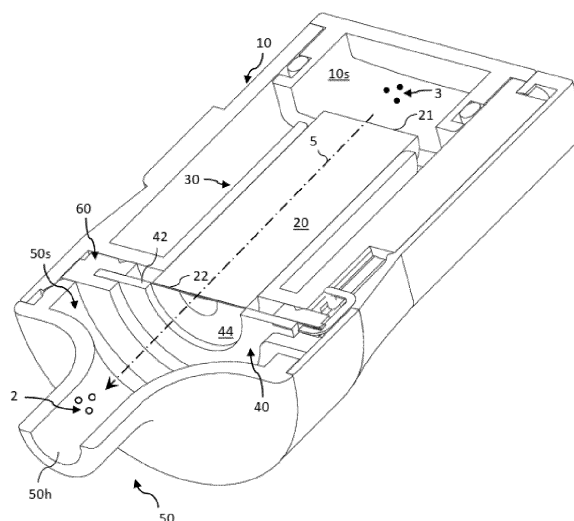
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(54) **A DEVICE AND A METHOD FOR GENERATING AEROSOL**

(57) An aerosol generating device (1) includes a mouthpiece (50), a container (10) having an accommodation space (10s) for accommodating a liquid (3) to be aerosolized, an ultrasonic generator (40) to generate the aerosol (2); and a wick (20) for transporting the liquid from the accommodation space to the ultrasonic generator. The ultrasonic generator is disposed between the mouthpiece and the wick. An inlet end (21) of the wick inside the accommodation space receives the liquid. An

outlet end (22) of the wick disposed in contact with the ultrasonic generator provides the liquid to the ultrasonic generator. The accommodation space, the wick and the mouthpiece define a fluid conduction path (5) that passes through the ultrasonic generator. The container comprises an outlet opening (12). The wick is disposed in the outlet opening and filling the outlet opening. A method for generating an aerosol by the aerosol generating device is also provided.

FIG 10



Description

[0001] The present invention generally relates to aerosol generating devices, such as a personal vaporizer, an inhaler, an electric cigarette or e-cigarette, and particularly to techniques for generating aerosol by wick-based devices using ultrasonic aerosolization.

Background

[0002] In recent years, use of aerosol generated by non-combustion techniques has become pervasive. Users are adapting to use of aerosol generated without combustion to avoid known adverse effects of combustion, such as of traditional cigarettes in which an end is lit to burn/combust tobacco or other ingredients to generate smoke. Non-combustion aerosol generators also referred to as personal vaporizers, inhalers, e-cigarettes are increasingly becoming popular. Such aerosol generators use electrical heating or ultrasonic techniques to aerosolize a liquid stored inside the aerosol generator.

[0003] The ultrasonic technique uses an ultrasonic generator (also referred to as ultrasonic actuator or transducer) with piezoceramic that generates ultrasound to efficiently aerosolize or nebulize the liquid. However, when the aerosol generator is not being actively used for generating aerosol, vapors from the liquid stored in the aerosol generator settle on an under-side of the ultrasonic generator (i.e. the side facing the reservoir) and form droplets (e.g. by condensation) which accumulate at different locations including at an upper-side of the ultrasonic generator (i.e. the opposite side or flip side of the under-side). The droplets prevent efficient and swift restarting of nebulization when the ultrasonic generator is used.

[0004] A similar problem may occur when liquid from the aerosol generator leaks towards the ultrasonic generator and settles on the ultrasonic generator, in particular on an upper side of the ultrasonic generator.

[0005] Due to one or more of the above issues, users experience delay in aerosol generation and need to shake or hit the device for knocking off the droplets from the ultrasonic generator to aid aerosol generation.

[0006] The above problems of vaporization and condensation and/or leakage are further aggravated when the liquid stored in the aerosol generator includes components, such as water, that are prone to vaporization and condensation and leakage, and thus use of such components, e.g. water, is limited in the liquids to be aerosolized, although components such as water are generally safe and economical.

[0007] Thus, a technique for generating aerosol is desired which reduces or obviates one or more of the above disadvantages.

Summary

[0008] The present disclosure aims to provide a technique which reduces or obviates one or more of the above disadvantages. It is an object of the present disclosure to provide an aerosol generating device which reduces or obviates unintended accumulation of the liquid on the ultrasonic generator. Furthermore, it is an object of the present disclosure to provide a method for generating an aerosol which reduces or obviates unintended accumulation of the liquid on the ultrasonic generator. Yet another object of the present disclosure is to enable use of liquid (for aerosolization) having high water content by reducing or obviating unintended accumulation of the liquid on the ultrasonic generator.

[0009] One or more of the above objects of the present technique are achieved by the invention set out by the features of the independent claims. Advantageous embodiments are provided in dependent claims.

[0010] In a first aspect of the present technique an aerosol generating device for generating an aerosol is presented. The aerosol generating device may be a personal vaporizer, an inhaler, an electric cigarette or e-cigarette. The aerosol generating device may be a portable and/or pocket-size device. The aerosol generating device (hereinafter also referred to as aerosol generator or simply as device) includes a container (also referred to as a reservoir), a wick (also referred to as a capillary element), an ultrasonic generator (also referred to as ultrasonic probe, transducer, actuator) and a mouthpiece.

[0011] The container has an accommodation space for accommodating or holding or storing a liquid to be aerosolized. The wick transports the liquid from the accommodation space (i.e. the liquid stored in the accommodation space) to the ultrasonic generator. The wick has an inlet end for receiving the liquid into the wick from the accommodation space. The inlet end is disposed inside the container, i.e. in the accommodation space, for receiving the liquid. The wick has an outlet end disposed in contact with the ultrasonic generator. The outlet end provides the liquid to the ultrasonic generator. The ultrasonic generator applies ultrasound to the liquid received by the outlet end of the wick, thereby aerosolizing the liquid and generating the aerosol from the liquid. The mouthpiece discharges the generated aerosol to an outside of the device, for example when drawn or sucked by a user. The accommodation space, the wick and the mouthpiece - all together - define a fluid conduction path for transporting the liquid from the accommodation space to the ultrasonic generator and transporting the aerosol generated by the ultrasonic generator to the mouthpiece. The ultrasonic generator

is disposed, e.g. disposed directly, between the mouthpiece, i.e. a discharge opening of the mouthpiece, and the wick. The fluid conduction path passes through the ultrasonic generator. The container comprises an outlet opening. The wick is disposed in the outlet opening in such a way that the wick fills, or completely fills or completely packs, the outlet opening.

[0012] Aerosol generation may also be referred to as fogging, aerosolization, atomization, nebulization., and like terms.

[0013] The phrase 'disposed in contact' as used in the present technique may mean 'disposed in direct contact', 'disposed in direct physical contact' or 'disposed in surface-to-surface contact', unless otherwise stated.

[0014] The phrase 'fills' as used in the present technique may mean 'completely fills', 'crammed', 'jammed', 'occupies an entire cross-sectional area', unless otherwise stated. Here, the cross-sectional plane or area is defined perpendicular to the longitudinal axis of the device and/or of the accommodation chamber and/or of the guide.

[0015] The working of the device may be understood as follows: the liquid from the accommodation space is received into the wick via the inlet end of the wick. The received liquid travels through the wick to the outlet end of wick, by capillary action or wicking action of the wick. The outlet end provides the liquid to the ultrasonic generator - by being in direct contact i.e. surface-to-surface contact, or directly adjoining or abutting, with the ultrasonic generator. The ultrasonic generator generates ultrasound, for example when actuated or controlled or activated by a user of the device, for example when provided with electrical power from a battery or a power source. The generated ultrasound aerosolizes the liquid provided by the outlet end of the wick, consequently generating the aerosol which is then discharged to an outside of the device via the mouthpiece. The atomization, and consequent removal, of the liquid from the outlet end of the wick, by action of the ultrasound generator, provides a suction force or sustains capillary or wicking action of conducting or transporting the liquid from the accommodation space into the inlet end of the wick and therefrom to the outlet end of the wick.

[0016] The wick lies directly against the surface of the ultrasound generator and may thus be spatially sealed in such a way that no liquid located in the container can reach the ultrasound generator except the liquid that is transported through the wick. In other words, the liquid may be able to reach the ultrasound generator exclusively by means of the capillary element or the wick.

[0017] The wick may be formed of woven or non-woven fabric, such as cotton. The wick may have a fibrous structure or a spongy structure. The wick may include ceramic- or graphite-based materials. The wick may include at least one of cellulose acetate, polyester, polyolefin, polyethylene, polypropylene fibers or nylon fibers.

[0018] Any conduction or movement or travelling or transporting of the liquid by the wick and/or into the wick and/or within the wick may be due to wicking action or capillary action, for example when enforced or implemented or effected by aerosolization of the liquid caused at the outlet end of the wick by the ultrasound generated by the ultrasound generator.

[0019] A material of the wick may be such that capillaries of the wick hold the liquid so that the liquid does not escape by itself, i.e. in absence of the wicking force generated by the operation (i.e. ultrasound generation) of the ultrasound generator. Only by the vibrations of the ultrasonic generator the liquid in the wick may be taken out of the capillaries of the wick.

[0020] A position and/or orientation of the wick may be located or fixed with respect to the container, particularly with respect to the outlet opening of the container, for example, but not limited to, by means of an interference fit or press fit.

[0021] The fluid conduction path may be understood as comprising at least two sections or parts or segments - a first section or segment which may be referred to as a liquid transport section or segment, and a second section or segment which may be referred to as an aerosol transport section or segment.

[0022] The liquid transport section may be defined at least by the wick, for example by the inlet end of the wick, the outlet end of the wick and the intervening part or middle part of the wick (i.e. part of the wick extending between the inlet end and the outlet end of the wick). Via the liquid transport section, the liquid from the accommodation space is transported to the ultrasonic generator. The liquid transport section extends from the accommodation space to the ultrasonic generator.

[0023] The aerosol transport section may be defined at least by a space or chamber or channel between the ultrasonic generator and a discharge opening (i.e. an exit opening) of the mouthpiece. Via the aerosol transport section, the aerosol generated at and by the ultrasonic generator is transported to the discharge opening of the mouthpiece.

[0024] The discharge opening may be an opening of the mouthpiece through which or via which the aerosol is finally exited or discharged out of the mouthpiece and/or of the aerosol generating device, for example to a user.

[0025] The liquid transport section and the aerosol transport section are connected or continuous or partially overlap, and together form the fluid conduction path.

[0026] The fluid conduction path passes through the ultrasonic generator. The ultrasonic generator may have a receiving surface (also referred to as a first surface or under-side or wick-facing surface or bottom surface) and a discharge surface (also referred to as a second surface or upper-side or discharge opening facing surface or upper surface).

[0027] The receiving surface and the discharge surface may be flip sides or surfaces, i.e. opposite sides or surface of the ultrasonic generator.

[0028] The receiving surface faces the wick and is in direct physical contact (surface-to surface contact) with the wick, i.e. with the outlet end of the wick.

[0029] The receiving surface receives the liquid from the outlet end of the wick.

[0030] The discharge surface faces the discharge opening of the mouthpiece.

[0031] The aerosol generated at and by the ultrasonic generator leaves the ultrasonic generator from the discharge surface towards the discharge opening of the mouthpiece.

[0032] The ultrasonic generator may be configured to be driven at a frequency in a range of 1.4 kHz to 3 MHz. The aerosol generating device, in particular the ultrasonic generator, may be configured to generate aerosol from a water-based liquid (i.e. a liquid containing 80 wt% water or more), with the aerosol having droplets with a size or an average size of 10 μm or less, in particular less than or equal to 5 μm , and/or equal to or larger than 1 μm , in particular larger than or equal to 2 μm , and/or without heating at least one of the fluid, the liquid and the aerosol (i.e. by maintaining a temperature of the liquid, a temperature of the aerosol may correspond to the temperature of the liquid). The aerosol may include a plurality of droplets having a size distribution with an average or mean being less than or equal to 10 μm , in particular less than or equal to 5 μm .

[0033] The ultrasonic generator may have a first part for example a piezoelectric or piezoceramic part or element, and a second part for example a mesh or metallic mesh part or a part having a plurality of passageways formed therein or a perforated part.

[0034] In other words, the ultrasonic generator may have a first part comprising a piezoelectric element; and a second part comprising a plurality of passageways (for example a mesh or perforated plate) for allowing the fluid to pass therethrough.

[0035] The outlet end of the wick may be in contact with the second part of the ultrasonic generator.

[0036] The outlet end of the wick may be in contact with the passageways formed in or through the second part of the ultrasonic generator.

[0037] The second part may be vibrated by the first part.

[0038] The second part may have a disc shape or circular shape. A diameter of the second part may be equal to or larger than a diameter of the outlet opening of the container and/or than a diameter of the outlet end of the wick in contact with the second part.

[0039] The second part may have planar shape, or may have a curved shape protruding towards the wick or with respect to the wick - for example a concave or convex shape such as a concave or convex dome shape.

[0040] A shape of the wick at the outlet end, i.e. the shape of the outlet end of the wick, may correspond to the shape of the second part. For example, when the second part has planar shape the shape of the outlet end of the wick may also be planar, or when the second part has a curved shape protruding towards the wick or with respect to the wick - for example a concave or convex shape such as a concave or convex dome shape, the shape of the outlet end of the wick may also have a curved shape - for example a concave or convex shape such as a concave or convex dome shape. Simply put, the shape of the outlet end of the wick and the shape of the second part of the ultrasonic generator may fit or match or correspond or resemble or complement each other. Thus, the contact between the outlet end of the wick and the ultrasound generator may be enhanced, example may be closely fit - which in turn improves aerosol generation, and also provided structural rigidity to the arrangement of the wick and the ultrasound generator.

[0041] The second part may be surrounded by the first part, for example circumscribed by the first part.

[0042] The first part may have an annular shape, for example an annular circular or disc shape, and the second part may be disposed at or in the center of the annular shape.

[0043] The receiving surface and the discharge surface of the ultrasonic generator may be surfaces of the second part.

[0044] The receiving surface and the discharge surface may be in fluid communication with each other via the mesh or the passageways or the perforations of the second part.

[0045] The fluid conduction path may pass through the second part, i.e. through the mesh or the passageways or the perforations of the second part from the receiving surface to the discharge surface of the ultrasonic generator. In other words, the passageways or the mesh or the perforations may form a part or segment or section of the fluid conduction path.

[0046] A section or segment of the fluid conduction path, i.e. the section disposed in or within or through the ultrasonic generator, may be surrounded by the first part, for example circumscribed by the first part.

[0047] The first part may have an annular shape, for example an annular circular or disc shape and the fluid conduction path may extend or pass through the center of the annular shape.

[0048] The wick is disposed in the outlet opening in such a way that the wick fills, or completely fills, the outlet opening.

[0049] The wick may fill the outlet opening such that the container is leak proof.

[0050] The container may be leak proof with the wick disposed in and filling out the outlet opening.

[0051] The wick may fill the outlet opening such that a contact region between the wick and the opening that the container is leak proof.

[0052] The wick may have at least two sections or parts or segments - an inner or first section of the wick which is disposed out of the outlet opening and in or into the accommodation space, and an opening section or second section of the wick which is disposed in or within the outlet opening (i.e. not protruding out of any side of the outlet opening, or simply put limited within or flush with the external and the internal surface of the container).

[0053] The two sections or parts or segments of the wick may be integrally formed.

[0054] Additionally, optionally, the wick may have a third section or part or segment - an external section of the wick which is disposed protruding from the outlet opening to an outside of the container i.e. disposed outside the accommodation space and outside the outlet opening.

[0055] The wick by being inserted into the outlet opening may be pressed into the outlet opening, i.e. by walls or surfaces (of the container) defining the outlet opening, and thus assumes the cross-sectional shape and/or size (such as diameter) of the outlet opening.

[0056] A default cross-sectional shape of the wick, e.g. of the opening section of the wick, and a cross-sectional shape of the outlet opening may be same, e.g. both may have circular shape. Alternatively, a default cross-sectional shape of the wick, e.g. of the opening section of the wick, and a cross-sectional shape of the outlet opening may be different, and the wick when inserted into the outlet opening is pressed into the outlet opening and thus assumes the cross-sectional shape of the outlet opening. A default cross-sectional shape of the wick may be understood as a cross-sectional shape of the wick before being inserted into the outlet opening.

[0057] A default cross-sectional area of the wick, e.g. of the opening section of the wick, may be greater than the cross-sectional area of the outlet opening. A default cross-sectional area of the wick may be understood as a cross-sectional area of the wick before being inserted into the outlet opening.

[0058] Except for the outlet opening, the container, for example the accommodation space defined by the container, may be liquid tight or hermetically sealed or fluid tight.

[0059] Except for the outlet opening, the container, for example the accommodation space defined by the container, may be liquid tight or hermetically sealed or fluid tight, particularly for flow of liquid from an inside of the container (i.e. from the accommodation space) to an outside of the container (i.e. outside of an external surface of the container).

[0060] The outlet opening may be the only exit or outflow opening from the accommodation space to an outside of the container.

[0061] The outlet opening may be completely filled, or jammed by or stuffed by or crammed by, the wick. In other words, the entire cross-sectional area of the outlet opening is occupied by the wick such that the liquid in the accommodation space passes through the outlet opening only via or through the wick. Simply put, the wick is disposed through or in the outlet opening such that there is no gap or air gap or spatial gap remaining in the outlet opening, i.e. between an outer surface (e.g. outer circumferential surface), of the wick and a surface of the container defining the outlet opening. Since there is no space or channel or gap between the outer surface of the wick and the surface of the container defining the outlet opening, any unintended flow of liquid or vapor out of the container is reduced or ceased.

[0062] Simply put, the container may be liquid-tight or hermetically sealed except for the outlet opening such that the liquid from the accommodation space is transported to the ultrasonic generator only via the wick disposed in the outlet opening.

[0063] The wick may be interference fitted or press-fitted in the outlet opening, for example in such a way that entire circumscribing surface of the outlet opening is in direct contact (or in surface-to-surface contact) with an outer circumferential surface of the wick.

[0064] Additionally and optionally, the wick may have a solid body configured to implement capillary action or wicking.

[0065] An inner surface of the container defines the accommodation space. The accommodation space may have a volume of 3 ml or less, in particular of 2 ml or less.

[0066] The container may comprise a guide having a tubular shape and extending from the outlet opening of the container into the accommodation space. The guide and the container may be integrally formed.

[0067] The guide may include a receiving space. The wick is received in the receiving space.

[0068] The guide (including the receiving space) may occupy only a part of the accommodation space. For example, the guide may occupy between 10 and 90 percent of a total volume of the accommodation space, or between 20 and 80 percent of the total volume of the accommodation space, or between 30 and 70 percent of a total volume of the accommodation space, or between 10 and 30 percent of the total volume of the accommodation space.

[0069] The receiving space may be continuous with and/or in fluid communication with the outlet opening.

[0070] The receiving space may be sequentially formed with the outlet opening.

[0071] The outlet opening may be in fluid communication with the accommodation space via, or only via, the receiving space.

[0072] The receiving space may be concentric and/or coaxial with the outlet opening.

[0073] A cross-sectional area of the receiving space may be filled by the wick. The cross-sectional area of the receiving space may be equal to or smaller than a cross-sectional area of the outlet opening. Additionally or alternatively, the cross-sectional area of the receiving space may be constant along a longitudinal axis thereof.

[0074] A total or entire inner volume of the guide may be filled, or completely filled or packed, by the wick.

[0075] The receiving space may be completely filled or entirely filled (cross-sectionally and longitudinally) or completely packed, by the wick.

[0076] The default cross-sectional shape of the wick, e.g. of the inner section of the wick, and a cross-sectional shape

of the receiving space may be same, e.g. both may have circular shape. Alternatively, the default cross-sectional shape of the wick, e.g. of the inner section of the wick, and a cross-sectional shape of the receiving space may be different, and the wick when inserted into the receiving space may be pressed by a circumferential wall (defining the receiving space) of the guide and thus may assume the cross-sectional shape of the receiving space.

[0077] The default cross-sectional area of the wick, e.g. of the inner section of the wick, may be greater than the cross-sectional area of the receiving space.

[0078] In other words, except for the outlet opening and the receiving space connected thereto, the container, i.e. the accommodation space defined by the container, may be liquid tight or hermetically sealed or fluid tight.

[0079] Except for the outlet opening and the receiving space connected thereto, the container, for example the accommodation space defined by the container, may be liquid tight or hermetically sealed or fluid tight, particularly for flow of liquid from the inside of the container (i.e. from the accommodation space) to the outside of the container (i.e. outside of an external surface of the container).

[0080] The outlet opening and the receiving space connected thereto may define or form the only exit from the accommodation space to the outside of the container.

[0081] The outlet opening and/or the receiving space may be completely filled, or jammed by or stuffed by or crammed by or packed by, the wick. In other words, the entire cross-sectional area of the outlet opening and/or the receiving space is occupied by the wick such that the liquid in the accommodation space passes through the outlet opening and/or the receiving space only via the wick or through an inside of the wick or through a body of the wick or through capillary channels or spaces of the wick. Simply put, the wick may be disposed through or in the outlet opening and/or the receiving space such that there is no gap or air gap or air channel remaining in the outlet opening and/or the receiving space, between an outer surface, e.g. outer circumferential surface, of the wick and the surface of the container defining the outlet opening and/or the circumferential wall of the guide defining the receiving space. Since there is no space or channel or gap between the outer surface of the wick and the surface of the container defining the outlet opening and/or the circumferential wall of the guide defining the receiving space, any unintended flow of liquid or vapor out of the container is reduced or ceased.

[0082] Simply put, the container may be liquid-tight except for the outlet opening and the receiving space connected thereto, such that the liquid from the accommodation space is transported to the ultrasonic generator only via the wick disposed through the receiving space and the outlet opening.

[0083] The guide may include an inlet end having an inlet or inlet hole. The inlet end of the wick may be in fluid communication with the accommodation space via the inlet of the guide.

[0084] The guide may have a circumferential wall extending between the inlet end of the guide and an outlet end of the guide. The outlet end of the guide may have an outlet or outlet hole in communication with the outlet opening. The outlet of the guide may have the same diameter and/or cross-sectional area as the outlet opening of the container.

[0085] The outlet end of the guide may be connected or coupled to the inner surface of the container. The coupling may be fluid-tight or liquid-tight.

[0086] The circumferential wall of the guide may be liquid-tight such that the liquid in the accommodation space enters the wick only via the inlet of the guide.

[0087] A gap may be defined between the guide, i.e. the inlet end of the guide, and the inner surface of the container. The liquid from the accommodation space is received into the wick via the gap.

[0088] The wick may be disposed protruding from the guide, i.e. from the inlet end of the guide, into the accommodation space.

[0089] The wick may be disposed protruding from the guide, i.e. from the inlet end of the guide, into the gap.

[0090] The guide may hermetically separate the accommodation space of the container from the ultrasonic generator except through the receiving space.

[0091] The wick may protrude out of or from the outlet opening to the ultrasonic generator. That is, the outlet opening may be spaced apart from the ultrasonic generator. The wick may protrude out of the outlet opening and above an external surface of the container. In other word, the protruding section or external section or part of the capillary element or the wick may be completely outside the container.

[0092] A length of the guide extending from the outlet opening of the container into the accommodation space may be equal to or greater than 50 percent of a length of the accommodation space, or may be equal to or greater than 70 percent of a length of the accommodation space, may be equal to or greater than 80 percent of a length of the accommodation space, or may be equal to or greater than 90 percent of a length of the accommodation space.

[0093] A length of the wick extending from the outlet opening of the container into the accommodation space may be equal to or greater than 50 percent of a length of the accommodation space, or may be equal to or greater than 70 percent of a length of the accommodation space, may be equal to or greater than 80 percent of a length of the accommodation space, or may be equal to or greater than 90 percent of a length of the accommodation space.

[0094] A (total) length of the wick may be greater than a length of the guide and/or may be greater than a combined length of the guide and outlet opening. The length of the guide may be measured from an edge of the outlet opening

facing the accommodation space.

[0095] The length of the accommodation space may be measured from an edge of the outlet opening facing the accommodation space to a bottom surface of the accommodation space, i.e. a surface of the bottom wall of the accommodation space defining the accommodation space.

[0096] The guide may have a cylinder shape, e.g. a right circular cylinder shape, and may have different cross-sectional shapes such as circular, triangular, polygonal.

[0097] The wick may have a cylinder shape, e.g. a right circular cylinder shape, and may have different cross-sectional shapes such as circular, triangular, polygonal.

[0098] The container may have a cylinder shape, e.g. a right circular cylinder shape or cuboid, and may have different cross-sectional shapes such as circular, triangular, polygonal.

[0099] The container may also have different parts or sections with different shapes - such as a first part or segment having a cylinder shape and a second part or segment having a frustoconical or cuboidal or frusto-pyramidal shape.

[0100] The guide and/or the wick may extend along a longitudinal axis of the container and/or of the aerosol generating device.

[0101] The guide and/or the wick may be coaxial and/or concentric with the container and/or with the aerosol generating device.

[0102] The guide and/or the wick may be disposed along the longitudinal axis of the container and/or of the aerosol generating device.

[0103] The longitudinal axis may be a central longitudinal axis of the container and/or of the aerosol generating device.

[0104] The container may comprise a body. The body may be formed in one-part form, i.e. integrally formed, for example molded or 3-D printed in one part. Alternatively, the body may be formed in plurality of parts. The parts may be interconnectible with a fluid tight connection to form the body of the container. The parts may be molded or 3-D printed.

[0105] The container may include an inlet opening for filling or refilling the liquid into the accommodation space.

[0106] The container may include a closure for closing the inlet opening.

[0107] The closure may be a seal or a lid formed of elastomeric material such as rubber that can be detached from the opening for filling the accommodation space, or can be intentionally penetrated while being affixed to the inlet opening with a refilling device (such as a syringe needle) for filling the accommodation space.

[0108] The closure may be a valve e.g. a one-way valve or a filler valve (fill valve or refill valve).

[0109] The container may include a seal or seal element at the outlet opening and in contact with an outer surface of the wick. The seal element may be disposed inside the outlet opening or outside the outlet opening. The seal element may project into the outlet opening. An example of the seal element may be gasket, e.g. a gasket formed of elastic material such as rubber gasket.

[0110] The device may further include a holding element disposed between the mouthpiece and the container and/or disposed at or on the container, for supporting or mounting or fixing the ultrasonic generator.

[0111] The ultrasonic generator may be mounted onto or received in the holding element.

[0112] The holding element may for example be formed of an elastic or elastomeric material, such as silicon or rubber, and may be a cushion to hold and support the ultrasonic generator.

[0113] The holding element may be configured to damp the vibrations and/or noise generated by the ultrasonic generator from transmitting to the container and/or the mouthpiece and/or an external surface of the device

[0114] The container may include a container connecting member and the holding element may include a holding element connecting member. The container connecting member and the holding element connecting member may correspond to each other and may be engaged with each other for fixing or coupling the container and the holding element having the ultrasonic generator mounted thereon. The coupling may be detachable or reversible.

[0115] The mouthpiece, the ultrasonic generator, and the wick may be axially aligned, or linearly aligned i.e. in a straight line.

[0116] The ultrasonic generator may be stacked, e.g. in a straight line, atop the outlet opening of the container and the wick; and the mouthpiece may be stacked, e.g. in a straight line, atop the ultrasonic generator.

[0117] In the aerosol generating device one or more of the following arrangements may be implemented in an assembled state of the device:

(i) A longitudinal axis of the ultrasonic generator and a longitudinal axis of the wick may be coaxial or overlapping or same.

(ii) A longitudinal axis of the ultrasonic generator, a longitudinal axis of the wick and a longitudinal axis of the mouthpiece may be coaxial or overlapping or same.

(iii) A longitudinal axis of the ultrasonic generator, a longitudinal axis of the wick, a longitudinal axis of the mouthpiece, and a longitudinal axis of the container may be coaxial or overlapping or same.

(iv) A longitudinal axis of the ultrasonic generator and a longitudinal axis of the wick and the guide may be coaxial or overlapping or same.

(v) A longitudinal axis of the ultrasonic generator, a longitudinal axis of the wick and the guide and a longitudinal axis of the mouthpiece may be coaxial or overlapping or same.

(vi) A longitudinal axis of the ultrasonic generator, a longitudinal axis of the wick and the guide, a longitudinal axis of the mouthpiece, and a longitudinal axis of the container may be coaxial or overlapping or same.

[0118] In any of the above items (i) - (vi) the longitudinal axis of the ultrasonic generator may mean a longitudinal axis of the first part and the second part of the ultrasonic generator. The first part and the second part may have the same longitudinal axis.

[0119] In any of the above items (i) - (vi) the longitudinal axis of the guide may mean the longitudinal axis of the receiving space of the guide.

[0120] In any of the above items (i) - (vi) the longitudinal axis of the container may mean the longitudinal axis of the accommodation space of the container.

[0121] The wick may be disposed in the accommodation space without filling the accommodation space completely.

[0122] A section or part of sub-volume or segment of the accommodation space may be devoid of the wick or any absorbent material, and may be a free space or volume for receiving and holding the liquid in free form or state (i.e. without being adsorbed or held by the wick or any absorbent material). As a result, at least a part of the accommodation space may be utilized solely to accommodate the liquid to be aerosolized, which then can be transported to the ultrasound generator via the wick.

[0123] Alternatively, the wick may be disposed in the accommodation space and fill a cross-section of the accommodation space or the whole accommodation space. In such structure, optionally the guide may not be included.

[0124] In other words, the wick may be disposed in the accommodation space to fill a cross-section of the accommodation space, i.e. to be in contact with the inner surface of the accommodation space. The outlet opening may have a diameter and/or shape and/or a cross-sectional area corresponding to that of the accommodation space. The wick may be disposed such as to fill a cross-sectional area of a first portion of the accommodation space. A second portion of the accommodation space may be defined between the wick and a bottom of the accommodation space. The second portion is void of wick material and/or capillary material. Alternatively, the wick may fill the whole accommodation space.

[0125] The container may include or may be formed entirely by a guide segment defining the receiving space.

[0126] The wick may be disposed in the outlet opening and the guide segment in such a way that the wick fills, or completely fills, the outlet opening and/or the receiving space of the guide segment.

[0127] The guide segment may accommodate the liquid adsorbed into the wick disposed therein.

[0128] The guide segment may form the entire accommodation space.

[0129] Additionally and optionally, the container may include a reservoir segment, in addition to the guide segment. The reservoir segment does not include the wick or is devoid of the wick i.e. is not filled by the wick and may accommodate the liquid therein.

[0130] The reservoir segment of the accommodation space may be devoid of the wick or any absorbent material, and may be a free space or volume for receiving and holding the liquid in free form or state (i.e. without being adsorbed or held by the wick or any absorbent material). As a result, the reservoir segment may be utilized solely to accommodate the liquid to be aerosolized, which then can be transported to the ultrasound generator via the wick disposed in the guide segment.

[0131] In a second aspect of the present technique, a method for generating an aerosol is presented. The aerosol is generated by an aerosol generating device according to any embodiment of the first aspect, such as a personal vaporizer, an inhaler, an electric cigarette or e-cigarette.. In the method, a liquid may be filled or stored into the accommodation space of the container, and the liquid so stored or filled is aerosolized by the ultrasonic generator of the aerosol generating device. The liquid comprises water and ethanol. An amount of water is equal to or greater than 80 % by weight (i.e. 80 wt%).

[0132] The liquid may comprises at least one additional constituent, e.g. tobacco extract, nicotine extract, flavoring agent such as mint extract, clove extract, etc..

[0133] An amount of ethanol and/or at the least one additional constituent in the liquid may be equal to or greater than 10% by weight and equal to or less than 20 % by weight.

[0134] The liquid may not include one or more or all of the following - glycerin, propylene glycol and oil. The liquid may not contain at least one of or all of glycerin, propylene glycol and oil, preferably except for essential oils and/or except for aroma additives.

[0135] For aerosolizing, i.e. generating aerosol from the liquid, a temperature of the liquid and a temperature of the aerosol may be equal. Thus, no heating action is performed by the ultrasound generator. In particular, because of the low surface tension of the water-based liquid having a water content of 80 wt% or higher, no heating action is required for transforming the liquid into the aerosol.

[0136] At the time and/or at seat of aerosolizing, i.e. generating aerosol from the liquid, no heating action may be performed.

[0137] In the device according to the first aspect or the method according to the second aspect - the ultrasonic generator

may be vibrated at a frequency of less than or equal to 3.5 MHz (megahertz), or less than or equal to 3 MHz, in particular at a frequency in the range of 1.4 kHz to 3 MHz.

[0138] In the device according to the first aspect or the method according to the second aspect - a diameter of the droplets of the aerosol generated by the ultrasonic generator may be less than or equal to 10 microns, in particular less than or equal to 5 microns, and/or equal to or larger than 1 micron, in particular larger than or equal to 2 microns.

[0139] The droplet size may be measured by light diffraction e.g. laser light diffraction technique, or by light scattering, e.g. laser light scattering technique. An example for a suitable system for measuring the droplet size is Spraytec™ by Malvern Panalytical Ltd or the particle analyzer LS 13 320 XR by Beckmann Coulter GmbH.

[0140] The phrase 'fluid-tight' as used in the present application means impervious to any fluid including a gas, vapor or liquid, for example impervious to the liquid accommodated in the accommodation space or to the vapor generated from the liquid accommodated in the accommodation space.

[0141] The phrase 'liquid-tight' as used in the present application means impervious to any liquid, for example impervious to the liquid accommodated in the accommodation space.

[0142] The phrases 'upstream', 'downstream', 'upper', 'top', 'lower', 'bottom' and like phrases may be understood with reference to a direction or path of travel of the liquid (to be aerosolized) from the accommodation space towards the ultrasonic generator and of the aerosol from the ultrasonic generator to the mouthpiece.

[0143] Any references to 'radial', 'radially', 'circumferential', 'circumferentially' and like phrases is to be understood with reference to a central axis of the component being referred to, unless otherwise stated.

[0144] As a result of the aforementioned technique - i.e. the device according to the first aspect and/or the method according to the second aspect, unintended droplet accumulation on the surface of the ultrasonic generator facing the outlet opening of the container i.e. the inner surface or the under-side of the ultrasonic generator is reduced or ceased. This consequently reduces or ceases any migration of the liquid through the ultrasonic generator e.g. through the opening or passageways or mesh of the ultrasonic generator to the upper-side of the ultrasonic generator and thus droplet formation on the upper side of the ultrasonic generator is reduced or ceased.

[0145] Furthermore, the above effect not only increases the restart and fogging speed and efficiency for any liquid, but further optionally advantageously allows use of the liquid with high water content.

Brief description of the drawings

[0146] The above-mentioned attributes and other features and advantages of the present technique and the manner of attaining them will become more apparent and the present technique itself will be better understood by reference to the following description of embodiments of the present technique taken in conjunction with the accompanying drawings, wherein, in accordance with aspects of the present technique:

FIGs 1 and 2 depict perspective views of an exemplary embodiment an aerosol generating device in an assembled state;

FIG 3 depicts the aerosol generating device of FIG 1 in a disassembled state;

FIGs 4a, 4b and 4c schematically depict cross-sectional views of different exemplary embodiments of a container of the aerosol generating device for storing a liquid to be aerosolized;

FIGs 5a and 5b schematically depict cross-sectional views of the containers of FIGs 4a and 4b, respectively, fitted with a wick;

FIGs 6a and 6b schematically depict cross-sectional views at line I-I and II-II of the containers of FIGs 5a and 5b, respectively;

FIG 7 schematically depicts top view of the ultrasonic generator;

FIG 8 schematically depicts an exemplary embodiment of an arrangement of a seal at the wick of FIG 5a;

FIGs 9a and 9b schematically depict cross-sectional views of the containers of FIGs 5a and 5b, respectively, fitted with an ultrasonic generator;

FIG 10 depicts a sectional perspective view of a part of an exemplary embodiment of the aerosol generating device;

FIG 11 schematically depicts a cross-sectional view of the part of the aerosol generating device of FIG 10;

FIG 12 depicts a cross-sectional view of a part of another exemplary embodiment of the aerosol generating device;

FIG 13 schematically depicts dimensions of the structures/components of the aerosol generating device; and

FIG 14 schematically depicts further dimensions of the structures/components of the aerosol generating device.

Detailed description

[0147] Hereinafter, above-mentioned and other features of the present technique are described in detail. Various embodiments are described with reference to the drawing, wherein like reference numerals are used to refer to like elements throughout. In the following description, for purpose of explanation, numerous specific details are set forth in

order to provide a thorough understanding of one or more embodiments. It may be noted that the illustrated embodiments are intended to explain, and not to limit the invention. It may be evident that such embodiments may be practiced without these specific details.

[0148] FIGs 1 and 2 depict perspective views of an exemplary embodiment of an aerosol generating device 1 (hereinafter also referred to as the device) in an assembled state, and FIG 3 depicts the aerosol generating device 1 of FIG 1 in a disassembled state. The aerosol generating device may be a personal vaporizer, an inhaler, an electric cigarette or e-cigarette. It may be noted that although in the present description, the device has been depicted to have a structure which can be assembled and disassembled, the device of the present technique is not limited thereto. The device 1 may have a unitary structure i.e. not assembled and disassembled, or may have structure which can be assembled and disassembled but other than the structure depicted in FIGs 1 - 3.

[0149] The device 1 may extend along a longitudinal axis 1x.

[0150] The device 1 may have a linear shape extending along the longitudinal axis 1x, such as rod shape or bar shape.

[0151] The device 1 may include a main part or control part 8 and a cartridge part 9.

[0152] The device 1, e.g. the main part 8 of the device 1, may accommodate a power supply (not shown) such as a battery unit to supply power to an ultrasonic generator (not shown in FIGs 1 - 3, described later) and/or to other electronic components. The device 1 may include electrical contacts or terminals 9y to connect the power supply and the ultrasonic generator.

[0153] The device 1 may also include a controller to control an operation of the power supply and of the ultrasonic generator, and/or other components of the device 1.

[0154] The device 1 may further include a charging port 82 to charge the power supply of the device 1 by providing external power, one or more indicators or displays such as LED indicators 84, 88 to indicate or display operational status of the device 1, e.g. to indicate a charging state of the device 1, a full charge state, a low battery state, a state when the ultrasonic generator is being supplied with power to generate ultrasound, a standby state, and so and so forth.

[0155] The device may include a user interface 88, e.g. a button such as ON/OFF button, which a user may manipulate, e.g. press, to control function or operation of the device 1, such as to input user command to implement supply of power from the power supply to the ultrasonic generator to generate ultrasound for producing or generating aerosol. Optionally, the device 1 may include a surface feature 89 such as a logo or branding or anti-slip surface modification.

[0156] The device 1, e.g. the cartridge part 9, may include a reservoir or a container (not shown in FIGs 1 - 3, described later) to hold or accommodate a liquid to be aerosolized to generate aerosol and a mouthpiece 50 to discharge the aerosol so generated to an outside of the device 1.

[0157] The main part 8 and the cartridge part 9 may be formed as one body or may have a structure which may be assembled and disassembled with help of interconnecting engagement parts 8x, 9x disposed on the main part 8 and the cartridge part 9.

[0158] More particularly, the main part 8 may include a main engagement part 8x and the cartridge part 9 may include a cartridge engagement part 9x. The main engagement part 8x may be reversibly engaged and disengaged with the cartridge engagement part 9x to connect and disconnect the main part 8 and the cartridge part 9 to assemble and disassemble the device 1.

[0159] Hereinafter, with reference to FIGs 4a - 10, an arrangement and structure of different components of the cartridge part 9 of the device 1 are described.

[0160] The device 1, i.e. the cartridge part 9, includes a container 10 as shown in FIGs 4a, 4b and 4c having an outlet opening 12, a wick 20 fitted into the outlet opening 12 as shown in FIGs 5a and 5b, the ultrasonic or ultrasound generator 40 (also referred to as ultrasound or ultrasonic transducer or probe or head or actuator) arranged with the wick 20 as shown in FIGs 9a and 9b. FIGs 10, 11 and 12 show an exemplary embodiment of the device 1 in which the container 10, the wick 20, the ultrasonic generator 40 and the mouthpiece 50 are depicted in their relative arrangement.

[0161] The container 10 may include a guide 30 as shown in FIGs 4b and 4c or may not include the guide 30 as shown in FIG 4a. FIGs 10 and 11 show an exemplary embodiment of the device 1 with the guide 30. However, it may be noted that the arrangement shown in FIGs 10 and 11 is applicable mutatis mutandis to the device 1 without the guide 30. FIG 12 shows an exemplary embodiment of the device 1 without the guide 30.

[0162] Hereinafter, each of above components is described in further detail.

[0163] As shown in FIGs 4a - 4c, the container 10 is a liquid reservoir and includes an accommodation space 10s for accommodating or storing or holding a liquid 3 (shown in FIG 10) to be aerosolized.

[0164] The container 10 may be formed of a polymeric material such as plastic.

[0165] The container 10 may include at least a part or segment that is transparent allowing a view of an inside of the container 10 i.e. of the accommodation space 10s - thus allowing a user to view level of liquid present inside the accommodation space 10s.

[0166] The container 10 may include a body 11. The body 11 may include the outlet opening 12.

[0167] The body 11 may be formed in one part i.e. may be integrally formed as shown in FIG 4c; or may be formed by a plurality of parts 11a, 11b as shown in FIGs 4a and 4b, such as a first body segment or part 11a e.g. a main container

body 11a and a second body segment or part 11b e.g. a container cover 11b.

[0168] The parts 11a, 11b may be interconnectible with a fluid tight connection 11x thereinbetween to form or completely assemble the body 11 of the container 10. The parts 11a, 11b may be reversibly interconnectible with the fluid tight connection 11x i.e. may be coupled and uncoupled from each other.

[0169] The fluid tight connection 11x may be a screw and thread type connection, or an interference-fit connection, etc.

[0170] The container 10 - whether formed in one part as shown in FIG 4c or assembled by plurality of interconnectible parts as shown in FIGs 4a and 4b - may define the accommodation space 10s in a fluid-tight or a liquid-tight or hermetically sealed manner with respect to an outside of the container 10, except for or besides the outlet opening 12.

[0171] In other words, the accommodation space 10s of the container 10 is in fluid communication with an outside of the container 10 for allowing flow of the liquid from the accommodation space 10s to the outside of the container 10 only via the outlet opening 12.

[0172] The container 10, or body 11 of the container 10, may include the guide 30 extending from the outlet opening 12 into the accommodation space 10s.

[0173] The guide 30 may have a hollow tubular shape and may define a receiving space 30s.

[0174] The guide 30 may be attached to or may contact a part of the inner surface of the container 10 that encircles or circumscribes the outlet opening 12. In other words, the outlet opening 12, at an inside of the container 10 may be accommodated inside the guide 30 or inside a circumferential wall 35 of the guide 30. A contact interface or part 38 between the guide 30 and the inner surface 10s of the container 10 may be liquid-tight or hermetically sealed. For example, the guide 30 may be formed integrally with the part of the inner surface of the container 10 that encircles or circumscribes the outlet opening 12.

[0175] More particularly, the guide 30 may have a hollow tubular shaped body having an outlet end 32 connected to the inner surface 10a of the container 10 surrounding or encircling the outlet opening 12. The outlet end 32 of the guide 30 may include an outlet 32h which fluidly communicates with the outlet opening 12.

[0176] The hollow tubular shaped body of the guide 30 may include an inlet end 31 disposed inside the accommodation space 10s spaced apart from the inner surface 10a of the container 10 by a gap 4. The inlet end 31 of the guide 30 may include an inlet 31h which fluidly communicates with the accommodation space 10s.

[0177] The circumferential wall 35 of the guide 30 may extend longitudinally between the inlet end 31 and the outlet end 32 of the guide 30.

[0178] In other words, the accommodation space 10s of the container 10 is in fluid communication with an outside of the container 10 for allowing flow of the liquid from the accommodation space 10s to the outside of the container 10 only via the guide 30 and the outlet opening 12, for example only via sequentially arranged the inlet 31h, the receiving space 30s, the outlet 32h and the outlet opening 12.

[0179] The guide 30 may be disposed inside the accommodation space 10s in a cantilever arrangement and may be connected to the inner surface 10s of the container 10 only at one end of the guide 30, i.e. the outlet end 32 of the guide 30.

[0180] The circumferential wall 35 and the inlet 31 of the guide 30 may be spaced apart from the inner surface 10s of the container 10.

[0181] The container 10 may further include an inlet opening 18 and a cover 19 which covers or seals the inlet opening 18. The inlet opening 18 and/or the cover 19 may allow only flow of liquid into the accommodation space 10s from an outside of the container i.e. the liquid from the accommodation space 10s may not flow out of the accommodation space 10s via the inlet opening 18 and/or the cover 19. The inlet opening 18 and/or the cover 19 may be used for filling or refilling the liquid into the accommodation space 10s.

[0182] FIG 5a shows the wick 20 inserted into and through the outlet opening 12 of the container 10 shown in FIG 4a and FIG 9a shows the ultrasonic generator 40 arranged in contact with the wick 20 shown in FIG 5a.

[0183] FIG 5b shows the wick 20 inserted into and through the outlet opening 12 and the guide 30 of the container 10 shown in FIG 4b and FIG 9b shows the ultrasonic generator 40 arranged in contact with the wick 20 shown in FIG 5b.

[0184] The wick 20 may have a solid tubular shape and may be configured to transport liquid through capillary action or wicking action.

[0185] The wick 20 transports the liquid from the accommodation space 10s to the ultrasonic generator 40 via the outlet opening 12 (when the container 10 does not include the guide 30) or via the outlet opening 12 and the guide 30 (when the container 10 includes the guide 30).

[0186] The wick 20 has an inlet end 21 for receiving the liquid 3 into the wick 20 from the accommodation space 10s. The inlet end 21 is disposed inside the container 10 i.e. in the accommodation space 10s for receiving the liquid 3.

[0187] The wick 20 has an outlet end 22 disposed in contact with the ultrasonic generator 40. The outlet end 22 provides the liquid 3 to the ultrasonic generator 40.

[0188] The outlet end 22 of the wick 30 is exposed to an outside of the outlet opening 12, and may either be flush with the external surface 10b of the container 10, or may protrude outside away from the external surface 10b of the container 10, or may be disposed within the outlet opening 12.

[0189] The outlet end 22 of the wick 20 is in direct contact with the ultrasonic generator 40.

[0190] In arrangement where the outlet end 22 of the wick 20 is disposed within the outlet opening 12 (i.e. does not protrude beyond or from the external surface 10b of the container 10, or is not flush with the external surface 10b of the container 10) the ultrasonic generator 40 may be shaped to protrude into the outlet opening 12 to directly contact the outlet end 22 of the wick 20, for example a second part (described later) of the ultrasonic generator 40 may be shaped to protrude into the outlet opening 12.

[0191] The ultrasonic generator 40 applies ultrasound to the liquid received by the outlet end 22 of the wick, thereby aerosolizing the liquid 3 and generating the aerosol 2 from the liquid 3 (as shown in FIG 10). The mouthpiece 50 discharges the generated aerosol 4 to an outside of the device 1, for example when drawn or sucked by a user.

[0192] As shown in FIG 10, the accommodation space 10s, the wick 20 and the mouthpiece 50 - all together - define a fluid conduction path 5 for transporting the liquid 3 from the accommodation space 10s to the ultrasonic generator 40 and transporting the aerosol 2 generated by the ultrasonic generator 40 to the mouthpiece 50.

[0193] The ultrasonic generator 40 is disposed, e.g. disposed directly, between the mouthpiece 50 and the wick 20. The fluid conduction path 5 passes through the ultrasonic generator 40.

[0194] As can be understood from FIGs 4a, 5a, 6a and 9a, the wick 20 is disposed in the outlet opening 12 in such a way that the wick 20 fills, i.e. completely fills, the outlet opening 12.

[0195] As shown in FIG 6a, which is a cross-section at line I-I of FIG 5a, an outer circumferential surface 20c of the wick 20 may directly contact an entire circumferential surface 12c defining the outlet opening 12.

[0196] In other words, the outlet opening 12 may be completely filled, or jammed by or stuffed by or crammed by, the wick 20. Simply put, the entire cross-sectional area of the outlet opening 12 is occupied by the wick 20 such that the liquid in the accommodation space 10s passes through the outlet opening 12 only via the wick 20.

[0197] As can be understood from FIGs 4b, 5b, 6b and 9b, the wick 20 is disposed in the outlet opening 12 and the guide 30 in such a way that the wick 20 fills, or completely fills, the outlet opening 12 and/or the receiving space 30s of the guide 30.

[0198] As shown in FIG 6b, which is a cross-section at line II-II of FIG 5b, the outer circumferential surface 20c of the wick 20 may directly contact an inner surface 30a of the circumferential wall 35 of the guide 30 at least at one lateral cross-section perpendicular to the longitudinal axis of the guide 30.

[0199] Preferably the wick 20 occupies an entire volume or space of the receiving space 30s.

[0200] In other words, the outlet opening 12 and/or the receiving space 30s of the guide 30 may be completely filled, or jammed by or stuffed by or crammed by, the wick 20.

[0201] The wick 20 may be received in the outlet opening 12 and/or the receiving space 30s of the guide 30 by being interference-fitted into the outlet opening 12 and/or the receiving space 30s of the guide 30.

[0202] To further enhance the sealing between the wick 20 and the outlet opening 12, a seal element 12s, e.g. a rubber gasket, for example as shown in FIG 8, may be disposed at the outlet opening 12. The seal 12s may contact the outer circumferential surface 20c of the wick 20.

[0203] FIG 7 shows an exemplary embodiment of the ultrasonic generator 40. The ultrasonic generator 40 may have a first part 42 comprising a piezoelectric element; and a second part 44 comprising a plurality of passageways 44p or a mesh 44p e.g. a metallic mesh. The passageways 44p or the mesh 44p makes the second part 44 permeable to fluid, and particularly to the aerosol generated by the ultrasonic generator 40.

[0204] The outlet end 22 of the wick 10 may be in direct contact with the second part 44 of the ultrasonic generator 40.

[0205] The outlet end 22 of the wick 20 may be in contact with the passageways 44p or the mesh 44p formed in or through the second part 44 of the ultrasonic generator 40.

[0206] The second part 44 may be vibrated by the first part 42.

[0207] The first part 42 may have an annular shape and the second part 44 may be disposed at a center of the annularly shaped first part 42.

[0208] The second part 44 includes two opposite or flip sides or surfaces - a receiving surface and a discharge surface - which are in fluid communication with each other via the mesh 44p or the passageways 44p.

[0209] The outlet end 22 of the wick 20 is in direct contact with the second part 44 at the receiving surface. The liquid 3 is supplied by the outlet end 22 of the wick and received by the receiving surface of the second part 44. The first part 42 vibrates by piezoelectric effect, and implements or transmits the vibrations to the second part 44, for example by being in direct contact with the second part 44. As a result the second part 44 vibrates and the liquid received from the outlet end 22 of the wick 20 is aerosolized.

[0210] The generated aerosol leaves the second part 44 of the ultrasonic generator 40 at or from the discharge surface of the second part 44.

[0211] Simply put, the receiving surface of the second part 44 may be understood as the surface of the second part 44 facing the outlet opening 12 and the outlet end 22 of the wick 20, and the discharge surface of the second part 44 may be understood as the surface of the second part 44 facing the mouthpiece or facing a discharge opening 50h of the mouthpiece 50.

[0212] The aerosol 4 is discharged from the discharge surface of the second part 44 into an aerosol chamber 50h

defined between the discharge opening 50h of the mouthpiece 50 and the ultrasonic generator 40 and then to the outside of the device 1 via the discharge opening 50h of the mouthpiece 50.

[0213] The device 1 may further include a holding element 60 disposed between the mouthpiece 50 and the container 10.

[0214] The ultrasonic generator 40 may be mounted onto or receiving into the holding element 60 for supporting or mounting or fixing the ultrasonic generator 40 between the mouthpiece 50 and the container 10.

[0215] The container may include a container connecting member 15 (as shown for example in FIG 8) and the holding element may include a holding element connecting member (not shown). The container connecting member 15 and the holding element connecting member may correspond to each other and may be engaged with each other for fixing or coupling the container 10 and the holding element 60 having the ultrasonic generator 40 mounted thereon - as shown in FIGs 9a and 9b. The coupling may be detachable or reversible.

[0216] Referring to FIG 14, the wick 20 may have at least two sections or parts or segments - an inner section 24, i.e. a first section, of the wick 20 which is disposed out of the outlet opening 12 and in the accommodation space 10s, and an opening section 25, i.e. a second section, of the wick 20 which is disposed entirely in or within the outlet opening 12 i.e. not protruding out of any side of the outlet opening 12. Additionally, optionally, the wick 20 may have a third section or part or segment - an external section or an outer section 26 of the wick which is disposed protruding from the outlet opening 12 to an outside of the container 10, i.e. disposed outside the accommodation space 10s and outside the outlet opening 12.

[0217] A length L_w of the inner section 24 of the wick 20 may be smaller than or equal to a length L_c of the accommodation space 10s, and/or may be between 0 mm and 50 mm, preferably between 10 mm and 30 mm.

[0218] A length L_h of the outlet opening 12 and/or of the opening section 25 of the wick 20 may be between 0.5 mm and 3.5 mm, preferably between 0.8 mm and 3.2 mm.

[0219] A length L_{p1} of the outer section 26 of the wick 20 may be 0 mm or may be between 0 mm and 3.5 mm, in particular between 0.1 mm and 3 mm.

[0220] A length L_c of the accommodation space 10s may be between 10 mm and 60 mm, in particular between 15 mm and 50 mm.

[0221] A part, say an inner protruding part, of the inner section 24 of the wick 20 may protrude out of the guide 30 into the accommodation space 10s.

[0222] A length L_{p2} of the inner protruding part of the inner section 24 of the wick 20 may be equal to a difference between the length L_w of the inner section 24 of the wick 20 and the length L_g of the guide 30. The length L_{p2} of the inner protruding part of the inner section 24 of the wick 20 may be 0 mm, or may be between 0 mm and 15 mm or between 5 and 10 mm.

[0223] A length L_g of the guide 30, extending from the outlet opening 12 into the accommodation space 10s, may be 0 mm, or may be greater than 0 mm and less than or equal to the length L_c of the accommodation space, in particular between 0 mm and 45 mm or between 10 mm and 30 mm.

[0224] The length L_w of the inner section 24 of the wick 20 may be equal to or greater than 50 percent of the length L_c of the accommodation space 10s, or may be equal to or greater than 70 percent of the length L_c of the accommodation space 10s, may be equal to or greater than 80 percent of the length L_c of the accommodation space 10s, or may be equal to or greater than 90 percent of the length L_c of the accommodation space 10s.

[0225] The length L_g of the guide 30 may be equal to or greater than 50 percent of the length L_c of the accommodation space 10s, or may be equal to or greater than 70 percent of the length L_c of the accommodation space 10s, or may be equal to or greater than 80 percent of the length L_c of the accommodation space 10s, or may be equal to or greater than 90 percent of the length L_c of the accommodation space 10s.

[0226] Referring to FIG 13, the wick 20 may have a full length FL between 15 mm to 25 mm, for example 19 mm.

[0227] A combined length PL of the guide 30 and the outlet opening 12 may be between 12 mm to 18 mm, for example 16 mm.

[0228] The wick 20 may protrude on both sides i.e. the inlet end 21 of the wick 20 may protrude into the accommodation space 10s out of the guide 30 and the outlet end 22 of the wick 20 may protrude out of the outlet opening 12 to an outside of the container 10 or the accommodation space 10s.

[0229] A diameter D_1 of the receiving space 30s of the guide 30 and/or of the outlet opening 12 may be between 6 mm to 9 mm, for example 7.5 mm.

[0230] A diameter D_2 of the guide 30 may be between 8 mm to 11 mm, for example 9.5 mm.

[0231] FIG 12 shows another exemplary embodiment of the device 1 in which the wick 20 may be directly disposed in the accommodation space 10s i.e. in contact with the inner surface 10a of the accommodation space 10s and occupies the accommodation space 10s - completely or partially.

[0232] The container 10 may include a guide segment 10g defining the receiving space 30s.

[0233] As can be seen from FIG 12, the wick 20 is disposed in the outlet opening 12 and the guide segment 10g in such a way that the wick 20 fills, or completely fills, the outlet opening 12 and/or the receiving space 30s of the guide

segment 10g. The guide segment 10g may accommodate the liquid 3 adsorbed into the wick 20 disposed therein.

[0234] The guide segment 10g may form the entire accommodation space 10s.

[0235] Additionally and optionally, the container 10 may include a reservoir segment 10f, in addition to the guide segment 10f. The reservoir segment 10f does not include the wick 20 i.e. is not filled by the wick 20 and may accommodate the liquid 3 therein.

[0236] The present technique also envisages a method for generating an aerosol. The aerosol is generated by an aerosol generating device according to the first aspect. In the method, a liquid may be filled or stored into the accommodation space of the container, and the liquid so stored or filled is aerosolized by the ultrasonic generator of the aerosol generating device by an operation of the ultrasonic generator.

[0237] The present technique also envisages another method for generating an aerosol. The aerosol is generated by an aerosol generating device according to the first aspect. In the method, a liquid may be filled or stored into the accommodation space of the container, and the liquid so stored or filled is aerosolized by the ultrasonic generator of the aerosol generating device by an operation of the ultrasonic generator. The liquid comprises water and ethanol. An amount of water is equal to or greater than 80 % by weight.

[0238] While the present technique has been described in detail with reference to certain embodiments, it should be appreciated that the present technique is not limited to those precise embodiments. The scope of the invention is, therefore, indicated by the following claims rather than by the foregoing description.

List of reference signs

20	1	aerosol generating device	25	opening section of wick
	1x	longitudinal axis of the device	26	outer section of the wick
	2	aerosol	30	guide
	3	liquid to be aerosolized	30a	inner surface of the guide
25	4	gap	30b	outer surface of the guide
	5	fluid conduction path	30s	receiving space
	6	wire	31	inlet end of the guide
	8	main part	31h	inlet of the guide
	8x	main engagement part	32	outlet end of the guide
30	9	cartridge part	32h	outlet of the guide
	9x	cartridge engagement part	35	circumferential wall of guide
	9y	electrical terminals	38	contact part
	10	container	40	ultrasonic generator
35	10a	inner surface of the container	42	first part of ultrasonic generator
	10b	outer surface of the container	44	second part of ultrasonic generator
	10s	accommodation space	44p	passageways
	10g	guide segment of the container	50	mouthpiece
	10f	reservoir section of the container	50h	mouthpiece opening
40	11	body of the container	50s	aerosol chamber
	11a	first part of the body	60	holding element
	11b	second part of the body	82	charging port
	11x	fluid tight connection	84	indicator/display
45	12	outlet opening	86	user interface/button
	12c	inner surface of the outlet opening	88	LED indicator
	12s	seal	89	logo
	15	container connecting member	PL	combined length
	18	inlet opening	FL	full length of the wick
50	19	closure	D1	inner diameter guide/outlet opening
	20	wick	D2	outer diameter guide/outlet opening
	20a	top surface of the wick	Lc	length of the accommodation space
	20b	bottom surface of the wick	Lg	length of guide from outlet opening
	20c	outer surface of the wick	Lw	length of wick from outlet opening
55	21	inlet end of the wick	Lp1	length of wick outside of container
	22	outlet end of the wick	Lp2	length of the wick outside of guide
	24	inlet section of the wick		

Claims

1. An aerosol generating device (1) for generating an aerosol (2), the aerosol generating device (1) comprising:

- a container (10) having an accommodation space (10s) for accommodating a liquid (3) to be aerosolized;
- an ultrasonic generator (40) configured to generate the aerosol (2);
- a mouthpiece (50) having a discharge opening (50h) for discharging the aerosol (2) generated by the ultrasonic generator (40) therethrough; and
- a wick (20) for transporting the liquid (3) from the accommodation space (10s) to the ultrasonic generator (40), the wick (20) comprising an inlet end (21) disposed inside the accommodation space (10s) for receiving the liquid (3), and an outlet end (22) disposed in contact with the ultrasonic generator (40) for providing the liquid (3) to the ultrasonic generator (40);

wherein the accommodation space (10s), the wick (20) and the mouthpiece (50) define a fluid conduction path (5) for transporting the liquid (3) from the accommodation space (10s) to the ultrasonic generator (40) and transporting the aerosol (2) generated by the ultrasonic generator (40) to the mouthpiece (50);

wherein the ultrasonic generator (40) is disposed between the discharge opening (50h) of the mouthpiece (50) and the wick (20) and the fluid conduction path (5) passes through the ultrasonic generator (40); and wherein the container (10) comprises an outlet opening (12), and the wick (20) is disposed in the outlet opening (12) and filling the outlet opening (12).

2. The aerosol generating device (1) according to claim 1,

wherein the container (10) is liquid-tight except for the outlet opening (12) such that the liquid (3) from the accommodation space (10s) is transported to the ultrasonic generator (40) only via the wick (20); and/or wherein the wick (20) is interference fitted in the outlet opening (12).

3. The aerosol generating device (1) according to claim 1 or 2, wherein the container (10) comprises a guide (30) having a tubular shape and extending from the outlet opening (12) of the container (10) into the accommodation space (10s), and comprising a receiving space (30s) with the wick (20) received therein.

4. The aerosol generating device (1) according to claim 3, wherein a cross-sectional area of the receiving space (30s) is filled by the wick (20).

5. The aerosol generating device (1) according to claim 3 or 4, wherein:

- a circumferential wall (35) of the guide (30) is liquid-tight; and/or
- the inlet end (21) of the wick (20) is disposed protruding from the guide (30) into the accommodation space (10s); and/or
- a gap (4) is defined between the guide (30) and an inner surface (10a) of the container (10) for receiving the liquid (3) from the accommodation space (10s) into the wick (20), the inner surface (10a) of the container (10) defining the accommodation space (10s).

6. The aerosol generating device (1) according to any one of claims 3 to 5, wherein a length (L_g) of the guide (30) extending from the outlet opening (12) of the container (10) into the accommodation space (10s) is equal to or greater than 50 % or equal to or greater than 70 % of a length (L_c) of the accommodation space (10s).

7. The aerosol generating device (1) according to any one of claims 3 to 6,

wherein the guide (30) is integrally formed with the container (10); and/or wherein an inner diameter of the guide (30) is equal to a diameter of the outlet opening (12).

8. The aerosol generating device (1) according to any one of the preceding claims,

wherein a length (L_w) of the wick (20) extending from the outlet opening (12) of the container (10) into the accommodation space (10s) is equal to or greater than 50 % or equal to or greater than 70 % of a length (L_c)

of the accommodation space (10s); and/or

wherein a diameter (D1) of the wick (20) and/or a diameter of the outlet opening (12) and/or an inner diameter of the guide (30) is equal to or greater than 5 mm or than 8 mm.

5 9. The aerosol generating device (1) according to any one of the preceding claims, wherein the mouthpiece (50), the ultrasonic generator (40), and the wick (20) are axially aligned.

10. The aerosol generating device (1) according to any one of the preceding claims,

10 wherein the ultrasonic generator (40) is configured to be driven at a frequency in a range of 1.4 kHz to 3 MHz; and/or

wherein the ultrasonic generator (40) comprises:

15 a first part (42) comprising a piezoelectric element; and

a second part (44) comprising a plurality of passageways (44p) for allowing the fluid to pass therethrough, and wherein the outlet end (22) of the wick (20) is in contact with the second part (44) of the ultrasonic generator (40).

20 11. The aerosol generating device (1) according to any one of the preceding claims, further comprising a holding element (60) for holding the ultrasonic generator (40), the holding element being configured to damp vibrations of the ultrasonic generator (40).

25 12. The aerosol generating device (1) according to any one of the preceding claims, wherein the wick (20) is disposed in the accommodation space (10s) and filling a cross-section of the accommodation space (10s).

13. The aerosol generating device (1) according to any one of the preceding claims, wherein the container (10) comprises:

an inlet opening (18) for filling the liquid (3) into the accommodation space (10s), and
a closure (19) for closing the inlet opening (18).

30 14. The aerosol generating device (1) according to any one of the preceding claims, wherein the container (10) comprises: a seal (12s) at the outlet opening (12) and in contact with an outer surface (20c) of the wick (20) for sealing the container (10) and the wick (20) against each other.

35 15. A method for generating an aerosol (2) by an aerosol generating device (1) according to any one of the preceding claims, the method comprising:

filling a liquid (3) into the accommodation space (10s) of the container (10), and

40 aerosolizing the liquid (3) by the ultrasonic generator (40) of the aerosol generating device (1), wherein the liquid (3) comprises water and ethanol, and

wherein an amount of water is equal to or greater than 80 % by weight and/or an average droplet size of the aerosol is less than or equal to 10 μm .

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FIG 1

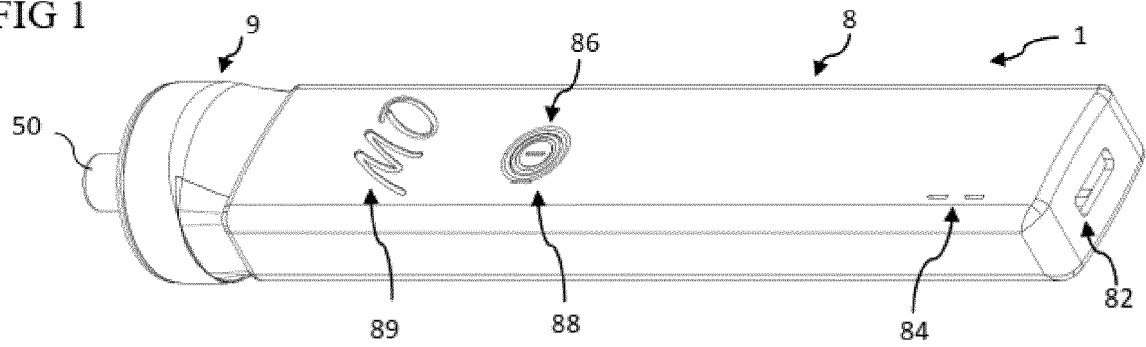


FIG 2

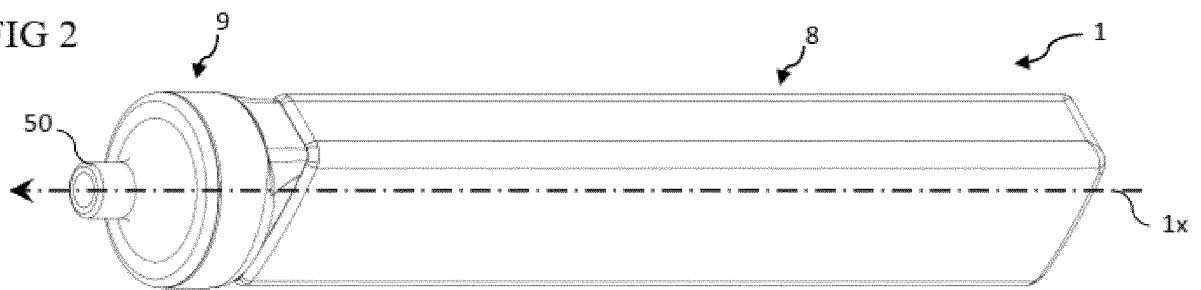


FIG 3

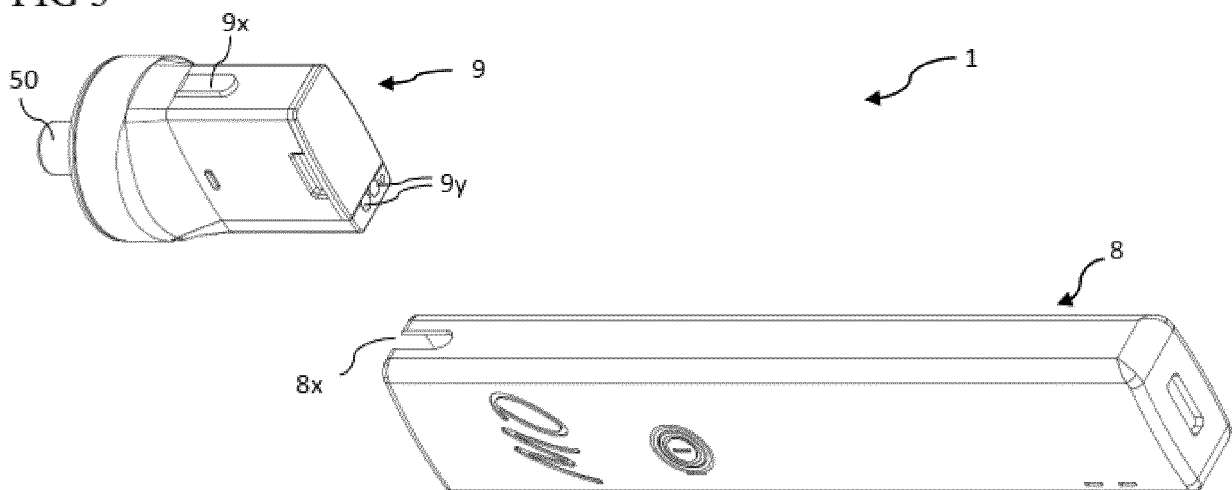


FIG 4a

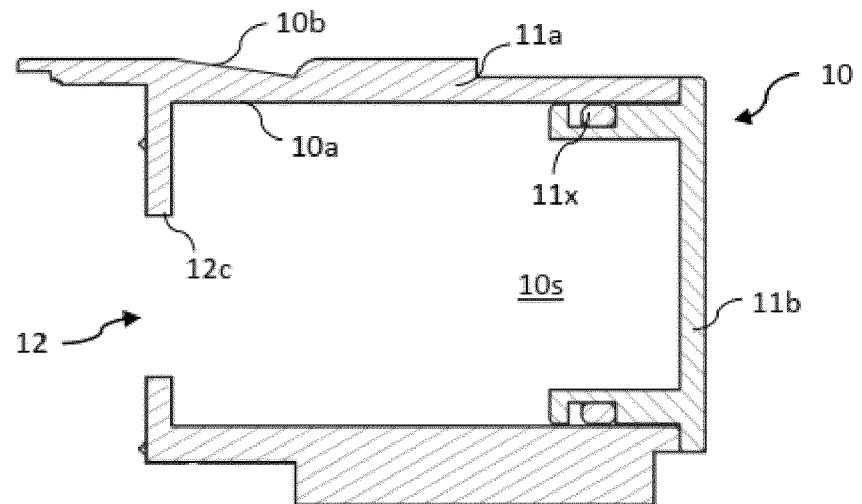


FIG 4b

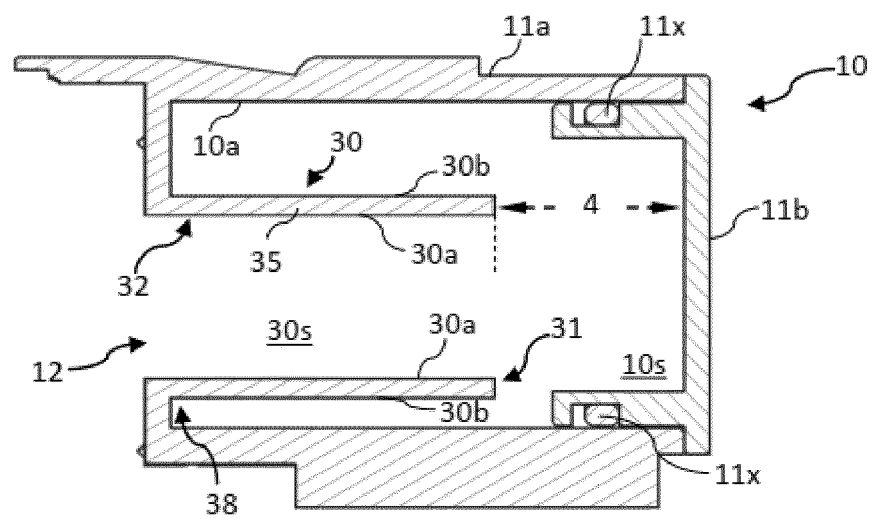


FIG 4c

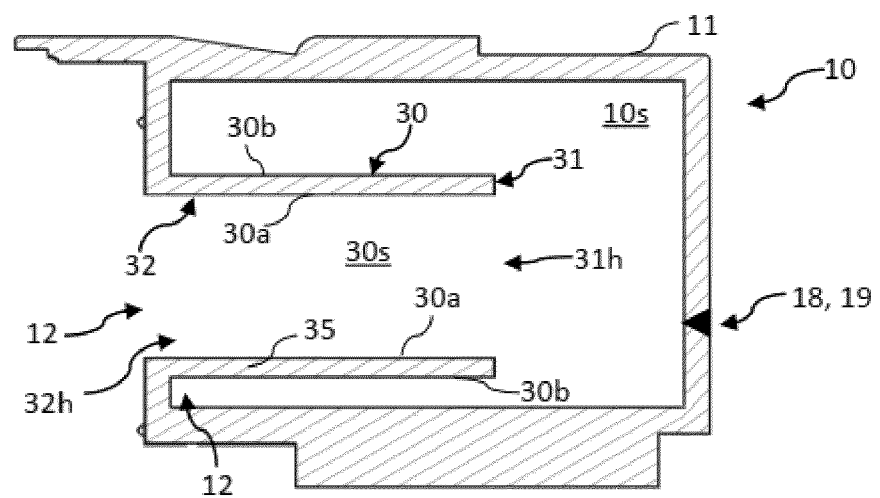


FIG 5a

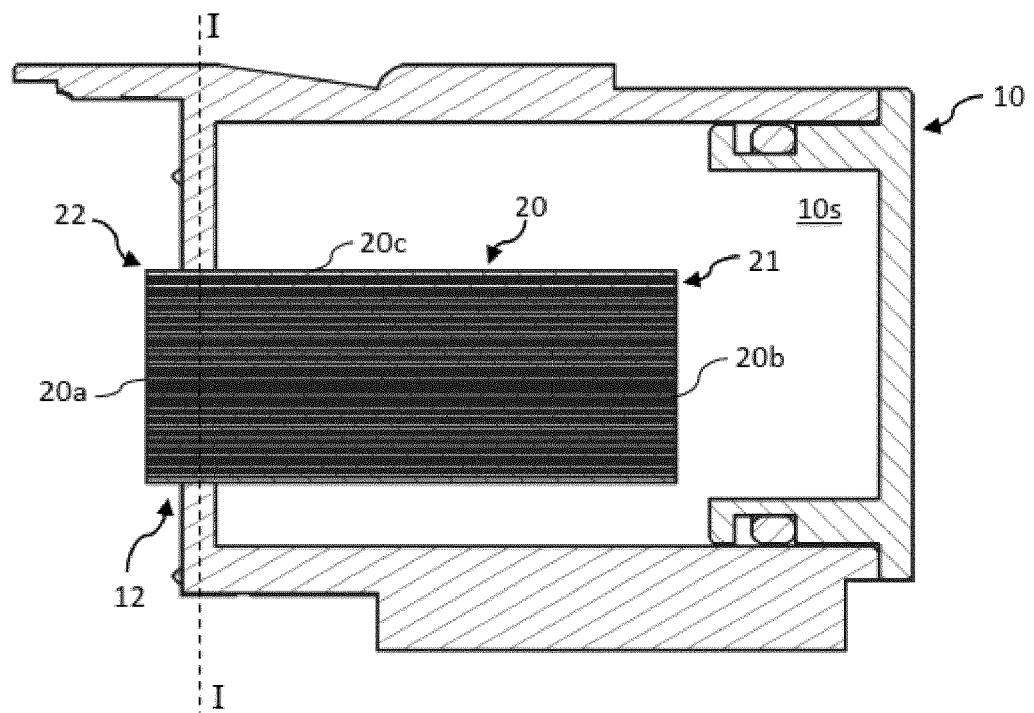


FIG 5b

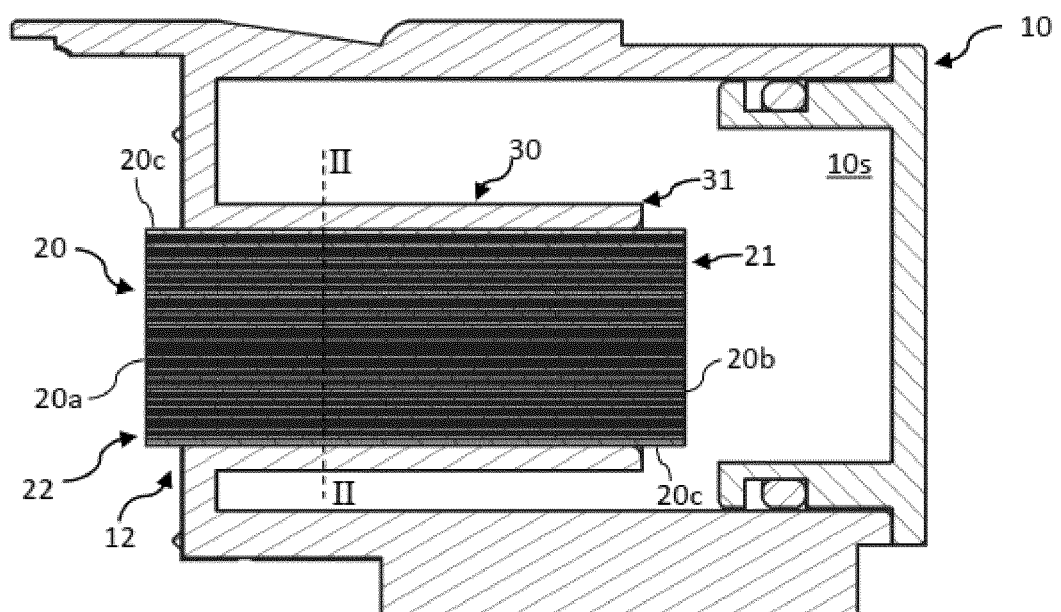


FIG 6a

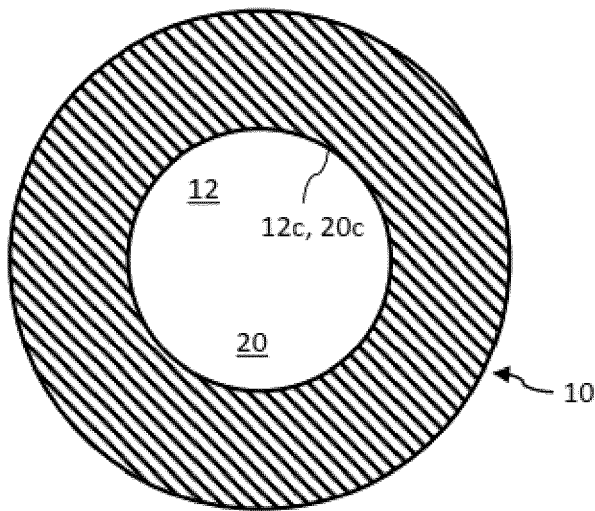


FIG 6b

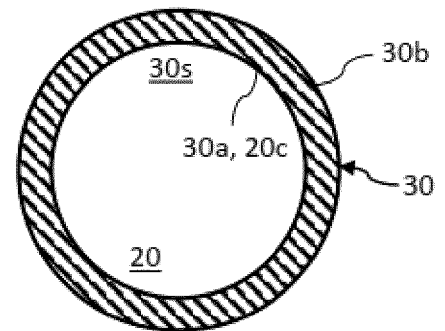


FIG 7

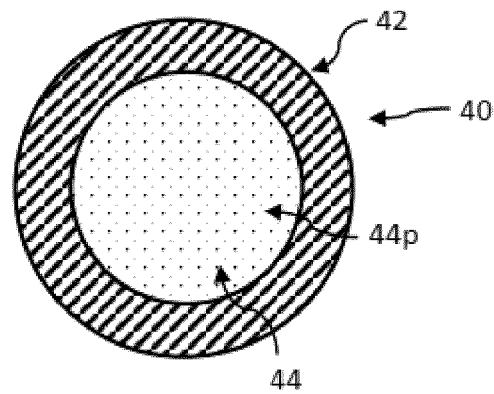


FIG 8

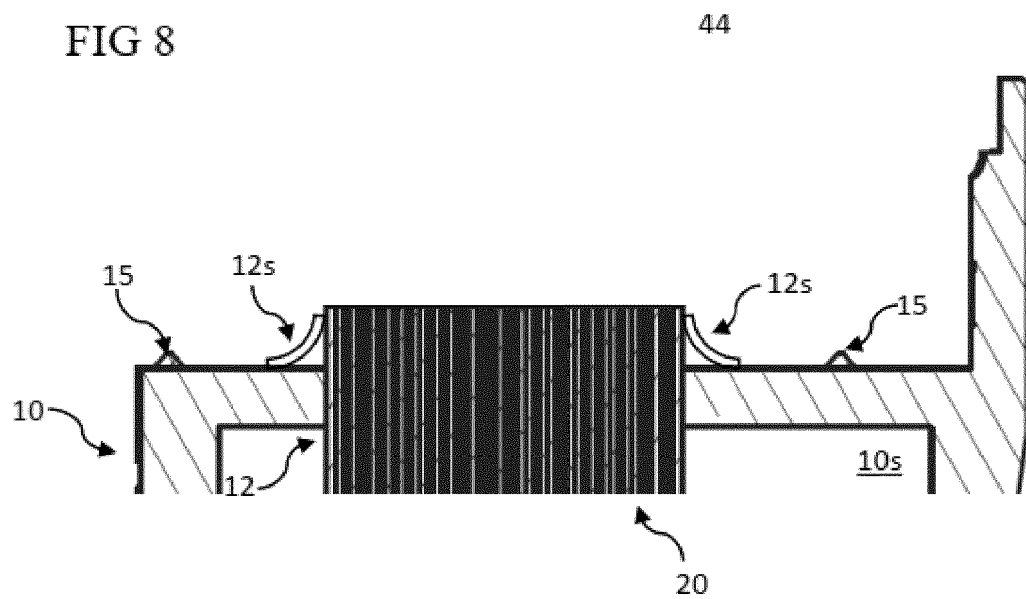


FIG 9a

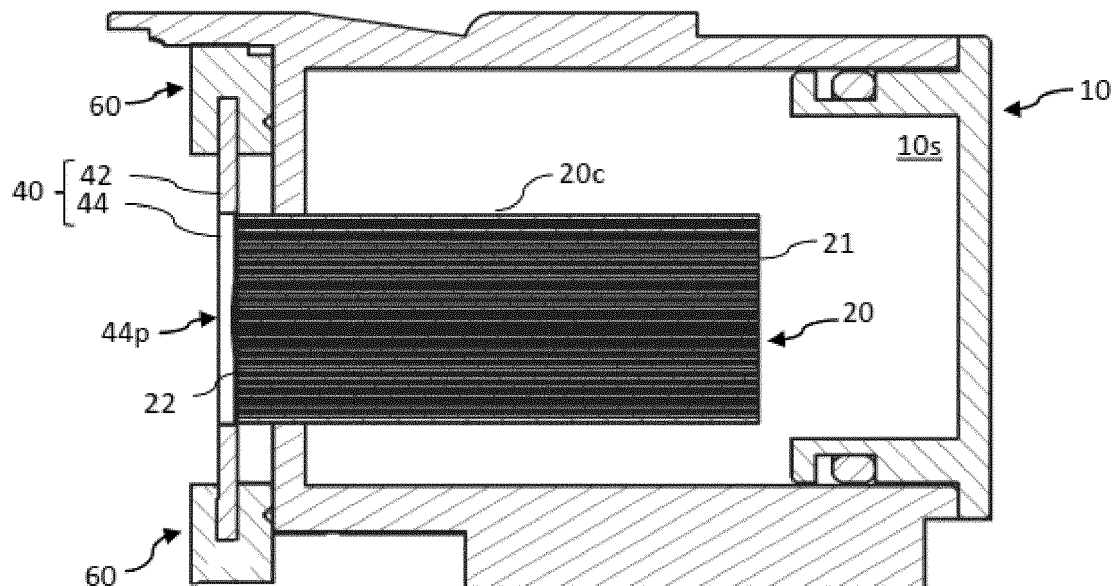


FIG 9b

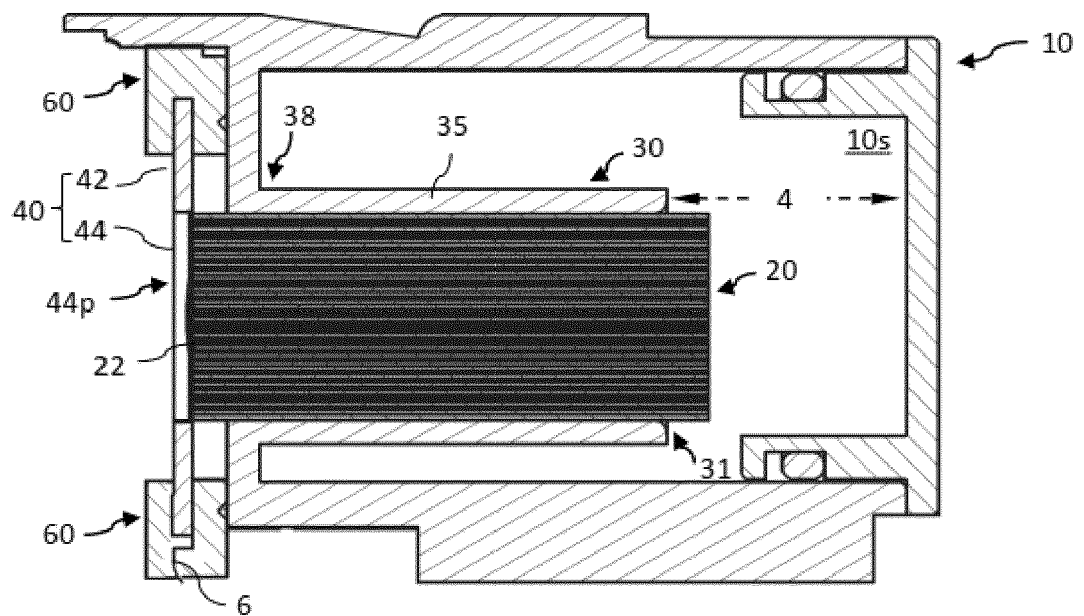


FIG 10

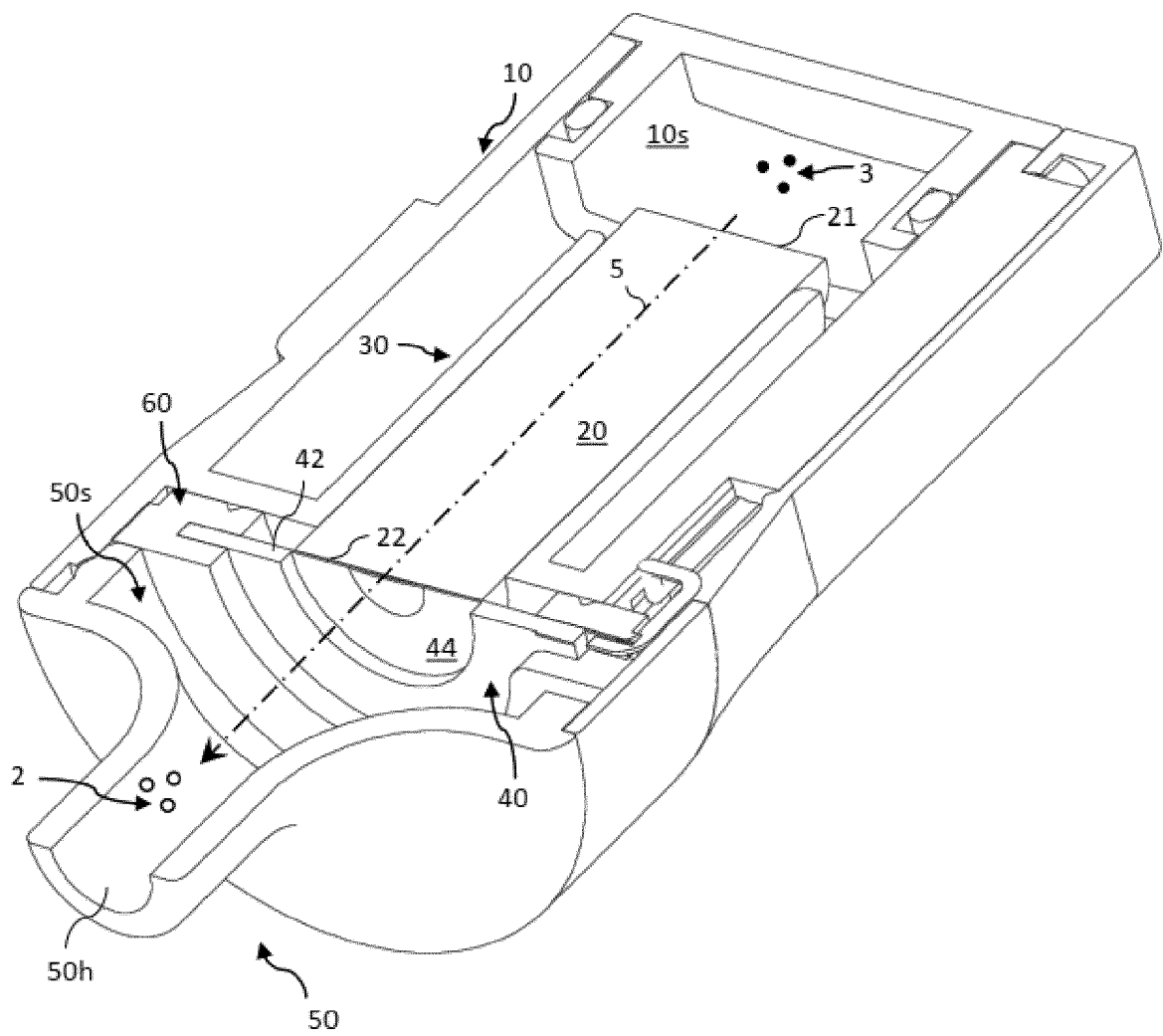


FIG 11

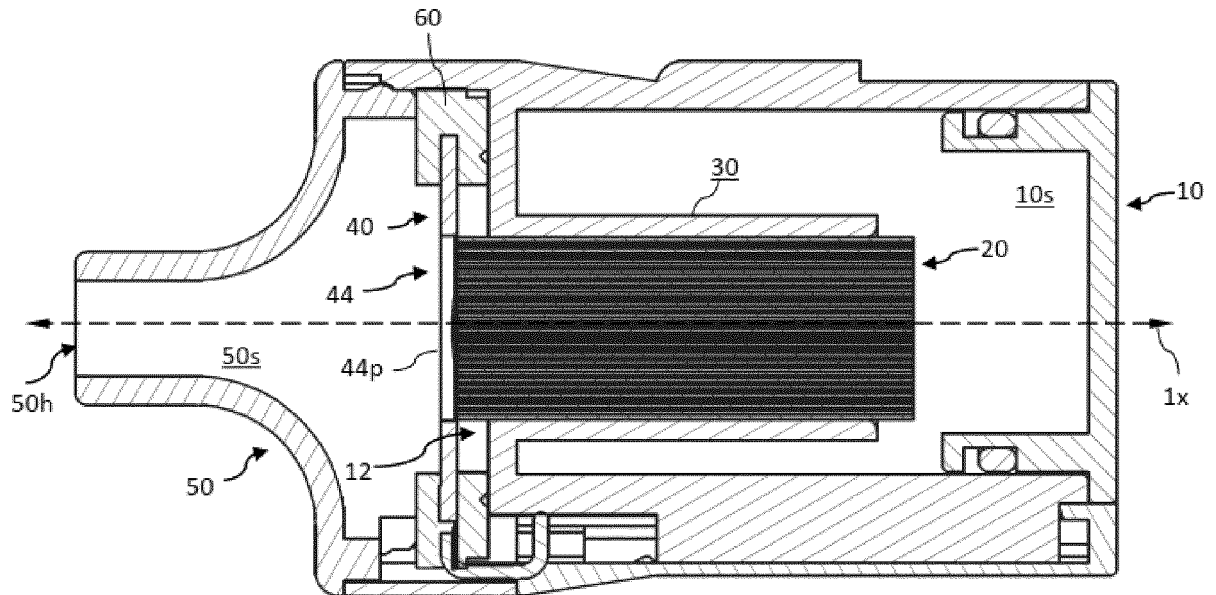


FIG 12

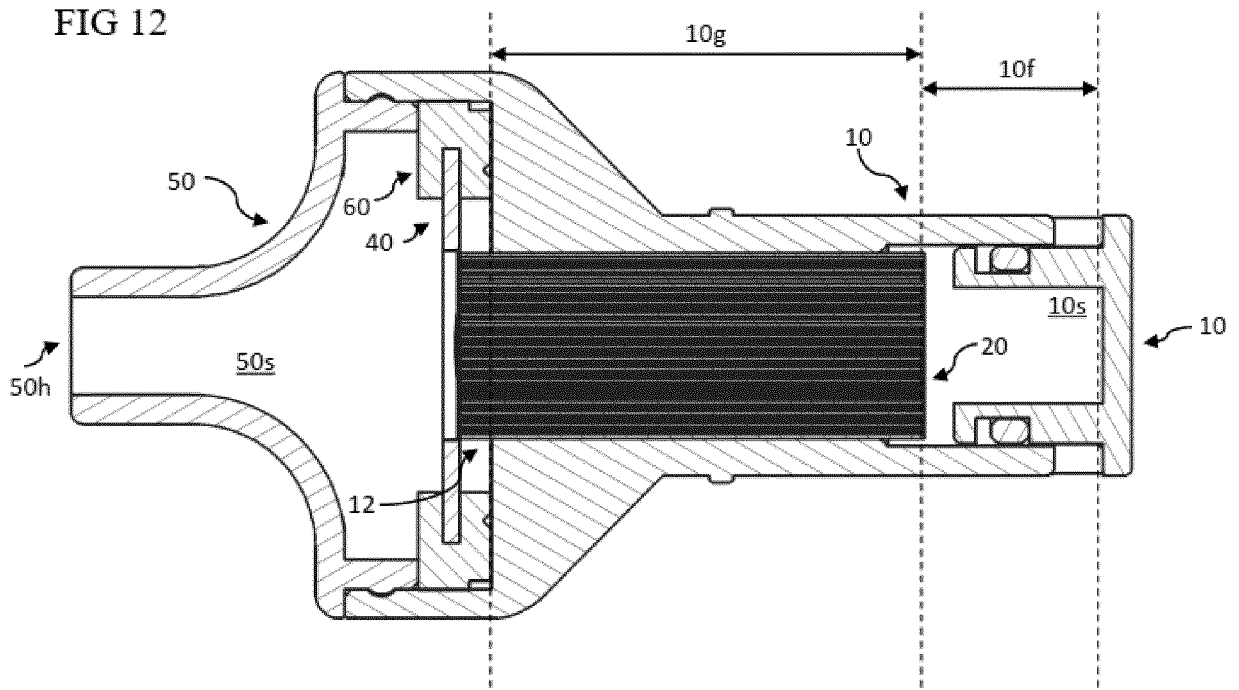


FIG 13

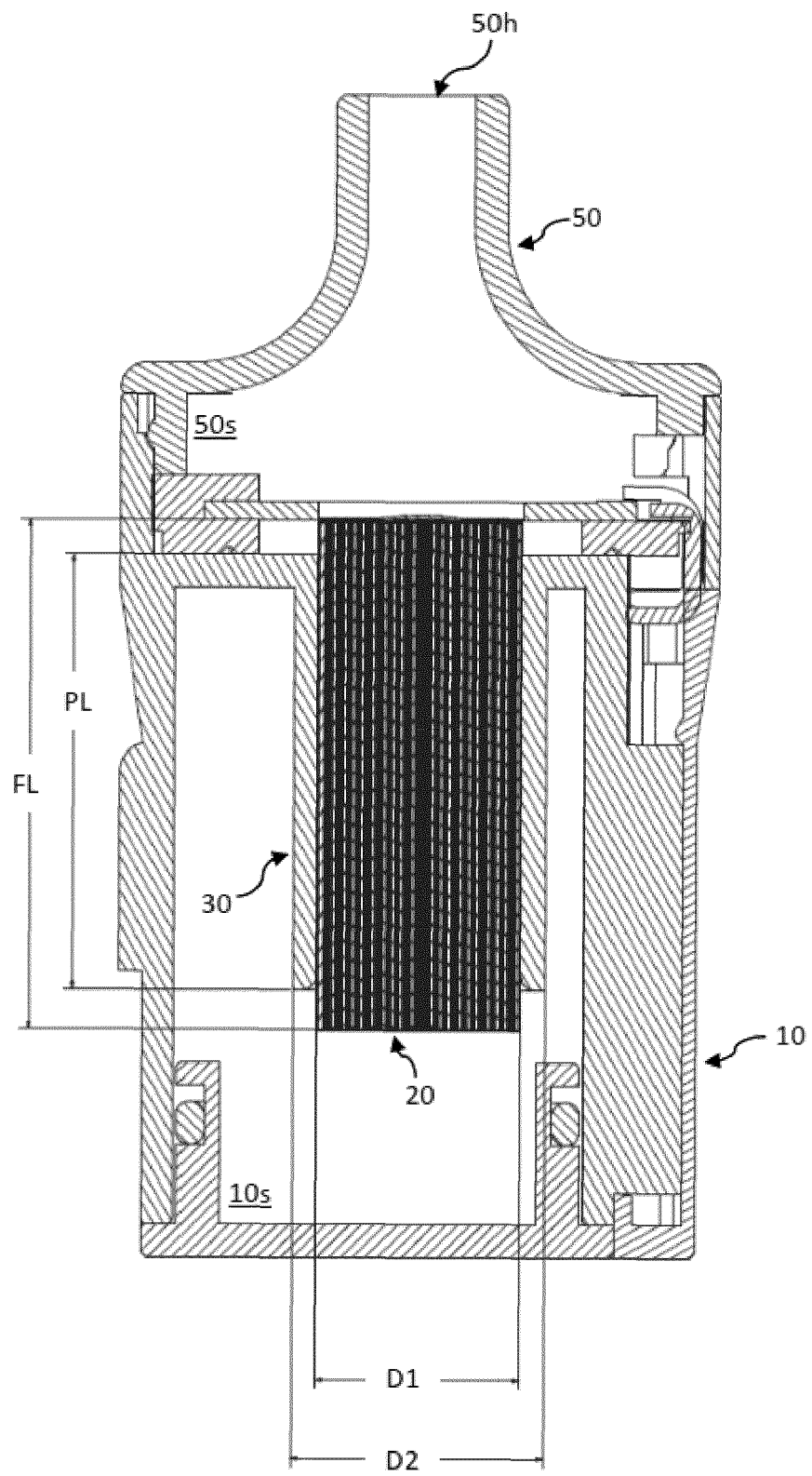
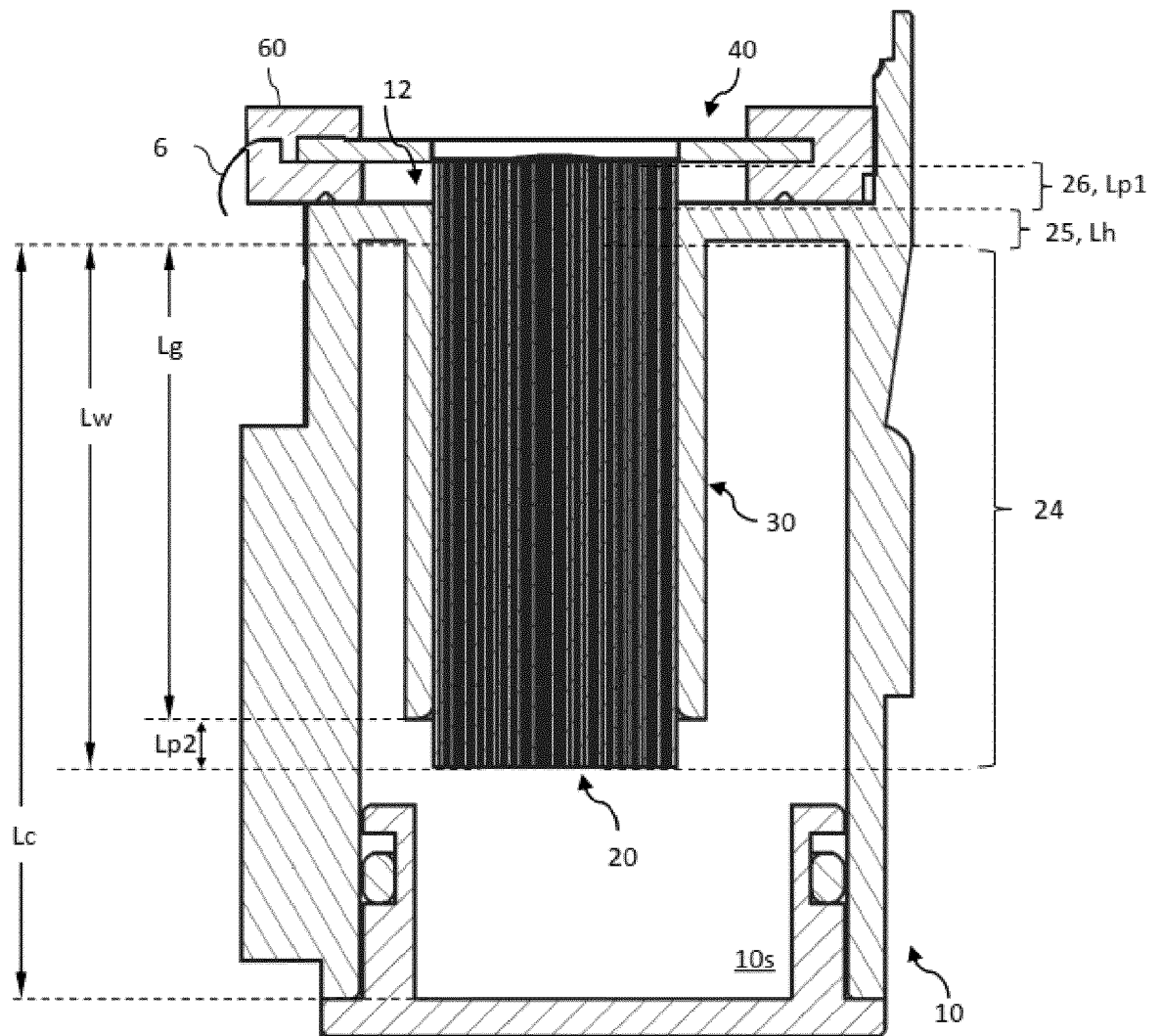


FIG 14





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Application Number

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X	WO 2021/081009 A1 (RESPIRA TECH INC [US]) 29 April 2021 (2021-04-29) * abstract; figures 7, 8, 23-25, 27a, 40a-42 * * paragraph [0181] - paragraph [0184] * * paragraph [0187] * * paragraph [0192] * * paragraph [0214] - paragraph [0215] * * paragraph [0218] - paragraph [0219] * * paragraph [0222] * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC)
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A	US 2020/120989 A1 (DANEK MARIO [US]) 23 April 2020 (2020-04-23) * abstract; figures 1-11, 15, * * paragraph [0033] - paragraph [0034] * * paragraph [0152] * * paragraph [0157] * * paragraph [0174] * * paragraph [0183] * -----	1-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 September 2022	Examiner Alaguero, Daniel
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