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(54) **AEROSOL PROVISION DEVICE**

(57) An aerosol provision device (100) is provided for generating an aerosol from aerosol generating material. The aerosol provision device has a receptacle (116) defining a heating zone (114) configured to receive at least a portion of an article (200) comprising aerosol generating material. The aerosol provision device also has a flexible coil configuration (110) comprising a flexible support (122) extending around at least a portion of the receptacle (116), an inductor coil (126) formed on the flexible support; and a resistive heating coil (124) formed on the flexible support.

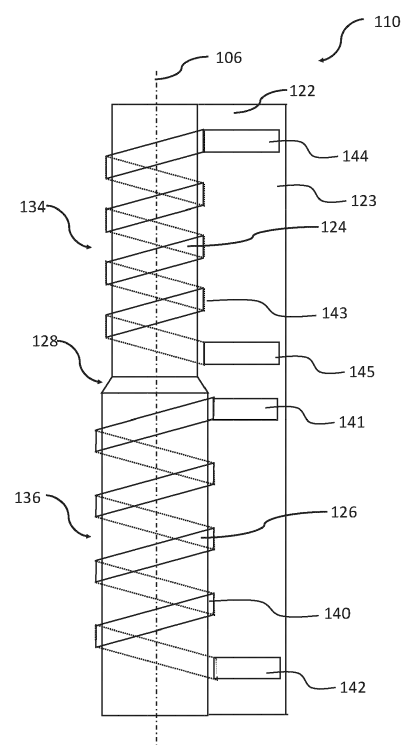


FIG. 3

Description

Technical Field

[0001] The present invention relates to an aerosol provision device for generating an aerosol from aerosol generating material. The present invention also relates to a blank of a flexible coil configuration for an aerosol provision device, an aerosol provision system, and a method of assembling an aerosol provision device.

Background

[0002] Smoking articles such as cigarettes, cigars and the like burn tobacco during use to create tobacco smoke. Attempts have been made to provide alternatives to these articles by creating products that release compounds without combusting. Examples of such products are so-called "heat not burn" products or tobacco heating devices or products, which release compounds by heating, but not burning, material. The material may be, for example, tobacco or other non-tobacco products, which may or may not contain nicotine.

Summary

[0003] In accordance with some embodiments described herein, there is provided an aerosol provision device for generating aerosol from aerosol generating material, the aerosol provision device comprising a receptacle defining a heating zone configured to receive at least a portion of an article comprising aerosol generating material, and a flexible coil configuration comprising a flexible support extending around at least a portion of the receptacle, an inductor coil formed on the flexible support, and a resistive heating coil formed on the flexible support.

[0004] The aerosol provision device may comprise a heating element.

[0005] The receptacle may comprise the heating element.

[0006] The flexible coil configuration may extend around at least a portion of the heating element.

[0007] The heating element may be tubular.

[0008] The heating element may define at least a portion of the receptacle.

[0009] At least one of the inductor coil and the resistive heating coil may be helical. Each of the inductor coil and the resistive heating coil may be helical.

[0010] The inductor coil may extend around at least a portion of the heating element.

[0011] The resistive heating coil may extend around at least a portion of the heating element.

[0012] The inductor coil may extend around at least a portion of the receptacle. The resistive heating coil may extend around at least a portion of the receptacle. The resistive heating coil may be configured to heat the heating element by conduction. The heating element

may be configured to conduct heat from the resistive heating coil to the heating zone.

[0013] The heating element may comprise material heatable by penetration with a varying magnetic field generated by the inductor coil. The heating element may be configured to directly transfer heat to the heating zone.

[0014] The flexible support may comprise an inductor coil portion and a resistive heating coil portion. The resistive heating coil portion of the heating element may be configured to conduct heat from the resistive heating coil to the heating zone and the inductor coil portion of the heating element may be configured to generate heat by penetration with the varying magnetic field generated by the inductor coil to heat the heating zone.

[0015] A spacing between the inductor coil portion and the receptacle may be greater than the resistive heating coil portion and the receptacle.

[0016] A spacing between the inductor coil portion and the heating zone may be greater than the resistive heating coil portion and the heating zone.

[0017] A spacing between the inductor coil portion and the heating element may be greater than the resistive heating coil portion and the heating element.

[0018] The resistive heating coil portion of the flexible support may be in contact with the receptacle. The resistive heating coil portion of the flexible support may be in contact with the heating element. The inductor coil portion of the flexible support may be spaced from the receptacle. The inductor coil portion of the flexible support may be radially spaced from the receptacle.

[0019] The inductor coil portion of the flexible support may be spaced from the receptacle by about 0.5 mm to 2.5 mm, and optionally about 1.0 mm to 1.5 mm. The inductor coil portion of the flexible support may be radially spaced from the receptacle by about 0.5 mm to 2.5 mm, and optionally about 1.0 mm to 1.5 mm. An insulating material may be disposed between the inductor coil portion and the receptacle. An insulating material may be disposed between the inductor coil portion and the heating zone. The insulating material may space the inductor coil portion from the receptacle. The insulating material may space the inductor coil portion from the heating zone.

[0020] The flexible support may comprise a transition section between the inductor coil portion and the resistive heating coil portion. The transition portion may have an external cross section that increases between the resistive heating coil portion to the inductor coil portion. The transition section may comprise interruptions in the flexible support. The interruptions may include cut-outs. The interruptions may include a plurality of apertures. The interruptions may include a plurality of slits. The plurality of apertures may be equally spaced and radially aligned along the flexible support.

[0021] The spacing between the inductor coil portion and the heating element may be equal to the spacing

between the resistive heating coil portion and the heating element.

[0022] The spacing between the inductor coil portion and the receptacle may be equal to the spacing between the resistive heating coil portion and the receptacle.

[0023] The spacing between the inductor coil portion and the heating zone may be equal to the spacing between the resistive heating coil portion and the heating zone.

[0024] The resistive heating coil portion of the flexible support may be spaced from the receptacle. The resistive heating coil portion of the flexible support may be radially spaced from the receptacle. The resistive heating coil portion of the flexible support may be spaced from the receptacle by about 0.5 mm to 2.5 mm, and optionally about 1.0 mm to 1.5 mm. The resistive heating coil portion of the flexible support may be radially spaced from the receptacle by about 0.5 mm to 2.5 mm, and optionally about 1.0 mm to 1.5 mm. A thermally conductive member may be disposed between the resistive heating coil portion and the receptacle.

[0025] The inductor coil may be printed on the flexible support. The resistive heating coil may be printed on the flexible support.

[0026] The inductor coil may be printed on one side of the flexible support. The resistive heating coil may be printed on one side of the flexible support. The side on which the inductor and/or resistive heating coil is printed on may be the inner or outer side of the flexible support. The inductor coil may be printed on the same side of the flexible support as the resistive heating coil. The inductor coil may be printed on the opposite side of the flexible support to the resistive heating coil. The inductor coil may be printed on each side of the flexible support. The resistive heating coil may be printed on each side of the flexible support. The coil portions printed on each side of the flexible support may be electrically connected with each other. The coil portions printed on each side of the flexible support may be free from being electrically connected with each other.

[0027] The inductor coil and resistive heating coil may extend along concentric longitudinal axes. The inductor coil and resistive heating coil may be spaced from each other. The inductor coil may be a helical coil. The resistive heating coil may be a helical coil.

[0028] The flexible support may be configured to be rolled around the heating element forming a tubular member. The inductor coil may form a helical coil arrangement when the flexible support is rolled into a tubular member. The resistive heating coil may form a helical coil arrangement when the flexible support is rolled into a tubular member.

[0029] The flexible support may have a unitary construction.

[0030] The flexible support may be a film. The film may be a polyamide film. The film thickness may be in the range of between 25 μ m and 150 μ m.

[0031] The resistive heating coil may be formed on one

or both sides of the flexible support. The resistive heating coil may be formed on one or both sides of the resistive heating coil portion of the flexible support. The inductor coil may be formed on one or both sides of the flexible support. The inductor coil may be formed on one or both sides of the inductor coil portion of the flexible support.

[0032] The flexible support may have a generally constant thickness of about 0.2 mm to 0.8 mm. The inductor coil may have a generally constant thickness of about 0.1 mm to 0.5 mm. The resistive heating coil may have a generally constant thickness of about 0.1 mm to 0.5 mm.

[0033] The flexible support may be a film. The heating element may be a susceptor.

[0034] The aerosol provision device may comprise a flexible circuit board comprising the flexible coil configuration.

[0035] The aerosol provision device may comprise a controller configured to control activation of the inductor coil and the resistive heating coil. The controller may be configured to operate the inductor coil to act as a magnetic field generator. The controller may be configured to operate the resistive heating coil to act as a resistive heating element. The controller may be configured to supply an alternating current to the inductor coil. The controller may be configured to supply an alternating or constant current to the resistive heating coil.

[0036] In accordance with some embodiments described herein, there is provided a blank of a flexible coil configuration for an aerosol provision device, the flexible coil configuration comprising a flexible support configured to be formed into a tubular arrangement, an inductor coil formed on the flexible support, and a resistive heating coil formed on the flexible support.

[0037] The inductor coil may be a helical coil. The resistive heating coil may be a helical coil.

[0038] The electrically conductive path may be formed on the flexible support as a plurality of electrically conductive portions discontinuously formed on the flexible support. Each electrically conductive portion discontinuously formed on the flexible support may be spaced apart from adjacent portions of the plurality of electrically conductive portions discontinuously formed on the flexible support.

[0039] The plurality of electrically conductive portions discontinuously formed on the flexible support may be connected together via a plurality of connections.

[0040] Each connection may be formed by a cut-out in the flexible support.

[0041] Each connection may connect two adjacent electrically conductive portions discontinuously formed on the flexible support. The two adjacent electrically conductive portions discontinuously formed on the flexible support may be soldered together via the connection. The connection may be solder.

[0042] The electrically conductive path may comprise a plurality of electrically parallel conductive tracks. The plurality of electrically parallel conductive tracks may be arranged in an electrically parallel configuration. The

electrically conductive path may comprise between 7 and 25 electrically parallel conductive tracks. The electrically parallel conductive tracks may comprise between 7 and 25 parallel conductive tracks on each side of the flexible support. The electrically parallel conductive tracks may

comprise between 14 and 50 parallel conductive tracks.

[0043] Each electrically parallel conductive track may have a width of between 100 μ m and 250 μ m.

[0044] The plurality of electrically parallel conductive tracks may define an active width of the electrically conductive path, and the active width may be between 1mm and 4mm.

[0045] The plurality of parallel conductive tracks may comprise a first series of parallel conductive tracks formed on a first side of the flexible support and a second series of parallel conductive tracks formed on a second, opposite side of the flexible support. The first series of parallel conductive tracks may overlap the second series of parallel conductive tracks.

[0046] The plurality of parallel conductive tracks may comprise a first conductive track formed on a first side of the flexible support and a second conductive track formed on a second, opposite side of the flexible support. The first conductive track formed on the first side of the flexible support may overlap the second conductive track formed on the second side of the flexible support. The first conductive track may be a single track. The second conductive track may be a single track. The first conductive track may be electrically parallel to the second conductive track along at least part of their length.

[0047] The plurality of parallel conductive tracks may be electrically insulated from each other along at least part of their length.

[0048] Each connection may connect two adjacent discontinuous portions. The connection may be configured to connect adjacent discontinuous portions when the flexible support is rolled around the receptacle such as to form a closed electrical circuit.

[0049] In accordance with some embodiments described herein, there is provided an aerosol provision system comprising the aerosol provision device as described in any of the above and an article comprising aerosol generating material.

[0050] In accordance with some embodiments described herein, there is provided a method of assembling an aerosol provision device, the method comprising providing a receptacle defining a heating zone configured to receive at least a portion of an article comprising aerosol generating material, and disposing a flexible coil configuration around at least a portion of the receptacle wherein the flexible coil configuration comprises a flexible support, an inductor coil formed on the flexible support; and a resistive heating coil formed on the flexible support.

Brief Description of the Drawings

[0051] Embodiments of the invention will now be described, by way of example only, with reference to ac-

companying drawings, in which:

Figure 1 shows a schematic view of an aerosol provision system;

Figure 2 shows a schematic view of an aerosol provision device;

Figure 3 shows a schematic view of a flexible coil configuration;

Figure 4 shows a schematic view of a blank of the flexible coil configuration ;

Figure 5 shows a schematic side view of the flexible coil configuration;

Figure 6 shows a schematic cross-sectional view of the resistive heating coil portion of the flexible coil configuration;

Figure 7 shows a schematic cross-sectional view of the inductor coil portion of the flexible coil configuration; and

Figure 8 shows a flowchart illustrating a method of assembling a flexible coil configuration.

Detailed Description

[0052] As used herein, the term "delivery mechanism" is intended to encompass systems that deliver a substance to a user, and includes: non-combustible aerosol provision systems that release compounds from an aerosolisable material without combusting the aerosolisable material, such as electronic cigarettes, tobacco heating products, and hybrid systems to generate aerosol using a combination of aerosolisable materials; and articles comprising aerosolisable material and configured to be used in one of these non-combustible aerosol provision systems.

[0053] According to the present disclosure, a "non-combustible" aerosol provision system is one where a constituent aerosol-generating material of the aerosol provision system (or component thereof) is not combusted or burned in order to facilitate delivery of at least one substance to a user.

[0054] In some embodiments, the delivery system is a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system.

[0055] In some embodiments, the non-combustible aerosol provision system is an electronic cigarette, also known as a vaping device or electronic nicotine delivery system (END), although it is noted that the presence of nicotine in the aerosol-generating material is not a requirement.

[0056] In some embodiments, the non-combustible aerosol provision system is an aerosol-generating material heating system, also known as a heat-not-burn system. An example of such a system is a tobacco heating system.

[0057] In some embodiments, the non-combustible aerosol provision system is a hybrid system to generate aerosol using a combination of aerosol-generating materials, one or a plurality of which may be heated. Each of

the aerosol-generating materials may be, for example, in the form of a solid, liquid or gel and may or may not contain nicotine. In some embodiments, the hybrid system comprises a liquid or gel aerosol-generating material and a solid aerosol-generating material. The solid aerosol-generating material may comprise, for example, tobacco or a non-tobacco product.

[0058] Typically, the non-combustible aerosol provision system may comprise a non-combustible aerosol provision device and a consumable for use with the non-combustible aerosol provision device.

[0059] In some embodiments, the disclosure relates to consumables comprising aerosol-generating material and configured to be used with non-combustible aerosol provision devices. These consumables are sometimes referred to as articles throughout the disclosure.

[0060] In some embodiments, the non-combustible aerosol provision system, such as a non-combustible aerosol provision device thereof, may comprise a power source and a controller. The power source may, for example, be an electric power source or an exothermic power source. In some embodiments, the exothermic power source comprises a carbon substrate which may be energised so as to distribute power in the form of heat to an aerosol-generating material or to a heat transfer material in proximity to the exothermic power source.

[0061] In some embodiments, the non-combustible aerosol provision system may comprise an area for receiving the consumable, an aerosol generator, an aerosol generation area, a housing, a mouthpiece, a filter and/or an aerosol-modifying agent.

[0062] In some embodiments, the consumable for use with the non-combustible aerosol provision device may comprise aerosol-generating material, an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol generator, an aerosol generation area, a housing, a wrapper, a filter, a mouthpiece, and/or an aerosol-modifying agent.

[0063] As used herein, the term "aerosol-generating material" (which is sometimes referred to herein as an aerosolisable material) is a material that is capable of generating aerosol, for example when heated, irradiated or energized in any other way. Aerosol-generating material may, for example, be in the form of a solid, liquid or semi-solid (such as a gel) which may or may not contain an active substance and/or flavourants.

[0064] The aerosol generating material may be a gel layer. The aerosol generating layer may be a solid material layer, such as reconstituted tobacco.

[0065] In some embodiments, the substance to be delivered comprises an active substance (sometimes referred to herein as an active compound).

[0066] The aerosol-generating material may comprise one or more active substances and/or flavours, one or more aerosol-former materials, and optionally one or more other functional material.

[0067] The aerosol-generating material may comprise

a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. Optionally, a solvent, such as water, is also present and one or more other components of the aerosol-generating material may or may not be soluble in the solvent. In some embodiments, the aerosol-generating material is substantially free from botanical material. In particular, in some embodiments, the aerosol-generating material is substantially tobacco free.

[0068] The aerosol-generating material may comprise or be in the form of an aerosol-generating film. The aerosol-generating film may comprise a binder, such as a gelling agent, and an aerosol former. Optionally, a substance to be delivered and/or filler may also be present. The aerosol-generating film may be substantially free from botanical material. In particular, in some embodiments, the aerosol-generating material is substantially tobacco free.

[0069] The aerosol-generating film may have a thickness of about 0.015 mm to about 1 mm. For example, the thickness may be in the range of about 0.05 mm, 0.1 mm or 0.15 mm to about 0.5 mm or 0.3 mm.

[0070] The aerosol-generating film may be continuous. For example, the film may comprise or be a continuous sheet of material.

[0071] The aerosol-generating film may be discontinuous. For example, the aerosol-generating film may comprise one or more discrete portions or regions of aerosol-generating material, such as dots, stripes or lines, which may be supported on a support. In such embodiments, the support may be planar or non-planar.

[0072] In embodiments, the aerosol-generating material comprises a plurality of aerosol-generating films. In embodiments, the aerosol-generating film comprises a plurality of aerosol-generating film regions. Such plurality of aerosol-generating films and/or plurality of aerosol-generating film regions may have different properties, for example at least one of different compositions, thicknesses, density, active substances and/or flavours, one or more aerosol-former materials, and optionally one or more other functional material.

[0073] The aerosol-generating film may be formed by combining a binder, such as a gelling agent, with a solvent, such as water, an aerosol-former and one or more other components, such as one or more substances to be delivered, to form a slurry and then heating the slurry to volatilise at least some of the solvent to form the aerosol-generating film.

[0074] The slurry may be heated to remove at least about 60 wt%, 70 wt%, 80 wt%, 85 wt% or 90 wt% of the solvent.

[0075] The aerosol-generating material may be an "amorphous solid". In some embodiments, the amorphous solid is a "monolithic solid". The aerosol-generating material may be non-fibrous or fibrous. In some embodiments, the aerosol-generating material may be a dried gel. The aerosol-generating material may be a solid material that may retain some fluid, such as liquid,

within it. In some embodiments the retained fluid may be water (such as water absorbed from the surroundings of the aerosol-generating material) or the retained fluid may be solvent (such as when the aerosol-generating material is formed from a slurry). In some embodiments, the solvent may be water.

[0076] The aerosol-former material may comprise one or more constituents capable of forming an aerosol. In some embodiments, the aerosol-former material may comprise one or more of glycerine, glycerol, propylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, 1,3-butylene glycol, erythritol, meso-Erythritol, ethyl vanillate, ethyl laurate, a diethyl suberate, triethyl citrate, triacetin, a diacetin mixture, benzyl benzoate, benzyl phenyl acetate, tributyrin, lauryl acetate, lauric acid, myristic acid, and propylene carbonate.

[0077] The one or more other functional materials may comprise one or more of pH regulators, colouring agents, preservatives, binders, fillers, stabilizers, and/or antioxidants.

[0078] The material may be present on or in a support, to form a substrate. The support may, for example, be or comprise paper, card, paperboard, cardboard, reconstituted material, a plastics material, a ceramic material, a composite material, glass, a metal, or a metal alloy.

[0079] An aerosol provision device can receive an article comprising aerosol generating material for heating. An "article" in this context is a component that includes or contains in use the aerosol generating material, which is heated to volatilise the aerosol generating material, and optionally other components in use. A user may insert the article into or onto the aerosol provision device before it is heated to produce an aerosol, which the user subsequently inhales. The article may be, for example, of a predetermined or specific size that is configured to be placed within a heating chamber of the device which is sized to receive the article.

[0080] An aerosol generator is an apparatus configured to cause aerosol to be generated from the aerosol-generating material. In some embodiments, the aerosol generator is a heater configured to subject the aerosol-generating material to heat energy, so as to release one or more volatiles from the aerosol-generating material to form an aerosol.

[0081] A consumable is an article comprising or consisting of aerosol-generating material, part or all of which is intended to be consumed during use by a user. A consumable may comprise one or more other components, such as an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol transfer component, an aerosol generation area, a housing, a wrapper, a mouthpiece, a filter and/or an aerosol-modifying agent. A consumable may also comprise an aerosol generator, such as a heater, that emits heat to cause the aerosol-generating material to generate aerosol in use. The heater may comprise a conductor which can be heated by the passage of an electrical current through the conductor.

[0082] Non-combustible aerosol provision systems may comprise a modular assembly including both a reusable aerosol provision device and a replaceable aerosol generating article. In some implementations, the non-combustible aerosol provision device may comprise a power source and a controller (or control circuitry). The power source may, for example, comprise an electric power source, such as a battery or rechargeable battery. In some implementations, the non-combustible aerosol provision device may also comprise an aerosol generating component. However, in other implementations the aerosol generating article may comprise partially, or entirely, the aerosol generating component.

[0083] Figure 1 shows an aerosol provision system 10 comprising an aerosol provision device 100 for generating aerosol from aerosol generating material and an article 200. The article 200 is an article comprising aerosol generating material. The article 200 is received by the device 100. The device 100 may be used to heat the replaceable article 200 comprising the aerosol generating material, to generate aerosol or other inhalable medium which is inhaled by a user of the device 100. In use, the article 200 is inserted into the device 100 for heating.

[0084] The device 100 comprises a body 102. The body 102 surrounds and houses various components of the device 100. The body 102 defines a device housing. An opening 108 is formed in one end of the body 102, through which the article 200 may be inserted into a receptacle 116.

[0085] The aerosol provision device 100 comprises an aerosol generator 112. The aerosol generator comprises a heating assembly 110. The aerosol generator 112 is housed within the body 102. The heater assembly 110 is configured to heat at least a portion of an aerosol generating material received by the device 100. The heater assembly 110 is configured to heat at least a portion of an aerosol generating material received by a heating chamber of the device 100. The heating chamber is formed by the receptacle 116. The receptacle 116 acts as a support member. The receptacle 116 extends along and around and is substantially coaxial with a longitudinal axis of the device 100. The receptacle 116 is open at its proximal end such that an article 200 can be received by the receptacle 116 therethrough.

[0086] The proximal end may also be referred to as the "mouth end". The aerosol provision device 100 accordingly defines a proximal direction, which is directed towards the user when in use. Further, the aerosol provision device 100 likewise defines a distal direction, which is directed away from the user when in use. The terms 'proximal' and 'distal' as applied to features of the device 100 will be described by reference to the relative positioning of such features with respect to each other in a proximal-distal direction along a longitudinal axis 106.

[0087] As shown in Figure 2, the aerosol generator 112 is arranged to heat a heating zone 114 defined by the receptacle 116. In use, the article may be fully or partially inserted into the heating zone 114 defined by the recep-

tacle 116 where it may be heated by one or more components of the device 100.

[0088] The aerosol generator 112 comprises a heating element 118. The heating element 118 is comprised in the receptacle 116 and defines at least a portion of the receptacle 116. In the present arrangement, the heating element 118 is tubular. The heating element 118 defines a peripheral wall of the receptacle 116. A base 117 of the receptacle 116 is defined at a distal end of the receptacle 116 from the opening 108.

[0089] An air flow path 119 is defined by the aerosol generator 112. The air flow path 119 is shown as an air conduit from external to the device to the base 117 of the receptacle 116 such that air is able to flow through the article 200. In embodiments, the air flow path 119 is defined by the receptacle 116, with air flowing along the wall of the receptacle. In embodiments, the air flow path 119 is defined along the internal side of the receptacle 116 between the receptacle 116 and the article 200 along at least part of a length of the air flow path 119. In embodiments, the air flow path 119 is defined on an external side of the receptacle 116 along at least part of a length of the air flow path 119.

[0090] The heating element 118 is tubular. The tubular heating element 118 has a circular cross-section and is configured to extend around at least a portion of the article 200 containing aerosol generating material. The tubular cross-section is not limited to circular and in other examples may take the form of a rectangular, triangular, elliptical or other polygonal cross section. The heating element 118 comprises material that is thermally conductive.

[0091] In other examples, the configuration of the heating element 118 may vary. In some examples the heating element cross section may be rectangular, triangular, elliptical or other shapes. The heating element 118 may comprise a plurality of heating element portions. At least one portion, in embodiments, may have a blade-like profile and, in use, an aerosol generating article may be forced onto the heating element 118 so that the blade-like profile of the heating element 118 inserts into a distal end of the aerosol generating article 200.

[0092] In the example shown, the aerosol provision device 100 is elongate, extending along a longitudinal axis 106. The aerosol provision device 100 has a proximal end, which will be closest to the user (e.g. the user's mouth) when the device is in use, and a distal end, which will be furthest from the user when in use. The user inhales aerosol generated by the aerosol provision device 100 by drawing the generated aerosol towards the proximal end.

[0093] The device 100 comprises an electronics module 150. The electronics module 150 may comprise, for example, a printed circuit board (PCB). The PCB may support at least one controller 154, such as a processor, and memory. The PCB may also comprise one or more electrical tracks to electrically connect together various

electronic components of the device 100. For example, the battery terminals may be electrically connected to the PCB so that power can be distributed throughout the device 100.

[0094] The aerosol provision device 100 includes a power source 152. The power source 152 is disposed within the housing. The power source 152 is a battery, such as a rechargeable battery or a non-rechargeable battery. Examples of suitable batteries include, for example, a lithium battery (such as a lithium-ion battery), a nickel battery (such as a nickel-cadmium battery), and an alkaline battery. The battery is electrically coupled to the heating assembly to supply electrical power when required and under control of a controller 154 to heat the aerosol generating material. The aerosol provision device 100 may comprise a device electrical connector, wherein the power source 152 is releasably connected to the device electrical connector. The power source 152 is electrically connected to the heating assembly 110. The controller 154 may also be referred to as a control unit. The controller 154 may comprise processor and a memory. The controller 154 is disposed within the body 102. The controller 154 may form part of the aerosol generator 112.

[0095] The device comprises a flexible coil configuration 110. Referring to Figures 3 and 4, an example flexible coil configuration 110 of the aerosol provision device 100 is shown. The flexible coil configuration 110 comprises a flexible support 122, a resistive heating coil 124, and an inductor coil 126. The flexible coil configuration 110 may be a flexible printed circuit. In this embodiment, the flexible support 122 is formed into a tubular member. The tubular member has a longitudinal axis 106. The longitudinal axis 106 of the tubular member is concentric with the longitudinal axis 106 of the aerosol provision device 100.

[0096] As shown in Figure 3, in an embodiment, the flexible support 122 comprises an extended portion 123. The extended portion 123, when assembled, extends from the tubular configuration. The extended portion 123, in embodiments, is planar in an assembled form. The extended portion 123 of the flexible support 122 defines an electrical connector region. The extended portion 123 aids connection of the flexible coil configuration 110 to other electrical components, such as the electronics module 150.

[0097] The flexible support 122 comprises a thin, flexible sheet of material. The flexible support 122 may be a film. The film is made of polyamide. The flexible support 122 has a thickness of about 50 μm . In examples, the flexible support 122 may have a thickness in the range of between 25 μm (micron) and 150 μm (micron).

[0098] The resistive heating coil 124 and inductor coil 126 are formed on the flexible support 122. In other embodiments, the resistive heating coil 124 and the inductor coil 126 may be at least one of deposited on, printed on, engraved into, or adhered to the flexible support.

[0099] The flexible support 122 comprises a resistive heating coil portion 134 and an inductor coil portion 136. The respective portions are defined at least in part by the location of each of the resistive heating coil 124 and the inductor coil 126. The resistive heating coil portion 134 and the inductor coil portion 136 are longitudinally spaced along the flexible support 122. The inductor coil 126 is formed on the inductor coil portion 136 of the flexible support 122. The resistive heating coil 124 is formed on the resistive heating coil portion 134 of the flexible support 122. The flexible support 122 comprises a support layer. The support layer is a single sheet forming both of the resistive heating coil portion 134 and the inductor coil portion 136. Accordingly, assembly may be easily performed. Each of the inductor coil 126 and resistive heating coil 124 extend around at least a portion of the heating element.

[0100] The inductor coil 126 and the resistive heating coil 124 are spaced from each other and concentrically aligned along the longitudinal axis 106 of the flexible coil configuration 110.

[0101] In this embodiment, the inductor coil 126 and resistive heating coil 124 each take the form of a helical coil. However, other embodiments are envisaged. By way of example, the flexible coil arrangement 120 may form a flat coil. The flat coil may comprise a spiral. The flat coil may be planar.

[0102] The inductor coil 126 is configured to generate a varying magnetic field. The heating element 118 comprises material heatable by penetration with a varying magnetic field generated by the inductor coil 126. The varying magnetic field generated by the inductor coil 126 penetrates the heating element 118 suitably positioned with respect to the inductor coil 126 portion of the flexible support 122, and generates eddy currents inside the heating element 118. The heating element 118 has electrical resistance to the eddy currents, and hence the flow of the eddy currents against this resistance causes the heating element 118 to be heated by Joule heating. In cases where the heating element 118 comprises ferromagnetic material such as iron, nickel or cobalt, heat may also be generated by magnetic hysteresis losses in the susceptor, i.e. by the varying orientation of magnetic dipoles in the magnetic material as a result of their alignment with the varying magnetic field. In inductive heating, as compared to heating by conduction for example, heat is generated inside the heating element 118, allowing for rapid heating of the heating zone. Further, there need not be any physical contact between the inductor coil portion 136 and the heating element 118, allowing for enhanced freedom in construction and application.

[0103] The resistive heating coil 124 is configured to generate heat by resistive heating and heat the heating element 118 by thermal conduction. The heating element 118 conducts heat from the resistive heating coil portion 134 of the flexible support 122 to the heating zone 114.

[0104] The flexible support 122 has a small thickness

to allow for the efficient conduction of thermal energy from the resistive heating coil 124 to the heating zone 114.

[0105] The flexible support 122 is electrically insulative. The flexible support 122 may comprise an electrically insulative layer and a conductive layer.

[0106] The flexible support 122 comprises a transition section 128 located between the inductor coil portion 136 and the resistive heating coil portion 134. The transition section 128 may be omitted. The transition section 128 is configured to facilitate a change in cross-sectional geometry along the longitudinal axis 106 of the flexible coil configuration 110, corresponding to the longitudinal axis 106 of the device 100, from the inductor coil portion 136 to the resistive heating coil portion 134 by having a cross sectional area that increases from the resistive heating coil portion 134 to the inductor coil portion 136. In other words, the transition section 128 may have a flared shape.

[0107] The transition section 128 comprises a series of interruptions 130 (shown in Figure 4) in the flexible support 122 that are equally spaced and aligned along a plane perpendicular to the longitudinal axis 106 of the flexible coil configuration 110. The interruptions 130 comprise a plurality of apertures which aid in forming the flared shaped of the transition section 128. The interruptions may include or comprise other configurations, such as slits and folds. The interruptions may be omitted. The series of interruptions 130 are equally spaced across the flexible support 122 to help provide a consistent transition.

[0108] Figure 4 shows an embodiment of a blank 120 of a flexible coil configuration, such as the flexible coil configuration 110 described above, for use in an aerosol provision device, such as the aerosol provision device 100. The flexible support 122 is configured to be manipulated from this state into a desired shape. Such manipulation may include bending, such as rolling or otherwise flexing the flexible support 122. In the example of Figure 3, the flexible support 122 is formed into a tubular member. The flexible support 122 is wrapped around another component, such as the receptacle 116.

[0109] The inductor coil 126 when assembled defines an inductor electrically conductive path 140. The electrically conductive path 140 extends from a first type of connection 141, such as a positive connection, and a second type of connection 142, such as a negative connection. The first type of connection 141 and the second type of connection 142 provide connection of the inductor coil 126 to other electrical components, such as the electronics module 150. The first type of connection 141 and the second type of connection 142 are disposed on the extended portion 123, although other configurations are possible, such as being on the tubular portion.

[0110] The resistive heating coil 124 when assembled defines a resistively heated electrically conductive path 143. The electrically conductive path 143 extends from a first type of connection 144, such as a positive connection

tion, and a second type of connection 145, such as a negative connection. The first type of connection 144 and the second type of connection 144 provide connection of the resistive heating coil 124 to other electrical components, such as the electronics module 150. The first type of connection 144 and the second type of connection 145 are disposed on the extended portion 123, although other configurations are possible, such as being on the tubular portion.

[0111] The inductor coil 126 and resistive heating coil 124 comprise a plurality of electrically conductive portions discontinuously formed on the flexible support 122, also identified as a plurality of discontinuous electrically conductive portions 138. The configuration of such coils is generally the same and so only one is described below. The plurality of discontinuous electrically conductive portions 138 are formed on the flexible support 122. The plurality of discontinuous electrically conductive portions 138 are printed onto the flexible support 122. In embodiments, the plurality of discontinuous electrically conductive portions 138 are deposited on, engraved into or adhered to the flexible support 122. Each portion of the plurality of discontinuous electrically conductive portions 138 is spaced from other portions of the plurality of discontinuous electrically conductive portions 138 on the flexible support 122. Prior to forming the flexible coil configuration 110 into the desired shape, the plurality of discontinuous electrically conductive portions 138 are free from forming a single conductive path due to these being separated by the electrically insulative flexible support 122. In an assembled configuration, adjacent plurality of discontinuous electrically conductive portions 138 move into electrical contact.

[0112] The blank 120 of the flexible circuit configuration 110 comprises a plurality of connections 132. Each connection 132 of the plurality of connections 132 is configured to connect two adjacent discontinuous electrically conductive portions so as to form an electrically conductive path when the flexible support 132 is formed into a tubular member. In other words, the plurality of connections 132 are configured to close the electrically conductive path (140, 143) such that two distinct conductive paths are formed corresponding to the inductor coil 126 and the resistive heating coil 124.

[0113] When the flexible coil configuration 110 is in the form of the blank 120, the flexible support 132 takes a generally flat shape. Advantageously, this provides ease of manufacture when forming the electrically conductive path (140, 143) on the flexible support 132.

[0114] The blank 200 may be formed into the flexible coil configuration 110 by forming the flexible support 122 into a tubular member. The flexible support 122 may be formed into a tubular member by wrapping the flexible support 122 around the receptacle 116.

[0115] In this embodiment, when the flexible support 122 is rolled into a tubular member, the inductor coil 126 and resistive heating coil 124 each take the form of a helical coil. In this form, the inductor coil 126 and resistive

heating coil 124 are longitudinally spaced from each other and concentrically aligned along the axis 106 of the flexible coil configuration 110.

[0116] The flexible support 122 may have a unitary construction. A unitary construction can mean that the flexible support 122 is easier to manufacture.

[0117] In embodiments, the electrically conductive path (140, 143) comprises a plurality of electrically parallel conductive tracks (not shown). There may be between 7 and 25 electrically parallel conductive tracks (not shown). The electrically parallel conductive tracks may comprise between 7 and 25 parallel conductive tracks on each side of the flexible support 122. The electrically parallel conductive tracks may comprise between 14 and 50 parallel conductive tracks.

[0118] Each electrically parallel conductive track may have a width of between 100 μ m and 250 μ m.

[0119] The plurality electrically parallel conductive tracks may define an active width of the electrically conductive path, and the active width may be between 1mm and 4mm.

[0120] The plurality of parallel conductive tracks may comprise a first series of parallel conductive tracks formed on a first side of the flexible support 122 and a second series of parallel conductive tracks formed on a second, opposite side of the flexible support 122. The first series of parallel conductive tracks may overlap the second series of parallel conductive tracks.

[0121] The plurality of parallel conductive tracks may comprise a first conductive track formed on a first side of the flexible support and a second conductive track formed on a second, opposite side of the flexible support. The first conductive track formed on the first side of the flexible support may overlap the second conductive track formed on the second side of the flexible support. The first conductive track may be a single track. The second conductive track may be a single track. The first conductive track may be electrically parallel to the second conductive track along at least part of their length.

[0122] The plurality of parallel conductive tracks may be electrically insulated from each other along at least part of their length.

[0123] Figure 5 shows a side view of the blank of the flexible coil configuration 110. In this example, the flexible coil configuration 110 comprises a layer of flexible support 122 and a layer of electrically conductive material 162, such as copper or aluminium. The layer of conductor material 162 may be formed on the flexible support 122 by at least one of printing, engraving, depositing or adhering. The layer of conductor material 162 may comprise the inductor coil 126 and the resistive heating coil 124.

[0124] In embodiments, conductor material is disposed on both sides of the flexible support 122 forming a double-sided flexible coil configuration. In this double-sided configuration, the inductor coil 126 may be formed on both sides of the inductor coil portion 136 of the flexible support 122 and the resistive heating coil 124 may be

formed on both sides of the resistive heating coil portion 134 of the flexible support 122.

[0125] In embodiments, the thickness of the flexible support 122 is generally constant and in the range of 0.2 mm to 0.8 mm. In examples, the thickness of the electrically conductive material 162 is generally constant and in the range of 0.1 mm to 0.5 mm.

[0126] Figures 6 and 7 each show a cross sectional view of the flexible coil configuration 110. In embodiments, the spacing between the inductor coil portion 136 and the heating element 118 is greater than the resistive heating coil portion 134 and the heating element 118. The inductor coil portion 136 is radially spaced from the heating element 118. This spacing may aid in facilitating the formation of a concentrated magnetic flux path that intersects the heating element 118 to generate heat in the heating element 118 to heat the heating zone 114. An insulation member 164 in embodiments is disposed between the inductor coil portion 136 and the heating element 118 to improve the transfer of heat from the heating element 118 into the heating zone 114. The insulation member 164 is free from a material heatable by penetration with a varying magnetic field generated by the inductor coil 126. The insulating member 164 acts to space the inductor coil portion 136 from the heating element 118 to maintain a constant radial distance between the inductor coil 126 and the heating element 118 to provide uniform heat generation in the heating element 118.

[0127] In examples, the inductor coil portion 136 may be radially spaced from the heating element 118 by about 0.5 mm to 2 mm, and optionally 1.0 mm to 1.5 mm.

[0128] The resistive heating coil portion 134 is in contact with the heating element 118. Such an arrangement maximises heat conduction from the resistive heating coil 124 to the heating zone 114. In other examples, the resistive heating coil portion 134 is spaced from the heating element 118. Such spacing is less than the spacing between the inductor coil portion 136 and the heating element 118. In embodiments, the spacing between the resistive heating coil portion 134 and the heating element 118 is equal to the spacing between the inductor coil portion 136 and the heating element 118. A material of high thermal conductivity may be disposed between the resistive heating coil portion 134 and the heating element 118 to improve the conduction of heat from the resistive coil portion 134 into the heating zone 114.

[0129] In embodiments, the resistive heating coil portion 134 may be radially spaced from the heating element 118 by about 0.1 mm to 2 mm, by about 0.1 mm to 0.5 mm, by about 0.1 mm to 1.5 mm and by about 1.0 mm to 1.5 mm.

[0130] Figure 8 illustrates a method 300 of assembling an aerosol provision device 100. In step 302, the receptacle 116 is provided defining a heating zone 114 configured to receive at least a portion of an article 200 comprising aerosol generating material. In step 304, a flexible coil configuration 110 is wrapped around at least a portion

of the receptacle 116. The flexible coil configuration 110 comprises a flexible support 122, an inductor coil 126 formed on the flexible support 122, and a resistive heating coil 124 formed on the flexible support 122. The method may further comprise rolling the flexible support 122 around the receptacle 116 to form a tubular member.

[0131] The electronics assembly 150 is in the body 102 of the device 100. The electronics assembly 150 comprises the power source 152. The power source 152 may be, for example, a battery, such as a rechargeable battery or a non-rechargeable battery. Examples of suitable batteries include, for example, a lithium battery (such as a lithium-ion battery), a nickel battery (such as a nickel-cadmium battery), and an alkaline battery. The battery is electrically coupled to the flexible coil configuration 110 to supply electrical power when required and under control of a controller 154 such as a microcontroller, to heat the aerosol generating material. The controller 154 may be configured to control activation of at least one of the inductor coil 126 or the resistive heating coil 124.

[0132] The controller 154 may be configured to operate the inductor coil 126 to act as a magnetic field generator. In this example, the controller 154 may be configured to supply an alternating current to the inductor coil 126 causing the inductor coil 126 to generate a time-changing magnetic field. Upon interaction with the time varying magnetic field, the heating element 118 will generate heat.

[0133] The controller 154 may be configured to operate the resistive heating coil 124 to act as a resistive heating element. In this example, the controller 154 is configured to supply a constant current to the resistive heating coil 124 causing the resistive heating coil 124 to generate heat.

[0134] The controller 154 may be configured to activate the coils at different times to improve the energy efficiency of the device. In one example, both the resistive heating coil 124 and the inductor coil 126 are initially activated to induce rapid heating. Once a suitable level of heating is achieved the inductor coil 126 is deactivated to reduce the energy consumption of the device.

[0135] The various embodiments described herein are presented only to assist in understanding and teaching the claimed features. These embodiments are provided as a representative sample of embodiments only, and are not exhaustive and/or exclusive. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects described herein are not to be considered limitations on the scope of the invention as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claimed invention. Various embodiments of the invention may suitably comprise, consist of, or consist essentially of, appropriate combinations of the disclosed elements, components, features, parts, steps, means, etc., other than those specifically described herein. In addition, this disclosure

may include other inventions not presently claimed, but which may be claimed in future.

Claims

1. An aerosol provision device for generating an aerosol from aerosol generating material, the aerosol provision device comprising:

a receptacle defining a heating zone configured to receive at least a portion of an article comprising aerosol generating material; and
a flexible coil configuration comprising a flexible support extending around at least a portion of the receptacle, an inductor coil formed on the flexible support; and a resistive heating coil formed on the flexible support.

2. The aerosol provision device of claim 1, wherein the receptacle comprises a heating element.

3. The aerosol provision device of claim 2, wherein the heating element is configured to conduct heat from the resistive heating coil to the heating zone.

4. The aerosol provision device of claim 2 or 3, wherein the heating element is configured to generate heat by penetration with a varying magnetic field generated by the inductor coil to heat the heating zone.

5. The aerosol provision device of any of claims 1 to 4, wherein at least one of the inductor coil and the resistive heating coil is helical.

6. The aerosol provision device of any of claims 1 to 5, wherein the flexible support comprises an inductor coil portion and a resistive heating coil portion.

7. The aerosol provision device of claim 6, wherein a spacing between the inductor coil portion and the heating zone is greater than the resistive heating coil portion and the heating zone.

8. The aerosol provision device of claim 6 or 7, comprising an insulating material disposed between the inductor coil portion and the heating zone.

9. The aerosol provision device of any of claims 6, 7 or 8, wherein the flexible support comprises a transition section between the inductor coil portion and the resistive heating coil portion.

10. The aerosol provision device of any of claims 1 to 9, wherein the flexible support is configured to be wrapped around the receptacle forming a tubular member.

11. The aerosol provision device of any of claims 1 to 10, wherein the inductor coil and the resistive heating coil form a helical coil arrangement when the flexible support is rolled into a tubular member.

12. The aerosol provision device of any of claims 1 to 11, wherein the flexible support has a unitary construction.

13. A blank of a flexible coil configuration for an aerosol provision device, the flexible coil configuration comprising:

a flexible support configured to be formed into a tubular arrangement;
an inductor coil formed on the flexible support; and
a resistive heating coil formed on the flexible support.

14. An aerosol provision system comprising the aerosol provision device of any of claims 1 to 12, and an article comprising aerosol-generating material.

15. A method of assembling an aerosol provision device, the method comprising;

providing a receptacle defining a heating zone configured to receive at least a portion of an article comprising aerosol generating material; and
disposing a flexible coil configuration around at least a portion of the receptacle;
wherein the flexible coil configuration comprises a flexible support, an inductor coil formed on the flexible support; and a resistive heating coil formed on the flexible support.

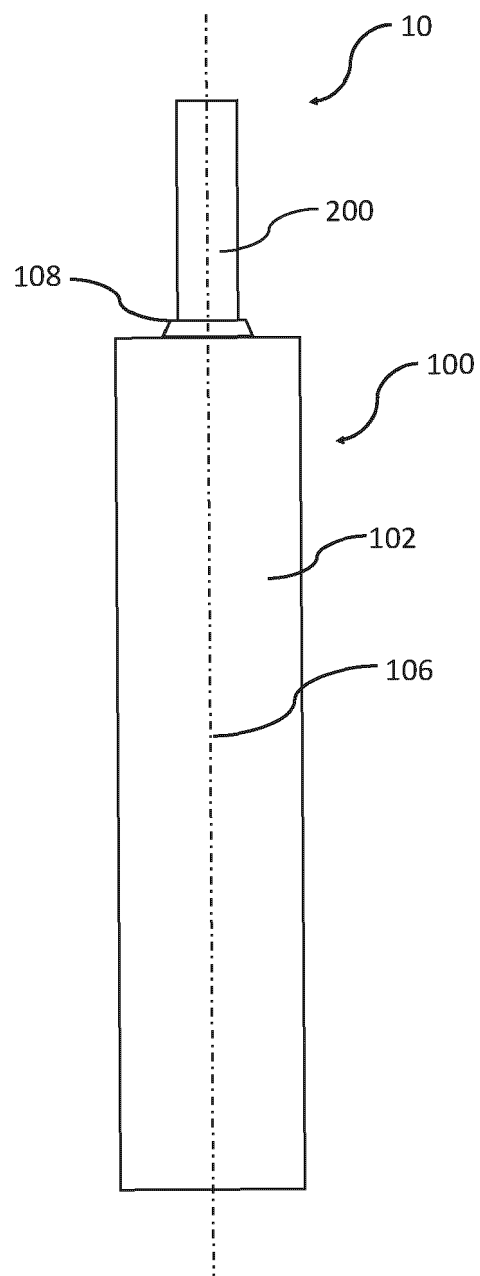


FIG. 1

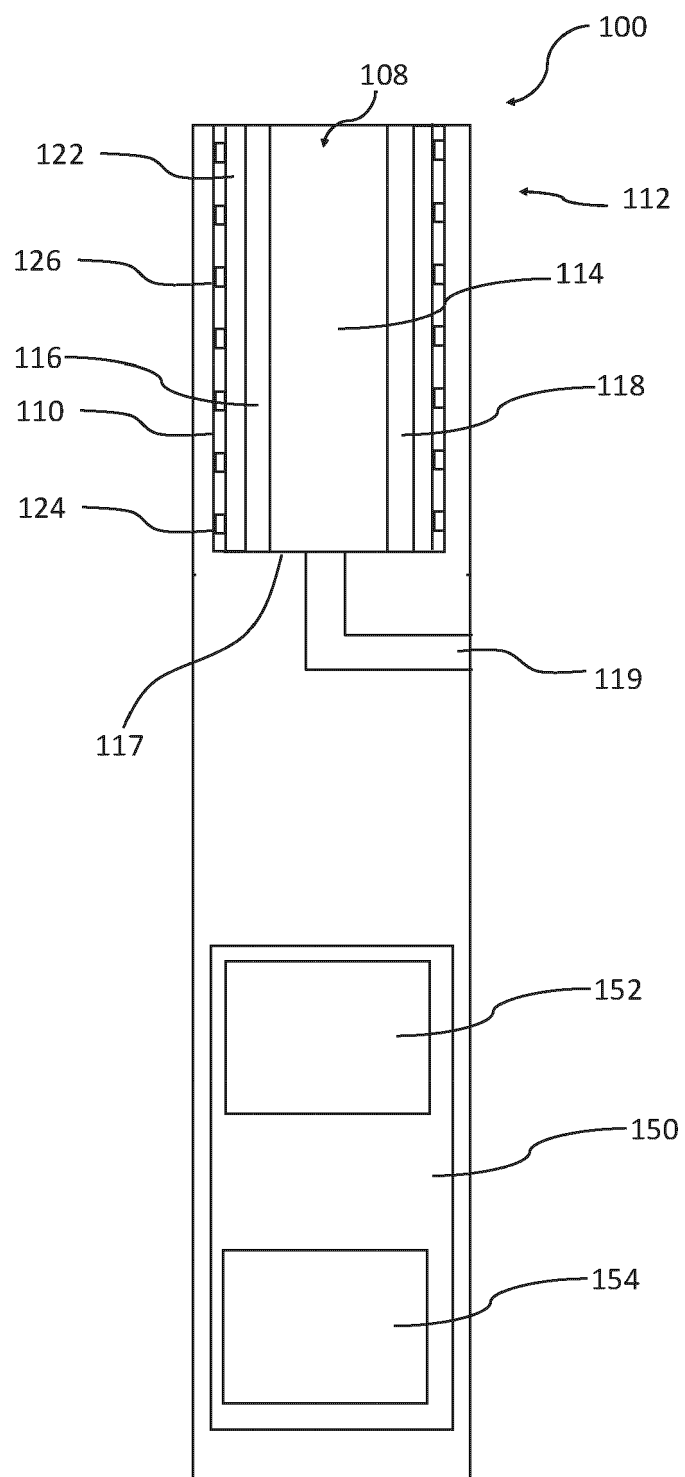


FIG. 2

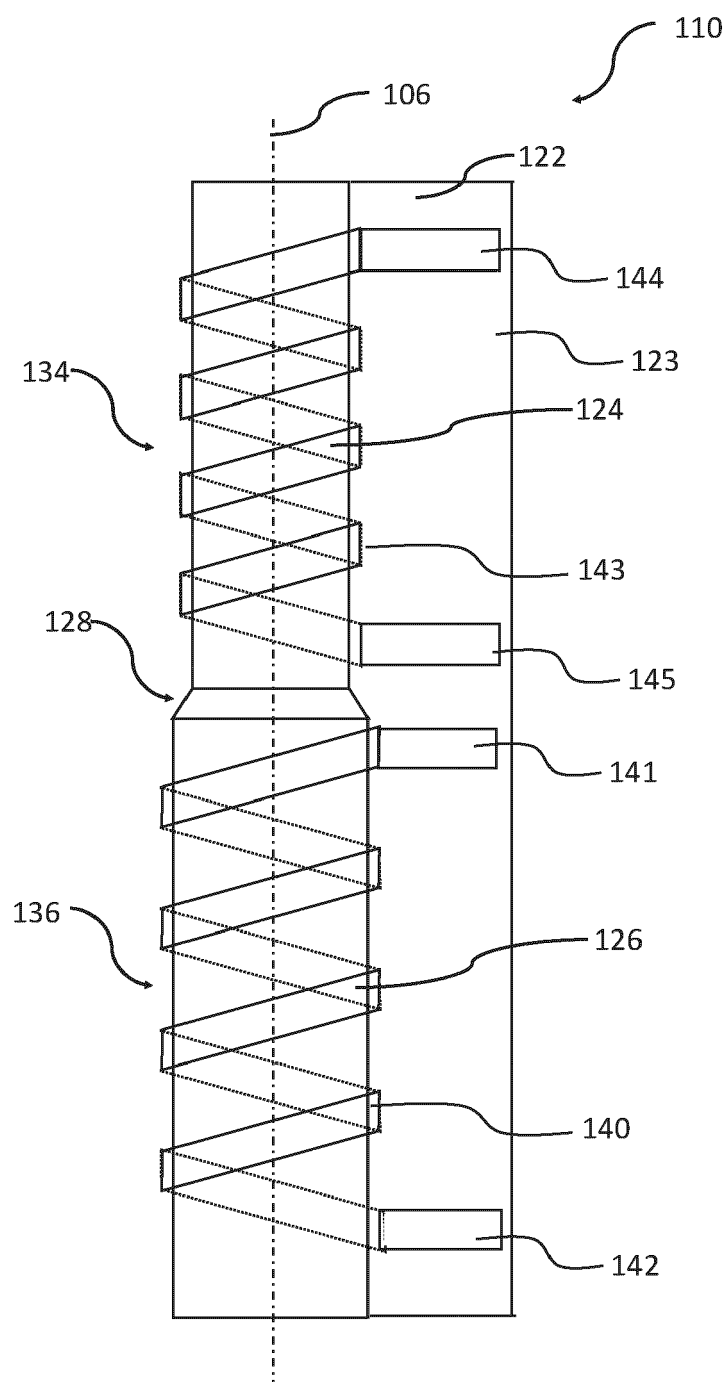


FIG. 3

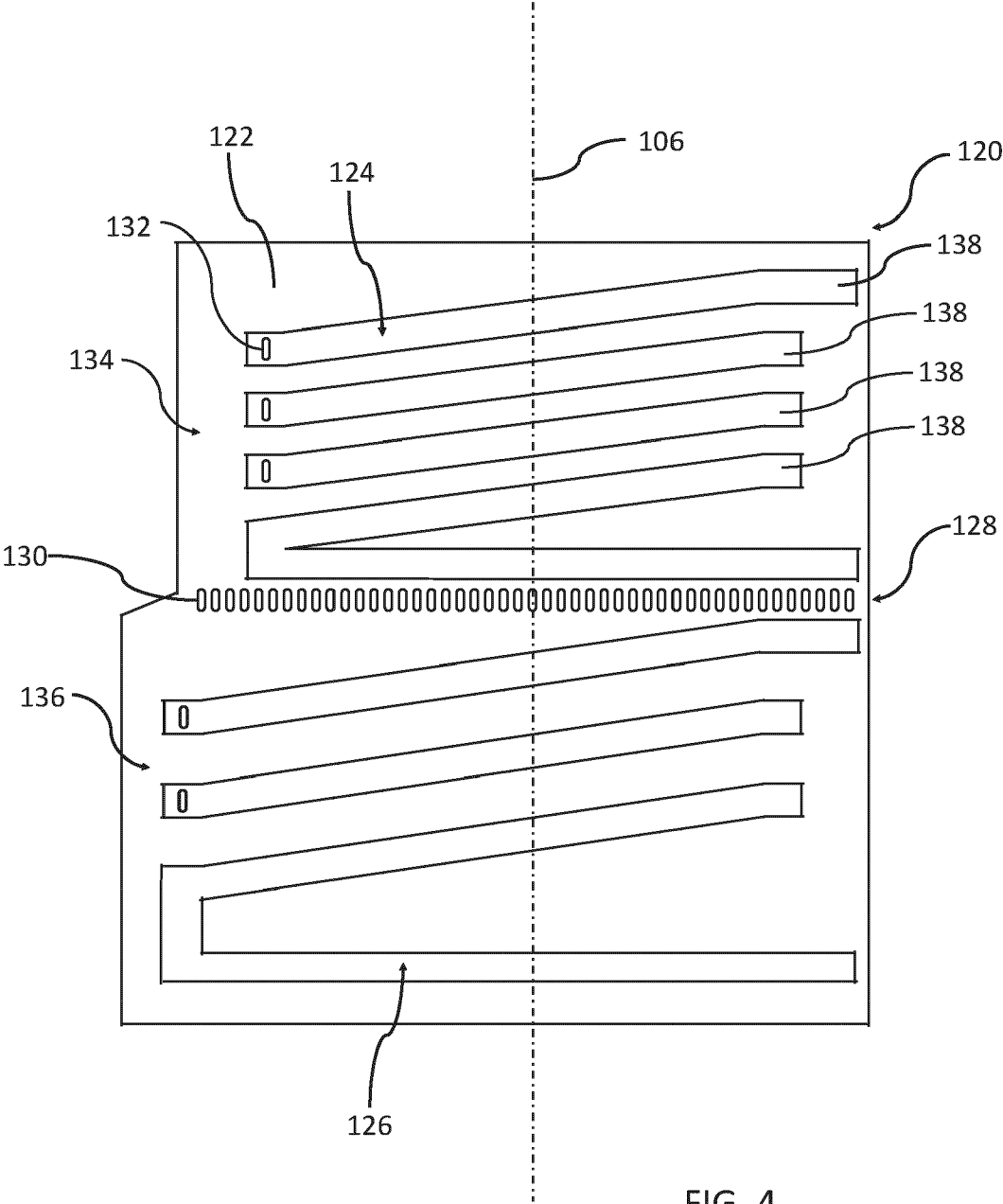


FIG. 4

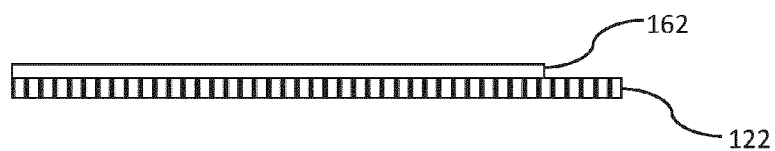


FIG. 5

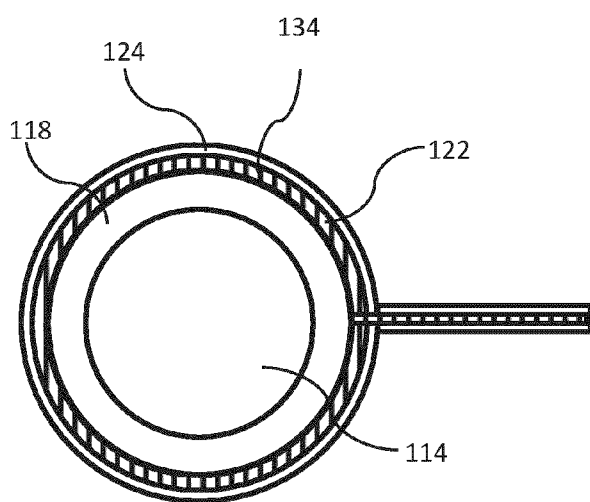


FIG. 6

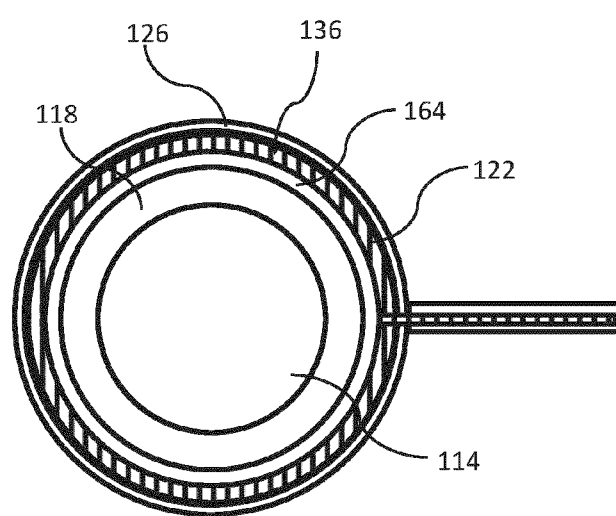


FIG. 7

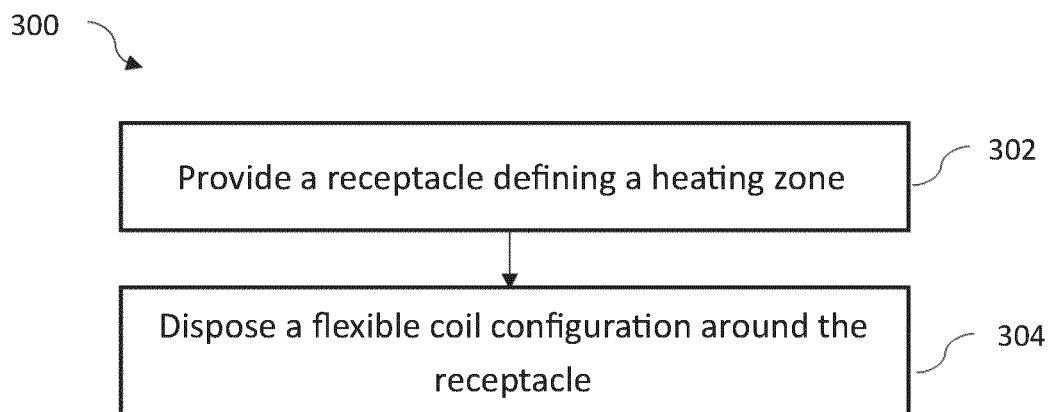


FIG. 8



EUROPEAN SEARCH REPORT

Application Number

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Place of search		Date of completion of the search	Examiner
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