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(54) AEROSOL-GENERATING DEVICE WITH PIERCING ASSEMBLY

AEROSOLERZEUGUNGSVORRICHTUNG MIT STANZANORDNUNG

DISPOSITIF DE GÉNÉRATION D'AÉROSOL DOTÉ D'UN ENSEMBLE DE PERÇAGE

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Description

[0001] This disclosure relates to piercing systems for piercing cartridges used in aerosol-generating devices. More particularly, this disclosure relates to piercing assemblies for use in shisha devices.

[0002] Traditional shisha devices are used to smoke tobacco and are configured such that vapor and smoke pass through a water basin before inhalation by a consumer. Shisha devices may include one outlet, or more than one outlet so that the device may be used by more than one consumer at a time. Use of shisha devices is considered by some to be a leisure activity and a social experience.

[0003] Typically, traditional shishas are used in combination with a substrate, sometimes referred to in the art as hookah tobacco, tobacco molasses, or simply as molasses. Traditional shisha substrates are relatively high in sugar (in some cases, up to ~50 % vs. the ~20 % typically found in conventional tobacco substrates, such as in combustible cigarettes). The tobacco used in shisha devices may be mixed with other ingredients to, for example, increase the volume of the vapor and smoke produced, to alter flavor, or both.

[0004] Traditional shisha devices employ charcoal, such as charcoal pellets to heat and sometimes combust the tobacco substrate to generate an aerosol for inhalation by a user. Using charcoal to heat the tobacco may cause full or partial combustion of the tobacco or other ingredients. Additionally, charcoal may generate harmful or potentially harmful products, such as carbon monoxide, which may mix with the shisha vapor and pass through the water basin to the outlet.

[0005] One way to reduce the production of carbon monoxide and combustion by-products is to employ e-liquids rather than tobacco. Shisha devices that employ e-liquids eliminate combustion by-products but deprive shisha consumers of the traditional tobacco-based experience.

[0006] Other shisha devices have been proposed that employ electric heaters to heat, but not combust, tobacco. Such electrically heated heat-not-burn shisha devices heat the tobacco substrate to a temperature sufficient to produce an aerosol from the substrate without combusting the substrate, and therefore reduce or eliminate by-products associated with combustion of tobacco.

[0007] Shisha devices may employ a cartridge for housing an aerosol-forming substrate. The cartridge may be filled with such aerosol-forming substrate. The aerosol-forming substrate may comprise tobacco, preferably shisha substrate, such as molasses-a mixture of tobacco, water, sugar, and other components, such as glycerine, flavors, etc. The heating system of the electrically heated shisha device heats the contents of the cartridge to generate aerosol, which is conveyed through an airflow path to a user.

[0008] In order to facilitate airflow through the cartridge and the flow of the aerosol from the cartridge, a shisha cartridge may have one or more holes through one or more walls. The cartridge may include one or more holes at the top, one or more holes at the bottom, or both one or more holes at the top and one or more holes at the bottom. Alternatively, the top may be open, that is, the top wall may be partially or completely absent.

[0009] Prior art cartridges typically have one or more openings on at least one of the walls of the cartridge, such as in one or both of the top and bottom walls. At least some of the holes or openings in the top and bottom walls may be closed by a removable (for example, peelable) sealing layer, such as a film, sticker, or liner, during storage. The removable layer may protect the contents (for example, the molasses) from exposure to air and oxygen. The removable layer may be removed (for example, pulled or peeled off) by a user prior to first use of the cartridge.

[0010] The holes or openings in the cartridge, if left unsealed, may lead to loss of freshness (for example, moisture content) or contamination of the substrate, as well as issues with leakage. For one or more reasons, such as in order to maintain freshness, to prevent leakage of the substrate, or to preserve the quality and integrity of the substrate during storage, it is desirable to form the openings or holes of the cartridge only immediately prior to use. A prior art is given by the patent documentation EP 3 216 357. Said prior art discloses an aerosol-generating device comprising a piercing element configured to pierce a wall of the cartridge.

[0011] It would be desirable to provide a piercing assembly for piercing cartridges used in aerosol-generating devices. It would be desirable to provide a piercing assembly that can be incorporated as part of an aerosol-generating device. It would be desirable to provide a piercing assembly that does not require additional equipment in addition to the aerosol-generating device. It would be desirable to provide a piercing assembly that is convenient and easy to use. It would be desirable to provide a piercing assembly that can be used with a cartridge that does not have pre-formed air inlets or outlets. It would be desirable to provide a piercing assembly that does not require a user to directly handle a piercing element when piercing a cartridge.

[0012] According to embodiments of the present disclosure, a piercing assembly is provided that can be used in aerosol-generating devices. For example, the piercing assembly may be used in shisha devices. The piercing assembly may be used to form one or more openings in a cartridge. For example, the piercing assembly may be used to form one or more openings in a shisha cartridge.

[0013] The piercing assembly may be a part of a cap used with an aerosol-generating device. The cap may be incorporated as part of a shisha device.

[0014] The piercing assembly comprises a cap. The cap may be mountable on the aerosol-generating device. The cap comprises a body with a cavity. The cavity may be for receiving a cartridge and a piercing element. The piercing element may be constructed to pierce a wall of

a cartridge received therein. The piercing element is configured for piercing (for example, creating one or more holes in) a cartridge.

[0015] The piercing assembly may be operated by inserting a cartridge into the aerosol-generating device. The cap may be placed onto the device (for example onto the receptacle of the aerosol-generating element). The cap may be pressed down such that the piercing element engages the cartridge. The piercing element of the piercing assembly may pierce (for example, create one or more holes in) the cartridge. The aerosol-generating device may be a shisha device and the cartridge may be a shisha cartridge.

[0016] The piercing system of the present disclosure may provide various advantages to both the manufacturer and the user. Some of the advantages include that the piercing system is convenient, easy, and safe to use. The user of the shisha device does not need additional equipment to pierce a cartridge. Further, the user can pierce the cartridge without having to directly handle a piercing element. The piercing assembly may also allow the cartridge to be pierced without removing a sticker or film from the cartridge. The piercing assembly may also enable use of the shisha device with cartridges that do not necessarily have pre-formed holes or openings. This means that cartridges may be provided completely sealed without holes, reducing the chance of leakage and removing any need for such stickers. The cartridge may be placed into the shisha device or into the cap prior to opening of the cartridge. The piercing assembly thus reduces the chance of leaks and other messes. The piercing element enables the use of a cartridge without pre-formed perforations. This allows for one or more of cheaper, faster, and easier manufacturing of cartridges.

[0017] According to an embodiment of the present disclosure, the piercing system may comprise a cap. The cap may be engageable with an aerosol-generating device. The aerosol-generating device may comprise an aerosol-generating element comprising a body and a receptacle for receiving a cartridge comprising an aerosol-forming substrate. The aerosol-generating device may comprise a vessel having a liquid fill level and defining a head space outlet above the liquid fill level. The aerosol-generating device may comprise a conduit for conveying airflow from the receptacle to the vessel. The cap may be engageable with the body. The cap may comprise a frame comprising a cavity. The cap may have a center axis. The cavity may be arranged for receiving the cartridge. The cap may comprise a piercing element disposed within the cavity and configured to pierce a wall of the cartridge. The cap may comprise a spring element. The spring element may be configured for biasing the receptacle axially away from the piercing element. The cap may be movable, relative to the body, between a first position and a second position. In the first position, the piercing element may not be engaged with the cartridge received in the receptacle. In the second position, the piercing element may be engaged with the cartridge received in the receptacle to pierce the cartridge.

[0018] According to an embodiment of the present disclosure, the piercing system comprises a cap mountable on an aerosol-generating device. The aerosol-generating device comprises an aerosol-generating element comprising a body and a receptacle for receiving a cartridge comprising an aerosol-forming substrate; a vessel having a liquid fill level and defining a head space outlet above the liquid fill level; and a conduit for conveying airflow from the receptacle to the vessel. The cap may be engageable with the body. The cap may comprise a frame comprising a cavity and having a center axis. The cavity may be arranged for receiving the cartridge. The cap may further comprise a piercing element disposed within the cavity and configured to pierce a wall of the cartridge. The cap may comprise a spring element biasing the receptacle axially away from the piercing element. The cap may be movable, relative to the body, between a first position and a second position. In the first position, the piercing element may not be engaged with the cartridge received in the receptacle. In the second position, the piercing element may be engaged with the cartridge received in the receptacle to pierce the cartridge.

[0019] The cap frame may comprise a side wall, an open end, and a closed end comprising an end wall. The center axis extends from the open end to the closed end. The piercing element may be oriented to face toward the open end. The piercing element may be disposed adjacent the closed end. The piercing element may be coaxial with the center axis. The piercing element may be centered on the center axis.

[0020] The cap may be movable, relative to the body, between the second position and a third position and between the third position and the first position. The third position may be an intermediate position between the first and second positions. In the third position, an air path may be open between an external environment, the cavity, and the cartridge.

[0021] The cap may comprise an outer shroud and an inner shroud disposed within the outer shroud. The outer shroud may comprise the piercing element. The inner shroud may define the cavity. The outer shroud may be axially movable relative to the inner shroud. The inner shroud may comprise a cylindrical side wall coaxial with the center axis, and an end wall at one end of the cylindrical side wall. The end wall may comprise an opening configured to receive the piercing element. When the piercing element is received in the end wall opening and the cap is in the third position, a gap configured to allow airflow through the opening may remain between the piercing element and the end wall of the inner shroud.

[0022] The inner shroud may comprise one or more guide tracks. The outer shroud may comprise one or more track pins configured to cooperate with the one or more guide tracks. Each of the one or more guide tracks may comprise a first portion and a second portion. The first portion may define a first distance and the second portion may define a second distance that is shorter than

the first distance. The first portion may guide the track pin in an axial direction and in a radial direction. The first portion may define a piercing position of the piercing element.

[0023] The aerosol-generating device may comprise a second piercing element. The second piercing element may extend from the base of the receptacle into the receptacle in a direction away from the base of the receptacle.

[0024] The aerosol-generating device may be a shisha device. The cartridge may be a shisha cartridge. The piercing system may be used with the shisha device to pierce the shisha cartridge. The piercing system may be part of the shisha device.

[0025] The term "aerosol" is used herein to refer to a suspension of solid particles or liquid droplets or a combination of solid particles and liquid droplets in a gas. The gas may be air. The solid particles or liquid droplets may comprise one or more volatile flavor compounds. Aerosol may be visible or invisible. Aerosol may include vapors of substances that are ordinarily liquid or solid at room temperature. Aerosol may include vapors of substances that are ordinarily liquid or solid at room temperature, in combination with solid particles or in combination with liquid droplets or in combination with both solid particles and liquid droplets. In some embodiments, the aerosol comprises nicotine.

[0026] The term "aerosol-forming substrate" is used herein to refer to a material capable of releasing one or more volatile compounds that can form an aerosol. In some embodiments, an aerosol-forming substrate may be heated to volatilize one or more components of the aerosol-forming substrate to form an aerosol. As an alternative to heating or combustion, in some cases volatile compounds may be released by a chemical reaction or by a mechanical stimulus, such as ultrasound. The aerosol-forming substrate may be disposed inside the cartridge. Aerosol-forming substrate may be solid or liquid or may comprise both solid and liquid components. Aerosol-forming substrate may be adsorbed, coated, impregnated or otherwise loaded onto a carrier or support. Aerosol-forming substrate may comprise nicotine. Aerosol-forming substrate may comprise plant-based material. Aerosol-forming substrate may comprise tobacco. Aerosol-forming substrate may comprise a tobacco-containing material containing volatile tobacco flavor compounds, which are released from the aerosol-forming substrate upon heating. Aerosol-forming substrate may alternatively comprise a non-tobacco-containing material. Aerosol-forming substrate may comprise homogenized plant-based material. Aerosol-forming substrate may comprise homogenized tobacco material. Aerosol-forming substrate may comprise at least one aerosol-former. Aerosol-forming substrate may comprise other additives and ingredients, such as flavorants.

[0027] The terms "integral" and "integrally formed" are used herein to describe elements that are formed in one piece (a single, unitary piece). Integral or integrally formed components may be configured such that they cannot be separably removed from each other without causing structural damage to the piece.

[0028] The term "piercing edge" is used herein to describe an edge that is capable of piercing a cartridge. A piercing edge has a length. A piercing edge may terminate at a piercing end. An example of a piercing edge is a knife edge.

[0029] The term "piercing point" is used herein to describe a pointed end of an object that is capable of piercing a cartridge. An example of a piercing point is a needle tip.

[0030] As used herein, the singular forms "a," "an," and "the" also encompass embodiments having plural referents, unless the content clearly dictates otherwise.

[0031] As used herein, "or" is generally employed in its sense including "one or the other or both" unless the content clearly dictates otherwise.

[0032] The term "about" is used herein in conjunction with numeric values to include normal variations in measurements as expected by persons skilled in the art, and is understood to have the same meaning as "approximately." The term "about" understood to cover a typical margin of error. A typical margin of error may be, for example, $\pm$5 % of the stated value.

[0033] As used herein, "have," "having," "include," "including," "comprise," "comprising" or the 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.

[0034] 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 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.

[0035] The term "substantially" as used herein can be understood to modify the term that follows by at least about 90 %, at least about 95 %, or at least about 98 %. The term "not substantially" as used herein can be understood to have the inverse meaning of "substantially," i.e., modifying the term that follows by not more than 10 %, not more than 5 %, or not more than 2 %.

[0036] Any direction referred to herein, such as "top," "bottom," "left," "right," "upper," "lower," and other directions or orientations are described herein for clarity and brevity but are not intended to be limiting of an actual device or system. Devices and systems described herein may be used in a number of directions and orientations.

[0037] An aerosol-generating device may comprise an aerosol-generating element. The aerosol-generating element may comprise a body and a receptacle for receiving a cartridge comprising an aerosol-forming substrate. The aerosol-generating device may comprise a vessel

having a liquid fill level and defining a head space outlet above the liquid fill level. The aerosol-generating device may comprise a conduit for conveying airflow from the receptacle to the vessel. A cap with a piercing system may be used with the aerosol-generating device to engage the aerosol-generating element and a cartridge inserted therein. The cap may be engageable with the body of the aerosol-generating element. According to some embodiments, the cap along with a piercing assembly within the cap forms a piercing system for piercing the cartridge.

[0038] The aerosol-generating device may be a shisha device. A shisha device may comprise an aerosol-generating element comprising a body and a receptacle for receiving a cartridge comprising an aerosol-forming substrate. The shisha device may comprise a vessel having a liquid fill level and defining a head space outlet above the liquid fill level, and a conduit for conveying airflow from the receptacle to the vessel. A cap with a piercing system may be used with the shisha device to engage the aerosol-generating element and a cartridge inserted therein. The cap may be engageable with the body of the aerosol-generating element. According to some embodiments, the cap along with a piercing assembly within the cap forms a piercing system for piercing the cartridge.

[0039] The cap may comprise a frame comprising a cavity and having a center axis. The cavity may be arranged for receiving the cartridge. The cap may further comprise a piercing assembly disposed within the cavity and configured to pierce a wall of the cartridge. The cap may advantageously be used to operate the piercing device. This allows a user to pierce the cartridge without having to come directly into contact with the piercing element. The cap may also reinforce and protect the piercing assembly. The user also does not need to handle the cartridge after piercing and before using the cartridge in the shisha device. This may help prevent leaks and messes from an open cartridge.

[0040] The cap may comprise an outer frame. The outer frame may have any suitable shape. In some embodiments, the outer frame is formed by a cylindrical outer wall extending between a first end wall and an open second end. The first end wall may be a top wall. The outer frame may be open at the bottom. The outer frame may define a cavity for housing the piercing assembly. The cap and piercing assembly may define a longitudinal axis. The longitudinal axis may be a center axis. The longitudinal axis may be coaxial with the hollow tube of the stem pipe. The shape and size of the outer frame may be configured to suitably limit the maximum movement path of the piercing assembly.

[0041] The first end wall of the cap may have a protrusion extending into the cavity. The protrusion may be configured for pressing on the piercing assembly (for example, an outer shroud), while leaving a gap between the cap outer frame and the piercing assembly. The protrusion may be disposed along the center axis. This provides even distribution of force. The outer frame may be configured to form a part of the airflow path through the device. The air gap may also serve to provide thermal insulation between the heating element and the cap.

[0042] The piercing assembly may include a body and a piercing element arranged on the body. The body may comprise an outer shroud defining a cavity. The piercing element may be at least partially disposed within the cavity. The outer shroud may comprise a cylindrical outer wall extending between a first end wall and an open second end. The outer shroud may define a cavity for housing the piercing element and an inner shroud.

[0043] According to an embodiment, the outer shroud comprises the piercing element. The piercing element extends axially downward inside the cavity of the outer shroud. The piercing element may be integral with the outer shroud or may be attached to the inside of the first end wall of the outer shroud.

[0044] The piercing element may have any suitable shape for piercing a wall of the cartridge. For example, the piercing element may comprise one or more piercing edges or piercing points. The piercing edges or piercing points are configured to pierce a wall (for example, top wall) of the cartridge. The number of piercing points or edges is not particularly limited. The piercing element may have only a single piercing point or edge. The piercing element may have a plurality of piercing points or edges. For example, the piercing element may have 2 or more, 3 or more, 4 or more, 5 or more, 6 or more, or 8 or more piercing points or edges. The piercing element may have 20 or fewer, 15 or fewer, 12 or fewer, 10 or fewer, or 8 or fewer piercing points or edges. In one embodiment, the piercing element is shaped like an inverted crown with multiple piercing points extending downward. The inverted crown may have from 4 to 10 or from 6 to 8 piercing points or edges.

[0045] The piercing assembly may include an inner shroud. The inner shroud may be constructed to at least partially fit within the cavity of the outer shroud. The inner shroud may have an outer wall comprising a first part and a second part. The first and second parts may be cylindrical elements with different diameters. The first part may be a cylindrical wall with a first diameter, and the second part may be a cylindrical wall with a second diameter. The second diameter may be greater than the first diameter. The second part may be coaxial with and below the first part such that a shoulder is formed at the transition between the first and second parts. The shoulder may support a compression spring. The compression spring may fit around the first part. The compression spring may extend from the shoulder to the first end wall of the outer shroud.

[0046] The outer wall of the inner shroud may extend between a first end wall and an open second end. The inner shroud may define a cavity for receiving the cartridge. The inner shroud may have an opening at the first end wall. The opening may be configured to receive the piercing element. The opening may further include one or more recesses or channels for facilitating airflow

through the inner shroud while the piercing element is received in the opening.

[0047] The outer and inner shrouds may include a track and pin system to guide the movement of the outer and inner shrouds relative to one another. The outer shroud may be vertically, horizontally, or both vertically and horizontally movable. The inner shroud may be vertically, horizontally, or both vertically and horizontally movable. In one embodiment, the inner shroud defines the track and the outer shroud comprises one or more pins. Alternatively, the track may be defined in the outer shroud and the one or more pins may be on the inner shroud. In one embodiment, the outer shroud comprises one or more pins extending radially inwardly from its cylindrical outer wall. The inner shroud may include one or more tracks corresponding to the one or more pins. The one or more tracks may be disposed on the second (lower) part of the inner shroud. The one or more tracks may define multiple positions of the outer shroud. For example, the one or more tracks may define a first position that is a rest position, a second position that is a piercing position, and a third position that is a use position. When the outer shroud is in the second position, the compression spring biases the outer shroud upward. The one or more tracks may also define a fourth position that is a release position. When the outer shroud is in the fourth position, the compression spring biases the outer shroud upward. As the compression spring biases the outer shroud upward, it also biases the cap outer frame upward.

[0048] The outer shroud may be pressed down (for example, by a user pressing on the cap outer frame) from the first position to the second position. In entering the second position, the piercing element engages and pierces the cartridge. When pressure is released from the outer shroud, the compression spring returns the outer shroud upward to a third position. In the third position, an airflow path is open through the openings formed in the cartridge. The airflow path may be open between an exterior of the shisha device and the vessel. The user may use the shisha device by drawing on the mouthpiece. To release and remove the cap, the user may again press on the outer shroud (for example, by pressing on the cap outer frame), causing the outer shroud to move to the fourth position. From the fourth position, the compression spring returns the outer shroud to the initial first position (the rest position).

[0049] The bottom of the cap outer frame may be attached to a support plate. The support plate may be configured to hold the piercing assembly inside the cavity of the outer frame. The support plate may be a substantially round plate with a center hole extending through the plate. The hole may be sized to accommodate the cartridge. The hole may also be sized to accept the receptacle that may house the cartridge. The hole may have an angled inner edge tapered inward at its upper side. The angled inner edge may aid in engaging the cap with the aerosol-generating element and receiving the cartridge in the inner shroud. The support plate may be attached in any suitable manner, such as by an adhesive or by a coupling element, such as screws, clips, a threaded coupling, snap fit, or friction fit.

[0050] The cap and piercing assembly may include a grip element configured to grip the cartridge. The grip element may include a ring member and one or more grip fingers extending from the ring member. The grip fingers may be spring fingers biased radially toward the center axis. The grip element may be positioned within the inner shroud. The grip element may be oriented with the one or more grip fingers pointing upward. When a cartridge is received in the inner shroud, the ring member may circumscribe the cartridge body. The one or more grip fingers may be configured such that the ends of the grip fingers abut against an upper flange of the cartridge. The one or more grip fingers may have a length that is less than the height of the cartridge. When the cap is removed, the cartridge is removed with the cap due to the grip fingers abutting against the flange, and thus preventing the cartridge from falling out of the cavity of the inner shroud.

[0051] The cap and piercing assembly may be made from any suitable material. Suitable materials include plastic, metal, ceramic, glass, and combinations thereof. Different parts of the piercing assembly may be made from different materials. For example, some parts, such as the outer shroud and inner shroud may be made of plastic, while other parts, such as the spring and gripping element may be made of metal. Other combinations are possible.

[0052] When a user uses the shisha device with the cap and piercing assembly according to an embodiment, the user may begin by placing a cartridge in the receptacle of the shisha device, and placing the cap onto or into the aerosol-generating element such that the cartridge is received in the inner shroud. If the cap includes a grip element, the grip fingers of the grip element may slide past the top of the cartridge such that the grip fingers grip the cartridge. The user may then push on the cap to pierce the cartridge. As the user pushes on the cap, the pins of the outer shroud slide along a path formed by the track in the inner shroud, guiding the outer shroud to the piercing position, where the piercing element pierces the top of the cartridge. After the user lets go of the cap, the compression spring pushes the cap frame and outer shroud up into an operating position. In the operating position, the air path through the cartridge is open. After using the shisha device, the user may push on the cap again to release the cap. The track-and-pin system will guide the motion of the cap and outer shroud, allowing the spring to return the cap to its initial (rest) position. The user may then remove the cap from the device.

[0053] In some embodiments, the shisha device includes a second piercing assembly. The second piercing assembly may be disposed at the upper end of the stem pipe, below the cartridge. The second piercing assembly may extend from the base of the receptacle into the re-

ceptacle in a direction away from the base of the receptacle. When the cap and piercing assembly are pressed down, the cartridge may also be pressed against the second piercing assembly. The cap may be pierced by both piercing assemblies. The piercing assemblies may pierce the top and bottom walls of the cartridge.

[0054] The cartridge may comprise any suitable body defining a cavity. Aerosol-forming substrate may be disposed in the cavity of the cartridge. The body is preferably formed from one or more heat resistant materials, such as a heat resistant metal or polymer. The body may comprise a thermally conductive material. For example, the body may comprise any of aluminum, copper, zinc, nickel, silver, any alloys thereof, and combinations thereof. Preferably, the body comprises aluminum.

[0055] The cartridge may be of any suitable shape. For example, the cartridge may have a shape configured to be received by a shisha device. The cartridge may have a substantially cuboidal shape, cylindrical shape, frustoconical shape, or any other suitable shape. Preferably, the cartridge has a generally cylindrical shape or a frustoconical shape.

[0056] The shisha device is configured to heat the aerosol-forming substrate in the cartridge. The device may be configured to heat the aerosol-forming substrate in the cartridge by conduction. The cartridge is preferably shaped and sized to allow contact with, or minimize distance from, a heating element of the shisha device to provide efficient heat transfer from the heating element to the aerosol-forming substrate in the cartridge. The heat may be generated by any suitable mechanism, such as by resistive heating or by induction. In order to facilitate inductive heating, the cartridge may be provided with a susceptor. For example, the cartridge body may be made from or include a material (for example, aluminum) that is capable of acting as a susceptor, or a susceptor material may be provided within the cavity of the cartridge. A susceptor material may be provided within the cavity of the cartridge in any form, for example a powder, a solid block, shreds, etc.

[0057] Any suitable aerosol-forming substrate may be provided in the cavity defined by the body of the cartridge. The aerosol-forming substrate is preferably a substrate capable of releasing volatile compounds. The aerosol-forming substrate is preferably a substrate capable of releasing compounds that may form an aerosol. The volatile compounds may be released by heating the aerosol-forming substrate. The volatile compounds may be released by a chemical reaction or by a mechanical stimulus, such as ultrasound. Aerosol-forming substrate may be solid or liquid or may comprise both solid and liquid components. Aerosol-forming substrate may be adsorbed, coated, impregnated or otherwise loaded onto a carrier or support.

[0058] The aerosol-forming substrate may comprise nicotine. The nicotine containing aerosol-forming substrate may comprise a nicotine salt matrix. The aerosol-forming substrate may comprise plant-based material. The aerosol-forming substrate preferably comprises tobacco. The tobacco containing material preferably comprises volatile tobacco flavor compounds, which are released from the aerosol-forming substrate upon heating. The aerosol-forming substrate may comprise homogenized tobacco material. Homogenized tobacco material may be formed by agglomerating particulate tobacco. The aerosol-forming substrate may alternatively or additionally comprise a non-tobacco-containing material. The aerosol-forming substrate may comprise homogenized plant-based material. Aerosol-forming substrate may comprise at least one aerosol-former. Aerosol-forming substrate may comprise other additives and ingredients, such as flavorants. Preferably, the aerosol-forming substrate is a shisha substrate. A shisha substrate is understood to mean a consumable material that is suitable for use in a shisha device. Shisha substrate may include molasses.

[0059] The aerosol-forming substrate may include, for example, one or more of: powder, granules, pellets, shreds, spaghettis, strips, or sheets. The aerosol-forming substrate may contain one or more of: herb leaf, tobacco leaf, fragments of tobacco ribs, reconstituted tobacco, homogenized tobacco, extruded tobacco, and expanded tobacco.

[0060] The aerosol-forming substrate may include at least one aerosol former. Suitable aerosol formers include compounds or mixtures of compounds which, in use, facilitate formation of a dense and stable aerosol and which are substantially resistant to thermal degradation at the operating temperature of the shisha device. Suitable aerosol formers are well known in the art and include, but are not limited to: polyhydric alcohols, such as triethylene glycol, 1,3-butanediol and glycerine; esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate; and aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate. Particularly preferred aerosol formers are polyhydric alcohols or mixtures thereof, such as triethylene glycol, 1,3-butanediol and, most preferred, glycerine. The aerosol-forming substrate may include any suitable amount of an aerosol former. For example, the aerosol former content of the substrate may be equal to or greater than 5 % on a dry weight basis, and preferably greater than 30 % by weight on a dry weight basis. The aerosol former content may be less than about 95 % on a dry weight basis. Preferably, the aerosol former content is up to about 55 %.

[0061] The aerosol-forming substrate preferably includes nicotine and at least one aerosol former. In some embodiments, the aerosol former is glycerine or a mixture of glycerine and one or more other suitable aerosol formers, such as those listed above.

[0062] The aerosol-forming substrate may include other additives and ingredients, such as flavorants, sweeteners, etc. In some examples, the aerosol-forming substrate includes one or more sugars in any suitable amount. Preferably, the aerosol-forming substrate in-

cludes invert sugar. Invert sugar is a mixture of glucose and fructose obtained by splitting sucrose. Preferably, the aerosol-forming substrate includes from about 1 % to about 40 % sugar, such as invert sugar, by weight. In some example, one or more sugars may be mixed with a suitable carrier such as cornstarch or maltodextrin.

[0063] In some examples, the aerosol-forming substrate includes one or more sensory-enhancing agents. Suitable sensory-enhancing agents include flavorants and sensation agents, such as cooling agents. Suitable flavorants include natural or synthetic menthol, peppermint, spearmint, coffee, tea, spices (such as cinnamon, clove, ginger, or combination thereof), cocoa, vanilla, fruit flavors, chocolate, eucalyptus, geranium, eugenol, agave, juniper, anethole, linalool, and any combination thereof.

[0064] In some examples, the aerosol-forming substrate is in the form of a suspension. For example, the aerosol-forming substrate may include molasses. As used herein, "molasses" means an aerosol-forming substrate composition comprising about 20 % or more sugar. For example, the molasses may include at least about 25 % by weight sugar, such as at least about 35 % by weight sugar. Typically, the molasses will contain less than about 60 % by weight sugar, such as less than about 50 % by weight sugar.

[0065] Any suitable amount of aerosol-forming substrate (for example, molasses or tobacco substrate) may be disposed in the cavity. In some preferred embodiments, about 3 g to about 25 g of the aerosol-forming substrate is disposed in the cavity. The cartridge may include at least 6 g, at least 7 g, at least 8 g, or at least 9 g of aerosol-forming substrate. The cartridge may include up to 15 g, up to 12 g; up to 11 g, or up to 10 g of aerosol-forming substrate. Preferably, from about 7 g to about 13 g of aerosol-forming substrate is disposed in the cavity.

[0066] The aerosol-forming substrate may be provided on or embedded in a thermally stable carrier. The term "thermally stable" is used herein to indicate a material that does not substantially degrade at temperatures to which the substrate is typically heated (e.g., about 150 °C to about 300 °C). The carrier may comprise a thin layer on which the substrate deposited on a first major surface, on second major outer surface, or on both the first and second major surfaces. The carrier may be formed of, for example, a paper, or paper-like material, a non-woven carbon fiber mat, a low mass open mesh metallic screen, or a perforated metallic foil or any other thermally stable polymer matrix. Alternatively, the carrier may take the form of powder, granules, pellets, shreds, spaghettis, strips or sheets. The carrier may be a non-woven fabric or fiber bundle into which tobacco components have been incorporated. The non-woven fabric or fiber bundle may comprise, for example, carbon fibers, natural cellulose fibers, or cellulose-derivative fibers.

[0067] The body of the cartridge may include one or more walls. In some embodiments, the body includes a top wall, a bottom wall, and a sidewall. The sidewall may be cylindrical or frustoconical, extending from the bottom to the top. The body may include one or more parts. For example, the sidewall and the bottom wall may be an integral single part. The sidewall and the bottom wall may be two parts configured to engage one another in any suitable manner. For example, the sidewall and the bottom wall may be configured to engage one another by threaded engagement or interference fit. The sidewall and the bottom wall may be two parts joined together. For example, the sidewall and the bottom wall may be joined together by welding or by an adhesive. The top wall and sidewall may be a single integral part. The sidewall and the top wall may be two parts configured to engage one another in any suitable manner. For example, sidewall and the top wall may be configured to engage one another by threaded engagement or interference fit. The sidewall and the top wall may be two parts joined together. For example, the sidewall and the top wall may be joined together by welding or by an adhesive. The top wall, sidewall and bottom wall may all be a single integral part. The top wall, the sidewall, and the bottom wall may be three separate parts configured to engage one another in any suitable manner. For example, the top wall, the sidewall, and the bottom wall may be configured to engage by threaded engagement interference fit, welding, or an adhesive.

[0068] One or more walls of the body may form a heatable wall or surface. As used herein, "heatable wall" and "heatable surface" mean an area of a wall or a surface to which heat may be applied, either directly or indirectly. The heatable wall or surface may function as a heat transfer surface through which heat may be transferred from outside of the body to the cavity or to an internal surface of the cavity.

[0069] Preferably, the body of the cartridge has a length (for example, an axial length along a vertical center axis) of about 15 cm or less. In some embodiments, the body has a length of about 10 cm or less. The body may have an inside diameter of about 1 cm or more. The inside diameter of the body may be about 1.75 cm or more. The cartridge may have a heatable surface area in the cavity from about 25 cm^2 to about 100 cm^2, such as from about 70 cm^2 to about 100 cm^2. The volume of the cavity may be from about 10 cm^3 to about 50 cm^3; preferably from about 25 cm^3 to about 40 cm^3. In some embodiments, the body has a length in a range from about 3.5 cm to about 7 cm. The inside diameter of the body may be from about 1.5 cm to about 4 cm. The body may have a heatable surface area in the cavity from about 30 cm^2 to about 100 cm^2, such as from about 70 cm^2 to about 100 cm^2. The volume of the cavity may be from about 10 cm^3 to about 50 cm^3; preferably from about 25 cm^3 to about 40 cm^3. Preferably, the body is cylindrical or frustoconical.

[0070] The cartridge body may include one or more openings or ventilation holes through one or more walls of the body. The ventilation holes may be inlets, outlets, or both. The ventilation holes may be disposed at the

bottom wall, top wall, sides, or a combination thereof, of the cartridge. In some embodiments, the cartridge does not include any preformed openings or ventilation holes. In some embodiments, the cartridge includes preformed openings or ventilation holes only in one wall. For example, the cartridge may include openings or ventilation holes in the bottom wall only. In some embodiments, one or more inlets or one or more outlets are formed in the cartridge walls by the piercing assembly to allow air to flow through the aerosol-forming substrate when the cartridge is used with a shisha device. In some embodiments, one or more inlets and outlets are formed in the cartridge walls by the piercing assembly to allow air to flow through the aerosol-forming substrate when the cartridge is used with a shisha device. In some embodiments, the bottom wall of the cartridge may define one or more openings to form the one or more outlets of the cartridge. Preferably, the one or more inlets and outlets are sized and shaped to provide a suitable resistance to draw (RTD) through the cartridge. In some examples, the RTD through the cartridge, from the inlet or inlets to the outlet or outlets, may be from about 10 mm H_2O to about 50 mm H_2O, preferably from about 20 mm H_2O to about 40 mm H_2O. The RTD of a specimen refers to the static pressure difference between the two ends of the specimen when it is traversed by an air flow under steady conditions in which the volumetric flow is 17.5 milliliters per second at the output end. The RTD of a specimen may be measured using the method set out in ISO Standard 6565:2002.

[0071] The one or more openings, once formed, on the body may cover 5 % or greater, 10 % or greater, 15 % or greater, 20 % or greater, or 25 % or greater of the area of the wall the openings are on. For example, if the openings are on the top wall, the openings may cover at least 5 % of the area of the top wall. The one or more openings on the body may cover 75 % or less, 50 % or less, 40 % or less, or 30 % or less of the area of the wall the openings are on.

[0072] The cartridge may further include a seal or layer covering one or more preformed openings prior to use. The cartridge may include a first removable seal covering the one or more inlets and a second removable seal covering the one or more outlets. The first and second seals are preferably sufficient to prevent air flow through the inlets and outlets to prevent leakage of the contents of the cartridge and to extend shelf life. The seal may comprise a peelable label of sticker, foil, or the like. The seal may comprise a pierceable label of sticker, foil, or the like. The label, sticker, or foil may be affixed to the cartridge in any suitable manner, such as with an adhesive, crimping, welding, or otherwise being joined to the container. The seal may comprise a tab that may be grasped to peel or remove the label, sticker, or foil from the cartridge.

[0073] In some embodiments the cartridge is a shisha cartridge that may be used with any suitable shisha device. Preferably, the shisha device is configured to sufficiently heat the aerosol-forming substrate in the cartridge to form an aerosol from the aerosol-forming substrate but not to combust the aerosol-forming substrate. For example, the shisha device may be configured to heat the aerosol-forming substrate to a temperature in a range from about 150 °C to about 300 °C; more preferably from about 180 °C to about 250 °C or from about 200 °C to about 230 °C.

[0074] The shisha device may include a receptacle for receiving the cartridge. The shisha device may include a heating element configured to contact or to be in proximity to the body of the cartridge when the cartridge is received in the receptacle. The heating element may form at least part of the receptacle. For example, the heating element may form at least a portion of the surface of the receptacle. The shisha cartridge may be configured to transfer heat from the heating element to the aerosol-forming substrate in the cavity by conduction. In some embodiments, the heating element includes an electric heating element. In some embodiments, the heating element includes a resistive heating component. For example, the heating element may include one or more resistive wires or other resistive elements. The resistive wires may be in contact with a thermally conductive material to distribute heat produced over a broader area. Examples of suitable conductive materials include aluminum, copper, zinc, nickel, silver, and combinations thereof. The heating element may form at least a portion of the surface of the receptacle.

[0075] The shisha device may include control electronics operably coupled to the heating element. The control electronics may be configured to control heating of the heating element. The control electronics may be configured to control the temperature to which the aerosol-forming substrate in the cartridge is heated. The control electronics may be provided in any suitable form and may, for example, include a controller or a memory and a controller. The controller may 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 electronics may include memory that contains instructions that cause one or more components of the circuitry to carry out a function or aspect of the control electronics. Functions attributable to control electronics in this disclosure may be embodied as one or more of software, firmware, and hardware.

[0076] The electronic circuitry may include 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.

[0077] In some examples, the control electronics may be configured to monitor the electrical resistance of the heating element and to control the supply of power to the heating element depending on the electrical resistance of the heating element. In this manner, the control electronics may regulate the temperature of the resistive el-

ement.

[0078] The shisha device may include a temperature sensor, such as a thermocouple. The temperature sensor may be operably coupled to the control electronics to control the temperature of the heating element. The temperature sensor may be positioned in any suitable location. For example, the temperature sensor may be configured to insert into the cartridge when received within the receptacle to monitor the temperature of the aerosol-forming substrate being heated. In addition or alternatively, the temperature sensor may be in contact with the heating element. In addition or alternatively, the temperature sensor may be positioned to detect temperature at an aerosol outlet of the shisha device or a portion thereof. The sensor may transmit signals regarding the sensed temperature to the control electronics. The control electronics may adjust heating of the heating elements in response to the signal to achieve a suitable temperature at the sensor.

[0079] The control electronics may be operably coupled to a power supply. The shisha device may include any suitable power supply. For example, a power supply of a shisha device may be a battery or set of batteries. The batteries of the power supply may be rechargeable, removable and replaceable, or rechargeable and removable and replaceable. Any suitable battery may be used. For example, heavy duty type or standard batteries existing in the market, such as used for industrial heavy-duty electrical power-tools. Alternatively, the power supply may be any type of electric power supply including a super or hyper-capacitor. Alternatively, the assembly may be connected to an external electrical power source, and electrically and electronically designed for such purpose. Regardless of the type of power supply employed, the power supply preferably provides sufficient energy for the normal functioning of the assembly for at least one shisha session until aerosol is depleted from the aerosol-forming substrate in the cartridge before being recharged or needing to connect to an external electrical power source. Preferably, the power supply provides sufficient energy for the normal functioning of the assembly for at least about 70 minutes of continuous operation of the device, before being recharged or needing to connect to an external electrical power source.

[0080] In one example, a shisha device includes an aerosol-generating element that includes a cartridge receptacle, a heating element, an aerosol outlet, and an air inlet. The cartridge receptacle is configured to receive a cartridge according to the present disclosure containing the aerosol-forming substrate. The heating element may define at least part of a surface of the receptacle.

[0081] The shisha device includes an air inlet channel in fluid connection with the receptacle. In use, when the substrate inside the cartridge is heated, aerosol former components in the substrate vaporize. Air flowing from the air inlet channel through the cartridge becomes entrained with aerosol generated from the aerosol former components in the cartridge.

[0082] Some electrically heated shisha devices employ pre-heated air and typically employ an airflow path such that the air travels in the vicinity of the heat source upon puffing. Further, some electrically heated shisha devices employ elements that increase radiation heat transfer by increasing the heated surface area.

[0083] The air inlet channel may include one or more apertures through the cartridge receptacle such that air from outside the shisha device may flow through the channel and into the cartridge receptacle through the one or more apertures. If a channel includes more than one aperture, the channel may include a manifold to direct air flowing through the channel to each aperture. Preferably, the shisha device includes two or more air inlet channels.

[0084] As described above, the cartridge includes one or more openings (such as inlets or outlets) formed in the body, allowing air to flow through the cartridge. If the receptacle includes one or more inlet apertures, at least some of the inlets in the cartridge may align with the apertures in the top of the receptacle. The cartridge may include an alignment feature configured to mate with a complementary alignment feature of the receptacle to align the inlets of the cartridge with the apertures of the receptacle when the cartridge is inserted into the receptacle.

[0085] Air that enters the cartridge may flow across or through, or both across and through the aerosol-forming substrate, entraining aerosol, and exiting the cartridge and receptacle via an aerosol outlet. From the aerosol outlet, the air carrying the aerosol enters a vessel of the shisha device via the stem pipe.

[0086] The shisha device may include any suitable vessel defining an interior volume configured to contain a liquid and defining an outlet in the headspace above a liquid fill level. The vessel may include an optically transparent or opaque housing to allow a consumer to observe contents contained in the vessel. The vessel may include a liquid fill demarcation, such as a liquid fill line. The vessel housing may be formed of any suitable material. For example, the vessel housing may include glass or suitable rigid plastic material. Preferably, the vessel is removable from a portion of the shisha assembly comprising the aerosol-generation element to allow a consumer to fill, empty or clean the vessel.

[0087] The vessel may be filled to a liquid fill level by a consumer. The liquid preferably includes water, which may optionally be infused with one or more colorants, flavorants, or colorants and flavorants. For example, the water may be infused with one or both of botanical and herbal infusions.

[0088] Aerosol entrained in air exiting the aerosol outlet of the receptacle may travel through a conduit positioned in the vessel. The conduit may be coupled to the aerosol outlet of the aerosol-generating element and may have an opening below the liquid fill level of the vessel, such that aerosol flowing through the vessel flows through the opening of the conduit, then through the liquid, into head-

space of the vessel and exits through a headspace outlet, for delivery to a consumer.

[0089] The headspace outlet may be coupled to a hose comprising a mouthpiece for delivering the aerosol to a consumer. The mouthpiece may include an activation element, such as a switch activatable by a user, a puff sensor arranged to detect a user puffing on the mouthpiece, or both a switch activatable by the user and a puff sensor. The activation element is operably coupled to the control electronics of the shisha device. The activation element may be wirelessly coupled to the control electronics. Activation of the activation element may cause the control electronics to activate the heating element, rather than constantly supplying energy to the heating element. Accordingly, the use of an activation element may serve to save energy relative to devices not employing such elements to provide on-demand heating rather than constant heating.

[0090] For purposes of example, one method for using a shisha device as described herein is provided below in chronological order. The vessel may be detached from other components of the shisha device and filled with water. One or more of natural fruit juices, botanicals, and herbal infusions may be added to the water for flavoring. The amount of liquid added should cover a portion of the conduit but should not exceed a fill level mark that may optionally exist on the vessel. The vessel is then reassembled to the shisha device. The cartridge may be placed into the receptacle. The cap may be placed onto the receptacle and cartridge such that the cartridge is received in the cavity inside the cap. The user may press the cap down against the cartridge such that the piercing element engages the cartridge to pierce one or more walls of the cartridge. The device may then be turned on. Turning on the device may initiate a heating profile of a heating element, to heat the aerosol-forming substrate to a temperature at or above a vaporization temperature but below a combustion temperature of the aerosol-forming substrate. The aerosol forming compounds of the aerosol-forming substrate vaporize, generating an aerosol. The user may puff on the mouthpiece as desired. The user may continue using the device as long as desired or until no more aerosol is visible or being delivered. In some embodiments, the device may be arranged to automatically shut off when the cartridge or a compartment of the cartridge is depleted of usable aerosol-forming substrate. In some embodiments, the consumer may refill the device with a fresh cartridge after, for example, receiving the cue from the device that the aerosol-forming substrate in the cartridge is depleted or nearly depleted. The shisha device may be turned off at any time by a consumer by, for example, switching off the device.

[0091] The shisha device may have any suitable air management. In one example, puffing action from the user will create a suction effect causing a low pressure inside the device which will cause external air to flow through an air inlet of the device, into the air inlet channel, and into the receptacle. The air may then flow through the cartridge in the receptacle and become entrained with aerosol produced from the aerosol-forming substrate. The air with entrained aerosol then exits the aerosol outlet of the receptacle, flows through the conduit to the liquid inside the vessel. The aerosol will then bubble out of the liquid and into head space in the vessel above the level of the liquid, out the headspace outlet, and through the hose and mouthpiece for delivery to the consumer. The flow of external air and the flow of the aerosol inside the shisha device may be driven by the action of puffing from the user.

[0092] Reference will now be made to the drawings, which depict one or more embodiments described in this disclosure. However, it will be understood that other embodiments not depicted in the drawings fall within the scope of this disclosure. Like numbers used in the figures refer to like components. The use of different numbers to refer to components in different figures is not intended to indicate that the different numbered components cannot be the same or similar to other numbered components. The figures are presented for purposes of illustration and not limitation. Schematic drawings presented in the figures are not necessarily to scale.

FIG. 1 is a schematic view of a shisha device.

FIGS. 2A and 2B are schematic top and bottom perspective views, respectively, of the body of a shisha cartridge for use in the shisha device of FIG. 1 according to an embodiment.

FIG. 3A is a schematic bottom view of a shisha cartridge after having been pierced by the piercing assembly according to an embodiment.

FIG. 3B is a schematic top view of a shisha cartridge use in the shisha device of FIG. 1 according to an embodiment.

FIGS. 4A and 4B are schematic view of a shisha device and cap with piercing assembly in use according to an embodiment.

FIG. 5A is cross-sectional side view of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 5B is an exploded view of the cap and piercing system of FIG. 5A.

FIG. 6 is a schematic perspective view of the cap frame of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 7 is a schematic perspective view of the outer shroud of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 8 is a schematic perspective view of the spring of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 9 is a schematic perspective view of the inner shroud of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 10 is a schematic perspective view of the support ring of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 11 is a schematic perspective view of the grip element of the cap and piercing system of FIG. 4A according to an embodiment.

FIGS. 12A and 12B are schematic cross sectional side and bottom views, respectively, of the outer shroud of the cap and piercing system of FIG. 4A according to an embodiment.

FIGS. 13A-13D are side views of the track and pin in different positions during use of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 14 is a cross sectional schematic partial view of the use of the cap and piercing system of FIG. 4A according to an embodiment.

FIG. 1 is a schematic sectional view of an example of a shisha device 100. The device 100 includes a vessel 17 defining an interior volume configured to contain liquid 19 and defining a headspace outlet 15 above a fill level for the liquid 19. The liquid 19 preferably includes water, which may optionally be infused with one or more colorants, one or more flavorants, or one or more colorants and one or more flavorants. For example, the water may be infused with one or both of botanical infusions and herbal infusions.

[0093] The device 100 also includes an aerosol-generating element 130. The aerosol-generating element 130 includes a receptacle 140 configured to receive a cartridge 200 comprising an aerosol-forming substrate. The aerosol-generating element 130 may also include a heating element 160. The heating element 160 may form at least one surface of the receptacle 140. In the depicted embodiment, the heating element 160 defines the side surfaces of the receptacle 140. The aerosol-generating element 130 also includes an air inlet channel 170 that draws air into the device 100. In some embodiments, portion of the air inlet channel 170 is formed by the heating element 160 to heat the air before the air enters the receptacle 140. The pre-heated air then enters the cartridge 200, which is also heated by heating element 160, to carry aerosol generated by the aerosol former and the aerosol-forming substrate. The air exits an outlet of the aerosol-generating element 130 and enters a conduit 190.

[0094] The conduit 190 carries the air and aerosol into the vessel 17 below the level of the liquid 19. The air and aerosol may bubble through the liquid 19 and exit the headspace outlet 15 of the vessel 17. A hose 20 may be attached to the headspace outlet 15 to carry the aerosol to the mouth of a user. A mouthpiece 25 may be attached to, or form a part of, the hose 20.

[0095] An exemplary air flow path of the device, in use, is depicted by thick arrows in FIG. 1.

[0096] The mouthpiece 25 may include an activation element 27. The activation element 27 may be a switch, button or the like, or may be a puff sensor or the like. The activation element 27 may be placed at any other suitable location of the device 100. The activation element 27 may be in wireless communication with the control electronics 30 to place the device 100 in condition for use or to cause control electronics to activate the heating element 160; for example, by causing power supply 35 to energize the heating element 160.

[0097] The control electronics 30 and power supply 35 may be located in any suitable position of the aerosol-generating element 130, including locations other than the bottom portion of the element 130 as depicted in FIG. 1.

[0098] Referring now to FIGS. 2A and 2B, various embodiments of the body 210 are shown. The body 210 may include a side wall 212, a top wall 215, and a bottom wall 213 defining a cavity 218. The side wall 212 may be cylindrical or frustoconical, as shown. FIG. 2A shows the body 210 with a portion of the top 215 removed, showing the cavity 218 inside the body. The body 210 may define a center axis A extending through the body 210. The top may comprise a flange 219 that extends from the sidewall 212 as shown in FIG. 2B.

[0099] Referring now to FIGS. 3A and 3B, one or both of the top 215 and bottom 213 of the body may have a plurality of apertures 217, 216 to allow air flow through the cartridge when the cartridge is in use. The apertures 217 of the top 215 may be formed by the piercing assembly. The cartridge 200 may also or alternatively include apertures along the sidewall 212. The apertures 216 of the bottom 213 may be blocked by a peelable seal or liner when the cartridge is stored prior to use or may be formed by a second piercing assembly on the side of the bottom wall.

[0100] A partial schematic view of a shisha device with the cap 400 and piercing assembly 401 is shown in FIG. 4A. The cap 400 may include an outer frame 410 housing the piercing assembly 401. The piercing assembly 401 may include an outer shroud 420 and a piercing element 440 on the inside wall of the outer shroud 420. In some embodiments, such as those illustrated for example, the piercing element 440 may be disposed on the inside end wall 421. The piercing assembly 401 may further include an inner shroud 430 at least partially disposed within the outer shroud. The piercing element 440 may be oriented

toward a cartridge 200 placed within a receptacle of the shisha device 100. Once the cartridge 200 has been pierced by the piercing assembly 401, an airflow path is established through the cartridge 200, as shown in FIG. 4B.

[0101] An example of a cap 400 and piercing assembly 401 is shown in FIGS. 5A and 5B. Detailed views of each of the elements of the cap 400 and piercing assembly 401 are shown in FIGS. 6-11. The cap 400 and piercing assembly 401 may define a longitudinal axis A. The longitudinal axis A may be a center axis. The longitudinal axis A may be coaxial with the hollow tube of the stem pipe 190.

[0102] The cap outer frame 410, shown in FIG. 6, may comprise a cylindrical outer wall 413 extending between a first end wall 411 and an open second end 412. The outer frame 410 may define a cavity 419 for housing the piercing assembly 401. The first end wall 411 may have a protrusion 414 extending from the inside wall. The protrusion 414 may be configured for pressing on the outer shroud 420 while leaving a gap between the cap outer frame 410 and the outer shroud 420.

[0103] The cap 400 may include a grip element 450, shown in FIG. 11, configured to grip the cartridge 200. The grip element 450 may include a ring member 451 and one or more grip fingers 452. The one or more grip fingers 452 extend from the ring member 451 to upper ends 453. The grip element 450 may be positioned within the inner shroud 430, as shown in FIG. 5A. The one or more grip fingers 452 may be configured such that the ends of the grip fingers 452 abut against an upper flange of the cartridge 200 when the cartridge 200 is received in the inner shroud 430.

[0104] The outer frame 410 may optionally include screw holes 462 configured for fastening a support plate 460 (FIG. 10) to the bottom of the outer frame 410. Alternatively, the support plate 460 may be fastened by other means, such as by an adhesive. The support plate 460 may be a substantially round plate with a center hole 461 extending through the plate. The support plate 460 may be sized to hold the piercing assembly 401 inside the cavity 419 of the outer frame 410, as shown in FIG. 5A.

[0105] The outer shroud 420, shown in FIGS. 7, 12A, and 12B, is constructed to at least partially fit within the cavity 419 of the cap outer frame 410. The outer shroud 420 may comprise a cylindrical outer wall 423 extending between a first end wall 421 and an open second end 422. The outer shroud 420 may define a cavity 429 for housing the piercing element 440 and the inner shroud 430. The outer shroud 420 comprises the piercing element 440. The piercing element 440 extends axially downward inside the cavity of the outer shroud 420. The piercing element 440 is centered with respect to a longitudinal axis A of the outer shroud 420. The piercing element 440 may be integral with the outer shroud 420 or may be attached to the inside of the first end wall 421 of the outer shroud 420. The piercing element 440 may comprise one or more piecing edges or piercing points 441. The piecing edges or piercing points 441 are configured to pierce a wall (for example, top wall) of the cartridge 200. The piercing element 440 may have a width W440. The width W440 may be configured such that the piercing element 440 is able to fit through an opening 437 on the inner shroud 430. The outer shroud 420 may comprise a bottom flange 427. The bottom flange 427 may extend outwardly from the bottom of the outer wall 423.

[0106] The inner shroud 430, shown in FIG. 9, is constructed to at least partially fit within the cavity 429 of the outer shroud 420. The inner shroud 430 may have an outer wall comprising first part 433 and a second part 434. The first part 433 may be a cylindrical wall with a first diameter, and the second part 434 may be a cylindrical wall with a second diameter. The second diameter may be greater than the first diameter. The first and second parts 433, 434 may be separated by a shoulder 435. The shoulder 435 may be constructed to support the compression spring 470. The compression spring 470 may fit around the first part 433. The end of the compression spring 470 may be supported on the shoulder 435, so that the spring may be compressed against the shoulder 435. The outer wall of the inner shroud 430 may extend between a first end wall 431 and an open second end 432. The inner shroud 440 may define a cavity 439 for receiving a cartridge 200. The inner shroud 430 may have an opening 437 at the first end wall 431. The opening 437 may be configured to receive the piercing element 440. The opening 437 may further include one or more channels 438 for facilitating airflow through the inner shroud 430 while the piercing element 440 is received in the opening 437.

[0107] The outer and inner shrouds 420, 430 may include a track and pin system to guide the movement of the outer shroud 420. The outer shroud 420 may comprise one or more pins 425 extending radially inwardly from its cylindrical outer wall 423. The inner shroud 430 may include one or more tracks 436 corresponding to the one or more pins 425. An exemplary track 436 and the path guided by the track 436 are shown in FIGS. 13A-13D. At first, the cap outer frame 410 and the outer shroud 420 are in a first position P1. The first position P1 may be considered a rest position. The guide track may comprise a first portion and a second portion. The guide track may comprise a second position P2, which may be a piercing position of the piercing element. The first portion may define a first distance between the first position P1 and a second position P2. The first portion may define a third position P3. The third position P3 may be a use position. The second portion may define a second distance between the third position P3 and a fourth position P4. The second distance may be shorter than the first distance. The first portion may guide the track pin in an axial direction and in a radial direction. A force may be applied to the cap outer frame 410 and the outer shroud 420, for example, the cap 410 may be pressed down (for

example, by a user) to move the pin from the first position P1 to the second position P2 (see arrow in FIG. 13A), where the piercing element 440 engages and pierces the cartridge 200. When the force removed, for example, when pressure is released from (for example, the user lets go of) the cap outer frame 410 and the outer shroud 420, the compression spring 470 returns the cap outer frame 410 and the outer shroud 420 up to a third position P3. The movement of the cap during the initial pushing down of the cap to pierce the cartridge and the release of the cap to allow the cap to return to the third (use) position is defined by the first portion of the track. In the third position P3, an airflow path is open through the openings formed in the cartridge 200, and is open between an exterior of the shisha device and the vessel. To release and remove the cap 400, the user may again press on the cap outer frame 410, causing the cap outer frame 410 and the outer shroud 420 to move to a fourth position P4, from where the compression spring 470 returns the cap outer frame 410 and the outer shroud 420 to the initial first position P1. The movement of the cap during the second instance of pushing down on the cap to release the cap is defined by the second portion of the track.

[0108] The operation of the shisha device 100 and the cap 400 and piercing assembly 401 are also schematically shown in FIG. 14. The shisha device 100 includes an aerosol-generating element 130 with a receptacle 140 configured to receive a cartridge 200 comprising an aerosol-forming substrate. The aerosol-generating element 130 may also include a heating element 160. The heating element 160 may form a part of the receptacle 140. A user may begin by placing the cartridge 200 in the receptacle 140 (step 1) and placing the cap 400 onto the cartridge 200 (step 2) such that the cartridge 200 is received in the inner shroud 430. If the cap includes a grip element 450, the top of the cartridge 200 may slide past the grip element 450 such that the grip fingers 452 grip the cartridge 200. The user may then push on the cap to pierce the cartridge 200 (step 3). After letting go of the cap 400, the spring 470 pushes the cap frame 410 and outer shroud 420 up into the operating position (step 4). In the operating position, the air path through the cartridge 200 is open, and the user may use the shisha device as usual. After using the shisha device, the user may push on the cap 400 again to release the cap (step 5). The track-and-pin system will guide the motion of the cap 400, allowing the spring 470 to return the cap 400 to its beginning position (step 6). The user may then remove the cap 400 from the device (step 7).

[0109] Thus, piercing systems for shisha devices are described. Various modifications and variations of the invention will be apparent to those skilled in the art without departing from the scope 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, chemical arts, and aerosol-generating article manufacturing or related fields are intended to be within the scope of the following claims.

Claims

1. An aerosol-generating device (100) comprising:

an aerosol-generating element (130) comprising a body and a receptacle (140) for receiving a cartridge (200) comprising an aerosol-forming substrate;
a vessel (17) having a liquid fill level and defining a head space outlet above the liquid fill level;
a conduit (190) for conveying airflow from the receptacle to the vessel; and
a cap (400) engageable with the body, the cap comprising:

a frame (410) comprising a cavity (419) and having a center axis, wherein the cavity is arranged for receiving the cartridge; and
a piercing element (440) disposed within the cavity and configured to pierce a wall of the cartridge,

wherein the cap is movable, relative to the body, between a first position (P1) and a second position (P2), between the second position and a third position (P3), and between the third position and the first position, and
wherein the third position is an intermediate position between the first and second positions, in which an air path between an external environment, the cavity, and the receptacle is open.

2. The aerosol-generating device according to claim 1, wherein the cap frame comprises a side wall, an open end, and a closed end comprising an end wall, wherein the center axis extends from the open end to the closed end, and wherein the piercing element is oriented to face toward the open end.

3. The aerosol-generating device according to claim 2, wherein the piercing element is disposed adjacent the closed end.

4. The aerosol-generating device according to any of the preceding claims, wherein the piercing element is coaxial with the center axis.

5. The aerosol-generating device according to any of the preceding claims, the cap further comprising a spring element biasing the piercing element away from the receptacle.

6. The aerosol-generating device according to any of the preceding claims,

   wherein in the first position, the piercing element is not engaged with the cartridge received in the receptacle, and
   wherein in the second position, the piercing element is engaged with the cartridge received in the receptacle to pierce the cartridge.

7. The aerosol-generating device according to any of the preceding claims, the cap further comprising an outer shroud and an inner shroud disposed within the outer shroud,
   wherein the outer shroud comprises the piercing element and wherein the inner shroud defines the cavity, and wherein the outer shroud is axially movable relative to the inner shroud.

8. The aerosol-generating device according to claim 7, wherein the inner shroud comprises a cylindrical side wall coaxial with the center axis, and an end wall at one end of the cylindrical side wall, the end wall comprising an opening configured to receive the piercing element.

9. The aerosol-generating device according to claim 8, wherein when the piercing element is received in the end wall opening and the cap is in the third position, a gap configured to allow airflow through the opening of the end wall of the inner shroud remains between the piercing element and the end wall of the inner shroud.

10. The aerosol-generating device according to any of claims 7 to 9, wherein the inner shroud comprises one or more guide tracks and the outer shroud comprises one or more track pins configured to cooperate with the one or more guide tracks.

11. The aerosol-generating device according to claim 10, wherein each of the one or more guide tracks comprise a first portion and a second portion, the first portion defining a first distance and the second portion defining a second distance that is shorter than the first distance.

12. The aerosol-generating device according to claim 11, wherein the first portion is configured to guide the track pin in an axial direction and in a radial direction.

13. The aerosol-generating device according to claim 11 or 12, wherein an end position of the first portion defines a piercing position of the piercing element.

14. The aerosol-generating device according to any of the preceding claims, wherein the aerosol-generating device comprises a second piercing element in a base of the receptacle of the body, wherein the second piercing element extends from the base of the receptacle into the receptacle in a direction away from the base of the receptacle.

Patentansprüche

1. Aerosolerzeugungsvorrichtung (100), aufweisend:

   ein aerosolerzeugendes Element (130), umfassend einen Körper und eine Aufnahme (140) zum Aufnehmen einer Patrone (200), umfassend ein aerosolbildendes Substrat;
   einen Behälter (17), aufweisend einen Flüssigkeitsfüllstand und einen Kopfraumauslass oberhalb des Flüssigkeitsfüllstandes definierend;
   eine Leitung (190) zum Fördern des Luftstroms von der Aufnahme zu dem Behälter; und
   eine mit dem Körper in Eingriff bringbare Kappe (400), die Kappe umfassend:

      einen Kragen (410), umfassend einen Hohlraum (419) und eine Mittelachse umfassend, wobei der Hohlraum zum Aufnehmen der Patrone angeordnet ist; und
      ein Durchstechelement (440), das innerhalb des Hohlraums angeordnet und so konfiguriert ist, dass es eine Wand der Kartusche durchsticht,

   wobei die Kappe, in Bezug auf den Körper, zwischen einer ersten Position (P1) und einer zweiten Position (P2), zwischen der zweiten Position und einer dritten Position (P3) und zwischen der dritten Position und der ersten Position beweglich ist, und
   wobei die dritte Position eine Zwischenposition zwischen der ersten und der zweiten Position ist, in der ein Luftpfad zwischen einer äußeren Umgebung, dem Hohlraum und der Aufnahme offen ist.

2. Aerosolerzeugungsvorrichtung nach Anspruch 1, wobei der Kappenkragen eine Seitenwand, ein offenes Ende und ein geschlossenes Ende umfasst, das eine Endwand umfasst, wobei sich die Mittelachse von dem offenen Ende zu dem geschlossenen Ende erstreckt, und wobei das Durchstechelement derart ausgerichtet ist, dass es in Richtung des offenen Endes weist.

3. Aerosolerzeugungsvorrichtung nach Anspruch 2, wobei das Durchstechelement angrenzend an das geschlossene Ende angeordnet ist.

4. Aerosolerzeugungsvorrichtung gemäß einem belie-

bigen der vorhergehenden Ansprüche, wobei das Durchstechelement koaxial zu der Mittelachse ist.

5. Aerosolerzeugungsvorrichtung gemäß einem beliebigen der vorhergehenden Ansprüche, wobei die Kappe ferner ein Federelement umfasst, welches das Durchstechelement von der Aufnahme weg vorspannt.

6. Aerosolerzeugungsvorrichtung gemäß einem beliebigen der vorhergehenden Ansprüche,

wobei das Durchstechelement in der ersten Position nicht mit der in der Aufnahme aufgenommenen Patrone in Eingriff ist, und
wobei in der zweiten Position das Durchstechelement mit der in der Aufnahme aufgenommenen Patrone in Eingriff ist, um die Patrone zu durchstechen.

7. Aerosolerzeugungsvorrichtung gemäß einem beliebigen der vorhergehenden Ansprüche, wobei die Kappe ferner eine äußere Ummantelung und eine innere Ummantelung, die innerhalb der äußeren Ummantelung angeordnet ist, umfasst,
wobei die äußere Ummantelung das Durchstechelement umfasst und wobei die innere Ummantelung den Hohlraum definiert, und wobei die äußere Ummantelung relativ zu der inneren Ummantelung axial beweglich ist.

8. Aerosolerzeugungsvorrichtung nach Anspruch 7, wobei die innere Ummantelung eine zylindrische Seitenwand, die koaxial zu der Mittelachse ist, und eine Endwand an einem Ende der zylindrischen Seitenwand umfasst, wobei die Endwand eine Öffnung umfasst, die konfiguriert ist, das Durchstechelement aufzunehmen.

9. Aerosolerzeugungsvorrichtung nach Anspruch 8, wobei, wenn das Durchstechelement in der Endwandöffnung aufgenommen ist und sich die Kappe in der dritten Position befindet, ein Spalt, der so konfiguriert ist, dass er einen Luftstrom durch die Öffnung der Endwand der inneren Ummantelung hindurch ermöglicht, zwischen dem Durchstechelement und der Endwand der inneren Ummantelung verbleibt.

10. Aerosolerzeugungsvorrichtung nach einem der Ansprüche 7 bis 9, wobei die innere Ummantelung eine oder mehrere Führungsspuren umfasst und die äußere Ummantelung einen oder mehrere zum Zusammenwirken mit der einen oder den mehreren Führungsspuren ausgelegte Führungsstifte umfasst.

11. Aerosolerzeugungsvorrichtung nach Anspruch 10, wobei jede der einen oder mehreren Führungsspuren einen ersten Abschnitt und einen zweiten Abschnitt umfasst, wobei der erste Abschnitt einen ersten Abstand definiert und der zweite Abschnitt einen zweiten Abstand definiert, der kürzer als der erste Abstand ist.

12. Aerosolerzeugungsvorrichtung nach Anspruch 11, wobei der erste Abschnitt konfiguriert ist, den Führungsstift in einer axialen Richtung und in einer radialen Richtung zu führen.

13. Aerosolerzeugungsvorrichtung nach Anspruch 11 oder 12, wobei eine Endposition des ersten Abschnitts eine Durchstechposition des Durchstechelements definiert.

14. Aerosolerzeugungsvorrichtung gemäß einem beliebigen der vorhergehenden Ansprüche, wobei die Aerosolerzeugungsvorrichtung ein zweites Durchstechelement in einer Basis der Aufnahme des Körpers umfasst, wobei sich das zweite Durchstechelement von der Basis der Aufnahme in einer Richtung weg von der Basis der Aufnahme in die Aufnahme erstreckt.

Revendications

1. Dispositif de génération d'aérosol (100) comprenant :

un élément de génération d'aérosol (130) comprenant un corps et un réceptacle (140) destiné à recevoir une cartouche (200) comprenant un substrat formant aérosol ;
un récipient (17) ayant un niveau de remplissage de liquide et définissant une sortie d'espace de tête au-dessus du niveau de remplissage de liquide ;
un conduit (190) destiné à acheminer un écoulement d'air depuis le réceptacle jusqu'au récipient ; et
un capuchon (400) pouvant venir en prise avec le corps, le capuchon comprenant :

un cadre (410) comprenant une cavité (419) et ayant un axe central, dans lequel la cavité est agencée pour recevoir la cartouche ; et
un élément de perçage (440) disposé au sein de la cavité et configuré pour percer une paroi de la cartouche,

dans lequel le capuchon est mobile, par rapport au corps, entre une première position (P1) et une deuxième position (P2), entre la deuxième position et une troisième position (P3), et entre la troisième position et la première position, et

dans lequel la troisième position est une position intermédiaire entre les première et deuxième positions, dans laquelle un trajet d'air entre un environnement externe, la cavité et le réceptacle est ouvert.

2. Dispositif de génération d'aérosol selon la revendication 1, dans lequel le cadre de capuchon comprend une paroi latérale, une extrémité ouverte, et une extrémité fermée comprenant une paroi d'extrémité, dans lequel l'axe central s'étend de l'extrémité ouverte à l'extrémité fermée, et dans lequel l'élément de perçage est orienté pour être tourné vers l'extrémité ouverte.

3. Dispositif de génération d'aérosol selon la revendication 2, dans lequel l'élément de perçage est disposé adjacent à l'extrémité fermée.

4. Dispositif de génération d'aérosol selon l'une quelconque des revendications précédentes, dans lequel l'élément de perçage est coaxial à l'axe central.

5. Dispositif de génération d'aérosol selon l'une quelconque des revendications précédentes, le capuchon comprenant en outre un élément à ressort sollicitant l'élément de perçage en éloignement du réceptacle.

6. Dispositif de génération d'aérosol selon l'une quelconque des revendications précédentes,

dans lequel dans la première position, l'élément de perçage n'est pas en prise avec la cartouche reçue dans le réceptacle, et
dans lequel dans la deuxième position, l'élément de perçage est en prise avec la cartouche reçue dans le réceptacle pour percer la cartouche.

7. Dispositif de génération d'aérosol selon l'une quelconque des revendications précédentes, le capuchon comprenant en outre un carénage extérieur et un carénage intérieur disposé au sein du carénage extérieur,
dans lequel le carénage extérieur comprend l'élément de perçage et dans lequel le carénage intérieur définit la cavité, et dans lequel le carénage extérieur est axialement mobile par rapport au carénage intérieur.

8. Dispositif de génération d'aérosol selon la revendication 7, dans lequel le carénage intérieur comprend une paroi latérale cylindrique coaxiale à l'axe central, et une paroi d'extrémité au niveau d'une extrémité de la paroi latérale cylindrique, la paroi d'extrémité comprenant une ouverture configurée pour recevoir l'élément de perçage.

9. Dispositif de génération d'aérosol selon la revendication 8, dans lequel, lorsque l'élément de perçage est reçu dans l'ouverture de paroi d'extrémité et le capuchon est dans la troisième position, un écartement configuré pour permettre un écoulement d'air à travers l'ouverture de la paroi d'extrémité du carénage intérieur reste entre l'élément de perçage et la paroi d'extrémité du carénage intérieur.

10. Dispositif de génération d'aérosol selon l'une quelconque des revendications 7 à 9, dans lequel le carénage intérieur comprend une ou plusieurs pistes de guidage et le carénage extérieur comprend une ou plusieurs tiges de piste configurées pour coopérer avec les une ou plusieurs pistes de guidage.

11. Dispositif de génération d'aérosol selon la revendication 10, dans lequel chacune des une ou plusieurs pistes de guidage comprend une première portion et une deuxième portion, la première portion définissant une première distance et la deuxième portion définissant une deuxième distance qui est plus courte que la première distance.

12. Dispositif de génération d'aérosol selon la revendication 11, dans lequel la première portion est configurée pour guider la tige de piste dans une direction axiale et dans une direction radiale.

13. Dispositif de génération d'aérosol selon la revendication 11 ou 12, dans lequel une position d'extrémité de la première portion définit une position de perçage de l'élément de perçage.

14. Dispositif de génération d'aérosol selon l'une quelconque des revendications précédentes, dans lequel le dispositif de génération d'aérosol comprend un deuxième élément de perçage dans une base du réceptacle du corps, dans lequel le deuxième élément de perçage s'étend depuis la base du réceptacle jusque dans le réceptacle dans une direction en éloignement de la base du réceptacle.

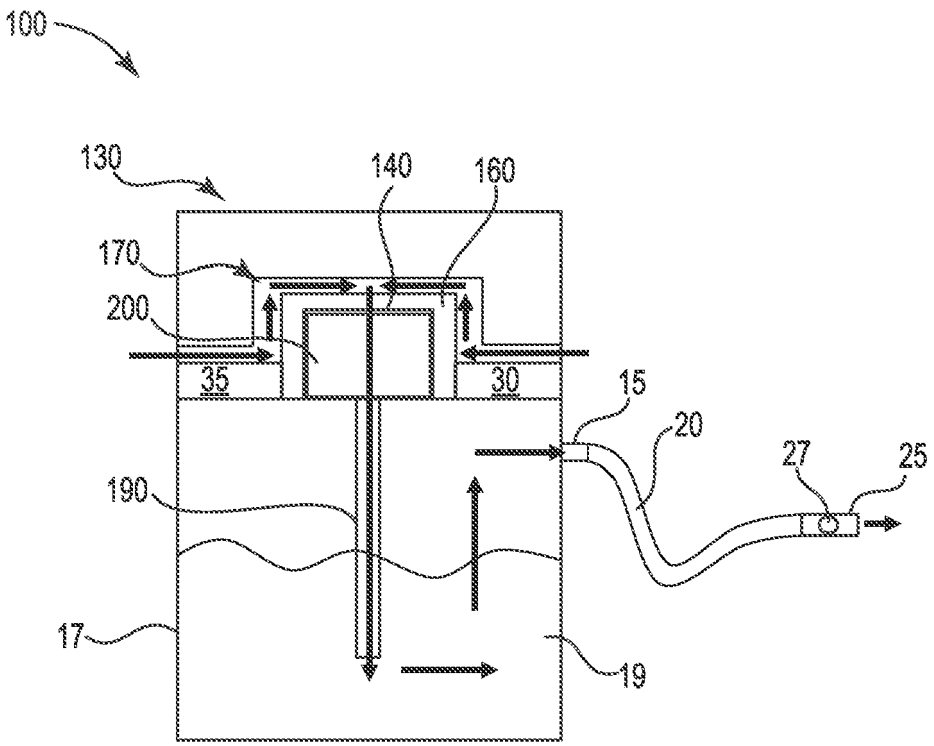

FIG. 1

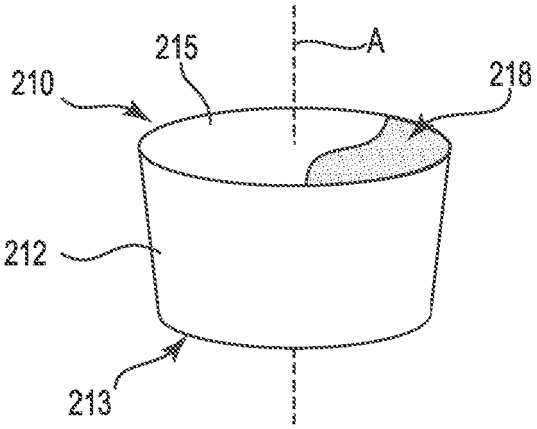

FIG. 2A

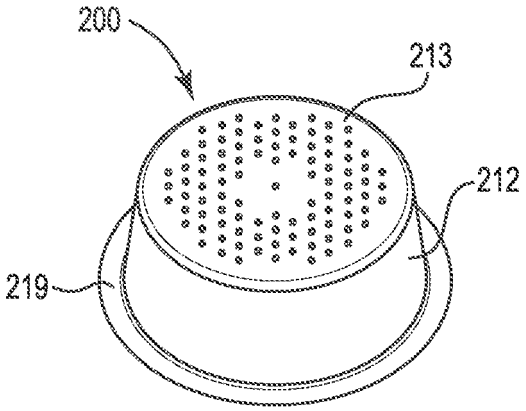

FIG. 2B

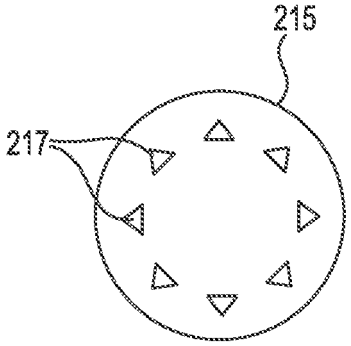

FIG. 3A

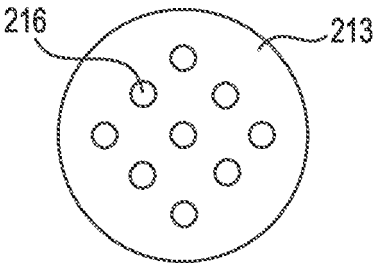

FIG. 3B

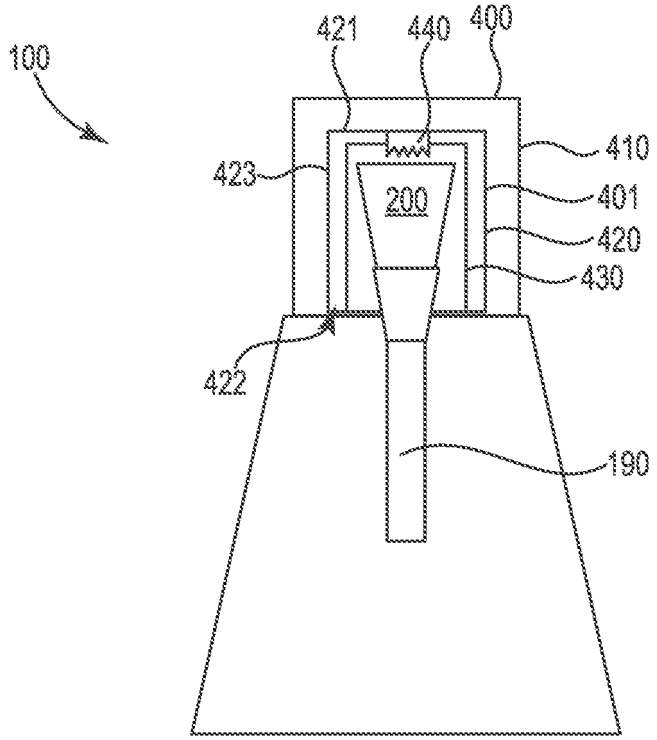

FIG. 4A

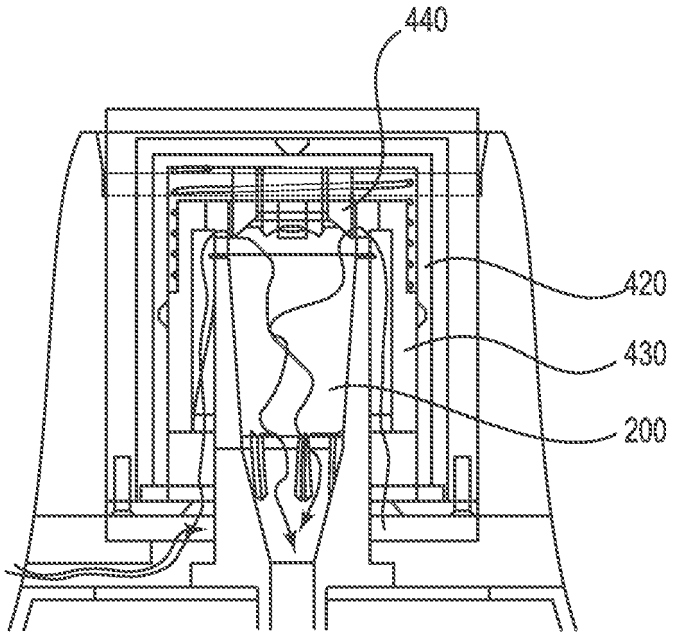

FIG. 4B

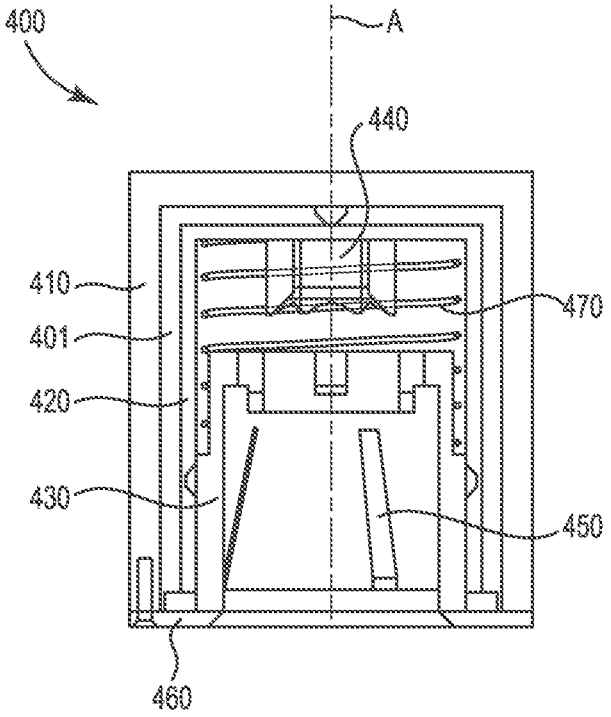
400
A
440
410
401
420
430
470
450
460

FIG. 5A

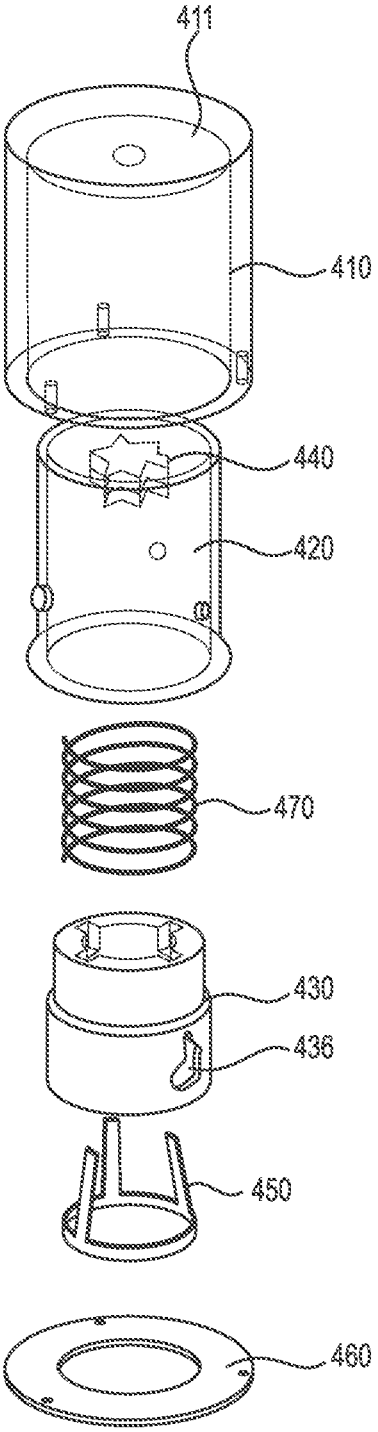
411
410
440
420
470
430
436
450
460

FIG. 5B

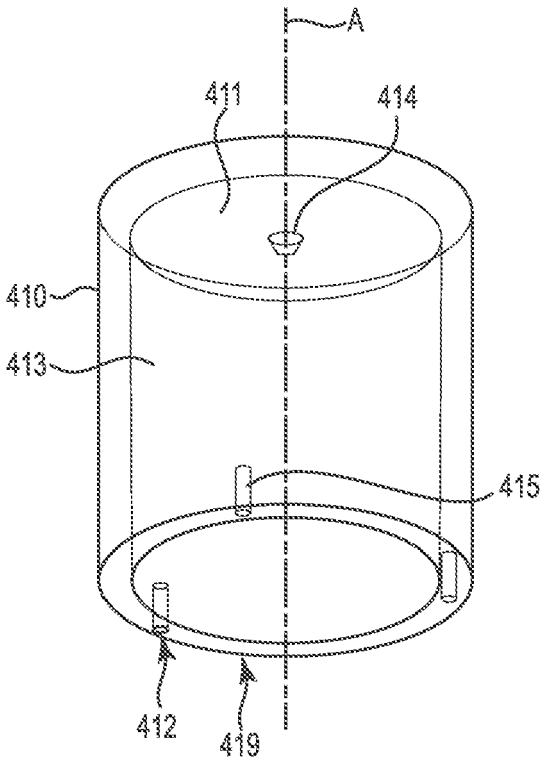

FIG. 6

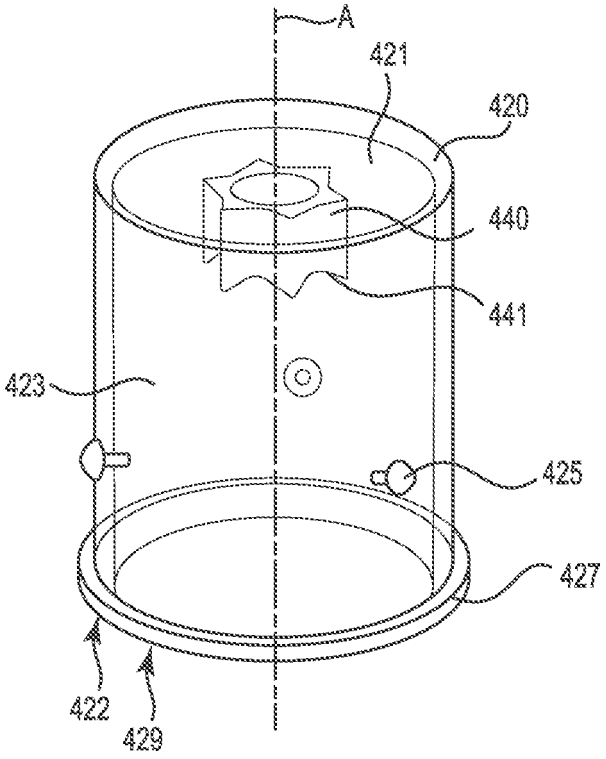

FIG. 7

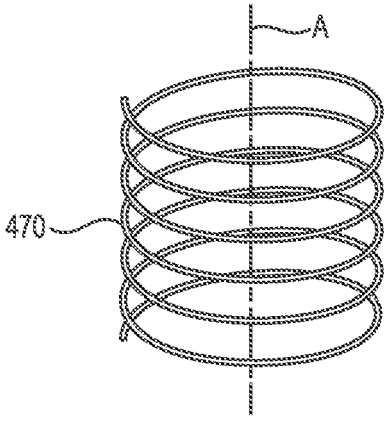

FIG. 8

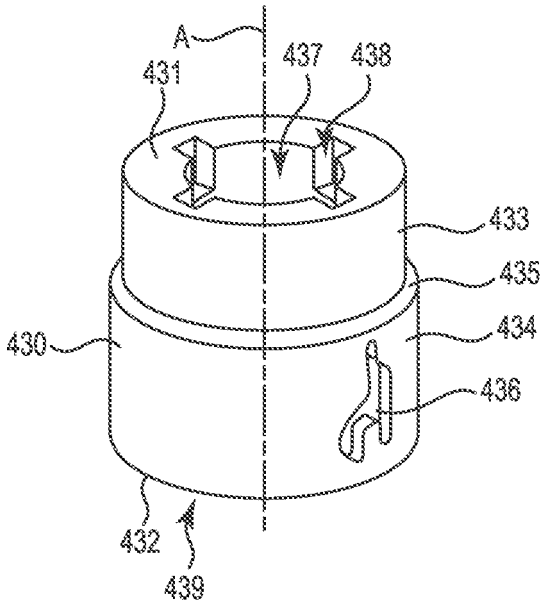

FIG. 9

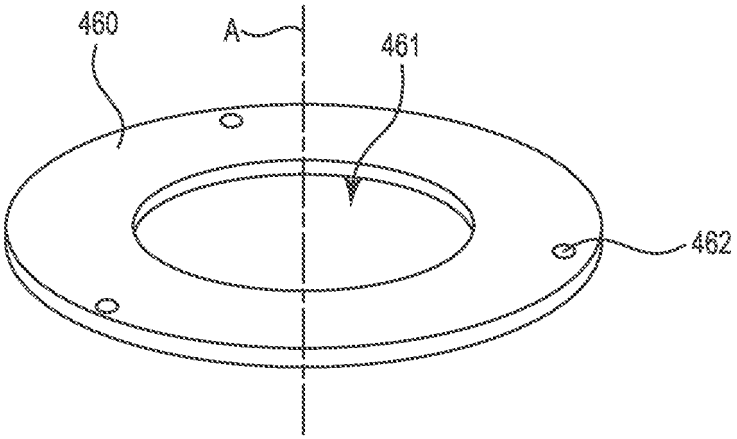

FIG. 10

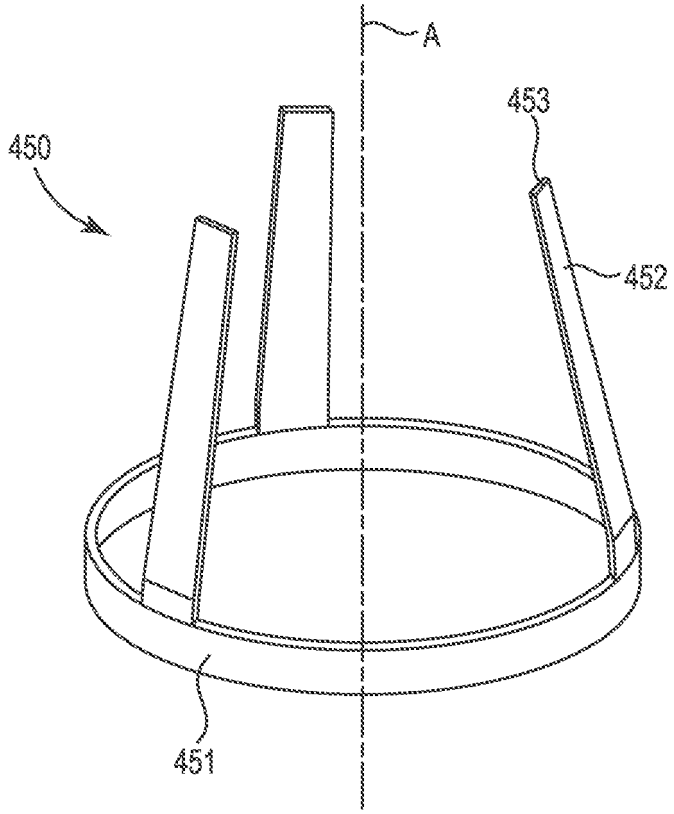

FIG. 11

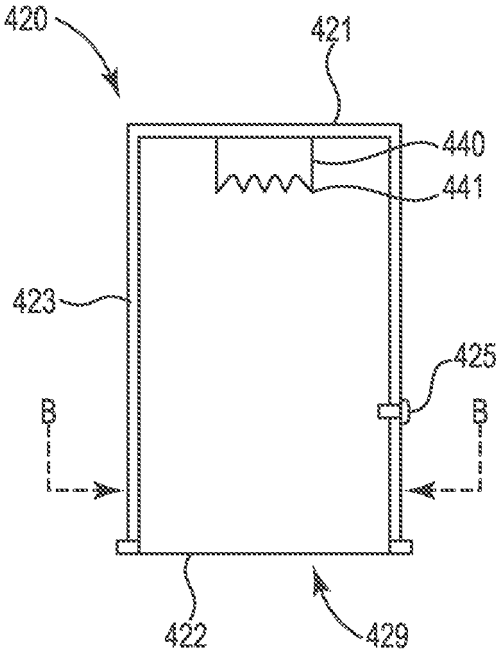

FIG. 12A

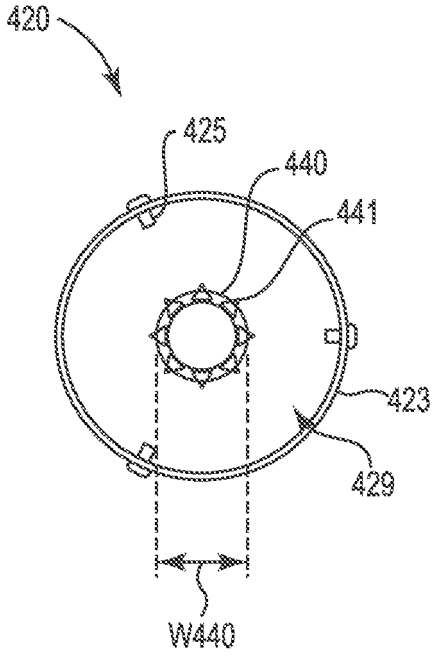

FIG. 12B

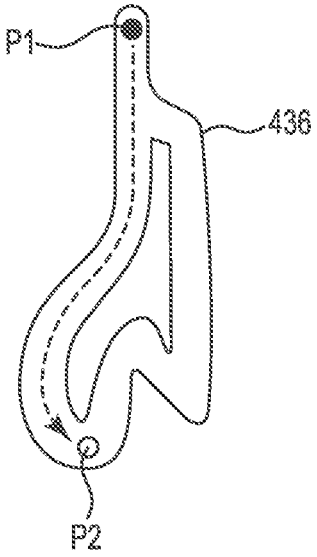

FIG. 13A

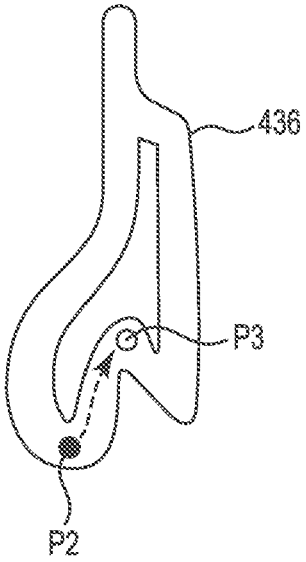

FIG. 13B

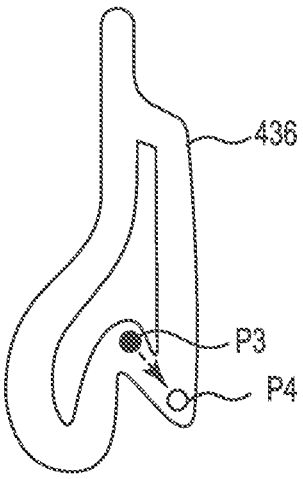

FIG. 13C

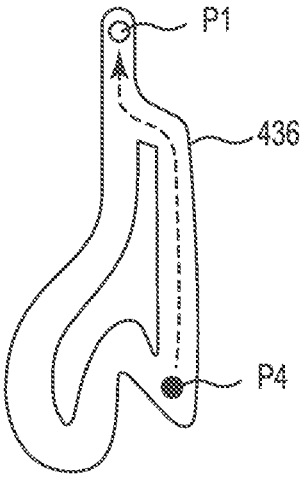

FIG. 13D

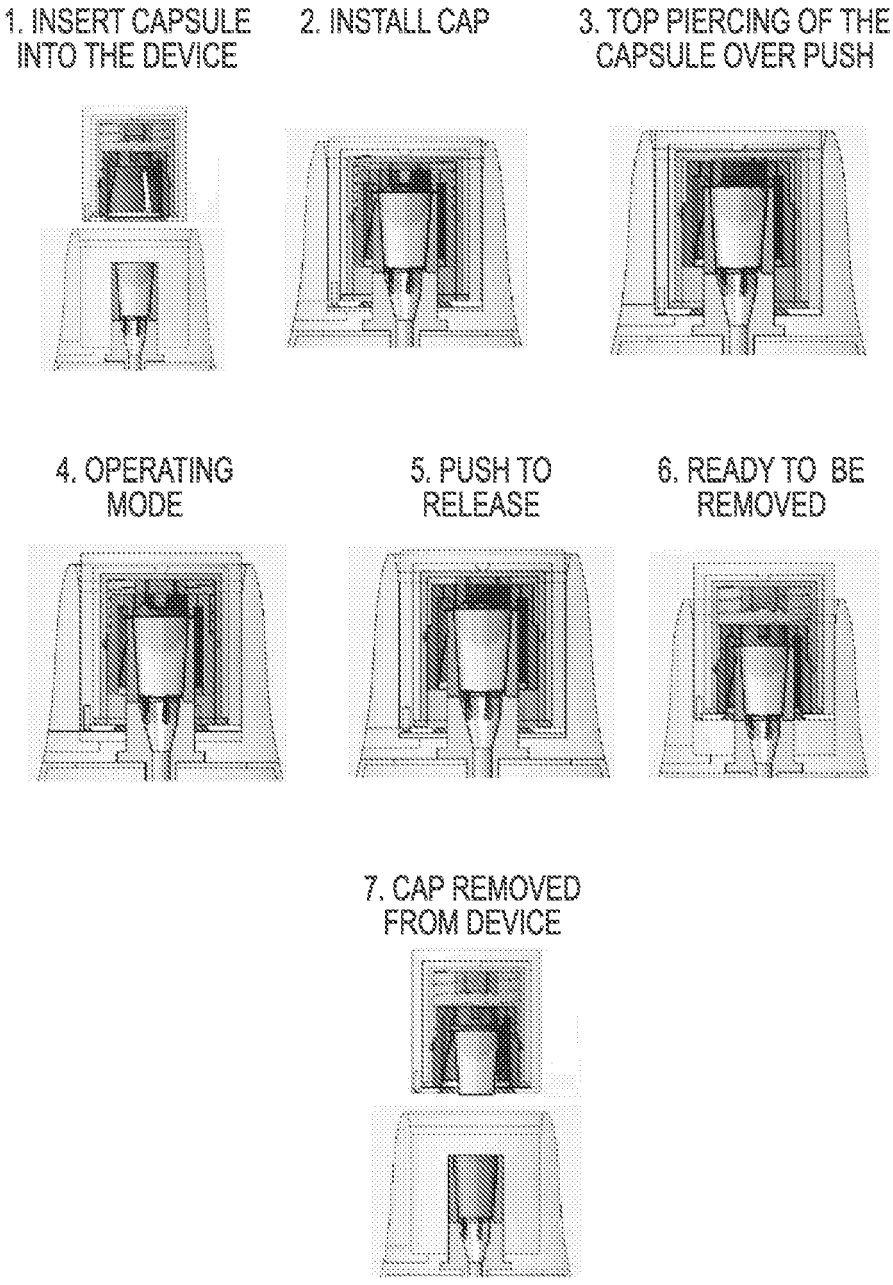
1. INSERT CAPSULE INTO THE DEVICE
2. INSTALL CAP
3. TOP PIERCING OF THE CAPSULE OVER PUSH
4. OPERATING MODE
5. PUSH TO RELEASE
6. READY TO BE REMOVED
7. CAP REMOVED FROM DEVICE

FIG. 14

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 3216357 A **[0010]**